

A Comprehensive Watershed Management Plan for the Duck Creek Watershed

**A Collaboration of
Partners of the Duck Creek Watershed Committee
and the residents of
the Duck Creek Watershed**

February 2005

The mission and vision of the project are as follows:

Mission Statement: To restore and protect the long term health and sustainability of the Duck Creek Watershed through the wise management of its water resources and land uses.

Vision: Our vision is to develop a watershed management plan that addresses the problems we face within the Duck Creek Watershed in addition to providing adequate funding and implementation mechanisms to solve these problems.

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ACRONYM REFERENCE LIST

AFRRI -Appalachian Flood Risk Reduction Initiative	NRCS -Natural Resources Conservation Service
Al -Aluminum	ODNR -Ohio Department of Natural Resources
AMD -Acid Mine Drainage	OEPA -Ohio Environmental Protection Agency
AML -Abandoned Mine Land	FSA -Farm Service Agency
BMPs -Best Management Practices	RAMP -Rural Abandoned Mineland Program
BOD -Biological Oxygen Demand	QHEI -Qualitative Habitat Evaluation Index
CSS -Combined Sewage Systems	RC&D -Resource Conservation & Development
DBH -Diameter Breast Height	RM -River Mile
DO -Dissolved Oxygen	MWCD -Muskingum Watershed Conservancy District
EWH -Exceptional Warm Water Habitat	SWCD -Soil & Water Conservation District
Fe -Iron	TSS -Total Suspended Solids
FEMA -Federal Emergency Management Agency	TMDL -Total Maximum Daily Load
GIS -Geographic Information Systems	USDA -United States Department of Agriculture
IBI -Index of Biological Integrity	USFWS -United States Fish & Wildlife Service
ICI -Invertebrate Community Index	WWH -Warm Water Habitat
ILGARD -Institute for Local Government & Rural Development	LEAP -Livestock Environmental Assurance Program
Mn -Manganese	CRP -Conservation Reserve Program
MRM -Mineral Resource Management	EQIP -Environmental Quality Incentives Program
NPDES -National Pollution Discharge Elimination System	
NPS -Non-point Source Pollution	

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INTRODUCTION, DEFINING THE WATERSHED

Location Statistics

The Duck Creek Watershed is located in the Western Allegheny Plateau Region of southeastern Ohio and falls between 39° 23' 53" North Latitude by 81° 15' 20" West Longitude to 39° 52' 01" North Latitude by 81° 39' 04" West Longitude. The 288 square mile (184,354 acres) watershed lies in Noble (67.2%), Washington (28.4%), Monroe (3.2%), and Guernsey (1.2%) counties (**See Map 1: Watershed and Public Lands Map**). The Duck Creek Watershed is located in parts of Aurelius, Fearing, Lawrence, Liberty, Marietta, Muskingum and Salem Townships within Washington County; and in all or parts of Brookfield, Buffalo, Center, Elk, Enoch, Jackson, Jefferson, Marion, Noble, Olive and Stock Townships within Noble County. In addition, the watershed lies within Spencer Township in Guernsey County, as well as Bethel and Franklin Townships in Monroe County.

The following cities and villages are incorporated areas within the Duck Creek Watershed: Marietta, Lower Salem, Macksburg, Belle Valley, Caldwell, Dexter City, and Summerfield. Marietta is the only Phase II storm water community in the Duck Creek Watershed. Marietta and Washington County have recently hired a storm water specialist to ensure that Marietta complies with all Phase II stormwater regulations. Fulda, Carlisle, Florence, Ava, Sharon, Dudley, Hunkadora, East Union, Ashton, Hoskinville, Middleburg, Gem, Newburg, Three Forks, South Olive, Road Fork, Elba, Germantown, Warner, Whipple, Stanleyville, Caywood, Moundsville, Hirambsburg, and Fredricksdale are considered unincorporated areas within the watershed (See: Watershed and Public Lands Map).

Districts

The following districts serve the people of the watershed:

- Washington and Noble Soil and Water Conservation Districts
- Buckeye Hills Hocking Valley Regional Development District
- Army Corps of Engineers, Huntington District
- Ohio Environmental Protection Agency, Southeastern District Office
- Public Sewage Districts: Caldwell Sewer District, City of Marietta Wastewater District.
- Public Water Districts: Clear Water Corporation, Noble County Water Authority, Noble Water District, Caldwell Water Department, Pure Water Company Inc., City of Marietta Water, Reno Water District and Highland Ridge Water
- School Districts: Caldwell Exempted, Noble Local, Marietta City Schools, and Fort Frye Local, Switzerland of Ohio and Rolling Hills School District.
- Southeast Ohio Joint Solid Waste Management District
- Agricultural districts in Noble County of Duck Creek Watershed: 25 landowners totaling 5,333 acres
- Agricultural Districts in Washington County of Duck Creek Watershed: 19 landowners totaling 3,851 acres.

Land Use

The Duck Creek Watershed is a predominately rural watershed that is located in the foothills of the Appalachian Mountains. The terrain is composed of hills, ridges, and plateaus. The highest point in the watershed, 1,210 feet above sea level, is at the headwaters of the West Fork of Duck Creek. The lowest point is at the mouth of Duck Creek, 600 feet above sea level. Historically, farming and the abundance of renewable natural resources such as of forests for timbering, underground and surface coal deposits, and large oil and gas deposits made up the majority of the landuses in the watershed. These past landuses are now mixed with urban centers that are slightly expanding in land area. For example, there are five municipalities (Caldwell, Belle Valley, Macksburg, Lower Salem and Marietta) and numerous villages scattered throughout the watershed. The main transportation routes (Interstate I-77 and State Routes) are located in the valleys following the main branches and tributaries of Duck Creek. The county and townships roads intersect the remaining land area, primarily along the ridge tops. Currently, OEPA has issued National Pollutant Discharge Elimination System (NPDES) permits to seven facilities in the Duck Creek watershed that could discharge pollutants of concern. Six of these are mining operations and one is a sewage treatment plant for the City of Caldwell. The Ohio Department of Natural Resources (ODNR) also permits the mining operations.

Land use in the Duck Creek watershed includes a mix of deciduous forest, pasture/hay, evergreen forest, and agriculture. Land use data for the area are available from the Multi-Resolution Land Characterization (MRLC) database for Ohio and are shown in **Table 1** and the **Map 2: Land Use Map** (MRLC, 2000). Deciduous forest and pasture/hay collectively account for approximately 87 percent of the total land cover. The classification “deciduous forest” is defined as areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to seasonal change. The classification “pasture/hay” is defined as areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops (**Table 1-Land Use Distribution**).

The Duck Creek Watershed has various recreational landuses including, fishing, boating, swimming, hunting, hiking, birdwatching, sightseeing, and camping. Public land within the watershed include Wolf Run State Park north of Caldwell, Wayne National Forest in Elk Township in Noble County, Noble County Recreation Area located at the Noble County Fairgrounds, Ales Run Wildlife Area, and Ohio’s Buckeye Trail passes through the Wolf Run State Park.

DEMOGRAPHICS

Demographic information is limited to the watershed study area of Noble and Washington Counties except for calculations where the demographics are used to determine potential effects on water quality (such as the number of homes and population).

Table 1. Land Use distribution by Major land use category.

Land Use	Area (acres)	%
Deciduous Forest	108,163	58.68
Pasture/Hay	52,753	28.61
Evergreen Forest	7,377	4.01
Row Crops	7,076	3.83
Mixed Forest	2,679	1.46
Low-Intensity Residential	1,659	0.9
Open Water	1,361	0.83
Transitional	1,330	0.72
High-Intensity Commercial	823	0.45
Quarries/Strip Mines/Gravel Pits	429	0.23
Other Grasses	316	0.17
High-Intensity Residential	182	0.1
Woody Wetlands	139	0.1
Emergent Herbaceous Wetlands	67	0.035
Total	184,354	100

Source: MRLC, 2000.

Population Growth

According to the 2000 Census Report early population growth in the watershed followed two different trends depending on the county you examine (**Table 2-Population Growth Chart 1800-2030**). Washington County's population grew rapidly from 1800 (5,427) to 1980 (64,266) and then leveled off and declined slightly to a present day population of 63,254. Conversely, Noble County was not created until 1851 therefore; the population was not officially recorded until 1860 when 20,751 people resided in the county. Noble County's population reached a high point of 21,138 in 1880 and then declined steadily to a low of 10,428 in 1970. The present day population of Noble County is listed as 14,058. More recently, there has been a steady increase in population from 1990 to 2000 throughout both Washington and Noble Counties. For example, in the ten-year period Washington County increased a modest 1.6-% and Noble County increased 19%. Currently, there are approximately 15,518 people that live in the Duck Creek Watershed with 82% of the people living in rural areas and 18% living in urban areas.

The rapid increase in Washington County's population from 1800 to 1980 was due to the historically strategic location of Marietta on the Ohio and Muskingum Rivers. These rivers provided Washington County with significant trade and travel routes to the rest of the Northwest Territory. The Ohio River remains a strategic trade route to the Mississippi River and beyond. Currently, Washington County remains a productive location for various chemical and petroleum plants. Marietta, the county seat, is a popular tourist attraction due to its historic downtown featuring various points of interests and antique shops. Noble County's peak population in 1880 was due to the boom of the oil and gas wells throughout the county. Once the oil and gas wells ran dry people fled the county for fortunes elsewhere. Until recently Noble County has not benefited from resurgence in population. The population recently jumped by approximately 2,000 people in 1996 when Noble Correctional Institution opened. Even though the prisoners do not pay taxes or vote they are counted on the census reports. There has also been an increase in immigration from the suburbs in Northeastern Ohio. Many retirees seek a convenient, rural location directly south off of Interstate-77, to escape from the city life in and around Cleveland.

Future projections show that Washington County’s population will decrease by 1,598 people from 2000 to 2030 while Noble County is projected to gain 2,632 people in the same 30-year period.

Table 2 Population Growth Chart 1800-2030.

	1800	1810	1820	1830	1840	1850	1860	1870
Washington	5,427	5,991	10,425	11,731	20,823	29,540	36,268	40,609
Noble	n/a	n/a	n/a	n/a	n/a	n/a	20,751	19,949
	1880	1890	1900	1910	1920	1930	1940	1950
Washington	43,244	42,380	48,245	45,422	43,049	42,437	43,537	44,407
Noble	21,138	20,753	19,466	18,601	18,601	14,961	14,587	11,750
	1960	1970	1980	1990	2000	2010	2020	2030
Washington	51,689	57,160	64,266	62,254	63,251	63,508	63,085	61,653
Noble	10,982	10,428	11,310	11,336	14,058	15,365	16,227	16,690

Source: 2000 Census Report

Table 3: Watershed Population by Subwatershed

Subwatershed	Total # Homes	Population
Lower Duck Creek 05030201-120-040	1,470	3,704
Upper Duck Creek 05030201-120-030	425	1,071
West Fork Main 005030201-120-020	454	1,230
Paw Paw Creek 005030201-110-050	260	680
Middle Fork 005030201-110-030	166	515
Headwaters East Fork 005030201-110-010	254	779
East Fork above Middle Fork 005030201-110-020	301	918
East Fork below Middle Fork 005030201-110-040	133	351
Headwaters West Fork 005030201-120-010	1,950	8,118
Totals	5,413	17,366

Age, Employment, Income and Education

The following information was obtained from the Ohio Department of Development, Ohio County Profiles website. The average age of Duck Creek residents is approximately 37 year of age. Approximately 6% of residents are unemployed compared to 3.2% for the State of Ohio. In Duck Creek 8% of the residents are living under the poverty level, which is slightly better than the states’ average of 10.6%. The median household income in the watershed is \$32,940 for Noble County and \$34,275 for Washington County, below the state average of \$40,956. This is a common theme for counties in the Appalachian

Region of Ohio where there is a lack of infrastructure and employment due to its rural, rugged terrain. For all persons age 25 and over 81.5% have graduated High School, while 18% have earned an Associates Degree or higher.

Agricultural Statistics

The following information was obtained from the Ohio Department of Agriculture Annual Report and Statistics for 2002. Noble County has 640 farms averaging 163 acres in size, totaling 104,000 acres of farmland. Washington County has 9908 farms averaging 145 acres in size for a total of 144,000 acres of farmland. The farms in the watershed are predominantly family owned and operated and smaller in size than farms in the glaciated parts of Ohio. The rugged terrain of Duck Creek limits the amount of land that is suitable for agriculture. Duck Creek is home to 110 major livestock operations consisting of dairy, beef and sheep. There are 52,753 acres of pasture/hay in the watershed. The erosion rate for pasturelands in Duck Creek is 4.0 tons/acre/year (NRCS). Overgrazing, poor fertility, steep pasture areas, water availability and unlimited access to streams and woodlands are the main problems associated with pasture lands (TMDL, Ohio EPA). There is a nutrient deficiency on the pasture and hay lands within the Duck Creek Watershed (NRCS).

GENERAL WATERSHED INFORMATION

Past and Current Water Quality and Flood Prevention Efforts

The following past and current water quality efforts have been implemented throughout the watershed. These efforts have been instrumental in supplementing the Duck Creek Watershed Partnership by increasing acceptance and awareness of the partnership. In addition to the following efforts, the Duck Creek Watershed Partnership is currently involved in writing the Watershed Management Plan that involves an inventory of the watershed and identifying problems and potential solutions throughout the watershed.

The Ohio EPA recently completed a **Total Maximum Daily Load (TMDL)** study on the Duck Creek Watershed. Chemical, physical and biological sampling was conducted in the summer of 2000 to assess and characterize all potential sources of water quality impairment in the Duck Creek Watershed. Our partnership has worked closely with Ohio EPA's TMDL coordinator, Keith Orr. We have been consistently in contact with each other to insure the entire TMDL process is completed. The TMDL results combined with public input has provided this project with an understanding of the problems and potential solutions we face in the watershed.

The Washington and Noble Soil and Water Conservation Districts, NRCS and the Buckeye Hills RC & D have continually worked on educating the general public, installing BMP's and conservation practices, and providing technical assistance throughout the watershed. These agencies have implemented the following efforts within the Duck Creek Watershed:

- The Duck Creek Watershed received a **319-implementation grant** totaling \$356,550 in 1998. This grant focused on implementing and increasing public awareness towards grazing BMP's, riparian buffers, septic tanks and animal waste storage. Specifically, the grant installed 45,000 foot of fencing to exclude livestock from 750 acres of woodland, 90 acres of buffer strips along streams, developed 800 acres of pastureland management systems, inspected and cleaned out 100 rural septic systems, developed 15 animal waste systems,

developed alternative watering systems, and established 50 acres of critical area treatment demonstrations (Noble SWCD).

- The watershed has recently been approved for a second **319-implementation grant** worth \$650,000, which will be funded in April of 2004. There are two phases of the 319 grant, phase-1 involves reclaiming Ales Run subwatershed by reducing sediment and metal loads that enter into the stream and phase-2 involves implementing agricultural Best Management Practices (BMP's). Phase-2 is a partnership between Washington and Noble Soil and Water Conservation Districts, National Resource Conservation Service (NRCS) and the Duck Creek Watershed Partnership. Phase –1 (reclamation) is a partnership between Washington and Noble Soil and Water Conservation Districts, Ohio Department of Natural Resources Division of Wildlife, the Division of Mineral Resource Management, and the Duck Creek Watershed Partnership (Duck Creek Watershed Partnership).
- The **USDA's Environmental Quality Incentive Program (EQIP)** provides educational, technical, and financial assistance for the implementation of conservation practices throughout the watershed. Conservation practices available through EQIP are related to the management of manure storage/utilization systems and grazing lands. Washington County had 31 applications and 7 contracted plans in the past 7 years. Noble County had 75 applications and 23 of those applications were approved for the entire county (SWCD, NRCS, FSA).
- **USDA's Conservation Reserve Program (CRP)** is a federal program designed to take actively eroding land out of production. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Washington County had a total of \$6,000 in CRP programs; only two programs were contracted in Washington County. There was not any CRP programs in Noble County (SWCD, NRCS, FSA).
- **Livestock Environmental Assurance Program (LEAP)** meetings educate producers on the need and benefits of sound environmental practices on their farm (SWCD, Ohio Livestock Coalition). There is interest in the watershed to learn more about how to get the highest yield or most benefit out of the land while sustaining the land for future generations. For example, 30 Noble County and 35 Washington County Duck Creek residents have attended LEAP meetings over the past three years. There are two additional LEAP training sessions scheduled for 2004. This program will raise the level of awareness and improve the water quality throughout the watershed.

Listed below are additional past and current water quality and flood prevention efforts:

- Washington County conducted a **Wastewater Treatment Study/Plan** in 2000 that has identified sewage, home septic and storm water problems throughout the county. The study also looked at potential solutions to the problems outlined in the plan. The Washington County Commission funded the Wastewater Treatment Study.

- ODNR Division of Mineral Resource Management, NRCS and Office of Surface Mining (OSM) have worked to improve the water quality of duck creek through programs such as Abandoned Mine Lands (AML) and Rural Abandoned Mineland Program (RAMP). These programs helped reclaim abandoned surface mine areas throughout the watershed. These organizations will continue to play a large role in minimizing the adverse effects of the 3,000 acres of remaining abandoned mines in the Duck Creek Watershed. B&N coal company employs remining, an accepted reclamation BMP, at 5 of its 6 ongoing mine sites within the watershed. Once the remining process is complete the area is reclaimed to the Surface Mining Control and Reclamation Act's standards in which highwalls are no longer present and the disturbed area is revegetated.
- The **West Fork Duck Creek Watershed Project Work Plan** was completed by the Muskingum Watershed Conservancy District (MWCD) and several Federal and State Agencies. Duck Creek Watershed, although outside of the Muskingum River Basin, is considered as a sub-watershed under the jurisdiction of the MWCD. The MWCD was founded in 1933 under Chapter 6101 of the Ohio Revised Code and is one of 21 conservancy districts in Ohio. The MWCD is dedicated to flood control, conservation and recreation. In August 1965, the MWCD, Ohio Department of Natural Resources (ONDR), Guernsey Soil and Water Conservation District, Noble Soil and Water Conservation District, Noble County Commissioners, Washington Soil and Water Conservation District, Washington County Commissioners, Village of Caldwell, Ohio and the Village of Belle Valley, Ohio completed a work plan for West Fork of Duck Creek and identified opportunities for watershed protection, flood prevention, municipal water supply and water-based recreation.

The **project work plan** specifically focused on four issues:

- 1) Floodwater damage to rural lands, transportation facilities and village communities
- 2) The need for water-based recreation:
- 3) Shortages of water in the Belle Valley, Florence and Caldwell area; and
- 4) The need to reduce soil erosion

Major features of the project, included identification of 18 possible sites for flood prevention reservoirs and 19.9 miles of channelization to increase water carrying capacity of the stream. The recommended measures in the plan were to be installed over a five-year period. The plan also included land treatment practices to control erosion, sedimentation and runoff from the watershed.

- The Huntington, WV district of the Army Corps of Engineers is conducting a **Reconnaissance Study** in cooperation with the Duck Creek Watershed Project. The purpose of the reconnaissance study is to take a basin wide look at the Duck Creek Watershed and determine where flood prone areas and water quality problems are. The Army Corps will then determine what can be done to control and prevent flooding and improve the water quality in those areas. Bill Weekley from the planning branch of the Army Corps in Huntington is heading up the project for Duck Creek. He is taking a general look at the watershed by gathering data, taking video and pictures of flood prone areas, meeting with necessary agency personnel and landowners, and attending watershed meetings.

- Noble Emergency Management Agency gained approval in May of 2004, for a **County Wide Natural Hazard Mitigation Plan**. This plan will identify actions that can be taken to reduce or eliminate risk to people and property from hazards and their effects. The hazard mitigation plan is important because The Disaster Mitigation Act of 2000 requires local communities to have a natural hazard mitigation plan in place by November 1, 2003 to maintain eligibility for future hazard mitigation funds. All townships and villages within Noble County have approved this plan.
- Belle Valley in Noble County has been approved for a **Hazard Mitigation Grant Plan** that will elevate and/or purchase structures that are located in the 100-year flood plain and have been subjected to chronic flooding.
- **Washington Emergency Management Agency began the process of drafting a County Wide Natural Hazard Mitigation Plan in April of 2004. This plan will identify actions that can be taken to reduce or eliminate risk to people and property from hazards and their effects. The hazard mitigation plan is important because The Disaster Mitigation Act of 2000 requires local communities to have a natural hazard mitigation plan in place by November 1, 2003 to maintain eligibility for future hazard mitigation funds. All cities, townships and villages within Washington County will work towards drafting and adopting this plan.**

WATERSHED PLAN DEVELOPMENT

WATERSHED PARTNERS

The Duck Creek Watershed has various stakeholders and government agencies that have been willing to be involved in the watershed planning process. Since March of 2002 when this project officially began the number of stakeholders has increased and will continue to grow as the project moves onto the implementation phase. The stakeholders and their roles and responsibilities are outlined in **Table 3: Stakeholders and Partners Involved in the Watershed Management Planning Process**. A list and description of technical and professional assistance provided by government agencies can be found in **Appendix 1: Technical & Professional Assistance**.

The Duck Creek Watershed Partnership has developed an Advisory Committee that has been a valuable resource in the planning process. The Duck Creek Advisory Committee is committed to ensuring that the water quality in the Watershed continually improves. A memorandum of understanding was written and signed by the Washington SWCD Board and the Duck Creek Advisory Committee (see attached memorandum). The memorandum states that the committee will continuously give advice for problems and solutions pertaining to the watershed, participate in events sponsored by the Duck Creek project, and continually try to gain new membership to the committee. The Duck Creek Watershed Partnership has had a total of 12 advisory committee meetings since March of 2002. The meetings were well attended and the committee willingly participates in discussion. In general, the committee is responsible for attending monthly advisory committee meetings, assist with watershed management plan and makes decisions on

daily watershed activities. Specifically, the following job descriptions were created for the general committee members, chairperson, vice-chairperson, and secretary.

General committee members should attend committee meetings on a regular basis and participate in the meetings to the best of their ability and experience. Committee members are leaders in the community that are in contact with many community members on a daily basis. Therefore, committee members are responsible for disseminating as much information as possible to the Duck Creek Community. Committee members are also encouraged to attend functions such as tours and field days that take place within the Duck Creek Watershed.

The chairperson is required to perform the same duties as the general committee members. In addition, the chairperson is required to meet with the coordinator prior to the advisory committee meeting to go over the agenda in preparation for the upcoming meeting. At the meetings the chairperson is required to facilitate discussion, carryout the agenda and assure that the items on the agenda are addressed in a timely manner. In the future we may need to vote on some issues that may come up. In this event, the chairperson will initiate the vote and ensure that all members are given the opportunity to vote. The vice-chair is required to perform the same duties as the general committee members. In addition, the vice-chairperson is required to assume the responsibilities of the chairperson when he/she is unable to attend meetings and functions. The secretary is required to perform the same duties as the general committee members. In addition, the secretary is required to take minutes at each meeting and write them up in a timely manner. At each meeting the minutes from the previous meeting will be passed out and reviewed by the committee. The committee is a volunteer, non-profit organization that will continually be a part of the Watershed Project. Future funding for the committee may include membership fees, fund raising events, donations and/or applying for future grants.

If additional watershed stakeholders wish to participate on the advisory committee, then those persons should contact the Soil and Water Conservation District office. Those persons who contact the SWCD office will be given information about the meetings and what dates to attend.

Table 4: Stakeholders and Partners Involved in the Watershed Management Planning Process

Stakeholder Group	Stakeholders	Roles and Responsibilities
Washington SWCD Board of Supervisors	John Hartline, Mark Dailey, Roger Stollar, Jamey Rauch, Pat Gates	Sponsors of the project, provides financial and administrative assistance.
Noble SWCD Board of Supervisors	Kevin Stottsberry, John Biedenbach, Mike Zwick, Stephen Bond, Christopher Clark	Sponsors of the project, provides financial and administrative assistance.

Duck Creek Advisory Committee	Shawn Ray (Noble Co. Health Dept.) Becky A. Moore (Wash. Co. Trustee) Jeff Antil (Noble Co. Trustee) Jeff Lauer (Washington EMA) Chasity Schmelzenbach (Noble EMA) Ken Robinson (Washington Health Dept.) Nancy Raeder (Keepers of Duck Creek) Mark Jukich (Muskingum WCD) Bill Jonard (ODNR DMRM) George Slater (Farmers Union) Sandy Matthews (Wash. Co. Commissioner) Walt KcKee (Noble Co. Commissioner) Dave Brightbill (Citizen, Community Action) Dave Hawkins (Citizen) Roger Osborne (B&N Coal) Bonnie Arnold (Citizen) Terry Tamburini (OSU Extension)	Attend monthly advisory committee meetings, assist with watershed management plan and make decisions on daily watershed activities.
Duck Creek Technical Committee	Kevin Wagner (Washington SWCD) Jim Mizik (Noble SWCD) Dan Imhoff (OEPA) Chad Amos (ODNR) J.P. Lieser (OSU Extension) Bob Mulligan (ODNR) Bob First (Buckeye Hills RC&D)	Assist with the technical aspect of the project, education and outreach and review progress of project.
Stakeholders	300+ landowners, residents and public officials throughout the watershed	Participated in survey, public meetings and tours by discussing and prioritizing problems, solutions and positives in the watershed.
South Eastern Ohio Solid Waste Management District	Rob Reiter	Assisted the watershed with OEPA grant to clean up and monitor 3 dumps. Helps watershed reduce illegal dumping and post "no dumping signs"
ILGARD	Matt Trainer, J.B. Hoy	Assist the coordinator with mapping for the watershed management plan.
Noble County Commissioners	Walt McKee, Charles Cowgill, Danny Harmon	General financial support and approved Letter of Intent for Early Warning Detection System.
Washington County Commissioners	Sandy Matthews, John Grimes, Sam Cook	General financial support and approved Letter of Intent for Early Warning Detection System.
Stakeholder Group	Stakeholders	Roles and Responsibilities
Washington & Noble SWCD Assistance	Glenna Hoff (Education Specialist) Kathy Davis (Stormwater Specialist) Pam Brooker (DPA) Jim Mizik (Technician) Kevin Wagner (Technician) Rebecca Moore (Wildlife Specialist) Laura Schafer (DPA) Mary Campbell (Administrative Coordinator)	Assist with the management plan, education and outreach, and daily administrative activities.

Keepers of Duck Creek	20 local watershed residents	Work towards reducing flooding, improving water quality and providing a clean drinking water source for Duck Creek residents
Ken Strahler Construction	Ken Strahler and employees.	Helped clean up dump in Marietta.
Aurelius Township and Noble Correctional Institute	Equipment operator and inmates assisted with dump clean up.	Helped clean up dump in Macksburg.
B&N Coal	Roger Osborne and equipment operators.	Helped clean up dump and facilitated coal mine/reclamation tour
Kroger Wetland Working Group	Approximately 20 local citizens and agency volunteers.	Assist with clean up days, field trips and maintenance of Kroger Wetland
Boy Scout Troop 231	60 Boy Scouts	Constructing foot bridges, observation tower, viewing blind, educational signs and maintaining trails at Kroger Wetland
City of Marietta	Mayor, Street Department, and Tree Commission	Installed culvert, planted 9 trees and assisted with fence installation at Kroger Wetland Parking Lot.
Pioneer Masonry	Pioneer Masonry Owner	Provided 20 bags of quickcrete for fence at Kroger Wetland Parking Lot.
Sharon Stone	John McCord	Provided 121 tons of screenings for Kroger Wetland Parking Lot.
Smith Concrete	Ross Snyder	Reduced price for 121 tons of 304 stone for Kroger Parking Lot
Hartline Farms	Kyle and John Hartline	Provided equipment to clear and spread stone for Kroger Wetland Parking Lot.
Stollar Farms	Roger Stollar	Provided trucking for 121 tons of screenings for Kroger Wetland Parking Lot.
Green Care Lawn and Landscaping	Bryan Waller	Provided 121 tons of 304 stone for Kroger Wetland Parking Lot.
Millers Supply	Millers Supply	Provided culverts for Kroger Wetland Parking Lot.
City of Caldwell	Willard Radcliff	General Support

STRUCTURE, ORGANIZATION and ADMINISTRATION

Project Responsibility

The Washington and Noble Soil and Water Conservation District's (SWCD) Board of Supervisors is directly responsible for ensuring that the Watershed Management Plan for the Duck Creek Watershed is completed and implemented. Each Soil and Water District is administered by a governing board of five locally elected, unpaid, public officials called supervisors. The Board of Supervisors has the responsibility of setting policy and implementing the District's program priorities and goals. The Board is responsible for the administration and operation of the District and all its programs by employing staff members who carry out the day-to-day activities of the District. Soil and Water Conservation Districts are political sub-divisions of state government established under section 1515 of Ohio's Revised Code. They are a stand-

alone, tax-exempt, unit of State government much like a county or a township. Each District receives local funds from their County Commissioners, which are then matched with funds from the Ohio Department of Natural Resources Division of Soil and Water Conservation and the Ohio Soil and Water Conservation Commission. Districts are local resource management agencies who work with units of government, landowners and landusers, to carry out programs which provide technical and educational assistance for the development, wise use and conservation of our soil, water, and other related natural resources. The mission of the Districts is to ensure a balance between the wise use and protection of our natural resources for the benefit of all.

Project Background

The Duck Creek Watershed Partnership emerged from local concerns about flooding and poor water quality within the watershed. Past land uses such as surface mining, timbering and agriculture have caused many problems for the local residents. A local grass roots movement, The Keepers of Duck Creek, began in the early 1990's to keep a large hog farm from entering the watershed. The Keepers began to hold public meetings throughout the watershed to improve education about water quality and flooding in Duck Creek. Although the Keepers of Duck Creek have not been involved in the implementation process, they could in turn become an enormous asset to the project. The Keepers will be able to maintain the media's attention and attract local stakeholders to become more involved with the project. More involvement from local groups such as the Keepers of Duck Creek is always encouraged. In 1998 two events spurred the local movement on creating widespread interest and concern for the watershed. First, a catastrophic flood event hit the watershed dumping more than 10 inches of rain in a 96-hour period, causing widespread damage and taking the lives of 5 Duck Creek residents. Sadly, this flood event brought the problems residents face in Duck Creek to a state and national level. Locally, County Commissioners realized the need for improving the quality of life for Duck Creek residents. Secondly, Noble and Washington Soil and Water Districts, NRCS and Buckeye Hills Resource Conservation & Development received a 319-implementation grant totaling \$356,550. This grant focused on implementing and increasing public awareness towards grazing BMP's, riparian buffers, septic tanks and animal waste storage in the Duck Creek Watershed. These two events illustrated to the public that there are serious problems in the watershed and certain steps are being taken to resolve them. Between 1998 and 2002 there was enormous public interest in the Watershed because they felt nothing has been done to prevent flooding and improve the quality of water in Duck Creek. At the same time, the County Commissioners and the local SWCD's in Washington and Noble County recognized the need to address the flooding and water quality problems in Duck Creek. Currently, a memorandum of understanding has been reviewed and signed between the Keepers of Duck Creek and the Washington SWCD Board. The role of the Keepers to the Project includes continuing to be an advocacy group to the Partnership, participate in events the Partnership sponsors, and assist in education and outreach to different members in the Duck Creek Watershed Community (see attached memorandum).

In March of 2002 Washington and Noble SWCD's employed a watershed coordinator through a Watershed Coordinator Grant provided by ODNR and OEPA. Currently, the partnership will begin a 319 grant in the spring of 2004 and we are working with the Army Corps of Engineers to address the flooding problems in the watershed. Public interest has subsided somewhat; however; they are pleased to see our partnership has progressed.

PUBLIC INVOLVEMENT, EDUCATION & OUTREACH

Public Meetings

Overall, the Duck Creek Watershed Partnership has had a total of nine public meetings since March of 2002. Approximately 35 people attended each meeting, reaching about 315 people in all. Stakeholders in the watershed were invited to the first round of four public meetings (2 in Noble and 2 in Washington County) in October and November of 2002. Various stakeholder groups from all but two sub-watersheds were represented at the meetings. The goal of these meetings was to provide the public with an opportunity to share their views of the watershed. We encouraged the attendees to think about the Duck Creek Watershed and express what they feel are their concerns, potential solutions, past uses, and positive aspects within the watershed. The stakeholder survey found in this section asked the public to rank the concerns listed at the public meetings.

The following concerns discussed at the meetings are in random order:

- sewage/septic
- AMD/mining
- sediment
- reduced flow of stream
- agriculture related issues: cattle in streams, erosion, manure, riparian removal, cattle in forest, plow too close to stream, livestock access to stream and forest
- flooding
- not enough forest lands
- illegal dumps
- debris, logs, and trash in creek
- poor land management
- need for more drinking water and surface water
- drainage problems: culverts clogged, need more waterways
- road salt
- wildlife problems
- lack of awareness and education

The public offered a wide variety of solutions for discussion at the public meetings. The solutions include:

- more trash storage facilities in watershed
- dredge Duck Creek
- stop sediment sources
- dams that create lakes for recreation, drinking water, and flood control
- use gray water systems for home sewage
- reforestation of barren areas
- containment/farm ponds: reduce flooding, watering source, and trap sediments
- improved individual land management
- improved cooperation with agencies

- agriculture BMP's: filter strips, grass waterways, fence cattle out of forest, allow cattle access to certain points along stream, and alternative water sources
- allow riparian zones to grow back
- clean up dumps and use surveillance to prevent further dumping
- dry ponds and sediment/silt ponds
- wetlands to reduce sediment and flooding, recharge ground water, and filter out impurities and pollutants
- plant more trees
- improve septic systems and a public septic plan
- increase sewer access

The public was encouraged to provide input on positive aspects of the watershed as well as past uses they once enjoyed. While these lists are not as exhaustive as the problems and solutions they do provide insight as to what the public wants to see in the future.

Past Uses of Duck Creek:

- swim
- better fishing
- canoe/boat from Caldwell to Marietta

Positives Aspects of Duck Creek:

- recreation potential
- natural beauty

The remaining five Public Meetings were effective in providing a forum for the public to express their concerns and ask questions about the project. For example, we had the Army Corps of Engineers from Huntington, WV attend two of the meetings and an Ohio EPA employee attend a meeting. The public seemed to enjoy the Army Corps and OEPA's presence because their questions and concerns were being addressed and answered on the spot.

Newsletter

The Duck Creek Watershed Partnership has published a biannual newsletter titled "Duck Creek News" that has been sent out to 1,067 residents, landowners, businesses, and public officials of the watershed and disseminated at various functions around the area. Currently there are 1,050 people and/or businesses on the "Duck Creek News" mailing list. The newsletter provides a forum to reach out to the public and inform them about upcoming events, our progress in the watershed and educate them about relevant issues. Information about household septic systems, the Flood Warning and Emergency Evacuation Plan and TMDL public and committee meetings have been some issues addressed in the newsletter. The TMDL meetings were held to explain how the TMDL results allow us to identify and characterize potential sources of water quality impairment throughout the watershed. The outcome of the meetings was posted in the following newsletters to keep the public up to date with the TMDL process. The newsletter also addresses key water quality issues such as streamside buffers, illegal dump clean up, and the Kroger wetland. In addition, Duck Creek News has given members of the Duck Creek Advisory Committee the opportunity to write articles that focus on their experience as a life long Duck Creek resident. For example, Bonnie Arnold (resident and advisory committee member) wrote an informative article about the need for Belle Valley to be tied into Caldwell's sewer treatment plant. Belle Valley is a neighboring village that has an extremely bad septic problem; however the local politics have prevented a resolution. Bonnie's article helped increase the public's awareness towards the situation that will hopefully be resolved in the short term.

Survey

A stakeholder survey was sent out to approximately 1,000 Duck Creek Watershed residents and landowners in the Spring of 2003. The purpose of this questionnaire was to gauge stakeholders' opinions about the most important problems in the Duck Creek Watershed. This allowed us to prioritize the problems that were discussed at the public meetings. In addition, the survey attempted to gauge the willingness of stakeholders to participate in cost share programs and their reasons for not participating. It was important that we obtain everyone's input on the status of the Duck Creek Watershed. The results of this survey have helped determine what grants we have and will apply for and what cost share practices the grant money will be used for. The questionnaire results were published in the summer edition of the Duck Creek Watershed Newsletter that was published in August of 2003. The stakeholders returned 130 (13% responding) completed surveys into the partnership. Survey results are provided in **Tables 5 and 6**, while **Chart 1** illustrates the most important concerns Duck Creek stakeholders have. A copy of the Stakeholder Survey is located in **Appendix 2**.

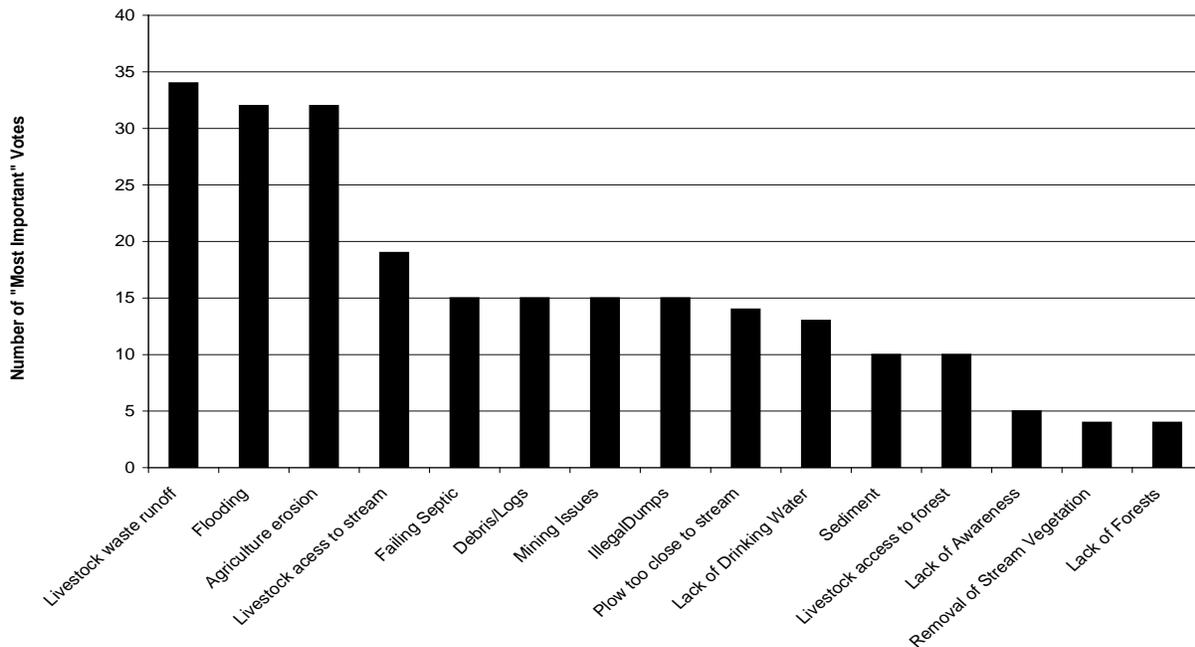
Table 5: Results of 130 resident surveys for the Duck Creek Watershed Management Plan. These results are based on the total votes and percentage of residents that voted for a specific topic.

Question	Topic in survey	Votes/130	% of Votes	Ranking
Ranking of Potential Cost Share Programs	Tree Plantings	43/130	33.1	1
	Livestock watering systems	42/130	32.3	2
	Woodland fencing	28/130	21.5	3
	Cleaning up illegal dumps	26/130	20.0	4
	Heavy use feeding pads	20/130	15.4	5
	Septic system repair and/or pumping	18/130	13.8	6
	Corridor Buffer Strips	16/130	12.3	7
	Wetland Creation	15/130	11.5	8
	Wetland Restoration	11/130	8.5	9
	Stream fencing w/ access to stream	10/130	7.7	10
	Animal Waste Storage	3/130	2.3	11
What Are the Reasons You Are Not Willing to Participate in Cost Share Programs	Willing to Participate in Programs Listed	63/130	48.5	1
	Need more information	21/130	16.2	2
	Prefer not to work w/ gov't	12/130	9.2	3
	Not interested in programs	11/130	8.5	4
	Want to do practices own way in own time frame	10/130	7.7	5
	No need for programs	9/130	6.9	6
	Fearful of calling attention to their problems	1/130	0.8	7

Table 6: Results of 130 resident surveys for the Duck Creek Watershed Management Plan
These results are based on the percent of residents that voted for a specific topic.

Question	Topic	Total Votes	% of Total Votes
Most Important General Concerns of 128 Duck Creek Residents	Flooding	32	24.6
	Failing Septic	15	11.6
	Debris/Logs	15	11.6
	Mining Issues	15	11.6
	Illegal Dumps	15	11.6
	Lack of Drinking Water	13	10.0
	Sediment	10	7.7
	Lack of Awareness	5	3.8
	Removal of Stream Vegetation	4	3.0
	Lack of Forests	4	3.0
	No answer	2	1.5
	Total	130	100.0
Most Important Agricultural Concerns of 109 Duck Creek Residents	Livestock waste runoff	34	26.2
	Agriculture erosion	32	24.6
	No answer	21	16.2
	Plow too close to stream	14	10.7
	Livestock access to forest	10	7.7
	Livestock access to stream	19	14.6
	Total	130	100
Would You Like to Receive More Information on the Available Cost Share Programs	Yes.....	45	35
	No.....	85	65
	Total	130	100

Chart 1. Most Important Concerns in Duck Creek



Media

The Duck Creek Watershed Partnership has attempted to increase education and outreach by submitting informative articles in local newspapers and newsletters as well as participating in radio and TV interviews. The Journal Leader and The Marietta Times (local newspapers) have allowed the watershed to submit articles and meeting notices on an as needed basis. Their cooperation has been helpful in reaching the general public that does not attend public meetings or receive the Duck Creek Newsletter. Washington and Noble Soil and Water Conservation Districts publish quarterly newsletters that serve as a valuable outreach mechanism for Duck Creek. A local radio station (WMOA) radio provides the Washington SWCD with a radio spot that airs every Saturday morning. The watershed lists upcoming events, programs and educational tidbits during these radio spots. Additionally, the Duck Creek Watershed Coordinator was interviewed by Ohio University National Public Radio and Marietta College's TV program.

Field Days and Tours

Field Days and Tours have played a significant role in reaching out to the school children and stakeholders of the watershed. Refer to **Table 7: Description of Field Days and Tours** for a complete list, dates, number of participants and the outcome/description of the event.

Table 7: Description of Field Days and Tours

Field Days/Tours	# of People in Attendance	Date	Outcome/Description
Wolf Run Clean Up Day	35	May-02	Collected approximately 30 bags of trash around Wolf Run State Park
Kroger Wetland Clean Up Day	20	April-03	Collected approximately 20 bags of trash and other large objects around Kroger Wetland
Kroger Wetland Historical Society Field Trip	8	August-03	Informed group about Kroger Wetland: past, present and future
2002 Ohio Minelands Partnership tour of Duck Creek and participated in panel discussion	50	October-03	Duck Creek conducted a stop on the tour at Otterslide Run on Middle Fork of Duck Creek. I demonstrated the benefits reclamation has to water quality. I showed before and after reclamation water quality data and what was actually done in this subwatershed to improve water quality.
Washington SWCD's fall foliage tour of Duck Creek	50	October-03	Duck Creek had a stop on the tour where we sampled for macroinvertebrates and had a display set up.
Log Pole Structure Construction for Earth Day	12	April-03	Constructed 3 log poles structures at unreclaimed strip mine to reduce sediment load.
Coal Mine tour of B&N coal lands for Salem Liberty Elementary Students	30	April-03	Roger Osborne from B&N Coal led a coal mine tour for 5th and 6th graders from Salem Liberty Elementary. We visited and learned about ongoing re-mining and reclamation sites.
Salem Liberty Earth Day Watershed Activities	100	April-03	Various watershed activities were presented to the Elementary students to increase education and awareness towards watersheds.
Noble County Earth Day Celebration	60	April-03	Various booths were set up outside the Noble County Courthouse to increase awareness about what local residents can do to improve the environment.
Kroger Wetland Ribbon Cutting	10	December-03	Official opening of Kroger Wetland

Field Days/Tours	# of People in Attendance	Date	Outcome/Description
Rumpke Grant Clean Up Days (3 dumps)	30	Throughout 2002 and 2003	Cleaned up 3 dumps in Duck Creek
Biological Monitoring at Noble County Conservation Day Camp (2002 and 2003)	65	June-02 and June-03	Demonstrated the importance, function and health indicators of watersheds. Explained how macroinvertebrates indicate healthy of streams, students found macros and assessed health of stream segment.
Guernsey County Conservation Field Day	65	June-03	Demonstrated the importance, function and health indicators of watersheds. Explained how macroinvertebrates indicate healthy of streams, students found macros and assessed health of stream segment.
Noble County Ag-School Day (2002 and 2003)	300	2002-2004	Demonstrated the importance, function and health indicators of watersheds. Explained how macroinvertebrates indicate healthy of streams, students found macros and assessed health of stream segment.
Power Point presentation to Kiwanis	25	March-03	Informed group about Kroger Wetland: past, present and future
2003 Ohio Minelands Partnership Panel Discussion	50	October-03	Discussed ongoing and future projects and health of Duck Creek
Washington SWCD's Farm City Day	420	2002-2004	Demonstrated the importance, function and health indicators of watersheds. Explained how macroinvertebrates indicate healthy of streams, students found macros and assessed health of stream segment.

Kroger Wetland

We have had some good progress on getting the Kroger Wetland project off the ground. The wetland is a perfect educational opportunity to illustrate the benefits wetlands can have on a watershed. For example, the Duck Creek Watershed is flood prone and sediment laden therefore, the partnership is promoting wetlands to soak up the surface water allowing it to recharge the ground water and release it slowly into the stream. Wetlands also trap sediment before it reaches the stream allowing for increased water in the channel. The Kroger Wetland will act as an actual field site that people can visit and learn about wetland habitat, functions and wildlife. Our accomplishments at the wetland include, completion of the gravel parking lot, fence installed to prevent dumping, 9 large trees planted in parking lot, trail cut and mulch donated and spread, local boy scout troop involved in cutting trail and spreading donated mulch, Kroger wetland sign completed. This project has involved a great deal of local volunteers and cooperation among the city of Marietta and the Duck Creek Partnership. Additionally, Glenna Hoff (Education Specialist), Rebecca Moore (Wildlife Specialist) and the Duck Creek Watershed Coordinator recently applied for an ODNR Division of Wildlife Grant that will help restore the Kroger Wetland. The grant will facilitate walking bridges, educational signs, an observation deck, water control structure, tree buffer and viewing blind. The Kroger Wetland will be an asset for the Duck Creek Watershed Community as we attempt to increase wetland awareness and discourage the construction of large dams and dredging.

Endorsement and Adoption of Plan

In addition to the Duck Creek Watershed Management Plan, a 10-page summary and a 1-page fact sheet will be published. These additional publications will allow local stakeholders, government officials and local companies and businesses to learn about the Management Plan without reading the entire document. This effort should increase endorsement and adoption by local stakeholders by providing a mechanism of outreach that is not overwhelmingly large and time consuming.

To facilitate the adoption and endorsement of our Watershed Management Plan the Duck Creek Partnership will employ various techniques. The techniques will range from public meetings to presenting the plan to local politicians. Once the plan is written and approved there will be two public meetings for the general public, local health departments, and local realtors. The purpose of these meetings will be to gain endorsements by the key stakeholders and inform the general public that the plan is complete. In addition to the meetings, the Duck Creek Partnership and the Soil and Water Conservation Districts will take on a county wide regional realtor workshop. The workshop will address issues such as soils, septic issues, and floodplain development. The Partnership will use these meetings and workshops as a springboard towards the implementation stage of this partnership. To gain the necessary adoptions and endorsements the Duck Creek Watershed will visit various groups, organizations, politicians, etc. These meetings will involve presenting the plan, (PowerPoint when necessary), passing out the 10-page summary or the 1-page fact sheet (depending on the audience), and providing time for questions and comments. The plan will be presented to the following groups, organizations, politicians, etc.:

- Washington and Noble County Commissioners
- Noble and Washington Counties Annual Trustee Meetings
- Mayors and City within the watershed
- Caldwell and Marietta City Councils
- Washington and Noble County Health Departments
- Senator DeWine
- Congressman Strickland
- Representative Hollister
- Representative Stewart
- Kiwanis Clubs
- Rotary Clubs
- 4-H Council
- Washington County Natural History Organization
- Keepers of Duck Creek
- Kroger Wetland Working Group
- Noble County Planning Commission
- Noble County Retail Merchants Association
- Noble and Washington Emergency Management Agencies
- Noble and Washington County Farm Bureau
- Washington and Noble OSU Extension Advisory Committees
- Washington County Planning Commission
- Board of Realtors

A copy of the plan will be available at the Noble, Washington, Guernsey and Monroe County Libraries and Soil and Water Conservation Districts. See the reference section for complete lists and addresses of Libraries in the watershed. Interested parties will have the opportunity to obtain the management plan on-line at the Washington Soil and Water Conservation District website (www.washingtonswcd.org) or the Ohio Watershed Network website (www.ohiowatersheds.osu.edu). Various media outlets will be utilized to disseminate the Duck Creek Watershed Management Plan. They include: Duck Creek Watershed Newsletter, Washington SWCD Newsletter, Noble SWCD Newsletter, Marietta Times Newspaper, The Journal Leader Newspaper, and WMOA Radio. Watershed tours, field days and a planned canoe club will facilitate long term public understanding and encourage early and continued participation in the plan.

Educational Philosophy

The Duck Creek Watershed Advisory Committee believes that education and outreach are two of the most important issues that we will face in the Duck Creek Watershed. The lack of education and outreach in the past has led to the majority of community members not fully understanding the value of a clean, healthy and sustainable watershed. Therefore, the Duck Creek Watershed Partnership will take an interdisciplinary approach in disseminating the Watershed Management Plan and increasing education and outreach throughout the watershed. Our plan will attempt to reach the majority of the Duck Creek community in a variety of different ways. For instance, field days and tours were conducted in the past with the focus being primarily on water quality and the benefits of surface mining reclamation. Clean up days and construction of log pole structures has also been demonstrated as a vital asset in the education/outreach to the public. Focusing again on water quality and how the public, of all ages, can help improve the environment. The partnership realizes we will have to continue offering a wide variety of educational opportunities (media, meetings, field days and tours) to reach different demographics. For example, people that attend public meetings may not be the same people that attend outside activities such as field days and tours. Reaching out to the elementary and high school children throughout the watershed is also a high priority. The school children are the future landowners, business owners, politicians, residents and agency personnel of the Duck Creek Watershed; therefore it is vital that we reach them at an early age.

Future Areas of Emphasis

In the coming months and years the partnership will continue similar educational and outreach activities as shown in **Table 6 Description of Field Days and Tours**. However, we would like to broaden our scope of activities to include a canoe club, a biannual trash clean sweep, training/information sessions that target concerns in the watershed and establishing working relationships with local high schools and colleges.

- Establishing a **Duck Creek Canoe Club** will encourage residents to get out into the water and take advantage of the recreational opportunities Duck Creek provides. Ideally, residents will gain a better understanding of the watershed as a whole and begin to take ownership of the water quality in the streams. Floating in a canoe provides the residents a view of the watershed that driving in a vehicle cannot duplicate.

- **Biannual trash clean sweeps** will take place in April and again October of 2004. Winter and spring floods deposit large amount of trash and debris along the banks of Duck Creek. Organizing a clean sweep twice a year will improve aesthetics and more importantly, encourage residents to take an active role in improving their watershed.
- **Training/information sessions** that target major water quality impairments and concerns residents have about the watershed. Flooding, dredging, importance of riparian vegetation (bank stabilization), agriculture practices and septic systems have been prioritized as educational areas of concentration for the Duck Creek Partnership. Considering their importance to watershed residents and water quality, these concerns will be addressed in the training/information sessions. For example, the training/information session on septic systems will involve representatives from local health departments that will describe basic features of septic systems, common problems and maintenance tips that will prevent future problems. The training will highlight water quality issues that can arise from malfunctioning septic systems.
- **Establish working relationships with local high schools and colleges.** The current Education Specialists at the local SWCD's have established great relationships with the elementary schools in the watershed. This has provided the Duck Creek Partnership with an excellent forum to educate the younger school children in the watershed. The partnership would like to establish the same relationship with Marietta College, Washington State Community College, Marietta High School and Caldwell High School. Establishing relationships with local colleges and high schools will allow us to reach the older students and utilize the resources that are available at colleges.

WATERSHED INVENTORY

DESCRIPTION OF WATERSHED

GEOLOGY

Geologic Features

The watershed lies in the unglaciated Central Allegheny Plateau land resource area. The major part of the watershed lies in the dissected Pennsylvanian rocks of the Conemaugh formation. These are principally interbedded shales and sandstone, which contain economically recoverable deposits of coal. Minor beds of limestone also occur in the northern half of the area. The Monongahela formation of Pennsylvanian age dominates the upper elevations in the southern part of the watershed where interbedded shales and sandstone are the principal residual rocks. Coal is found in the sequence and is being recovered by modern strip-mining methods. Currently, strip-mining practices are active in the watershed. In the West Fork of Duck Creek, East Fork below Middle Fork, and Middle Fork Duck Creek are the locations of active strip-mining practices. No prehistoric buried valleys occur in the watershed.

Topography

The topography is steep from the flood plain to the divide on the west, with moderately steep lands in the tributary headwater areas to the north and east. The stream pattern of Duck Creek is branching, with steep gradients in the many minor laterals as they descend to the main stem and flood plains that are relatively flat (USDA Washington and Noble Soil Surveys). According to the Gazetteer of Ohio Streams (ODNR, Division of Surface Water) the Duck Creek Watershed has an average gradient of 8.2 ft/mile, however this does not represent the watershed as a whole. For example, 29 tributaries are significantly steeper with an average gradient of 75.5(ft./mile) while the five main branches (Paw Paw, Duck Creek, West Fork, East Fork and Middle Fork) have an average gradient of 19.6 (ft./mile). This illustrates that the steep tributaries drain into slightly sloping main branches. Refer to the **Map 3: Shaded Relief Map** to visually see the topography of the watershed. For increased detail the following USGS Quadrangle Topographic Maps make up the Duck Creek Watershed: Marietta OH-WV, Caldwell North OH, Sarahsville OH, Stafford OH, Belmont WV-OH, Lower Salem OH, Caldwell South OH, Summerfield OH, Dalzell OH, Macksburg,OH

Soils

The soils that make up Duck Creek vary from headwaters to the mouth throughout the watershed. Duck Creek lies within Region 12 on the Ohio Department of Natural Resources' (ODNR) Soil Regions of Ohio map, which was generalized from the Natural Resource Conservation Service (NRCS) statewide geographic soil database known as STATSGO. Region 12 extends across parts of 13 counties, but it is identified by four soil series that are common in the watershed: Gilpin, Upshur, Lowell, and Guernsey. Soils in this region are formed from acidic sedimentary rocks, mainly sandstone, siltstone, limestone, and shale. Soils with clayey, red or yellowish brown subsoil are common in region 12. The STATSGO database recognizes soil series in associations identifying smaller areas that have a distinctive pattern, relief, and drainage, typically with a unique landscape. There are eight STATSGO soil associations that are found within the Duck Creek Watershed (**Map 4 - STATSGO Soils Map**). Descriptions for soil

series in the following soil associations can be found in the Washington or Noble County *USDA Soil Survey*.

- **Berks-Zanesville-Vandalia Association** is considered moderately deep and deep, moderately steep to very steep, well-drained and moderately well drained soils formed in residuum and colluvium derived from shale. The Berks-Zanesville-Vandalia association consists of narrow ridgetops, dissected hillsides, footslopes, and long slopes with some benched slopes. Slopes range from 15 to 70 percent and hillside slips are common. The composition of this association is about 35% Berks soils, 20% Vandalia soils, 10% Zanesville soils, and 35% soils of minor extent. Common landuses for this association includes hay, pastureland or woodland. In general, this association has major landuse limitations due to its high shrink swell potential, slope, bedrock between depths of 20 and 40 inches, seasonal wetness, droughtiness, moderately slow or slow permeability, and erosion and slippage hazards. Specifically, cropland and urban development would not be suitable for this association.
- **Gilpin-Upshur-Lowell Association** is considered moderately deep and deep, strongly sloping to very steep, well-drained soils formed in colluvium and residuum derived from siltstone, sandstone, shale and limestone. Most slopes are long with benches that range from 8 to 79 percent. The soils in this association are on rounded ridgetops and hillsides, while small streams drain most areas. This association is composed of 35% Gilpin, 15% Lowell, 15% Upshur and 35% soils of minor extent. In general, this association is used for cropland, pastureland or woodland. However, the steeper soils are generally unsuited to row crops, small grain, hay, pasture, and urban areas. Major landuse limitations include moderately slow or slow permeability, droughtiness, erosion hazard, slope, high shrink-swell potential, bedrock between depths of 20 and 40 inches, and slippage hazards.
- **Guernsey-Vandalia-Elba Association** is a deep soil, nearly level to very steep, moderately well drained and well-drained soils formed in colluvium and residuum derived from limestone, shale and siltstone. Ridgetops and hillsides make up this association where hillside slips are common and the slope ranges from 1 to 70 percent. The composition of this association is about 40% Guernsey soils, 25% Vandalia soils, 15% Elba soils, and 20% soils of minor extent. Level ridgetops are well or moderately suited to corn and small grain, well suited to hay and pasture and moderately suited to building site development. Soils on steep hillsides are unsuitable to cropland, pasture and urban uses. All soils in this association are well or moderately suited to woodland. Major landuse limitations of this association include erosion and slippage hazards, slope, seasonal wetness, moderately slow or slow permeability, and high shrink-swell potential.
- **Lowell-Barkcamp-Enoch Association** is a moderately deep and deep, nearly level to very steep, well-drained soils formed in siltstone, sandstone, and shale residuum and in ultra acid material mixed by surface mining. This association is located on hillsides, ridgetops and mine-spoil benches, with slopes ranging from 0 to 70 percent. Additionally, surface mining has created spoil ridges and highwalls of exposed bedrock. This association is composed of 45% Lowell soils, 10% Barkcamp soils, 10% Enoch soils, and 35% soils of minor extent. In unmined areas Lowell soils are used as cropland, pastureland, and woodland. In mined areas

vegetation is sparse as the land is left idle. Lowell soils that are less sloping are moderately suited to corn, small grain, and building site development. Steeper areas of Lowell soils are unsuitable for urban, crop and pastureland uses. Woodlands are well or moderately suited to Lowell soils. Some areas with Enoch and Barkcamp soils are suitable for urban uses after the soil has settled. Conversely, they are unsuited for cropland and pastureland. Major landuse limitations are slope, erosion hazard, moderately slow permeability and droughtiness. Specifically, the Barkcamp and Enoch soils are limited by increased stoniness, while Lowell soils are limited by bedrock between depths 20 and 40 inches. In addition, due to Barkcamp's moderately rapid or rapid permeability rate on-site waste disposal is hazardous.

- **Lowell-Gilpin-Upshur Association** is reddish clayey soils formed in residuum from shale, brownish loamy soils formed in residuum from siltstone, and brownish clayey soils formed in residuum from limestone, siltstone on shale on side slopes and ridgetops. The streams found in this association are small with narrow valleys. Steep and very steep sideslopes, and rolling and sloping ridgetops that are generally narrow and uneven are common in the Lowell-Gilpin-Upshur Association. This association is composed of 35% Lowell, 25% Gilpin, and 10% Upshur soils and 30% soils of minor extent. The majority of this association was cleared and farmed at one time is now idle or in brush and woodland. Most current farming occurs in valleys and on ridgetops and consists of mainly beef cattle and to a lesser extent, dairy farms. Approximately 65% of this association is wooded. Specifically, Lowell soils are well suited to pasture because it is higher in natural nutrient supply. The main landuse limitations for non-farm use in this association include slope, slow or very slow permeability and hazards of slips.
- **Mentor-Watertown-Huntington Association** is brownish loamy and sandy soils formed in waterlaid material on terraces and floodplains. This association is a band 50 miles long and ½ to 1 mile wide between the Ohio River and the very steep valley walls. Two levels of low terraces of glacial outwash and alluvium as well as floodplains make up this landscape. This composition of this association is 20% Mentor soils, 10% Watertown soils, 8% Huntington soils and 62% soils of minor extent. Farming, transportation, industry and urban uses are the most common landuses in this association. The only limitation to non-farm landuses is the constant threat of flooding. Gravel sources are plentiful throughout this association.
- **Morristown-Gilpin-Lowell Association** is deep and moderately deep, nearly level to very steep, well drained soils formed in clacareous material mixed by surface mining and in colluvium and residuum derived from limestone, siltstone, sandstone and shale. Coal mining has occurred extensively in this association where the landscape consists of hillsides and narrow to broad ridges. Small, intermittent tributaries with narrow flood plains drain this association. Slopes in this association range from 0 to 70 percent and slips are common on the steeper slopes. The composition of this association is 50% Morristown soils, 15% Gilpin soils, 10% Lowell soils and 25% soil of minor extent. Pasture or cropland is commonly found on the ridgetops while the hillsides are usually wooded. The less sloping parts of ridgetops are poorly suited or moderately suited to corn, small grain, and building development, however they are well or moderately suited to hay and pasture. The steeper soils in this association are not suitable for urban uses, cropland and pasture. Major landuse

limitations in this association include moderately slow permeability, bedrock between depths of 20 and 40 inches, slope, droughtiness and erosion hazards.

- **Upshur-Gilpin-Otwell Association** is brownish loamy soils formed in residuum from siltstone and reddish clayey soils formed in residuum from shale on side slopes and brownish loamy soils formed in water-laid material on terrace remnants. This association is on wide, gently sloping to sloping ridgetops, terrace remnants and moderately steep to very steep side slopes. The composition of this association is 30% Upshur soils, 20% Gilpin soils, 10% Otwell soils and 40% soil of minor extent. Approximately one-third of the association is made up of ridgetops and high terrace remnants. The predominant landuses of the Upshur-Gilpin-Otwell association include cropland, woodland and pastureland. Limitations for farm and non-farm use include severe erosion hazard, steep to very steep slopes, moderate depth over bedrock, and slip hazards.
- **Chagrin Series** is not listed in the STATSGO associations (**Map 4 –STATSGO Map**) because the STATSGO data is at a coarser scale than the detailed soil maps, which show that the Chagrin Series is the most common soil found near the streams within the Duck Creek Watershed. According to the *NRCS Soil Survey* of Washington and Noble Counties, the Chagrin soil is deep, nearly level, well drained, and located on flood plains where slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 300 to 800 acres. The majority of this soil series is used for corn, hay or pasture, and to a lesser extent woodlands. The main limitation of landuse for Chagrin soils is flooding. For example, the soil is not suitable for small buildings and septic tank absorption fields because of constant flooding events. Recreational development however, is well suited to this soil series because of the lack of infrastructure involved in most recreation. If excavation is necessary, instability is a hazard that must be accounted for.

Based on the extent of the associations in the sub-watersheds and the composition of soils in the associations, several generalizations can be made. Soils with a clayey subsoil are most dominant in the Lower Duck Creek sub-watershed, and they make up about half to two-thirds of all other sub-watersheds, except the Headwaters West Fork sub-watershed. Ultra acid, sparsely vegetated surface mined areas cover about ten percent of the West Fork, East Fork above Middle fork, and Middle Fork sub-watersheds. Calcareous, well-vegetated surface mined areas cover about ten percent of the Headwaters West sub-watershed.

Septic Tank Absorption Fields are an increasing concern in the Duck Creek Watershed. Malfunctioning septic tanks have had an adverse affect on the water quality in some parts of the watershed. The placement of septic tank absorption fields is critical for the system to function properly. Landowners and developers must research the site for proper soil type and flooding rates, and also contact their local health department prior to installing a septic system. To obtain proper soil information, contact your local Soil and Water Conservation District to obtain the *NRCS Soil Survey*. See the reference section for complete lists and addresses of SWCD Districts in the watershed.

The Sanitary Facilities Table in the *NRCS Soil Survey* of Washington and Noble Counties shows the degree and kind of soil limitations that affect septic tank absorption fields. According to the

soil survey tables the majority of the soil series named as part of the STATSGO soil associations in the Duck Creek Watershed have severe limitations that affect septic tank absorption fields (**Table 8**). A soil has severe limitations “if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required (NRCS Soil Survey)”. To observe the degree and kind of soil limitations that affect septic tank absorption fields in Duck Creek Watershed Refer to **Table 8: Soil Limitations for Septic Tank Absorption Fields**.

Highly Erodible Soils are a primary concern for the Duck Creek Watershed because our number one cause of impairment is due to sediment/siltation. Using slope and individual soil types, soils are classified by the NRCS into one of three categories: Highly Erodible Land (HEL), Potential Highly Erodible Land (PHEL), and Non Highly Erodible Land (NHEL; NRCS: Jon Bourdon, Washington County District Conservationist and Kim Ray, Noble County District Conservationist). Utilizing these classifications the Duck Creek Watershed was assessed to determine the amount of Highly Erodible Land by 14-digit subwatershed. **Table 8: Non Point Source Pollution & Potential Causes** shows the acreage and percentage of HEL for each of the 9 subwatersheds in Duck Creek. A map was not produced at this time because of incomplete Spatial Soil Data from ODNR. **Table 8** indicates the number of acres that are missing per subwatershed. Once all data are available a HEL soils map will produced to illustrate the HEL, PHEL and NHEL areas within the watershed. This map will assist landowners in recognizing the need to implement proper measures to reduce erosion in the Duck Creek Watershed. For example, if a landowner owns land that has HEL, they would need to incorporate Best Management Practices (BMP’s). Some BMP’s that would reduce erosion in cropland includes no till, field strips, hayland plantings, etc. Pastureland BMP’s would include woodland exclusion, stream exclusion, off stream watering sites, etc.

Table 8: Soil Limitations for Septic Tank Absorption Fields

Soil Name	Septic Tank Absorption Fields
Berks	Severe: thin layer, seepage, slope
Zanesville	Severe: wetness, percs slowly
Vandalia	Severe: slope, percs slowly, slippage
Gilpin	Severe: thin layer, seepage, slope
Upshur	Severe: slope, percs slowly, slippage,
Lowell	Severe: percs slowly, slope
Guernsey	Severe: wetness, percs slowly, slope
Elba	Severe: slope, percs slowly
Barkcamp	Severe: poor filter, unstable fill, slope
Enoch	Severe: unstable fill, slope, percs slowly,
Mentor	Slight
Watertown	Slight to Moderate: slope, poor filter
Huntington	Severe: subject to flooding
Morristown	Severe: percs slowly, slope, unstable fill
Otwell	Severe: slow permeability

Chagrin	Severe: flooding
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Severe: if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required

Moderate: if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations

Slight: if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome

Glacial History

The Duck Creek Watershed is located in the Unglaciaded Allegheny Plateau portion of Ohio. The Unglaciaded Appalachian Plateau makes up most of southeastern Ohio. Soils in this area often are low in fertility and acidic. The hilly nature of the area results in many problems with erosion. Specifically, the soils in the watershed have formed in material weathered from sedimentary rocks of Pennsylvanian and Permian geologic age. In small-localized areas the soils have weathered in place or have been transported by flowing water. To a larger extent, material weathered from rocks has moved down slope by a combination of gravity and local water flow (*USDA Soil Survey*).

Glaciers did not physically cover the watershed in the past, however current drainage patterns show their influence. Prior to glaciation, the majority of present day Duck Creek flowed to the southwest through Marietta River. The Marietta River flowed south then west and joined the Teays River, which was the major stream in the region of that time (Stout, 1938).

BIOLOGICAL FEATURES

Rare, threatened, endangered, invasive and nonnative species including fish, mussels, invertebrates, mammals, birds, reptiles, amphibians and plants.

Federal Species

According to the US Fish and Wildlife Service before a plant or animal can receive protection under the Endangered Species Act it must be placed on the Federal list of endangered and threatened wildlife and plants. The state of Ohio currently has 26 species that are considered endangered or threatened (US Fish and Wildlife Service). The Duck Creek Watershed (Washington, Noble, Guernsey and Monroe Counties) has four species that are listed as Endangered or Threatened Species and one species that is being evaluated for candidate status. A species is considered **endangered** when an animal or plant is in danger of extinction within the foreseeable future throughout all or a significant portion of its range. A species is considered **threatened** when an animal or plant is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

The following federally listed Species are found in the watershed:

- Indiana bat (*Myotis sodalis*).....Endangered
- Bald eagle (*Haliaeetus leucocephalus*).....Threatened
- Fanshell mussel (*Cyprogenia stegaria*).....Endangered
- Pink mucket pearly mussel (*Lampsilis abrupta*)...Endangered

- Sheepnose mussel (*Plethobasus cyphus*).....Being evaluated for candidate status

The Timber Rattlesnake is considered a pre-listed federal status species, which requires a conservation plan to be developed (US Fish and Wildlife Service). The plan will work towards keeping the species from being listed as endangered or threatened.

State Species

The ONDR Division of Natural Areas and Preserves records known locations of rare plants and animals, high quality of plant communities and other natural features. ODNR’s data base began in 1976 and currently contains over 13,000 records. A search was requested and preformed within the Duck Creek Watershed by ODNR Division of Natural Areas and Preserves. The search results indicate one perennial forb plant species, one deciduous tree species and two fish species are located in the Duck Creek Watershed. ODNR Division of Natural Areas and Preserves classifies the species found in Duck Creek, into one of the following designations:

A species is considered **Threatened** if it meets one or more of the following criteria:

- a species or subspecies whose survival in Ohio is not in immediate jeopardy, but to which a threat exists
- continued or increases stress will result in its becoming endangered
- a federally threatened species extant in Ohio but not on the endangered species list

A species is considered **Potentially Threatened** if it meets one or more of the following criteria:

- species is extant in Ohio and does not qualify as a endangered or threatened species, but is a proposed federal endangered or threatened species or a species listed in the *Federal Register* as under review for such a purpose.
- natural populations of the species are imperiled to the extent that the species could conceivably become a threatened species in Ohio within the foreseeable future
- natural population of the species, even though they are not threatened in Ohio at the time of designation, are believed to be declining in abundance or vitality at a significant rate throughout all or large portions of the state

A species is considered a **Species of Concern** if it meets one or more of the following criteria:

- a species or subspecies which might become threatened in Ohio under continued or increased stress
- a species or subspecies for which there is some concern but for which information is insufficient to permit an adequate status evaluation

The following state listed Species are found in the watershed:

- Narrow-leaved Pinweed (*Lechea tenuifolia*).....Threatened
- Butternut (*Juglans cinerea*).....Potentially Threatened
- River Redhorse (*Moxostoma carinatum*).....Species of Concern
- Eastern Sand Darter (*Ammocrypta pellucida*).....Species of Concern

Plant Communities

The ODNR Division of Natural Areas and Preserves also monitors plant communities, considered to be “high quality or rare”. The following are the three plant communities in the watershed that are considered “high quality or rare”:

Mixed mesophytic forest: Johnny Woods River

- 7-acre forest, dominant trees include sugar maple (70%), scattered hemlock, red oak, and yellow buckeye
- all trees are under 50 cm dbh
- located in Noble County, Noble Township within the east-central quarter of Section 6 and west-central quarter of Section 5
- located on a northwest facing slope between the 800-900 ft. contours on the south side of Johnny Woods River

Mixed mesophytic forest: Zimmer Woods

- 7-acre forest, dominant trees include tulip poplar (rel. den. 22%), sugar maple (rel. den. 21%) and beech (rel. den. 21%)
- diverse canopy, no recent disturbance and adjacent to floodplain forest makes this the best area in the watershed
- located in Washington County, Fearing Township within the southeastern quarter of Section 20

Floodplain Forest: Zimmer Wet Woods

- 7-acre forest, dominant trees include tulip poplar (rel. den. 21%) and sycamore (rel. den. 21%)
- important trees include box elder (rel. den. 14%) and sugar maple (rel. den. 14%)
- adjacent to mixed mesophytic forest (Zimmer Woods)
- located in Washington County, Fearing Township within the southeastern quarter of Section 20

Invasive, Non-native Species and Potential Impacts

The threat of invasive species colonizing our streams is increasing due to our global economy and trade. Non-native, invasive species like the Zebra Mussel, that adversely affect diversity and water quality of streams has not colonized Duck Creek at this time. In the coming years we may have to deal with exotic species invading the streams causing another suite of problems for our watershed (USDA- invasive species website).

Plants

The invasion of non-native plant species and the displacement of native species is a growing concern throughout the world. Specifically, Multiflora Rose (*Rosa multiflora*), Japanese Honeysuckle (*Lonicera japonica*) and Autumn Olive (*Eleagnus umbellata*) are the most problematic non-native, invasive plants found in the Duck Creek Watershed. Each plant was introduced and thrives in its non-native habitat because of multiple reproductive methods and a lack of natural competition. For example, Multiflora Rose has been successful because it

reproduces by producing an abundance of berries widely dispersed by birds and vigorous vegetative growth called tip layering (USDA- invasive species website). Many ecologists fear non-native, invasive plants will displace native plant species and create a monoculture that lacks diversity. In the Duck Creek Watershed non-native, invasive plants have colonized edge type of microclimates and some forest ecosystems but they have not adversely affected the quality of The Duck Creek Watershed.

Aquatics

The US Fish Commission introduced carp to Ohio waters in 1879. They were originally stocked in ponds of private landowners, but later escaped into streams. Currently, carp can be found in most low-gradient warm water streams, lakes and reservoirs throughout the state. The Ohio EPA found 30 carp in Duck Creek Watershed in 2000, during biological fish sampling for a Total Maximum Daily Load study (TMDL). Carp does especially well in areas of septic discharge and excessive vegetation. Feeding habits, or digging through sediment, often leads to increased turbidity. Large numbers of carp often indicates poor water quality due to its tolerance of pollutants and low Dissolve Oxygen (DO) levels (Chad Amos, ODNR-DSWC, 2003).

Managed Areas (for the locations of all public lands see Map 1: Watershed and Public Lands) ODNR & US Division of Forestry Managed Areas

Ales Run Wildlife Area is located in Jefferson Township, within Noble County in the East Fork below Middle Fork Subwatershed. The 2,905-acre wildlife area is managed by ODNR, Division of Wildlife and provides valuable wildlife habitat and hunting opportunities. Landuses are strictly limited to those that provide wildlife habitat. White-tailed deer, gray squirrel, ruffed grouse and wild turkey are the most popular wildlife species hunted at the wildlife area. Trapping is permitted for all legal species except beaver, which is permitted with special permit issued by the Division of Wildlife. Streams within the wildlife area are protected from all other landuses.

In the past however, 60% of Ales Run Wildlife Area has been surface mined for coal, prior to reclamation laws (pre 1972). The pre reclamation mining has left highwalls and spoil banks, consequently affecting the water quality of the stream (ONDR, Division of Mineral Resource Management & Division of Wildlife). B& N Coal Inc. purchased the property somewhere between the 1950-1960's and completed its mining operations in the 1970's. The coal removed from the basin was predominantly used to fuel electric producing utility companies in Ohio (ONDR Division of Wildlife).

In 1987 B& N Coal and the Division of Wildlife reached an agreement that allowed the land to be managed by the Division for wildlife management activities and provide permits for free hunting, fishing and trapping (ONDR Division of Wildlife). In May of 2000 the land was officially acquired from B&N Coal and named Ales Run.

- ***Wolf Run Lake*** was officially dedicated as a state park in 1968. Ohio Department of Natural Resources manages the 1,266-acre park, including the 214-acre lake as outlined in the *Historic and Cultural Resources* section of this plan. The lake is a secondary source of water for the village of Caldwell and portions of Noble County (see *Public Water* in next section of plan). Damming Wolf Run tributary and three unnamed tributaries created Wolf Run Lake;

resulting in a total of 2.93 stream miles that are dammed (see **Map 1: Watershed & Public Lands and Appendix 3: Dams, Lakes and Ponds Inventory**).

Non-ODNR Managed Areas

- American Electric Power manages 45,322.94 acres of ReCreation Lands in the Duck Creek Watershed
- US Forest Service manages 2,570.61 acres of Wayne National Forest (Marietta District) in the Duck Creek Watershed

WATER RESOURCES

Climate and Precipitation

In general, the watershed's climate is continental, moist-temperate. The watershed has a mean annual precipitation of 38 inches, with the greatest amount of precipitation occurring in May and June. On average the watershed has an annual snowfall of 26-inches. There is a wide range of air temperatures in Duck Creek because of our continental location and the absence of a large body of water. The mean annual temperature is 52° F, the mean annual maximum temperature is 64° F and the mean annual minimum temperature is 40.5°F. A mean maximum temperature of 74° F occurs in July and August, while a mean minimum temperature of 29° F occurs in January. The average date of the first killing frost is October 11 and the date of the last killing frost is May 8. An average 156 days comprise the frost-free season in the Duck Creek Watershed.

Surface Water

Wetlands

According to the Multi-Resolution Land Characterization (MRLC) database wetlands make up .135% (206 acres) of the watershed. Of the total percent of wetlands in the watershed, woody wetlands make up .1% (139 acres) and emergent herbaceous wetlands make up .035% (67 acres). Wetland acreage data is shown in **Table 1** and **Map 2** shows the location of woody wetlands and emergent herbaceous wetlands throughout the watershed.

Streams

The Gazetteer of Ohio Streams states that the Duck Creek Watershed has 34 named tributaries totaling 227.8 stream miles. The two main branches of Duck Creek are the West Fork (35 mi.) and East Fork (30 mi.). Two primary tributaries, Middle Fork (13.8 mi.) and Paw Paw Creek (11.6 mi.), flow into the East Fork near Middleburg and Lower Salem, respectively. The West Fork begins north of Belle Valley while the East Fork's origin is near Summerfield. These two main branches converge between Warner and Lower Salem to form the mainstem (24.3 mi.), and then flows into the Ohio River at Marietta. The stream pattern of Duck Creek is branching, with steep gradients in the many minor laterals as they descend to the main and tributary flood plains. Duck Creek Watershed has a drainage area of 285.6 square miles (182,952.3 acres) and has a gradient of 8.2 feet/mile (**Map 1**). **Table 9: Main Branch Statistics** shows drainage, flow, length and gradient of the main branches within the watershed.

Table 9: Main Branch Statistics

Stream Name	Drainage (mi ²)	Avg. Flow (cfs)*	Length (ft.)	Avg. Gradient (ft/mi)
Duck Creek (Includes East Fork)	285.6	286.15	51.5	8.2
West Fork	106	105.15	36.5	7.8
East Fork	135.6	134.84	29.5	12.5
Middle Fork	26.5	25.93	13.8	31.6
Paw Paw Creek	23.5	22.96	11.6	38

*Calculated using a USGS best-fit equation for estimating selected streamflow statistics in Ohio (G.F. Koltun and M.T. Whitehead, U.S. Geological Survey).

Hydrological Unit Codes (HUCs)

Watersheds of this size are difficult to manage and organize; therefore they are studied on a subwatershed basis. For management purposes watersheds are broken down into smaller areas called **Hydrological Unit Codes (HUCs)**. The Duck Creek Watershed is represented by 2 eleven digit HUCs. The East Fork's HUC is 5030201 110 (includes East Fork, Middle Fork and Paw Paw Creek), and the West Fork's HUC is 5030201 120 (includes West Fork to mainstem and into the Ohio River). These two HUCs are again divided into 9 fourteen digit HUCs. For a description and size of the nine 14-digit HUCs refer to **Table 10: Subwatersheds by 14 Digit Hydrological Unit Codes (HUC), Map 5: Subwatersheds and Overlay Transparency 1: HUC Subwatersheds**.

Table 10: Subwatersheds by 14 Digit Hydrological Unit Codes (HUC)

14 Digit HUC's	Description	Acres	Square Miles
05030201-120-040	Lower Duck Creek	11,855.7	18.5
05030201-120-030	Upper Duck Creek	15,817.7	24.7
05030201-120-020	West Fork	19,870.6	31.0
05030201-110-050	Paw Paw Creek	14,996.4	23.4
05030201-110-030	Middle Fork	16,982.7	26.5
05030201-110-010	Headwaters East Fork	20,249.7	31.6
05030201-110-020	East Fork above Middle Fork	25,783.6	40.3
05030201-110-040	East Fork below Middle Fork	9,176.4	14.3
05030201-120-010	Headwaters West Fork	48,219.5	75.3
TOTALS		182,952.3	285.6

Subwatershed and Tributary Information

Additional 14-digit subwatershed and tributary information concerning drainage, flow, length and gradient can be found in **Appendix 4: 14 Digit Subwatershed HUC Stream Statistics**.

- **Flow:** *there is no continuous flow data for the Duck Creek Watershed; therefore a USGS formula was used to calculate flow for the 14-digit subwatersheds (Appendix 4). The data was calculated using a USGS best-fit equation for estimating selected streamflow statistics in Ohio (G.F. Koltun and M.T. Whitehead, U.S. Geological Survey). In addition, a neighboring watershed's flow data was used to simulate Duck Creek's total in-stream flow, as well as other basin wide flow parameters (Table 10- Comparison of simulated and observed flow for 1981 to 1985, OEPA). According to the Ohio EPA this is an appropriate practice when*

the two watersheds are located close to one another and have similar land use and soil characteristics. The Upper Raccoon Creek watershed was chosen for its proximity to the Duck Creek watershed and its similar hydrologic characteristics. Both watersheds are located in southeast Ohio and the centers of each watershed are approximately 60 miles from one another. Additionally, land use in both watersheds is mostly forest and pastureland (Table 12: Land Use distribution for the Duck Creek and Raccoon Creek Watersheds). The Natural Resources Conservation Service has classified all soils according to their hydrologic characteristics. Soils in the same group have similar runoff potential under similar storm and cover conditions. For both the Duck Creek and Raccoon Creek watersheds, soil hydrologic group C is the dominant soil type. Soils in this hydrologic group are predominately clay loam soils; shallow sandy loams with a low permeability horizon impeding drainage (soils with high clay content), soils low in organic content. C group soils typically have slow infiltration rates, 0.05-0.15 in./hr. minimum infiltration capacity, when thoroughly wetted.

Table 11: Comparison of simulated and observed flow for 1981 to 1985, OEPA

Parameter	Duck Creek Data (cfs)	Parameter	Raccoon Creek Data (cfs)
Total Simulated In-stream Flow	146.06	Total Observed In-stream Flow	147.97
Total of highest 10% flows	67.66	Total of Observed highest 10% flows	67.4
Total of lowest 50% flows	15.64	Total of Observed lowest 50% flows	11.59
Simulated Summer Flow Volume: July, August and September	9.39	Observed Summer Flow Volume: July, August and September	5.97
Simulated Fall Flow Volume: October, November, and December	40.32	Observed Fall Flow Volume: October, November, and December	25.53
Simulated Winter Flow Volume: January, February and March	42.79	Observed Winter Flow Volume: January, February and March	53.79
Simulated Spring Flow Volume: April, May and June	53.56	Observed Spring Flow Volume: April, May and June	62.68
Total Simulated Storm Volume	141.61	Total Observed Storm Volume	145.47

Table 12: Land Use distribution for the Duck Creek and Raccoon Creek Watersheds

Land Use	Duck Creek		Raccoon Creek	
	Area (acres)	%	Area (acres)	%
Deciduous Forest	108,163	58.68	26,479	69.4
Pasture/Hay	52,753	28.61	6,240	16.4
Evergreen Forest	7,377	4.01	66	1.7
Row Crops	7,076	3.83	2,665	7
Mixed Forest	2,679	1.46	137	0.4
Low-Intensity Residential	1,659	0.9	355	0.9
Open Water	1,361	0.83	103	0.3
Transitional	1,330	0.72	968	2.5

High-Intensity Commercial	823	0.45	59	0.2
Quarries/Strip Mines/Gravel Pits	429	0.23	347	0.9
Other Grasses	316	0.17	55	0.1
High-Intensity Residential	182	0.1	33	0.1
Woody Wetlands	139	0.1	10	0.03
Emergent Herbaceous Wetlands	67	0.035	20	0.1
Total	184,354	100	38,136	100

- **10 year low flows:** due to the lack of flow data in the watershed 10-year low flow data was obtained from a USGS document titled Low-Flow Characteristics of Streams in Ohio through Water Year 1997, 2001. This document used the Little Muskingum River at Bloomfield, Ohio gauge as an index station for obtaining low flows for Duck Creek Watershed. 10-year low flows were determined at three sites within the watershed: Mainstem Duck Creek, East Fork and West Fork (**Table 12: 10 year low flows**).

Table 13: 10 year low flows (cfs)

Location	Period	Number of consecutive days	10-year low flow (cfs)
Main Stem Duck Creek at Stanleyville	Apr.-Mar.	1	0.7
	Apr.-Mar.	7	0.9
	Apr.-Mar.	30	2.1
	Apr.-Mar.	90	7.0
West Fork Duck Creek at Dexter City	Apr.-Mar.	1	0.2
	Apr.-Mar.	7	0.2
	Apr.-Mar.	30	0.5
	Apr.-Mar.	90	1.7
East Fork Duck Creek at Lower Salem	Apr.-Mar.	1	0.4
	Apr.-Mar.	7	0.6
	Apr.-Mar.	30	1.3
	Apr.-Mar.	90	4.0

Source: USGS; Low-Flow Characteristics of Streams in Ohio through Water Year 1997, 2001

100 Year Floodplain Area

The 100 year floodplain areas are indicated on **Map 6: 100-year floodplain map** and viewable by subwatershed using the subwatershed overlay of Duck Creek. Floodplain management and flooding are extremely important issues in the Duck Creek Watershed because they affect the majority of the stakeholder on a daily basis. For example, most major roads (including Interstate 77) follow or cross the streams along the floodplain of the watershed (**Map 6**). In addition, poor landuse planning has permitted structures to be built within the 100-year floodplain. Continued

development and filling of floodplains in the watershed will increase flooding rates and displace the floodwaters into new areas. In a recent survey, flooding was named the number one concern of stakeholders in the Duck Creek Watershed (see **Tables 5 and 6 and Chart 1**). Additionally, the Ohio EPA has found sediment to be the number one impairment within the watershed. The over abundance of sediment clogging the stream is directly correlated to chronic flooding and impaired water quality. The sustainability of the Duck Creek Watershed will depend on the reduction of sediment and the relating flooding, as well as managing floodplain filling and subsequent development.

Major Floods within the Duck Creek Watershed (Weekley 2003, Reconnaissance Study)

- July 14, 1913: this flood was regarded as the largest known flood within the watershed prior to the June 1998 flooding.
- August 1935: this flood produced an average of 7 feet of flood stage throughout the West Duck Fork Valley.
- March 1963: 2.5 inches of rainfall in 12 hours, on deeply frozen open ground produced an average 5 feet of flood stage inundating 2,750 acres through the valley. Flood damage in 1963 was estimated to be \$159,000.
- June 28-29, 1998: According to the USGS more than 10 inches of rain fell on the Duck Creek Watershed in a 96 hour period of time.

Flood of 1998

Many communities that border Duck Creek and its tributary streams (such as Belle Valley, Caldwell, Elba, Lower Salem, Macksburg, and Whipple) experienced severe flooding during June 1998, resulting in fatalities and extensive property damage. The USGS indirectly determined the peak discharge for Duck Creek by means of the slope-area method at a location approximately 7.7 miles downstream from the confluence of the East and West Forks of Duck Creek, in the community of Whipple. The slope-area calculations were based on data collected for about a 1,700 –ft-long stream segment whose upstream end was approximately 200 feet downstream from the confluence of Whipple Run and Duck Creek. The peak streamflow calculated for Duck Creek for this event is 41,600 CF/Sec. No streamflow data has been collected on Duck Creek from which to make a direct estimate of the flood recurrence interval; however, an estimate derived from the most current regional regression equations for estimating flood magnitude and frequency (Koltun and Roberts, 1990) indicated that the recurrence interval for the 1998 flood was greater than 100 years. The USGS surveyed 17 high water marks along the West Fork of Duck Creek as well as Duck Creek (Bill Weekley, Army Corps of Engineers)

- **Washington County – estimated \$10,000,000 damages countywide:** between the 27th and 29th of June 1998 Washington County was hit hard by flooding due to heavy runoff. The third night of thunderstorms was on Sunday the 28th into Monday the 29th. The Corps of Engineers at the Belleville Lock on the Ohio River at Reedsville measured 4 inches of rain in just 2.5 hours between 0400 and 0630 on the 28th. A presidential federal disaster declaration was made for Perry, Morgan, Washington, Athens, Meigs, and Jackson Counties. Between 500 and 600 dwellings were affected by the flood, the most being in Athens, Perry, and Washington Counties. In Washington County, the West Fork of Duck Creek rose some 20 feet and inundated the communities of Macksburg and Elba. The flooding in the headwaters around Caldwell and Dexter City of Noble County got worse as you traveled down the

stream into Washington County. In Macksburg, water was 4 feet in some homes. The community was without public water for 10 days. In the small community of Elba, 21 out of the 5 homes had damage. The floodwaters were swift here, and 1 home was forced 100 yards down Duck Creek. Further down the Duck Creek watershed, the East Fork meets the West Fork in the vicinity of Lower Salem and Warner. About 17 homes were flooded for 12 hours in Lower Salem. The combined waters of these forks inundated the Whipple region. The stream was 20 to 30 feet out of its banks. In the weeks following the flood, hay was still hanging from the elevated power lines along Route 821. A newly constructed church in Whipple had 5 feet of water inside. In Marietta, the damage from both the fallen trees and flooding was substantial. Several businesses were surprised, when storm sewers overflowed, or water came through roofs that were damaged by the wind. Stores on Second Street were especially hard hit by the flooding. The county engineer reported 18 county bridges washed out or damaged. The Ohio National Guard was in Washington County for 10 days following the flood. (Bill Weekley, Army Corps of Engineers)

- **Noble County – estimated \$10,000,000 in damages county wide**

The 1998 flood caused five deaths during the evening of the 27th and early morning hours of the 28th. In Caldwell, a 90-year-old man and 89-year-old woman were killed as flash flooding from the nearby Duck Creek washed part of their home away. Numerous roadways across the county were closed. However, two fatalities occurred as people tried to drive through water on the roads. Two more deaths occurred in Caldwell as a 71-year-old and 31-year-old men were killed when they tried to drive their cars through high water. In Belle Valley, a 37-year-old man was killed when he attempted to swim in the floodwaters of the West Fork of the Duck Creek after being stranded on the roof of a building. Several rescues by boat were required across the county. The hardest hit areas were the Mount Ephriam, Fredericksdale, Belle Valley, and Caldwell area. In addition to flooded private homes, many businesses in towns across the county suffered extensive damage, losing most of their inventory and equipment. (Bill Weekley, Army Corps of Engineers)

- 5 fatalities during 1998 flood
- Recurrence interval of 1998 flood was greater than 100 years
- Greater than 10 in. of rain in a 96 hr. period
- Peak stream flow (discharge): 41,600 ft³/s
- Destruction of Property
- Wolf Run Lake Emergency Spillway deficiency

Sinuosity

The majority of the Duck Creek Watershed has not been subjected to hydromodification (channelized or modified). This has allowed the watershed as a whole to maintain a natural channel with appropriate sinuosity. However, hydromodification has occurred at several segments throughout the watershed. Hydromodification is known as the alteration of the natural flow of water through a landscape, and often takes the form of channel modification or channelization. **Table 14: Physical Attributes of Streams** lists all sites by subwatershed, which have been subjected to hydromodification, therefore affecting sinuosity. Channel sinuosity is the ratio of stream channel length to valley distance. Concerning the main channels of Duck Creek, measurements taken from aerial photos using Arc View GIS indicate average sinuosity ratios of

1.3-1.4. Tributaries throughout the watershed have an average sinuosity ratio of 1.1. These sinuosity ratios are consistent to other streams of similar size and landuse in the Western Allegheny Plateau Ecoregion. (Bob Mulligan, ODNR-DSWC)

Entrenchment and Floodplain Connectivity

Entrenchment is a condition in which a stream begins to down-cut and contain water flow within the channel with little or no out of channel flooding. A stream must have adequate access to its floodplain in order for it to effectively transport and remove sediment loads from the aquatic system. When a stream floods and has access to its floodplain, it is able to deposit sediment into the floodplain. This effectively reduces the amount of sediment found in the normal stream channel. Entrenched streams typically do not have access to a sufficient floodplain to facilitate this process.

Watersheds that have been subjected to increased urbanization and development commonly result in entrenched streams. The large amount of impervious surfaces such as parking lots and roofs increase the peak storm water runoff within a watershed. Entrenchment is often an early indicator of a stream's response to this intense water discharge.

The Duck Creek Watershed has not experienced large-scale urban or industrial development, or suburban sprawl. As a result, entrenchment does not appear to be a significant problem at the current time. For example, landowners that own land or reside near floodplain areas comment frequently that Duck Creek is able to flow freely out of its banks when large precipitation events occur. In general, floodplains are subjected to flood events on average 5 to 6 times per year. There are however, a few locations where the filling of the floodplain has occurred, preventing the stream from accessing the floodplain. Refer to **Table 14** for the location by subwatershed where the stream does not have access to the floodplain. (Bob Mulligan, ODNR-DSWC)

Ohio Water Quality Standards

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the Clean Water Act's goal of "swimmable/fishable" waters.

Designated Use reflects how the water can potentially be used by humans and how well it supports a biological community. Every waterbody in Ohio has a designated use or uses; however, not all uses apply to all waters (i.e. they are waterbody specific).

- **Designated Uses and Subcategories for Surface Water (Ohio EPA)**

Aquatic Life

Exceptional Warm Water Habitat: capable of supporting and maintaining exceptional or unusual warmwater aquatic communities, most biologically productive.

Warmwater Habitat: capable of supporting and maintaining warmwater aquatic communities, typical for Ohio's rivers and streams.

Modified Warmwater Habitat: incapable of supporting and maintaining aquatic communities due to irretrievable habitat modifications.

Limited Resource Water Habitat: drainage <3 sq. miles, lack water or irretrievably altered, incapable of supporting and maintaining populations of coldwater aquatic organisms.

Coldwater Habitat: capable of supporting populations of coldwater aquatic organisms.

Water Body	<p><u>Public</u>: meets drinking water standards with conventional treatment.</p> <p><u>Agricultural</u>: suitable for irrigation and livestock watering without treatment.</p> <p><u>Industrial</u>: suitable for industrial and commercial use with or without treatment.</p>
Recreational	<p><u>Bathing Waters</u>: swimming areas with lifeguard, bathhouse and regular water testing.</p> <p><u>Primary Contact</u>: suitable for full body contact recreation (i.e. swimming or canoeing)</p> <p><u>Secondary Contact</u>: suitable for partial body contact recreation (i.e. wading)</p>
State Resource Water	Waters within park systems, scenic rivers, wetlands, and other ecologically significant areas.

Numeric Criteria includes chemical, physical and biological criteria that are set depending on a water bodies designated use. The ultimate determination of whether streams in the Duck Creek watershed are supporting their aquatic life use will be made by comparing observed biological data to Ohio’s biocriteria. The criteria for metals and sediment described below serve as the link between the desired biological conditions and the necessary water chemistry. The biocriteria that apply to the Duck Creek watershed are shown in **Table 15: Biological Criteria for the Western Allegheny Plateau**. The results of the most recent physical (QHEI) and biological (IBI, Miwb and ICI) water quality data can be referenced in **Appendix 5: Aquatic life use attainment status**. Chemical water data can be referenced in **Appendix 6: OEPA's Chemical Water Quality Sampling Data (Ohio EPA)**.

Site Type INDEX ^a	IBI*	IBI	IBI	Miwb*	Miwb	ICI*
	Headwaters	Wading	Boat	Wading	Boat	(all sites)
EWH Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH Habitat	24	24	24	6.2	5.8	22
LRW	18	18	18	4	4	8

^aOEPA use designations: EWH = exceptional warmwater habitat; WWH= warmwater habitat; MWH= marginal warmwater habitat; LRW=limited resource water.

*IBI=Index of Biotic Integrity; Miwb=Modified Index of well being; ICI=Invertebrate Community Index.

Source: OEPA, 2001.

- **Chemical** criteria represent the concentration of a pollutant that can be in the water and still protect the designated use of the waterbody.
- **Biological** criteria indicate the health of the in-stream biological community by using one of three indices:
 - Index of Biotic Integrity (IBI) (measures fish health).
 - Modified Index of well being (MIwb) (measures fish health).
 - Invertebrate Community Index (ICI) (measures bug or macroinvertebrate health)
- **Physical** criteria indicate the health and status of the stream habitat including the stream bottom, stream bank and adjacent landuse:
 - Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community
- **Numeric Water Quality Targets:** a TMDL was conducted on the Duck Creek Watershed from 2000-2003, by the Ohio EPA. A TMDL target is the quantitative value used to measure whether or not the applicable water quality standard is attained. TMDL targets must be the same as the numeric criteria expressed in water quality standards where such criteria exist, but site-specific targets should be identified in cases where only narrative criteria are available. The numeric targets that were used for the Duck Creek watershed are shown in **Table 16: Project Parameters & Numerical Targets of Water Quality Data**. The TMDL targets are explained below. (Keith Orr, Ohio EPA)

Table 16: Project Parameters & Numerical Targets of Water Quality Data

Parameters	Aquatic Use	Reference
pH	6.5-9.0	OEPA Rule 3745-1-07 ORC
Temp	8.3-29.4 Deg. Celsius	OEPA Rule 3745-1-07 ORC
Conductivity	<2400 micmhos/cm @23C	OEPA Rule 3745-1-07 ORC
DO	>5.0 mg/l	OEPA Rule 3745-1-07 ORC
T Phos	<0.10 mg/l	OEPA Study, 2003
T Nitrite-Nitrate	<1.0mg/l	OEPA Study, 2003
Fecal	None	None
Amonia (NH3)	1.1-13.0 mg/l (pH & Temp dependent)	OEPA Rule 3745-1-07 ORC
QHEI	> 60	Rankin 1991, OEPA
Miwb	> 8.4	Rankin 1991, OEPA
IBI	> 44 (variance of 4)	Rankin 1991, OEPA
ICI	> 36	Rankin 1991, OEPA
Total Aluminum	712.5 µg/L	USEPA, 1999
Total Iron	950 µg/L	USEPA, 1999
Total Manganese	950 µg/L	West Virginia TMDLs
Total Suspended Solids	8.0 mg/L	Reference reach approach

Ohio does not have numeric criteria for **aluminum**. Therefore, the national aquatic life standard of 750 µg/L was used as a basis for the Duck Creek aluminum TMDLs (USEPA, 1999). A 5 percent margin of safety (MOS) was introduced into the TMDL by basing the allocations on

meeting a target of 712.5 µg/L (750 µg/L minus 5 percent). A margin of safety is one of the required components of a TMDL.

Ohio does not have numeric criteria for **iron**. Therefore, the national aquatic life standard of 1,000 µg/L was used as the basis for the Duck Creek iron TMDLs (USEPA, 1999). A 5-percent MOS was introduced into the TMDL by basing the allocations on meeting a target of 950 µg/L (1,000 µg/L minus 5 percent).

Neither Ohio nor USEPA has established aquatic life criteria for **manganese**. A target of 1,000 µg/L was chosen based on best professional judgment. This value is the same as that used to develop numerous manganese TMDLs in mining affected watersheds in West Virginia and is believed to be protective of aquatic life. A 5 percent MOS was introduced into the TMDL by basing the allocations on meeting a target of 950 µg/L (1,000 µg/L minus 5 percent).

Ohio has established numeric criterion for **Dissolved Oxygen (DO)**. The Ohio Water Quality Standard establishes a target of 5.0 mg/l. This target is based on Ohio EPA's warmwater habitat water quality standard.

Neither Ohio nor USEPA has established aquatic life criteria for **total suspended solids (TSS)**. Average TSS concentrations in the upstream portions of Pawpaw Creek watershed were therefore used as a basis for the TMDL target because habitat conditions in these segments are among the best in the watershed. It should be noted that the primary concern in the impaired segments is stream bottom siltation for which TSS is an imperfect surrogate. Future monitoring should focus on collecting data such as cobble embeddedness or percent fine sediments as better indicators of the impairment. The average concentration of TSS in the upstream Pawpaw Creek segments was found to be 8 mg/L.

Narrative Criteria are the general water quality criteria that apply to all surface waters. These criteria state that all waters must be free from sludge; floating debris; oil and scum; color- and odor-producing materials; substances that are harmful to human, animal or aquatic life; and nutrients in concentrations that may cause algal blooms (Ohio EPA).

Antidegradation Policy establishes situations under which the director may allow new or increased discharges of pollutants, and requires those seeking to discharge additional pollutants to demonstrate an important social or economic need. Refer to <<http://www.epa.state.oh.us/dsw/wqs/wqs.html>> for more information (Ohio EPA).

Duck Creek's Use Designation

Waters in the Duck Creek watershed are considered impaired because they do not support their aquatic life use designation. Most streams in the watershed are designated for Warm Water Habitat (WWH) aquatic life use support, although Pawpaw Creek is an Exceptional EWH stream. Waters designated as WWH are capable of supporting and maintaining a balanced integrated community of warmwater aquatic organisms. Waters designated as EWH are capable of supporting "exceptional or unusual" assemblages of aquatic organisms that are characterized by a wide diversity of species, particularly those which are highly pollutant intolerant and/or are rare, threatened, or endangered. According to OEPA, attainment of aquatic life uses in Ohio is measured in two ways. First, water chemistry is compared to the available numeric criteria. For

example, DO in streams designated as WWH must average at least 5 mg/L. Second, the measured biological scores are compared to those seen in the least impacted areas of the same ecological region and aquatic life use. Attainment benchmarks from these least impacted areas are established in the form of “biocriteria,” which are then compared to the measurements obtained from the study area (**Table 14**). If the measurements of a stream do not achieve the biocriteria, the stream is considered in “nonattainment.” If the stream measurements achieve some of the biological criteria but not others, the stream is said to be in “partial-attainment.” (Keith Orr, Ohio EPA)

Lakes and Reservoirs (size, uses, watersheds, detention time)

There are many farm ponds of varying drainage and surface area throughout the watershed. However, the discussion of lakes and reservoirs within Duck Creek Watershed study area is limited to those structures included in ONDR’s Dam Safety inventory. There are 18 larger ponds/lakes that are inventoried by ONDR Division of Dam Safety. All information concerning these 18 structures can be found in **Appendix 3: Duck Creek Watershed Dams, Lakes and Ponds Inventory** (ONDR Division of Dam Safety inventory data, Rick Archer). Due to the size and storage of these structures, and the lack of resources available detention time (the time it takes for water to move through an impoundment) is not determined to be a factor affecting water quality and therefore is not included in this assessment.

There are two major lakes within the watershed that were constructed as part of the West Fork Duck Creek Watershed Work Plan as described in the *Past and Current Water Quality and Flood Prevention Efforts* section of this plan. These structures, ***Wolf Run Lake Dam and Caldwell Lake Dam***, control roughly 10.4 square miles of the watershed (**Map 1**). These two structures have a combined flood storage capacity of 720 acre-feet. The primary purpose of these dams is to control flooding in the subwatershed they are located in. Secondary purposes include providing a safe and reliable drinking water source to the local residents and provide recreational opportunities (**See Appendix 3**).

Wolf Run Lake was officially dedicated as a state park in 1968. Ohio Department of Natural Resources manages the 1,266-acre park, including the 214-acre lake as outlined in the *Historic and Cultural Resources* section of this plan. The lake is a secondary source of water for the village of Caldwell and portions of Noble County (see *Public Water* in next section of plan). Damming Wolf Run tributary and three unnamed tributaries created Wolf Run Lake; resulting in a total of 2.93 stream miles that are dammed (**Map 1 and Appendix 3**).

Caldwell Lake Reservoir was constructed in 1965 and is owned and managed by the Village of Caldwell. The 44-acre reservoir is the main source of water for the Village of Caldwell and portions of Noble County at the present time (see *Public Water* in next section of plan). Caldwell Lake Reservoir was formed by damming Dog Run tributary and three unnamed tributaries; resulting in a total of 1.52 stream miles that are dammed (**Map 1 and Appendix 3**).

Ground Water

According to the U.S. Geological Survey's National Water Summary of Ground Water in Ohio (1986), the groundwater aquifer in Duck Creek is composed of shaly sandstone and shale. This aquifer type has the smallest yield, 1 to 5 gallons/minute, of the productive aquifers in Ohio (USGS National Water Summary of Ground Water in Ohio, 1986). Even with relatively low yields, these aquifers are very important to watershed residents because they provide the only practical and reliable water supply. Most of the groundwater from the shaly sandstone and shale aquifers is a calcium-magnesium-bicarbonate type. Nitrate concentrations are higher from this aquifer type than any other aquifer in Ohio.

Flow and Use

Groundwater resources within the watershed include springs and wells and are documented by Noble and Washington SWCD observations as well as a 1984 ODNR study. According to SWCD field observations springs are fairly plentiful throughout the watershed. Many of the springs have been developed and the majority are reliable, producing sufficient water for households and, or livestock use (SWCD, 2004). During dry periods, however springs commonly run dry causing the users to haul water in from other sources. Future spring development will depend on the site-specific locations of impervious layers of bedrock and soil that create springs. A groundwater survey by ODNR indicates that the predominant bedrock in the watershed consists of sandstone, shale, fireclay, coal and limestone layers. This bedrock type produces an average yield for drilled wells of approximately 2 gallons per minute flow, at total depths ranging from 58 to 210 feet and depth to bedrock ranging from 2 to 33 feet (ODNR, 1984 ground water map). A secondary source of groundwater in the watershed is found in alluvium of the stream valleys consisting of clay and sand. These locations generally yield less than 3 gallons per minute flow, at total depths ranging from 35 to 75 feet and depth to bedrock ranging from 38 to 45 feet (ODNR, 1984). Wells greater than 5 gallons per minute flow are considered to be good indicators of groundwater, therefore wells in the Duck Creek Watershed are slightly below that of an adequate groundwater source (Guide to Streams, 2004).

Source Water Area Protection Plans (SWAP)

Public water associations are required by Ohio EPA to complete a Source Water Area Protection Plan (SWAP) for a determined area surrounding a public water source. According to the USEPA a SWAP is a study and report, unique to each water system that provides basic information about the water used to provide drinking water. These plans work towards protecting public water sources by identifying the area of land that directly contributes to the water used for drinking and identifying potential sources of contaminants to the drinking water supply.

The Duck Creek Watershed currently has one SWAP area that is located within the watershed boundary. The Village of Caldwell Water Supply, which originates from Wolf Run Lake and Caldwell Lake, is a 6,748 acre protection area that is located within the Headwaters of West Fork subwatershed (HUC: 05030201-120-010). Two additional SWAP designated areas are not located within the watershed, but supply water to Duck Creek residents. They include The City of Marietta Water Supply and Warren Water District.

On the attached map, Heather Raymond: Ohio EPA, Division of Drinking and Ground Water depicts the ground water sources in the Duck Creek Watershed by using current GIS technology.

The map indicates the areas that have the Source Water Area Protection Plan (SWAP), ground water drinking water source protection areas, low and high yielding areas and areas that are not capable of supplying drinking water to a municipality. New water service to the Duck Creek Watershed area is limited because of the lack of aquifers located within the ridges and the rugged, steep sloping hills. The most abundant sources of drinking water is located near major waterways because of the tremendous amount of recharge that particular area receives.

Sensitivity of groundwater: DRASTIC maps

DRASTIC maps and data indicate the potential for groundwater contamination if a contaminant were introduced into the environment at that point in the watershed. According to Ohio EPA Division of Drinking and Groundwater sensitivity of groundwater data is only available for the Washington County portion of the Duck Creek study area. The lack of groundwater resources, in addition to the impervious layers of bedrock and soil did not warrant the development of a DRASTIC map for the Noble County portion of the study area.

The Duck Creek Watershed has 813 acres that are considered to be a high potential for groundwater contamination (Ohio EPA, Division of Drinking and Groundwater). This highly susceptible area is located near Marietta, within the Lower Duck Creek Watershed subwatershed (05030201-120-040) at the confluence of the Ohio River. Within these 813 acres the Ohio EPA Division of Drinking and Groundwater has identified 18 potential contaminant sites out of 218 total sites within the entire watershed (**Appendix 7: Potential Contaminant Sites**). Of the 18 sites, 7 are leaking underground storage tanks, 3 are non-leaking underground storage tanks and 8 are hazardous waste handlers regulated by the US-EPA under the Resource Conservation and Recovery Act. These 18 potential contaminant sites should be monitored to ensure that the groundwater is not contaminated. (DRASTIC data provided by: Heather Raymond, Ohio EAP, Division of Drinking and Ground Water)

Public Water

NOTE: Within the Duck Creek Watershed GIS spatial data regarding public water districts and water lines is incomplete. As this spatial data becomes available corresponding maps will be created for this plan.

Public water is available in several areas of the watershed (Water Line and District Overlay). The location and source (surface water or groundwater) of the water differs depending on the location within the watershed. Public water providers, locations and sources are listed below:

- **Clear Water Corporation:** originates from surface water at Wolf Run Lake and Caldwell Lake. Both lakes are located within the West Fork Duck Creek Subwatershed; HUC: 05030201-120-010.
- **Noble County Water Authority:** originates from surface water at Wolf Run Lake and Caldwell Lake. Both lakes are located within the West Fork Duck Creek Subwatershed; HUC: 05030201-120-010.
- **Noble Water District:** originates from surface water at Wolf Run Lake and Caldwell Lake. Both lakes are located within the West Fork Duck Creek Subwatershed; HUC: 05030201-120-010.

- **Caldwell Water Department:** originates from surface water at Wolf Run Lake and Caldwell Lake. Both lakes are located within the West Fork Duck Creek Subwatershed; HUC: 05030201-120-010.
- **Pure Water Company Inc.:** originates from surface water at Wolf Run Lake and Caldwell Lake. Both lakes are located within the West Fork Duck Creek Subwatershed; HUC: 05030201-120-010.
- **City of Marietta Water:** originates from the Muskingum Buried Valley Aquifer, which is located outside of the watershed boundaries (Kevin Crock, City of Marietta Engineer). The city has a water treatment plant and 6 water wells at the Washington County Fairgrounds; both are located outside of the watershed. According to the water treatment plant manager there are no contaminants or problems with the groundwater that require extra treatment.
- **Reno Water District:** purchases water from the City of Marietta, which originates from the Muskingum Buried Valley Aquifer. The aquifer is located outside of the watershed boundaries.
- **Highland Ridge Water:** purchases water from Warren Water District, which originates from the Muskingum Buried Valley Aquifer. The aquifer, wells and treatment plant is located outside of the watershed boundaries. According to the water treatment plant manager there are no contaminants or problems with the groundwater that require extra treatment or concern.

Clear Water Corporation, Noble County Water Authority, Noble Water District, Caldwell Water Department and Pure Water Company Inc. are all treated by the Village of Caldwell's water treatment facility located in Caldwell along the West Fork of Duck Creek (Headwaters of West Fork Subwatershed; HUC: 05030201-120-010). According to the plant manager Rick Star, the surface water at the source meets or exceeds current surface drinking water standards, with no contaminants or problems that require extra treatment or concern. The quality of the drinking water however, declines as it sits in water lines for up to two weeks in some areas. This has raised some concern from local residents and water companies and they are in the process of looking at alternative drinking water sources.

LAND USE/LAND COVER

Land use in the Duck Creek watershed includes a mix of deciduous forest, pasture/hay, evergreen forest, and agriculture. Land use data for the area are available from the Multi-Resolution Land Characterization (MRLC) database for Ohio and are shown in **Table 1 on page 9 and Map 2** (MRLC, 2000). Deciduous forest and pasture/hay collectively account for approximately 87 percent of the total land cover. Landuse/cover acreage and percentages by subwatershed as described in the Inventory/Water Resource Section of this plan are found in the **Watershed Restoration and Project Goals Section**.

The Duck Creek Watershed has various recreational landuses including, fishing, boating, swimming, hunting, hiking, bird watching, sightseeing, and camping. Public land within the watershed include Wolf Run State Park north of Caldwell, Wayne National Forest in Elk Township in Noble County, Noble County Recreation Area located at the Noble County Fairgrounds, Ales Run Wildlife Area, and Ohio's Buckeye Trail passes through the Wolf Run State Park.

Wooded: 64.15%, 118,219 acres

Wooded areas (forests) include the following land uses: deciduous forest, evergreen forest and mixed forest (**Map 2 & Table 1**) The classification “deciduous forest” is defined as areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to seasonal change. The “wooded” or forested land use/cover category is the largest category class within the Duck Creek Watershed and is well above the state average of 30%. The Wayne National Forest makes up 2,571 acres of the “wooded” land use in the watershed, private landowners own the remaining 115,648 acres. Forests play an important role in the Duck Creek Watershed by providing a renewable natural resource, a source of income, vital wildlife habitat and recreational opportunities (Introduction Section of Plan). Various timber companies and saw mills operate throughout the watershed providing employment and valuable timber. According to a wide selection of timber companies and sawmills there have been an estimated 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the Duck Creek Watershed.

The largest saw mills are listed below:

- Ames/True Temper Sawmill, Dexter City: purchases and mills ash and hickory throughout the watershed for garden tool handles for Ames True Value Hardware and Lawn and Garden Stores.
- Dexter Hardwoods Inc, Dexter City: purchases and mills hardwood timber throughout the watershed.
- Donald Morris Lumber, Macksburg: purchases and mills hardwood timber throughout the watershed and the region.

Agriculture 32.61%, 60,145 acres

Agricultural areas include the following land uses: pasture/hay and row crops (**Map 2 & Table 1**). The classification “pasture/hay” is defined as areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops. This land use/cover category is the second largest in the watershed. Refer to **Watershed Restoration and Project Goals Section** to obtain agricultural land use/cover information per subwatershed (i.e. crop type, tillage, rotations, chemicals and livestock inventory). Chemical usage considered includes restricted and unrestricted pesticides and livestock inventories are calculated using animal units. Animal units are a federal designation that varies by animal species. The number of animals is multiplied by a factor (in parentheses) to determine the total number of animal units represented. For example, 1000 animal units = 1000 slaughter or feeder cattle (1.0), 700 mature dairy cattle (1.4). Additional factors included the following: swine weighing more than 55 lbs. = (0.4); horses = (2.0); sheep or lambs = (0.1).

Urban: 2.17%, 3,994 acres (Table 17)

Urban areas include the following land uses: high intensity residential, low intensity residential, high intensity commercial, transitional (**Map 2 & Table 1**). The following cities and villages are incorporated areas within the Duck Creek Watershed: Marietta, Lower Salem, Macksburg, Belle Valley, Caldwell, Dexter City, Macksburg, and Summerfield. Marietta is the only Phase II storm water community in the Duck Creek Watershed. Marietta and Washington County have recently hired a storm water specialist to ensure that Marietta complies with all Phase II stormwater

regulations. Fulda, Carlisle, Florence, Ava, Sharon, Dudley, Hunkadora, East Union, Ashton, Hoskinville, Middleburg, Gem, Newburg, Three Forks, South Olive, Road Fork, Elba, Germantown, Warner, Whipple, Stanleyville, Caywood, Moundsville, Hirambsburg, and Fredricksdale are considered unincorporated areas within the watershed.

NOTE: all urban, impervious, sewage treatment, public sewage and Home Sewage Treatment Systems statistics by subwatershed can be referenced in **Table 17: Urban Land Use and Sewage Statistics by Subwatershed.**

Impervious Surfaces: 1.52%, 2,796 acres (Table 17)

Impervious surfaces within the urban areas are the result of buildings, parking lots, driveways, roads and rooftops. The watershed coordinator has estimated approximately 70% of the urban areas are composed of impervious surfaces.

Sewage Treatment (Table 17)

The Duck Creek Watershed has only two areas that provide public sewage for its residents. Home Sewage Treatment Systems (HSTS) account for the majority of the sewage treatment in the watershed. Aerators and septic tanks with leach fields are the most common Home Sewage Treatment Systems utilized in Duck Creek. Unsewered areas that have negatively affected water quality include Belle Valley, subdivisions surrounding the Village of Caldwell (Bronze Heights, Maple Heights, South Acres, Florence, Crock Addition, Slater Addition, County Garage and Wolf Run Lake) Macksburg, Whipple, and Lower Salem.

Table 17: Urban Land Use and Sewage Statistics by Subwatershed

Subwatershed	Urban %	Impervious %	Total # Homes	Population	# Homes with Public Sewage	# Home Sewage Treatment Systems	Number of Failing Systems	% of Total Systems Failing
Lower Duck Creek 05030201-120-040	5.2	3.6	1,470	3,704	733	737	442	60
Upper Duck Creek 05030201-120-030	0.71	0.5	425	1,071	0	425	276	65
West Fork Main 005030201-120-020	3.8	2.7	454	1,230	0	454	309	68
Paw Paw Creek 005030201-110-050	0.01	0.007	260	680	0	260	156	60
Middle Fork 005030201-110-030	2.7	1.9	166	515	0	166	100	60
Headwaters East Fork 005030201-110-010	0.07	0.05	254	779	0	254	152	60
East Fork above Middle Fork 005030201-110-020	0.81	0.6	301	918	0	301	181	60
East Fork below Middle Fork 005030201-110-040	3.5	2.5	133	351	0	133	86	65

Headwaters West Fork 005030201-120-010	2.3	1.6	1,950	8,118	993	957	670	70
Totals	n/a	n/a	5,413	17,366	1,726	3,687	2,372	n/a

Public Sewage (Table 17)

The City of Marietta and the Village of Caldwell have the only two public sewer treatment plants in the watershed. The main discharge from the Caldwell Treatment Plant enters into the West Fork of Duck Creek off of Railroad Street on the downstream side of Caldwell. The Caldwell treatment plant, however is 65% Combined Sewer System (CSS-combined storm runoff and sewage). Therefore, within the combined system significant rain events cause the sewer to overflow into storm drains and enter into the West Fork of Duck Creek at 15-17 overflow outlets (Jeff Antil, Noble Wastewater Plant & Bruce Goff, OEPA Division of Surface Water). Exact locations of the overflow outlets are not known at this time. A reconnaissance of the stream segments during the 2004-sampling season will inventory the sites by Global Positioning System (GPS), and a corresponding GIS map will be created. The Marietta treatment plant is not a Combined Sewer System (CSS-combined storm runoff and sewage). The discharge point is located along the Ohio River (outside of Duck Creek); therefore discharge does not enter into the watershed study area. Location and basic public sewer treatment plant information is listed below:

Marietta

- services 733 homes and/or facilities in the eastern portion of Marietta that is within the watershed boundary
- subwatershed: Lower Duck Creek (HUC: 05030201-120-040)
- plant is located along the Ohio River outside of watershed study area
- discharges into Ohio River at plant site outside of watershed study area
- no sewer overflow system at present time
- refer to Table 17
- contact: Rick Groves, Marietta Sewer Treatment Plant

Caldwell

- services 993 homes/or facilities in the Village of Caldwell; includes Noble Correctional Institution that houses approximately 2,000 prisoners
- subwatershed: Headwaters of West Fork (HUC: 005030201-120-010)
- plant is located along the West Fork of Duck Creek on Railroad Street downstream of Caldwell
- discharges into the West Fork of Duck Creek downstream of Caldwell
- system has 32 sewer overflows throughout the system
- refer to Table 17
- Contact: Jeff Antil, Caldwell Sewer Treatment Plant

Home Sewage Treatment Systems (HSTS):

The Upper Duck Creek, Middle Fork Duck Creek, Paw Paw Creek, West Fork Duck Creek, East Fork above Middle Fork, East Fork below Middle Fork and Headwaters East Fork subwatersheds are not sewered by a public sewer system. Additionally, the areas outside of Marietta and Caldwell in Lower Duck Creek and Headwaters West Fork subwatersheds respectively, are unsewered. Table 17 lists the number of homes, population, homes without public sewer systems and the estimated percent of failing systems, per subwatershed. According to Washington and Noble County Health Departments the percentage of failing systems ranges from 60-70%, depending on the subwatershed. Washington and Noble County inspect HSTS sites prior to installation and post installation. Washington County however, does not inspect systems to ensure that they function properly once they are in operation. In 1999 the Noble County Health Department began inspecting the function and operation of aerator systems that were installed on or after January 1, 1997.

As water lines expand throughout the watershed water usage and development typically increase dramatically. Many times water lines are extended without public sewer access. This increase in HSTS can and has posed a threat to the water quality of Duck Creek. These facts warrant the Duck Creek Advisory Committee recommendation that the local Health Departments develop a comprehensive inspection program for HSTS. We recommend that every new system should be inspected every five years to ensure their proper operation and maintenance.

Industry

Oil and Gas Wells: various drilling, exploration and operation companies throughout the region service the 7,620 oil and gas wells in the watershed. The following list illustrates the breakdown of wells by subwatershed:

- West Fork Duck Creek: 2,498 wells
- Headwaters West Fork: 1,208 wells
- Middle Fork Duck Creek: 1,097 wells
- East Fork above Middle Fork: 926 wells
- Paw Paw Creek: 741 wells
- Upper Duck Creek: 524 wells
- Headwaters East Fork: 238 wells
- East Fork below Middle Fork: 223 wells
- Lower Duck Creek: 165 wells

(Data provided by ODNR Division of Mineral Resource Management. They are also responsible for the regulation and safety of oil and gas wells throughout Ohio.)

Timber/Sawmill

- **Dexter City:** Ames True Temper Sawmill and Dexter Hardwoods Inc.
- **Macksburg:** Donald Morris Lumber and Sawmill

Manufacturing/Factory/Service Industry

- **Caldwell:** Dana Corporation, International Converter/Packaging Dynamics,
- **Dexter City:** B&N Coal

- **Marietta:** Broughtons Dairy, Vanguard Paints, FlexMag Industries, Zides Sports Screen Printing, Richardson's Printing, Grae-Con Construction, Midwest Pipe and Supply, United Parcel Service, Master Mag East, Metal Tech: Steel Corp, Siding Window Solutions, Ohio Valley Apparatus & Machine, Hi-Vac Corporation, OhioValley Specialty Chemical Co., Ciscomp Inc.

Water: .83%, 1,361 acres

Water area includes the following land use classes: streams, lakes and ponds (Map 1 and Map 2)

Wetlands: .135%, 206 acres (Map 2)

- Woody Wetlands: .1%, 139 acres
- Emergent Herbaceous Wetlands: .035%, 67 acres

Barren: .23%, 429 acres

Barren areas include the following land use classes: quarries, strip mines and gravel pits. More information on coalmines and unreclaimed minelands can be referenced in the *Historical and Cultural Significance of Natural Resource Extraction* section of this plan.

Protected Lands (Map 1)

- **Wayne National Forest** is located in Enoch Township, within Noble County in the Duck Creek Watershed. There are 2,570.61 acres of the Wayne National Forest within the Duck Creek Watershed. Land uses include timber harvesting, camping, hiking, off road vehicles, horse back riding, wildlife habitat and other various recreational activities. Streams within the Wayne National Forest are protected from agricultural, urban and surface mining activity.
- **Ales Run Wildlife Area** is located in Jefferson Township, within Noble County in the East Fork below Middle Fork Subwatershed. There are 2,785.8 acres that make up the Ales Run Wildlife Area.
- **Wolf Run Lake State Park** was officially dedicated as a state park in 1968. Ohio Department of Natural Resources manages the 1,266-acre park, including the 214-acre lake as outlined in the *Historic and Cultural Resources* section of this plan. The lake is a secondary source of water for the village of Caldwell and portions of Noble County (see *Public Water* in next section of plan). Damming Wolf Run tributary and three unnamed tributaries created Wolf Run Lake; resulting in a total of 2.93 stream miles that are dammed (Map-1 and Appendix ? Duck Creek Watershed Dams, Lakes and Ponds Inventory).

Note: for more information on protected land refer to the “Cultural and Historical Resources” section of this plan

Conservation Easements

There are no known permanent conservation easements currently or expected in the Duck Creek Watershed (Noble and Washington SWCD).

Status and Trends: historic, current, projected land uses

Historically, farming and the abundance of nonrenewable natural resources such as of forests for timbering, underground and surface coal deposits, and large oil and gas deposits made up the majority of the landuses in the watershed. These past landuses are now mixed with urban centers that are slightly expanding in land area. For example, there are five municipalities (Caldwell, Belle Valley, Macksburg, Lower Salem and Marietta) and numerous villages scattered throughout the watershed. The main transportation routes (Interstate I-77 and State Routes) are located in the valleys following the main branches and tributaries of Duck Creek. The county and townships roads intersect the remaining land area, primarily along the ridge tops.

Currently, OEPA has issued National Pollutant Discharge Elimination System (NPDES) permits to seven facilities in the Duck Creek watershed that could discharge pollutants of concern. Six of these are mining operations and one is a sewage treatment plant for the City of Caldwell. The small number of NPDES permits shows that there is little commercial and industrial development in the watershed. Future projections do not indicate a sharp increase in commercial or industrial infrastructure in the watershed. However, recreation, wildlife sporting and ecotourism are becoming increasingly popular in the watershed. For example, Ales Run Wildlife Area, Wayne National Forest and Wolf Run State Park provide ideal Wild Turkey and Deer habitat, as well as multiple fishing and camping opportunities.

Currently, there are approximately 15,518 people that live in the Duck Creek Watershed with 82% of the people living in rural areas and 18% living in urban areas.

The rapid increase in Washington County's population from 1800 to 1980 was due to the historically strategic location of Marietta on the Ohio and Muskingum Rivers. These rivers provided Washington County with significant trade and travel routes to the rest of the Northwest Territory. The Ohio River remains a strategic trade route to the Mississippi River and beyond. Currently, Washington County remains a productive location for various chemical and petroleum plants. Marietta, the county seat, is a popular tourist attraction due to its historic downtown featuring various points of interests and antique shops. Noble County's peak population in 1880 was due to the boom of the oil and gas wells throughout the county. Once the oil and gas wells ran dry people fled the county for fortunes elsewhere. Until recently Noble County has not benefited from resurgence in population. The population recently jumped by approximately 2,000 people in 1996 when Noble Correctional Institution opened. Even though the prisoners do not pay taxes or vote they are counted on the census reports. There has also been an increase in immigration from the suburbs in Northeastern Ohio. Many retirees seek a convenient, rural location directly south off of Interstate-77, to escape from the city life in and around Cleveland. Future projections show that Washington County's population will decrease by 1,598 people from 2000 to 2030 while Noble County is projected to gain 2,632 people in the same 30-year period.

Future land uses are expected to remain relatively the same except where water and sewer lines become available. Tri-County Water Association is planning additional lines that will service the watershed in Noble County. These areas will likely experience increased urban landuses. Overall, we can expect more farmland to be left idle and eventually convert into "wooded" land uses. Additionally, housing and service industries will increase throughout the watershed, replacing agricultural and wooded land uses. The Duck Creek Watershed Partnership would like to increase the acreage of riparian buffer, particularly along the main stems of the watershed;

riparian buffers on tributaries are relatively intact due to steep terrain. The partnership would also like to increase the acreage of wetlands throughout the watershed to reduce sediments and flooding and provide valuable wildlife habitat.

HISTORIC AND CULTURAL RESOURCES

Native Americans are believed to be the first inhabitants of present day Duck Creek. Burial mounds, skeletons, and artifacts evidence their occupancy within the southeastern Ohio. From 1700-1800 white settlers were discouraged from settling north of the Ohio River because they feared Native Americans. During this time the Shawnee, Wyandot, Delaware and Iroquois roamed the Duck Creek Watershed. In 1788 The Northwest Territory became part of America when England ceded this territory to its former colonists as a result of the American Revolution. Historically, the Duck Creek Watershed was the place of death for John Gray, the last surviving veteran of the American Revolution. He died on March 29th, 1868 near Hiramburg in Noble County, Ohio at 104 years, 2 months and 23 days. The Northwest Territory included all of modern-day Ohio, Indiana, Illinois, and parts of Michigan and Wisconsin. Marietta - the first white settlement in Ohio - and the confluence of Duck Creek and the Ohio River, became the first capital of the Northwest Territory. The town was named for Marie Antoinette of France.

As a result of the Northwest Territory declaration settlers had an increased presence in the area north of the Ohio River. Within seven years of the establishment of the Northwest Territory the Native Americans that inhabited the Duck Creek Watershed were removed from their land by signing of the Treaty of Greenville in 1795. The Treaty of Greenville stated that the natives agreed to relinquish all claims to land south and east of a boundary that began roughly at the mouth of the Cuyahoga River. It ran southward to Fort Laurens and then turned westward to Fort Loramie and Fort Recovery. It then turned southward to the Ohio River. This treaty eased settler's fears of Native Americans in this part of Ohio paving the way for settlement. The Treaty of Greenville continued the trend of taking prosperous, land from the Native Americans and moving them westward to unfamiliar, often unproductive territory. Some scholars contend that the Treaty of Greenville formally ended tensions between the Indians and Americans in what is now present-day Ohio in the Duck Creek Watershed. Conversely, others suggest that this treaty added tension to their already strained relationship. For example, many Indians refused to honor the agreement and many white settlers flooded onto the Indians' land. Violence continued to dominate the relationship between these two peoples (Ohio Historical Society/Ohio History Central Website).

Pioneer settlements continued to prosper in the watershed area and the rest of the Ohio Territory. In 1803 the adult male population of the Ohio Territory reached 5,000, therefore the territory officially became the 17th state in the union. The first settlers to the Duck Creek area were New Englanders of Irish, English and German decent, travelling by way of Marietta Ohio, in Washington County up the valley of Duck Creek from the Ohio River into what is now Noble County. Their main goal was to acquire land west of New England where they anticipated an improved quality of life. Land ownership was the staple of life for many settlers in America. The first entry of land on the West Fork of Duck Creek was made in 1806 by a man named Bain, near where Belle Valley now is. Richard Fletcher made an entry of land in the same year (The History of Noble County, Ohio, Watkins, L. H.).

The Duck Creek Watershed was a historically significant stop on *the Underground Railroad* that funneled slaves from southern slave states into northern free states. The slaves were dropped off at the confluence of Duck Creek and the Ohio River. According to Henry R. Burke in *Journeys on the Underground Railroad* Josephus, a slave in Virginia delivered about 3-5 slaves a month from Parkersburg, Virginia to the mouth of Duck Creek in Ohio. Using his canoe, he rowed slaves to the island obstructing the path, dragged the canoe across, and delivered his crew to the other side. Once the slaves were at the mouth of Duck Creek they followed the drainage pattern north attempting to reach Canada where they could no longer be captured (Burke, pg.26).

The first settlers in Duck Creek took advantage of the various natural resources in the region such as agriculture, livestock and profitable industries from the many mineral resources of the area. Coal, iron ore, building stone, petroleum and salt were plentiful in the watershed. The first oil well site in North America was accidentally discovered near in Duck Creek near Caldwell, in 1814 when Robert McKee began drilling a well to obtain brine. At the depth of 475 feet, a crevice was struck containing oil. The oil was first considered a nuisance, but the true value of the oil was eventually realized and derricks soon lined the valley of Duck Creek. Oil prices declined drastically during the Civil War bringing an end to major drilling efforts in the area.

Historical and Cultural Significance of Natural Resource Extraction

- **Oil and Gas:** the oil and gas industry was a significant factor in shaping the history and culture of the Duck Creek Watershed. Pioneering the oil and gas industry, Duck Creek was home to the first oil well site in North America (The History of Noble County, Ohio, Watkins, L. H.). The well was accidentally discovered near in Duck Creek near Caldwell, in 1814 when Robert McKee began drilling a well to obtain brine. At the depth of 475 feet, a crevice was struck containing oil. The oil was first considered a nuisance, but the true value of the oil was eventually realized and derricks soon lined the valley of Duck Creek.

The Village of Macksburg was the home to the first, commercial oil production facility (1860) in Ohio (ODNR). Like many villages in the area, Macksburg was known as a prominent oil and gas town that was home to rich and prominent landowners. The financial success of the industry brought people to the area in droves and provided much needed employment. Macksburg however, fell victim to the boom and bust cycle of the oil and gas industry. Oil prices declined drastically during the Civil War bringing an end to major drilling efforts in the area. Most of the exploration and pumping companies fled leaving environmental and economic hardships behind. The industry is still present in the watershed but not at the boom that occurred in the 1860's. The watershed is also home to the deepest oil and gas well drilled in Ohio. In 1967 a well was drilled in Noble County at a depth of 11,442 feet (ODNR, Division of Mineral Resource Management).

- **Coal Mining (see Map 7: Abandoned Underground and Surface Mines)** underground and surface mining has played a significant role in the watershed by providing employment as well as affecting the quality of water in the streams. The first recorded production of coal in the watershed was in 1845 in Noble County (ODNR, Bill Jonard). Twenty-two years later, in 1867 Washington County's first recorded production occurred. A total of 119,313,313 tons of coal has been mined from the Duck Creek Watershed (Noble: 111,517,980 tons, Washington: 7,795,333 tons) since 1845 (Doug Crowell, ODNR, Ohio Geological Survey).

In addition, there are approximately 241 abandoned underground mines in the watershed. Noble County is home to 157, while Washington County claims 84 abandoned underground mines (Doug Crowell, ODNR, Ohio Geological Survey).

Prior to the passing of the Surface Mine Control Reclamation Act (SMCRA) of 1977 coal mine operators were not required to reclaim mined lands. These unreclaimed lands have negatively impacted streams in the Duck Creek Watershed. An Abandoned Mine Land (AML) program was set up to reclaim lands that were mined prior to 1977. The AML program is administered through ODNR by assessing a fee per ton of coal mined. In the Duck Creek Watershed a total of 1,435 acres of land has been reclaimed using AML funds (ODNR, Bill Jonard). However, an estimated 3,000 acres of unreclaimed land remains in the watershed (ODNR, Gary Novak).

From 1977 to 1981 coal mine operators were required to obtain a C-Reclamation Permit that enabled ODNR to regulate the extraction and reclamation of mine lands. Duck Creek has had 8,858 acres reclaimed via C-Reclamation Permits. From 1982 to the present D-Reclamation Permits have regulated 11,961 acres of extraction and reclamation in the watershed.

In all, the watershed has had approximately 22,254 acres of land reclaimed by AML funds, C-Reclamation Permits and D-Reclamation Permits. B&N Coal currently has 4 surface mining operations underway in the Duck Creek Watershed. Three of these operations are remining operations where coal is extracted from historic mining sites that left large deposits of coal and unreclaimed land behind (Roger Osborne). The remining process is considered by OEPA an acceptable mining Best Management Practice that removes all minable coal and reclaims the site to current regulations. Of the 4 current B&N operations, 3,625 acres are in various stages of the permitting process, of which 525 acres are actively being mined. In 2004, 500 acres within the watershed will be reclaimed and an additional 2,600 acres are in various stages of maintenance for the remainder of the bond period or are yet to be mined (Roger Osborne, B&N Coal). In addition, B&N is in the planning stages for an additional 1200 acres of permit area and they are going to be reclaiming approximately 80 acres under an AML contract this year. Only high sulfur bituminous coal remains in the watershed, therefore B&N Coal must mix their coal at the power plant with approximately 65% low sulfur coal.

The Duck Creek Watershed offers the following cultural, historical and recreational resources to the residents of the region:

- **Wolf Run State Park** is a valuable recreational and educational resource for Duck Creek and the Southeastern Ohio region. Land acquisition for the park began in 1963. Construction of the dam and spillway for the lake was complete in 1966 as part of the West Fork Duck Creek Watershed Project. Wolf Run received its name from the Wolf family, one of the first families to settle in the watershed. The 1,266-acre park, including the 214-acre lake was officially dedicated as a state park in 1968. The forested terrain, diverse wildlife and clean water provide a natural beauty that is unmatched in this region. Wolf Run State Park offers a family campground with 138 non-electric sites located on the south shore of the lake. Showers and laundry facilities are provided. A walk-in group area with fire rings is available

for use by organized youth groups on a reservation basis. A 20-site primitive fly-in camping area is located on the north side of the lake. The area is within walking distance of the 4,700-foot runway at the Noble County Airport. Picnic tables, fire rings and latrines are provided.

Wolf Run Lake is well known for large catches of bass, bluegill, crappie, trout and catfish. Boats with motors of up to 10 horsepower are permitted on the lake. A launching ramp and tie-ups are available on the south side of the lake, easily accessible from State Route 215. A public swimming beach is located on the south side of the lake and provides restrooms and changing booths. The beach is open during daylight hours only. Scuba diving is also permitted in the lake, except within the beach area. Proper equipment and marking of the diving area are required. Diving alone is prohibited.

A 3-mile section of the Buckeye Trail passes along the west side of the lake. A half-mile loop trail begins at the nature center providing opportunities for nature study and wildlife observation. Picnic areas are scattered amid the more scenic areas of the park. Hunting is permitted in special areas only. A hunting map can be obtained at the park office. A valid Ohio hunting and/or fishing license is required.

- **St. Mary's Church of the Immaculate Conception in Fulda, Ohio** off of State Route 564 was placed on the National Register of Historic Places in 1980 due to its Greek Revival, Gothic architecture and engineering.
- **The Crash site of the USS Shenandoah**, the first rigid airship built in the United States and the first in the world to be inflated with helium, was a pioneer in the history of American airship aviation. Its loss in a crash in the Duck Creek Watershed, in Noble County had important consequences for the future of the American military and its airship program. The crash site Near I-77 and Co. Rd. 37 and State Route 78 in Ava, Ohio was placed on the National Register of Historic Places in 1989. The Shenandoah was commanded and staffed by personnel from the U.S. Navy, it was intended for use as a scouting vessel, based on German Zeppelins used during World War I. On the afternoon of September 2, 1925, the Shenandoah departed from its hangar with a crew of 41 and two passengers. Traveling west across the Alleghenies into Ohio, the airship confronted a severe storm by the early morning near Ava in northern Noble County. Twenty-nine members of the crew survived the break-up, although some received serious injuries.
- **The Huffman Covered Bridge** located off of State Route 564 in Middleburg was added to the National Registry of Historic Places in 1975. The bridge was placed on the register because of its rare architecture and engineering and the lack of existing covered bridges in the United States.
- **Johnny Appleseed Monument** is located along SR 821 just South of Dexter City. It is made of small rocks and stones contributed by people throughout the United States where Johnny was known to have planted apple seeds. The gravesites of Johnny Appleseed's family are located nearby.

- **Wayne National Forest** is located in Enoch Township, within Noble County in the Duck Creek Watershed. There are 2,570.61 acres of the Wayne National Forest within the Duck Creek Watershed. Land uses include timber harvesting, camping, hiking, off road vehicles, horse back riding, wildlife habitat and other various recreational activities. Streams within the Wayne National Forest are protected from agricultural, urban and surface mining activity.
- **Ales Run Wildlife Area** is located in Jefferson Township, within Noble County in the East Fork below Middle Fork Subwatershed. The 2,905-acre wildlife area is managed by ODNR, Division of Wildlife and provides valuable wildlife habitat and hunting opportunities. Landuses are strictly limited to those that provide wildlife habitat. White-tailed deer, gray squirrel, ruffed grouse and wild turkey are the most popular wildlife species hunted at the wildlife area. Trapping is permitted for all legal species except beaver, which is permitted with special permit issued by the Division of Wildlife. Streams within the wildlife area are protected from all other landuses.
 In the past however, 60% of Ales Run Wildlife Area has been surface mined for coal, prior to reclamation laws (pre 1972). The pre reclamation mining has left highwalls and spoil banks, consequently affecting the water quality of the stream (ONDR, Division of Mineral Resource Management & Division of Wildlife). B& N Coal Inc. purchased the property somewhere between the 1950-1960's and completed its mining operations in the 1970's. The coal removed from the basin was predominantly used to fuel electric producing utility companies in Ohio (ONDR Division of Wildlife).
 In 1987 B& N Coal and the Division of Wildlife reached an agreement that allowed the land to be managed by the Division for wildlife management activities and provide permits for free hunting, fishing and trapping (ONDR Division of Wildlife). In May of 2000 the land was officially acquired from B&N Coal and named Ales Run.

PHYSICAL ATTRIBUTES OF STREAMS AND FLOODPLAIN AREAS

Early Settlement Conditions

According to local residents the streams within the Duck Creek Watershed were in excellent condition prior to coal mining operations which began in 1845. The streams were relatively free from sediment that now bogs down stream channels. Elder residents of the watershed recount fishing stories that entailed catching three to four feet long Muskie, Catfish and Bass. Once mining operations began and other land use changes began to occur, water quality declined and the fish soon followed. Another favorite story of local residents involves boating from the headwaters of Duck Creek down to Marietta, without getting stuck. Past and current landuses have produced large amounts of sediment, preventing clear passage from source to mouth.

Landuses in the watershed around the early 1800's consisted primarily of agriculture. The streams of Duck Creek provided early settlers with a reliable food and drinking water source as well as recreational opportunities. Common game found in and around the watershed includes turkey, elk, bear, bobcat, buffalo, wolves, raccoon and panther.

Note: The following categories are quantified by subwatershed in Table 14 on page?. Information was collected from the watershed study area only (Washington and Noble Counties).

Channel and Floodplain Condition: floodplain connectivity

The absence of permitted levies and entrenched stream miles, in addition to limited channelization in the watershed project area; the channel is considered to have adequate access to its floodplain (personal observation, Noble and Washington SWCD). The most severe filling of the floodplain in the watershed occurs in the Headwaters of West Fork Subwatershed @ river mile 0.5-1.5 along Salt Run. This filling project runs along State Route 78 within the Village of Caldwell. The stream channel is being straightened and the floodplain is being filled along the south side of the channel (**Table 14**). There have been various 401 and 404 permits issued by the Ohio EPA and The Army Corps of Engineers, respectively. Activities in streams and wetlands that are covered by these permits include dredging, filling, construction of bridges, walkways, culverts and other structures in wetlands, streams or rivers, mitigation/creation projects, restoration activities, utility trenching and pole placements, and other similar activities in streams and wetlands (US EPA). The vast majority of these permits have however, been as a result of surface mining activities throughout the watershed (Army Corps of Engineers, Huntington District).

Channelization/Hydromodification

Channelization is known as the alteration of the natural flow of water through a landscape, and often takes the form of channel modification or channelization. The majority of the Duck Creek Watershed has not been subjected to channelization or hydromodification (TMDL and personal observation). This has allowed the watershed as a whole, to maintain a natural channel with appropriate floodplain connectivity and sinuosity. However, channelization has occurred at several segments throughout the watershed. **Table 14** lists all sites by subwatershed that have been subjected to channelization/hydromodification. The longest and most severe channelized stream segment within the watershed is located in the Lower Duck Creek Subwatershed at the confluence of the Ohio River upstream to river mile 2.2. This channelization project occurred in ?? to make room for Interstate-77 (ODOT District 10). The second most severe channelized stream segment in the watershed occurs in the Headwaters of West Fork Subwatershed @ river mile 0.5-1.5 along Salt Run. This channelized segment runs along State Route 78 within the Village of Caldwell. The stream channel is being straightened and the floodplain is being filled along the south side of the channel (**Table 14**).

Forested Riparian Corridor Assessment

The streams within the Duck Creek Watershed, perennial and intermittent, were assessed for a 50-ft. wooded buffer area tangent to each streambank. Riparian forest assessment utilized Arcview GIS 3.2 and the following Land Use classes detailed in the *Land Use* section of this document: deciduous, coniferous and mixed forest (MLRA 2000). A 50-foot buffer was placed around all streams; stream segments were then measured for miles of buffer per subwatershed. Lower (38%) and Upper Duck (55%) Creek and the Headwaters of West Fork (56%) Subwatersheds have the lowest percentage of miles buffered in the watershed study area.

Complete results found in **Table 14** document miles and percentage of stream per subwatershed that are buffered.

Permanent Protection of Stream

There are no know permanent conservation easements currently or expected in the Duck Creek Watershed (Noble and Washington SWCD). There are however, state and federal protected lands within the watershed. Descriptions, landuses, and degrees of protection for each protected area are listed below:

- **Wayne National Forest** is located in Enoch Township, within Noble County in the Duck Creek Watershed. There are 2,570.61 acres of the Wayne National Forest within the Duck Creek Watershed. Land uses include timber harvesting, camping, hiking, off road vehicles, horse back riding, wildlife habitat and other various recreational activities. Streams within the Wayne National Forest are protected from agricultural, urban and surface mining activity.
- **Ales Run Wildlife Area** is located in Jefferson Township, within Noble County in the East Fork below Middle Fork Subwatershed. The 2,905-acre wildlife area is managed by ODNR, Division of Wildlife and provides valuable wildlife habitat and hunting opportunities. Landuses are strictly limited to those that provide wildlife habitat. White-tailed deer, gray squirrel, ruffed grouse and wild turkey are the most popular wildlife species hunted at the wildlife area. Trapping is permitted for all legal species except beaver, which is permitted with special permit issued by the Division of Wildlife. Streams within the wildlife area are protected from all other landuses.
- **Wolf Run State Park** is located in Noble Township, within Noble County in the Headwaters of West Fork Subwatershed and consists of 1,374.9 acres. Landuses within Wolf Run State Park include camping, hunting, fishing, hiking, swimming, boating, bird watching and scuba diving. Streams within the State Park are protected from all other landuses. Wolf Run Lake serves as the primary source of drinking water for Duck Creek Residents in Noble County.

Note: for more information on protected land refer to the “*Cultural and Historical Resources*” section of this plan

Dams

Dams, Lakes and Reservoirs (size, uses, watersheds, detention time)

There are many farm ponds of varying drainage and surface area throughout the watershed. However, the discussion of dams, lakes and reservoirs within Duck Creek Watershed study area is limited to those structures included in ONDR’s Dam Safety inventory. There Are 18 larger ponds/lakes that are inventoried by ONDR Division of Dam Safety. All information concerning these 18 structures can be found in **Appendix 3: Duck Creek Watershed Dams, Lakes and Ponds Inventory** (ONDR Division of Dam Safety inventory data, Rick Archer). Due to the size and storage of these structures, and the lack of resources available detention time (the time it takes for water to move through an impoundment) is not determined to be a factor affecting water quality and therefore is not included in this assessment.

There are two major dam lakes within the watershed that were constructed as part of the West Fork Duck Creek Watershed Work Plan as described in the *Past and Current Water Quality and*

Flood Prevention Efforts section of this plan. These structures, **Wolf Run Lake Dam and Caldwell Lake Dam** are located in the Headwaters of West Fork Subwatershed and control roughly 10.4 square miles of the watershed (Map 1). These two structures have a combined flood storage capacity of 720 acre-feet. The primary purpose of these dams is to control flooding in the subwatershed they are located in. Secondary purposes include providing a safe and reliable drinking water source to the local residents and provide recreational opportunities (See **Appendix 3**).

Wolf Run Lake was officially dedicated as a state park in 1968. Ohio Department of Natural Resources manages the 1,266-acre park, including the 214-acre lake as outlined in the *Historic and Cultural Resources* section of this plan. The lake is a primary source of water for the village of Caldwell and portions of Noble County (see *Public Water* section of plan). Damming Wolf Run tributary and three unnamed tributaries created Wolf Run Lake; resulting in a total of 3.14 stream miles that are dammed (**Map 1 and Appendix 3**).

Caldwell Lake Reservoir was constructed in 1965 and is owned and managed by the Village of Caldwell. The 44-acre reservoir is the main source of water for the Village of Caldwell and portions of Noble County at the present time (see *Public Water* section of plan). Caldwell Lake Reservoir was formed by damming Dog Run tributary and three unnamed tributaries; resulting in a total of 1.52 stream miles that are dammed (**Map 1 and Appendix 3**).

Streams with Unrestricted Livestock Access

Streams in the Duck Creek Watershed are utilized for watering livestock in the following methods: year round access, seasonal access, limited access crossings and rotational grazing (Washington and Noble SWCD and NRCS). The streams within the Duck Creek Watershed, perennial and intermittent, were assessed for unrestricted livestock access. Stream segments and adjacent landuses were analyzed to determine the miles and percent of streams per subwatershed, with unrestricted livestock access (Washington SWCD, Kevin Wagner and Noble SWCD, Jim Mizik). Middle Fork (45%), Headwaters of East Fork (40%) and Headwaters of West Fork (38%) are the subwatersheds that have the highest percentage of streams with livestock access. Complete results found in **Table 14** document miles and percentage of stream per subwatershed, that have unrestricted livestock access (**Table 14**).

Eroding Banks

Sites within the watershed that were found to have eroding banks are listed in **Table 14**. This analysis is a combination of the OEPA's TMDL results and personal observation by the watershed coordinator.

Riparian Levees

According to the floodplain managers and Emergency Management Agencies there are no permitted levies within the watershed study area (Jeff Lauer and Connie Holibitzol: Washington County, Chasity Schmelzenbach and Connie Holibitzol: Noble County). This topic is not included in **Table 14** because there are no levies in the watershed.

Entrenched Miles

The number and severity of entrenchment miles within the watershed study area is not considered significant. Refer to the *Watershed Inventory: biological features* section of this plan for more information about entrenchment in the watershed. This topic is not included in Table 14 because entrenchment is not considered to be a significant factor in the watershed.

Status and Trends: expected residential, commercial or industrial development (Table 14)

There is no scheduled residential, commercial or industrial development within Duck Creek in Washington County, excluding Marietta (Lauro, Washington and Noble County Building Department Head and Plans Examiner). In Marietta, a 14-lot subdivision is planned within the watershed, along Glendale Road Extension (Crock, City of Marietta Engineer). This subdivision is located outside of the floodplain within Lower Duck Creek Subwatershed (HUC: 05030201-120-040).

All potential residential, commercial or industrial development in Noble County will occur in the Headwaters of West Fork Subwatershed (HUC: 00503020-1120-010). Details of each development area are listed below:

- **Residential development:** surrounding Wolf Run Lake and the Noble County Airport,
- **Commercial development:** along State Route 821 from Belle Valley south to Caldwell and in Caldwell along State Route 78. A portion of the development will require filling of the floodplain on one side of West Fork of Duck Creek and Salt Run, respectively.
- **Industrial development:** the Noble County Chamber of Commerce has purchased approximately 25 acres of land North of Belle Valley along the West Fork of Duck Creek. A portion of the development will require filling of the floodplain on one side of the stream to raise the buildings out of the floodplain.

Status and Trends: expected road, highway, bridge, culvert and slip construction (Table 14)

The watershed will experience minor construction of roads, highways, bridges, culverts and slips in the coming years. Most of the planned construction is upkeep and maintenance to existing structures throughout the watershed. The details and location of each construction practice are listed below:

The City of Marietta

- Upkeep of existing structures only; no new projects are scheduled at the present time (Crock, City of Marietta Engineer).

Washington County

- Bridge replacements: at Cole Run Rd/Salem Township Road 321 within the Paw Paw Creek Subwatershed (HUC: 005030201-110-050) and the lower Macksburg bridge that spans the West Fork connecting Macksburg to State Route 821 within the West Fork Duck Creek Subwatershed (HUC: 005030201-120-020). (Badger, Washington County Engineer).

- Land slips: on County Road 16 within the Lower Duck Creek Subwatershed (HUC: 05030201-120-040) and on County Road 15 within the Paw Paw Creek Subwatershed (HUC: 005030201-110-050). (Badger, Washington County Engineer).

The Village of Caldwell

- Bridge replacements: the State Route 821 bridge spanning the West Fork of Duck Creek was replaced in 2003.

Noble County: not able to make contact with County Engineer

ODOT

- **I-77 and State Routes: see Table 14 for complete listing by subwatershed**

WATER RESOURCE QUALITY

Duck Creek's Use Designation

Waters in the Duck Creek watershed are considered impaired because they do not support their aquatic life use designation. Most streams in the watershed are designated for Warm Water Habitat (WWH) aquatic life use support, although Pawpaw Creek is an Exceptional EWH stream. Waters designated as WWH are capable of supporting and maintaining a balanced integrated community of warmwater aquatic organisms. Waters designated as EWH are capable of supporting "exceptional or unusual" assemblages of aquatic organisms that are characterized by a wide diversity of species, particularly those which are highly pollutant intolerant and/or are rare, threatened, or endangered. According to OEPA, attainment of aquatic life uses in Ohio is measured in two ways. First, water chemistry is compared to the available numeric criteria. For example, DO in streams designated as WWH must average at least 5 mg/L. Second, the measured biological scores are compared to those seen in the least impacted areas of the same ecological region and aquatic life use. Attainment benchmarks from these least impacted areas are established in the form of "biocriteria," which are then compared to the measurements obtained from the study area. (**Table 15: Biological Criteria for the Western Allegheny Plateau**). If the measurements of a stream do not achieve the biocriteria, the stream is considered in "nonattainment." If the stream measurements achieve some of the biological criteria but not others, the stream is said to be in "partial-attainment." (Keith Orr, Ohio EPA).

OEPA Aquatic Life Use Attainment Status

OEPA conducted a TMDL report for the Duck Creek Watershed that was approved in 2003. The TMDL report established an *aquatic life use attainment status* of sites sampled in the Duck Creek Watershed from June-October, 2000 (**Appendix 5**). In addition to attainment status this table lists sampling sites, Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), Qualitative Habitat Evaluation Index (QHEI) and the Invertebrate Community Index (ICI) for each site. These scores are based on the performance of the biotic community (i.e. fish and macroinvertebrates). The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community (i.e. stream banks, stream bottom, adjacent landuse, etc.). Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June-October 2000. Refer to **Table 15** for the corresponding biological criteria used to determine *aquatic life use attainment status* for the Duck Creek Watershed.

Chemical criteria represent the concentration of a pollutant that can be in the water and still protect the designated use of the waterbody.

Biological criteria indicate the health of the in-stream biological community by using one of three indices:

- Index of Biotic Integrity (IBI) (measures fish health).
- Modified Index of well being (MIwb) (measures fish health).
- Invertebrate Community Index (ICI) (measures bug or macroinvertebrate health)

Physical criteria indicate the health and status of the stream habitat including the stream bottom, stream bank and adjacent landuse:

- Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community

TMDL & Duck Creek Watershed Partnership Water Quality Monitoring Program

During the 2000 field season (June-October chemical, physical and biological sampling was conducted to assess and characterize all potential sources and causes of water quality impairment in the Duck Creek Watershed. This sampling in 2000 was important because it provided the Duck Creek Watershed Partnership with chemical, physical and biological water quality data, parameters and numerical targets of water quality, aquatic life use attainment status, causes and sources of impaired streams and water quality sampling sites. The following list provides references of the above data:

- Chemical data and corresponding parameters and numerical targets of water quality data can be referenced in **Appendix 6: OEPA's Chemical Water Quality Sampling Data** and **Table 16: Project Parameters & Numerical Targets of Water Quality Data**, respectively.
- Physical (QHEI) and biological (IBI, Miwb and ICI) water quality data and corresponding parameters and numerical targets can be referenced in **Appendix 5 and Table 16**, respectively.
- Aquatic life use attainment status can be referenced in **Appendix 5 and Map 8: Attainment Map**.
- Causes and sources of impaired streams can be referenced in **Table 18: Causes and Sources of Impairment and Aquatic Life Use Attainment Status** and **Map 9: Cause and Source Map**.
- Water quality sampling sites can be referenced in **Appendix 8: TMDL & Duck Creek Partnership Sampling Sites** and **Map 10: Monitoring Sites Map**.

Table 18. Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Duck Creek Sampling “Site ID”.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
Duck Creek (06-300) 2000 Western Allegheny Plateau (WAP) - WWH (existing)			
21.2/Upper 2	FULL	--	--
16.1/Upper 1	FULL	--	--
11.2/Lower 4	FULL	--	--
5.5/Lower 3	PARTIAL	Organic Enrichment/DO: in recovery	Agriculture: in recovery

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
3.2/Lower 8	FULL		
2.5/Lower 2	NON	DDT, contaminated sediments (metals), flow alterations	Hazardous waste: leaks and spills from waste storage ponds, and land disposal
1.8/Lower 1	NON	DDT, contaminated sediments (metals), flow alterations	Hazardous waste: leaks and spills from waste storage ponds, and land disposal
0.5/Lower 5	PARTIAL	Siltation, embedded conditions, DDT, Organic enrichment/DO	Hazardous waste leaks and spills from waste storage ponds NPS stormwater and/or urban runoff
Upper Duck Creek: RM 23.0-21.2	Threatened	Organic enrichment/DO, Nutrients, Bacteria	NPS stormwater and/or urban runoff from the Village of Warner
West Fork Duck Creek (06-340) 2000 (WAP) - WWH (existing)			
34.2/HeadWest9	FULL	--	--
33.3/HeadWest 8	FULL	--	--
31.4/HeadWest 7	FULL	--	--
28/HeadWest 6	FULL	--	--
23.1/HeadWest 5	FULL	--	--
23.0/HeadWest 5	--	--	--
22.3/ HeadWest 4	FULL	--	--
20.7/HeadWest 3	FULL	--	--
16/HeadWest 2	FULL	--	--
12.8/HeadWest 1	FULL	--	--
9.1/West 3	FULL	--	--
4.6/West 2	FULL	--	--
0.1/West 1	FULL	--	--
West Fork Headwaters: RM 30.0 to RM 20.7 Headwaters	Threatened	Organic enrichment/DO, Nutrients, Bacteria	NPS stormwater and/or urban runoff from Belle Valley, subdivisions between Belle Valley and Caldwell and Caldwell's Combined Sewer System
West Fork Main: RM 9.5 to RM 8.5	Threatened	Organic enrichment/DO, Nutrients, Bacteria	NPS stormwater and/or urban runoff from the Village of Macksburg
East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)			
30.3/HeadEast 12	FULL	--	--
28.4/HeadEast 2	FULL	--	--
26.3/HeadEast 1	FULL	--	--
20.7/EastAbove 3	FULL	--	--
14.2/EastAbove 2	FULL	--	--
9.6/EastAbove 1	FULL	--	--
4.2/EastBelow 2	PARTIAL	Aluminum, Iron, Manganese, Siltation, Ammonia	AMD: surface mining
0.9/EastBelow 1	FULL	--	--
East Fork Below Middle: RM 1.3 to 0.1	Threatened	Organic enrichment/DO, Nutrients, Bacteria	NPS stormwater and/or urban runoff from the Village of Lower Salem
Middle Fork Duck Creek (06-322) 2000 (WAP) - WWH (existing)			
11.8/Middle 4	FULL	--	--
10.8/Middle 3	FULL	--	--
10.4/Middle 3	NON	Aluminum, Iron, Manganese	AMD: surface mining
9.8/Middle 2	FULL		

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
5.4/Middle 1	PARTIAL	Aluminum, Iron, Manganese	AMD: surface mining
0.1/Middle 5	NON	Aluminum, Iron, Manganese, Siltation	AMD: surface mining
Pawpaw Creek (06-321) 2000 WAP - EWH (existing)			
11/PawPaw 4	FULL	--	--
9.6/PawPaw 3	FULL	--	--
8.2/PawPaw 2	FULL	--	--
3.8/PawPaw 1	PARTIAL	Siltation: in recovery	Equipment working in and around stream at time of sampling: in recovery
Whipple Run (06-306) 2000 (WAP) - WWH (existing)			
4.6/Upper 5	FULL	--	--
4/Upper 4	FULL	--	--
0.1/Upper 3	PARTIAL	Organic Enrichment/DO, Bacteria	Stormwater and septic run off from Whipple
Nelots Creek (06-360) 2000 (WAP) - WWH (proposed)			
1.4/West 8	FULL	--	--
0.1/West 7	FULL	--	--
Coal Run (06-366) 2000 (WAP) - WWH (proposed)			
3.6/HeadWest 12	FULL	--	--
2.9/HeadWest 11	FULL	--	--
0.8/HeadWest 10	FULL	--	--
Dog Run (06-346) 2000 (WAP) - WWH (existing)			
2.6/HeadWest 24	PARTIAL	Siltation	Pastureland
1/HeadWest 19	NON	Siltation	Removal of Riparian Veg. & Pastureland
Wolf Run (06-347) 2000 (WAP) - WWH (existing)			
2.5/HeadWest 18	PARTIAL	Flow Alterations Low DO, Ammonia, Bacteria	Hydrologic Modification ust. (Wolf Run Lake) Urban Runoff/storm sewers & onsite waste water systems
0.5/HeadWest 17	NON	Flow Alterations Low DO, Ammonia, Bacteria	Hydrologic Modification dst. (Wolf Run Lake) Urban Runoff/storm sewers & onsite waste water systems
0.5/HeadWest 17	FULL	--	--
Johnny Woods River (06-348) 2000 (WAP) - LWH (existing); WWH (proposed)			
1.4/HeadWest 14	FULL	--	--
0.3/HeadWest 13	FULL	--	--
Horse Run (06-363) 2000 (WAP) - WWH (proposed)			
2.3/HeadWest 16	FULL	--	--
1.7/HeadWest 15	FULL	--	--

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
Trib. to Horse Run (confluence @ RM 2.25) (06-347) 2000 (WAP) - WWH (proposed)			
0.1/HeadWest 25	FULL	--	--
Patty Creek (06-368) 2000 (WAP) - EWH (proposed)			
0.1/HeadWest 23	FULL	--	--
Salt Run (06-362) 2000 (WAP) - WWH (existing)			
2.1/HeadWest 21	FULL	--	--
0.9/HeadWest 20	FULL	--	--
0.2/	FULL	--	--
0.1 to 1.5/HeadWest 20	Threatened	Flow Alterations & Sediment	Hydromodification, Removal of Riparian Veg. & Filling of Floodplain
Trib to West Fork Duck Creek (confl. @ RM 9.35)(Macksburg Run)(06-361)2000 (WAP)			
0.1/West 9	FULL	--	--
Trib to West Fork Duck Creek (confl. @ RM 8.7)(Goose Hollow)			
0.0-1.7/West 10	Threatened	Aluminum, Manganese, Iron, Siltation	AMD: surface mining
Buffalo Run (06-342) 2000 (WAP) - LRW (existing); WWH (proposed)			
1.9/West 5	NON	Aluminum	AMD: surface mining
0.1/West 6	FULL	--	--
Warren Run (06-343) 2000 (WAP) - LWH (existing); WWH (proposed)			
0.1/HeadWest 22	NON	Aluminum	AMD: surface mining
Trib. to West Fork Duck Cr. (confluence @ RM 3.05) (06-359) 2000 (WAP) - WWH (proposed)			
0.2/West 11	NON	Aluminum, Manganese, Iron, Siltation	AMD: surface mining
Trib. to West Fork Duck Cr. (confluence @ RM 2.30) (06-358) 2000 (WAP) - WWH (proposed)			
0.2/West 4	FULL	--	--
Sugar Creek (06-304) 2000 (WAP) - WWH (existing)			
0.1/Lower 6	FULL	--	--
Killwell Run (06-301) 2000 (WAP) - WWH (existing)			
0.1/Lower 7	FULL	--	--
Otterslide Run (06-301) 2000 (WAP) - LWH (existing); WWH (proposed)			
0.1/Middle 7	PARTIAL	Aluminum, Iron, Manganese	AMD: surface mining
Mare Run (06-324) 2000 (WAP) - LWH (existing); WWH (proposed)			
0.7/Middle 6	PARTIAL	Aluminum Nutrients & Siltation	AMD: surface mining Pastureland & Removal of Riparian Veg.
0.1/	FULL	--	--
West Fork East Fork Duck Cr. (06-335) 2000 (WAP) – LWH (existing); WWH (proposed)			

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
1.4/HeadEast 9	FULL	--	--
0.1/HeadEast 3	FULL	--	--
Trib. to East Fork Duck Cr. (confluence @ RM 5.73) (06-353) 2000 (WAP) - WWH (proposed)			
0.1/EastBelow 3	NON	Aluminum, Manganese, Iron, Siltation	AMD: surface mining
Trib. to East Fork Duck Cr. (confluence @ RM 4.15) (06-352) 2000 (WAP) - WWH (proposed)			
0.1/EastBelow 4	PARTIAL	Siltation & Aluminum	AMD: surface mining
Barnes Run (06-334) 2000 (WAP) - LWH (existing); WWH (proposed)			
1.5/HeadEast 10	FULL	--	--
0.1/HeadEast 4	FULL	--	--
Schwab Run (06-330) 2000 (WAP) - LWH (existing); WWH (proposed)			
3.0/EastAbove 7	PARTIAL	Siltation	Pastureland
Greasy Run (06-332) 2000 (WAP) - LWH (existing); WWH (proposed)			
1.2/HeadEast 8	PARTIAL	Siltation	Pastureland
0.7/HeadEast 7	PARTIAL	Siltation	Pastureland
Elk Fork (06-331) 2000 (WAP) - LWH (existing); WWH (proposed)			
2.2/HeadEast 11	NON	Aluminum & Manganese	AMD: surface mining
1.8/HeadEast 6	FULL	--	--
0.1/Head East 5	NON	Nutrients	Pastureland
Creighton Run (06-327) 2000 (WAP) - LWH (existing); EWH (proposed)			
0.8/EastAbove 8	FULL		
Flag Run (06-329) 2000 (WAP) - LWH (existing); WWH (proposed)			
2.5 EastAbove 11	NON	Aluminum & Iron	AMD: surface mining
0.9/EastAbove 9	PARTIAL	Aluminum & Iron	AMD: surface mining
0.4/	FULL	--	--
0.1/EastAbove 4	FULL	--	--
Road Fork (06-328) 2000 (WAP) - LWH (Existing); CWH (proposed)			
2/EastAbove 10	FULL	--	--
		WWH (proposed)	
1.4/EastAbove 6	PARTIAL	Siltation Aluminum, Iron & Manganese	Pastureland AMD: surface mining
0.7/EastAbove 5	FULL	--	--

Sampling Sites

Sampling sites (**Appendix 8 & Map 10**) were selected based on a geometric design with additional coverage across the mainstem and both forks and to target specific potential influences (OEPA). The geometric site selection process involves subdividing by halves, the entire 287-mi² basin. This subdivision yields subbasin areas of 144 mi², 72 mi², 36 mi², 18 mi², 9 mi², 4.5 mi² and 2.2 mi². Sites that most closely matched these stratifications were selected for inclusion in the Ohio EPA 2000 TMDL study of Duck Creek (OEPA). Other sites were selected on a site specific basis depending on past land use problems. For example, additional sampling sites were selected directly downstream of the two Superfund dumpsites in the watershed. The Duck Creek Watershed Partnership will continue to sample the sites that were utilized in the TMDL to determine if water quality has improved throughout the watershed. Additional sites may be added in the heavily mined areas due to gaps that may arise in the sampling design.

NOTE: Additional information about water quality standards, numeric criteria, and designated uses can be found in the *Watershed Inventory: water resources* section of this plan.

Locationally-Referenced Use Designations/Use Attainment

The Duck Creek Watershed's Aquatic Use Attainment Status is based on the Warm Water Habitat designation. As previously stated, attainment of aquatic life uses in Ohio is measured in two ways. First, water chemistry is compared to the available numeric criteria. For example, DO in streams designated as WWH must average at least 5 mg/L (**Table 16: Project Parameters & Numerical Targets of Water Quality Data**). Second, the measured biological scores are compared to those seen in the least impacted areas of the same ecological region and aquatic life use. Attainment benchmarks from these least impacted areas are established in the form of "biocriteria," which are then compared to the measurements obtained from the study area. (**Table 15: Biological Criteria for the Western Allegheny Plateau**). If the measurements of a stream do not achieve the biocriteria, the stream is considered in "nonattainment." If the stream measurements achieve some of the biological criteria but not others, the stream is said to be in "partial-attainment." (Keith Orr, Ohio EPA).

The next step is to determine the number of stream miles in full, partial or non-attainment within the Duck Creek Watershed. The process of calculating attainment miles for each 14-digit subwatershed began by utilizing the *Aquatic Life Use Attainment Status* table provided by OEPA (**Appendix 5**). This table shows attainment status and the corresponding river mile of all monitored streams in the Duck Creek Watershed. Miles of attaining streams were calculated by noting the attainment status of a monitored site within a stream segment. If all of the sites upstream from the beginning monitored site were "fully attaining", the stream miles were tallied as "fully attaining". Once a site was considered "nonattaining" the miles upstream of this site were tallied "as non-attaining", until the next "fully attaining" monitored site was encountered. After a "fully attaining" site was found the miles upstream were again considered "fully attaining". This process continued throughout the 9 subwatersheds until all monitored streams were assessed. Refer to **Table 19: Attainment Miles and Status for Duck Creek Watershed** for a listing of fully, threatened, partial and nonattaining stream miles per subwatershed. **Map 8** shows the fully, partially, non-attaining and threatened stream segments throughout the watershed.

Table 19: Attainment Miles and Status for Duck Creek Watershed

Subwatershed	Attainment Miles						Total Miles
	Full	Threatened	Partial	Partial: in recovery	Non	Unmonitored Miles	
Lower Duck Creek 05030201-120-040	12.08	0	1.3	2.5	1.4	5.53	22.81
Upper Duck Creek 05030201-120-030	15.53	1.8	4	0	0	22.44	43.77
West Fork Main 005030201-120-020	22.66	2.7	0	0	2.15	19.57	47.08
Paw Paw Creek 005030201-110-050	5.97	0	0	4.4	0	33.4	43.77
Middle Fork 005030201-110-030	5.28	0	10.55	0	5.7	14.78	36.31
Headwaters East Fork 005030201-110-010	16.61	0	1.37	0	3.69	31.59	53.26
East Fork above Middle Fork 005030201-110-020	24.52	0	3.7	0	0.43	31.44	60.09
East Fork below Middle Fork 005030201-110-040	3.15	1	6.91	0	6.23	8.98	26.27
Headwaters West Fork 005030201-120-010	32.13	10.8	1.65	0	4.17	72.4	121.15
Total	137.93	16.3	29.48	6.9	23.77	240.13	454.51

Causes, Sources and Threats of Impairment

To determine specific causes and sources of impairment for particular stream segments per subwatershed, the following tables and/or appendices were utilized: Aquatic Life Use Attainment Status (**Appendix 5**), OEPA’s Appendix A 305 (b): rivers and streams report and Attainment Miles and Status for Duck Creek Watershed (**Table 19**). To view the causes and sources of impairment refer to the **Table 18: Causes and Sources of Impairment by River Mile and Duck Creek Sampling “Site ID” table and Map 9**.

Point Source Pollution

Point source pollution enters a water body from one identifiable source through means of a pipe, ditch, or some other type of discharge. Some types of point sources are permitted, while other types can stem from an open trash dump, spill, leaky underground tanks or illicit discharge.

NOTE: all point sources pollution categories below are categorized by subwatershed in Table 20.

Table 20: Point Source Pollution

Subwatershed	NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
Lower Duck Creek 05030201-120-040	0	56	1- animal waste	6	3
Upper Duck Creek 05030201-120-030	0	5	1- oil/gas spill	2	0
West Fork Main 005030201-120-020	1	21	none	9	0
Paw Paw Creek 005030201-110-050	0	2	none	11	0
Middle Fork 005030201-110-030	0	15	none	7	0
Headwaters East Fork 005030201-110-010	2	4	none	11	0
East Fork above Middle Fork 005030201-110-020	2	11	none	14	0
East Fork below Middle Fork 005030201-110-040	1	22	none	6	0
Headwaters West Fork 005030201-120-010	1	82	combined storm runoff and sewage system*	4	1
Total	7	218	2	70	4

*The Caldwell treatment plant is a Combined Sewer System (CSS-combined storm runoff and sewage). Significant rain events cause the sewer to overflow into storm drains and enter into the West Fork of Duck Creek at 15-17 overflow outlets (Jeff Antil, Noble Wastewater Plant & Bruce Goff, OEPA Division of Surface Water).

Sources: ODNR Division of Mineral Resource Management Oil & Gas Section, ODNR Division of Wildlife Investigator and the OEPA Southeast District.

NPDES

There are currently 7 National Pollution Discharge Elimination System (NPDES) permits issued in the watershed. One permit is from the Caldwell Wastewater Treatment Plant while the remaining 6 permits are for surface mining operations. Refer to **Table 21** for a complete listing of all recorded NPDES Point Source Permits Issued in the Duck Creek Watershed.

Table 21: NPDES Point Source Permits issued in the Duck Creek Watershed.

OEPA Permit Number	ODNR Permit Number	Facility Name	Description	Area (acres)
OG-MO-0077	D-706	B&N Coal	Mining	260.5
OG-MO-0187	D-787	B&N Coal	Mining	262.5
OG-MO-0078	D-807	B&N Coal	Mining	34.1
OG-MO-0080	D-958	B&N Coal	Mining	324.8
OG-MO-0287	D-1122	B&N Coal	Mining	282.5
OG-MO-0342	D-1194	B&N Coal	Mining	67.5
OH0020559	n/a	Village of Caldwell	Sewage Treatment	n/a

Spills and Illicit Discharges

Spills and illicit discharges in the watershed include: livestock waste, human waste, crude oil, and mine drainage containment pond leaks/spills. The Point Source Pollution Table originated from verified complaints gathered from ODNR Division of Mineral Resource Management Oil & Gas Section, ODNR Division of Wildlife Investigators and the OEPA Southeast District (Table 20). From 1999-2003 there has been one oil/gas spill and one fish kill within the Duck Creek Watershed (ODNR Division of Mineral Resource Management Oil & Gas Section, ODNR Division of Wildlife Investigator). Concerning sewage or human waste discharges 65% of the Caldwell treatment system is a Combined Sewer System (CSS-combined storm runoff and sewage). Therefore, within the combined sections significant rain events cause the sewer to overflow into storm drains and enter into the West Fork of Duck Creek at 15-17 overflow outlets (Jeff Antil, Noble Wastewater Plant & Bruce Goff, OEPA Division of Surface Water). Exact locations of the overflow outlets are not known at this time. A reconnaissance of the stream segments during the 2004-sampling season will inventory the sites by Global Positioning System (GPS), and a corresponding GIS map will be created. The exact number and amount of illicit discharges are difficult to quantify, however, according to Bruce Goff (OEPA) “any significant rain event” will cause the sewers to overflow into the storm sewers and enter the stream. The remaining 35% of the system that is not combined are discharged from the Caldwell Treatment Plant into West Fork of Duck Creek off of Railroad Street, on the downstream side of Caldwell. Refer to the Point Source Pollution Table below.

Open Trash Dumps

A survey documenting open trash dumps is completed every five years by the Southeastern Ohio Joint Solid Waste Management District in cooperation with Washington and Noble Health Departments. Dumps documented in the survey are not necessarily illegal, however, they are used to inventory and target areas that are prone to chronic dumping. Information on open trash dumps in the watershed was provided by the Southeastern Ohio Joint Solid Waste Management District (Reiter, 2003).

Non Point Sources

Note: The following Non Point Source categories are quantified by subwatershed in Table 22- Non Point Source Pollution & Potential Causes, unless otherwise noted.

Failing Home Sewage Treatment System (Table 22)

There are only two wastewater treatment systems in the watershed study area; therefore, the majority of the homes have Home Sewage Treatment Systems (HSTS). For example, only 32% of the total 5,413 homes in the watershed have public sewage (Table 17, Rick Groves: Marietta Treatment Plant and Jeff Antil: Caldwell Treatment Plant). Additionally, of the 3,687 homes without public sewage an estimated 64% have failing or inoperable HSTS (Ken Robinson: Washington Health Department and Shawn Ray: Noble Health Department). The percent of failing systems was determined by using the total number of HSTS's from **Table 17: Urban Land Use Statistics by Subwatershed** and estimating the percentage of those systems believed to be failing.

Number of Construction, bridge, road repair and land slip repair (Table 22)

The *Non Point Source Pollution & Potential Causes* table lists all expected construction, bridges, road repairs and landslip repairs throughout the watershed. These construction projects on an individual basis will impact the stream temporarily and have minimal long-term impacts to the health of the watershed. However, the accumulative impact of multiple projects may negatively affect flow, access to floodplains, entrenchment, flooding rates, etc. The seriousness of this situation has prompted the Duck Creek Advisory Committee to recommend that permits, procedures, Best Management Practices and when required; Environmental Impact Analysis precede future floodplain development and filling. This issue is particularly important in the Duck Creek Watershed because of the chronic flooding that has plagued the area. Additionally, the rugged terrain of the watershed provides few areas that are suitable for development. For example, most development in the watershed occurs in flat floodplains and/or ridge tops. Floodplains are of added convenience in Duck Creek because most state, county and township roads follow the streams; providing increased access to the floodplain.

Number and Size of Confined and Non-confined Livestock Operations (Table 22)

The number and size of confined and non-confined livestock operations are considered to be a source of nonpoint source pollution in the Duck Creek Watershed. Livestock operations, in close proximity to the stream, can cause sediment and manure to enter the stream, resulting in declining water quality. Additionally, operations that provides their livestock with unlimited access to the stream pose increased threats to water quality. For example, livestock accessing streams increase erosion loads by trampling stream banks and causing direct manure release into the stream. The number of stream miles with unlimited access and the percentage of total stream miles can be referenced in **Table 14: Physical Attributes of Streams**. This table indicates that Middle Fork (45%-access), East Fork above Middle Fork (40%-access) and Headwaters West Fork (38%-access) Subwatersheds have the highest percentages of livestock access to streams. Referencing **Appendix 9: Agriculture Land Use Statistics**, the total number of operations is estimated with the total # of animal units for confined and non confined operations

Acres of Highly Erodible Land and Potential Soil Loss

NOTE: the Spatial Soil Data for the Duck Creek Watershed is incomplete. According to Rick Griffin, NRCS Soil Scientist the remaining data will not be available from ODNR until August of 2004. The Spatial Soil Data for Washington County and the Wayne National Forest portions of Noble and Monroe Counties within the watershed is however, complete. For all available data, **Table 22: Non Point Source Pollution & Potential Causes** lists the acres of highly erodible land and the percentage of total acres by subwatershed.

Soil erosion is of special concern to the Duck Creek Watershed because of chronic flooding and sediment is considered the number one source of impairment (OEPA TMDL, 2003). In addition, the Duck Creek Watershed ranks 10th in Ohio for total soil loss from all sources due to an annual soil loss of 2,864,500 tons (NRCS). The percentage by subwatershed, of total acres that are considered “Highly Erodible Land” ranges from 75% to 95% (Table 8, all available data). Acreage of Highly Erodible Land was calculated by using Arcview GIS Spatial Soil Data (ODNR, Division of Soil and Water) and Noble, Washington, Guernsey and Monroe Counties Highly Erodible Land Soils Lists (NRCS: Doc Redmund, Soil Scientists). Highly Erodible Land was then selected out of the Spatial Soil Data and a new file was created that listed the acres of Highly Erodible Land per subwatershed.

Is the Stream Culverted?

All public and private roadways cross every stream in the watershed; therefore culverts are needed at each crossing. The lack of long culvert sections which redirect stream flow, however, indicate that the watershed is not negatively affected by culverts. All culverts in the watershed are small in length and are necessary for water to pass under roadways and maintain proper flow. Therefore, this section is not included in **Table 22: Non Point Source Pollution & Potential Causes**.

Channelization

Channelization is known as the alteration of the natural flow of water through a landscape, and often takes the form of channel modification or channelization. The majority of the Duck Creek Watershed has not been subjected to channelization or hydromodification (TMDL and personal observation). This has allowed the watershed as a whole, to maintain a natural channel with appropriate floodplain connectivity and sinuosity. However, channelization has occurred at several segments throughout the watershed. **Table 14: Physical Attributes of Streams** lists all sites by subwatershed that have been subjected to channelization/hydromodification. The longest and most severe channelized stream segment within the watershed is located in the Lower Duck Creek Subwatershed at the confluence of the Ohio River upstream to river mile 2.2. This channelization project occurred in ? to make room for Interstate-77 (Table 14, ODOT District 10). The second most severe channelized stream segment in the watershed occurs in the Headwaters of West Fork Subwatershed @ river mile 0.5-1.5 along Salt Run. This channelized segment runs along State Route 78 within the Village of Caldwell. The stream channel is being straightened and the floodplain is being filled along the south side of the channel (Table 14).

Levied Streams

As stated in the Physical Attributes of Streams and Floodplain Areas section of this document there are no permitted levies within the watershed study area (Jeff Lauer and Connie Holibitzol: Washington County, Chasity Schmelzenbach and Connie Holibitzol: Noble County). This topic is not included in Tables 14 or 22 because there are no levies in the watershed.

Dams: impounded stream miles

There are many farm ponds of varying drainage and surface area throughout the watershed. However, the discussion of dams, lakes and reservoirs within Duck Creek Watershed study area is limited to those structures included in ONDR's Dam Safety inventory. There Are 18 larger ponds/lakes that are inventoried by ONDR Division of Dam Safety. All information concerning these 18 structures can be found in **Appendix 3: Duck Creek Watershed Dams, Lakes and Ponds Inventory** (ONDR Division of Dam Safety inventory data, Rick Archer). The total number of stream miles impounded by the 18 dams is 6.43 miles. The majority (4.66 miles) of the total impounded stream miles (6.43 miles) is a result of the two largest manmade dams/lakes in the watershed, Caldwell Lake Reservoir and Wolf Run Lake Reservoir. The other 16 structures within the watershed account for the remaining 1.77 miles of impoundment. Considering the minute amount of impounded miles the net affect on water quality is minimal. This indicates that water quality, water flow and/or biological movement impairments predominantly occur within Wolf Run (Wolf Run Lake) and Dog Run (Caldwell Lake). Miles of impounded streams per subwatershed can be found in Table 22.

Petition Ditches

There are currently no petition ditches within the Duck Creek Watershed, therefore, this topic is not included in Table 22 and 14 (Washington and Noble County Engineers).

Table 22: Non Point Source Pollution & Potential Causes

Subwatershed	# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
Lower Duck Creek 05030201-120-040	442 (60%)	2/800	8/255	9,366 (79%)	1/na
Upper Duck Creek 05030201-120-030	276 (65%)	6/360	30/1,700	11,864 (75%)	1/.20
West Fork Main 005030201-120-020	309 (68%)	0/0	25/500	17,486* (88%)	none
Paw Paw Creek 005030201-110-050	156 (60%)	0/0	24/456	14,246 (95%)	none
Middle Fork 005030201-110-030	100 (60%)	1/50	53/1,148	14,775*** (87%)	6/.41
Headwaters East Fork 005030201-110-010	152 (60%)	3/275	53/1,252	18,833**** (93%)	none

East Fork above Middle Fork 005030201-110-020	181 (60%)	0/0	49/648	24,237 (94%)	1/.09
East Fork below Middle Fork 005030201-110-040	86 (65%)	0/0	21/296	7,524** (82%)	none
Headwaters West Fork 005030201-120-010	670 (70%)	4/375	147/3,095	No data available	9/5.73

HSTS - Home Sewage Treatment Systems

A.U. - Animal Units

* Lacking 5,440 acres of Spacial Soil Data at time of publication, ODNR.

**Lacking 1,088 acres of Spacial Soil Data at time of publication, ODNR.

***Lacking 5,248 acres of Spacial Soil Data at time of publication, ODNR.

****Lacking 1,280 acres of Spacial Soil Data at time of publication, ODNR.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Landuse/Landcover

Land Use	Area (acres)	%
Deciduous	24,884	51.7
Pasture/Hay	17,710	36.7
Evergreen	1,164	2.4
Row Crops	2,315	4.8
Mixed Forest	427	0.88
Low Intensity	715	1.50
Open Water	471	0.98
High Intensity	39	0.080
Transitional	44	0.09
Quarries	31	0.06
Other Grasses	39	0.08
Commercial/Industrial/Transp	312	0.65
Woody Wetlands	7	0.01
Emergent Herbaceous	12	0.02
Total	48,170	100.0

Basic Statistics

Size: 48,219.5 acres (75.3 mi²)
 Location: Noble & Guernsey Counties
 Avg. Flow: 74.44 cfs, Stream Mi.: 114.73
 Aquatic Life Use Designation: Warm Water Habitat
 Attainment Miles: 32.1 full, 10.8 threat, 1.65 partial, 4.2 non, 72.4 unmonitored
 Monitoring Sites: 25

Stream statistics

Names	Length	Gradient	Sample Sites
Headwaters West Fork	21.99	7.8	9
Johnny Woods River	3.32	3.8	2
Patty Creek	2.59	n/a	1
Coal Run	4.26	n/a	3
Wolf Run	3.96	43.7	2
Dog Run	4.25	45.5	2
Warren Run	1.85	129.3	1
Lick Run	1.28	138.4	None
Otter Run	1.35	103.7	None
Elk Run	0.95	47.8	None
Salt Run	4.23	n/a	2
46 Unnamed Streams	71.12	n/a	3
Total	121.15	n/a	25

Agricultural Statistics

Agriculture=41.6 (20,025 acres) 88% Pastureland
 12% Crop land

Croptype: 95% hay, 4% corn, small grains 1%
 Tillage: 80% conventional, 20% no-till
 Rotations: 5 yrs. of hay with 1 year of corn or soy beans
 Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U.	
			# of A.U. Confined	Non-confined
Beef	82	2,385	300	2,085
Dairy	1	150	75	75
Horses	31	210	0	210
Swine	0	0	0	0
Sheep	11	580	0	580
Other	26	145	0	145
Total	151	3,470	375	3,095

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	Homes w/ Sewers	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
2.3	1.6	1,950	8,118	993	957	670	70

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	Head West Monitoring Sites: 17, 18, 19, 20, 21, 22,	65.5 (56%)	44.4 (38%)	9	Wolf Run State Park**	Bridge replacement (2003): St. Rt. 821 in Caldwell	Dog Run @ RM 1.0 Salt Run @ RM .5-1.5 Wolf Run @ RM .5

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ Stream Miles Dammed
670 (70%)	4/375	147/3,095	No data available	9/5.73 mis.

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
1	82	combined storm runoff and sewage system*	4	1

Industry Statistics

Oil & Gas Wells: 1,208

Manufacturing & Factory: Dana Corporation, International Converter/Packaging Dynamics

Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Headwaters West Fork of Duck Creek Subwatershed, HUC: 05030201-120-010

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the Headwaters of West Fork Subwatershed.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
West Fork Duck Creek (06-340) 2000 (WAP) - WWH (existing)			
34.2/HeadWest9	FULL	--	--
33.3/HeadWest 8	FULL	--	--
31.4/HeadWest 7	FULL	--	--
28/HeadWest 6	FULL	--	--
23.1/HeadWest 5	FULL	--	--
23.0/HeadWest 5	--	--	--
22.3/ HeadWest 4	FULL	--	--
20.7/HeadWest 3	FULL	--	--
16/HeadWest 2	FULL	--	--
12.8/HeadWest 1	FULL	--	--
9.1/West 3	FULL	--	--
4.6/West 2	FULL	--	--
0.1/West 1	FULL	--	--
West Fork Headwaters: RM 30.0 to RM 20.7 Headwaters	Threatened	Organic enrichment/DO, Nutrients, Bacteria, Fecal Coliform, E.Coli	NPS stormwater and/or urban runoff from Belle Valley, subdivisions between Belle Valley and Caldwell and Caldwell's Combined Sewer System
Coal Run (06-366) 2000 (WAP) - WWH (proposed)			
3.6/HeadWest 12	FULL	--	--
2.9/HeadWest 11	FULL	--	--
0.8/HeadWest 10	FULL	--	--
Dog Run (06-346) 2000 (WAP) - WWH (existing)			
2.6/HeadWest 24	PARTIAL	Siltation	Pastureland
1/HeadWest 19	NON	Siltation	Removal of Riparian Veg. & Pastureland
Wolf Run (06-347) 2000 (WAP) - WWH (existing)			
2.5/HeadWest 18	FULL	--	--
0.5/HeadWest 17	NON	Flow Alterations Low DO, Ammonia, Bacteria	Hydrologic Modification dst. (Wolf Run Lake) Urban Runoff/storm sewers & onsite waste water systems
Johnny Woods River (06-348) 2000 (WAP) - LWH (existing); WWH (proposed)			
1.4/HeadWest 14	FULL	--	--
0.3/HeadWest 13	FULL	--	--
Horse Run (06-363) 2000 (WAP) - WWH (proposed)			
2.3/HeadWest 16	FULL	--	--
1.7/HeadWest 15	FULL	--	--

Headwaters West Fork of Duck Creek Subwatershed, HUC: 05030201-120-010

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
Trib. to Horse Run (confluence @ RM 2.25) (06-347) 2000 (WAP) - WWH (proposed)			
0.1/HeadWest 25	FULL	--	--
Patty Creek (06-368) 2000 (WAP) - EWH (proposed)			
0.1/HeadWest 23	FULL	--	--
Salt Run (06-362) 2000 (WAP) - WWH (existing)			
2.1/HeadWest 21	FULL	--	--
0.9/HeadWest 20	FULL	--	--
0.2/	FULL	--	--
0.9/HeadWest 20	Threatened	Flow Alterations & Sediment	Hydromodification, Removal of Riparian Veg. & Filling of Floodplain
Warren Run (06-343) 2000 (WAP) - LWH (existing); WWH (proposed)			
0.1/HeadWest 22	NON	Aluminum	AMD: surface mining

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Aquatic life use attainment status of sites sampled in the *Headwaters of West Fork Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

River Mile/Site ID	IBI	MIwb	ICI ^a	QHEI	Attainment Status ^b	Site Location
West Fork Duck Creek (06-340) 2000 (WAP) - WWH (existing)						
34.2/HeadWest9	54	--	VG	51	FULL	
33.3/HeadWest 8	48	--	VG	58.5	FULL	
31.4/HeadWest 7	47	8.7	40	74.5	FULL	
28/HeadWest 6	46	8.9	46	61.5	FULL	
23.1/HeadWest 5	50	8.7	--	63.5	FULL	
23.00/HeadWest 5	46	9.5	P		--	Acute Mix zone effluent was not acutely toxic
22.3/ HeadWest 4	44	8.8	MG ^{ns}		FULL	dst. Caldwell WWTP
20.7/HeadWest 3	46	9.2	44	60	FULL	dst. Dana / recovery
16/HeadWest 2	51	9.9	32 ^{ns}	74	FULL	adjacent SR 821 nr. I-77 crossover
12.8/HeadWest 1	48	9.6	48	65.5	FULL	ust. Dexter
Coal Run (06-366) 2000 (WAP) - WWH (proposed)						
3.6/HeadWest 12	54	--	MG ^{ns}	47	FULL	cattle, NPS sedimentation/nutrients
2.9/HeadWest 11	50	--	MG ^{ns}	51	FULL	cattle, NPS sedimentation/nutrients
0.8/HeadWest 10	54	--	G	55	FULL	siltation
Dog Run (06-346) 2000 (WAP) - WWH (existing)						
2.6/HeadWest 24	28*	--	MG ^{ns}	59	PARTIAL	ust. Lk Caldwell/interstitial pool/NPS
1/HeadWest 19	32*	--	F*	35.5	NON	dst Lk Caldwell/NPS silt, more lentic
Wolf Run (06-347) 2000 (WAP) - WWH (existing)						
2.5/HeadWest 18	40 ^{ns}	--	MG ^{ns}	59	PARTIAL	ust. Lake Caldwell
0.5/HeadWest 17	--	--	F*		(NON)	dst Wolf Run Res releases/ town NPS
0.5/HeadWest 17	50	--	--	46.5	(FULL)	dst. Wolf Run Reservoir
Johnny Woods River (06-348) 2000 (WAP) - LWH (existing); WWH (proposed)						
1.4/HeadWest 14	50	--	G	54	FULL	
0.3/HeadWest 13	48	--	G	70	FULL	
Horse Run (06-363) 2000 (WAP) - WWH (proposed)						
2.3/HeadWest 16	48	--	G	56	FULL	
1.7/HeadWest 15	48	--	G	57	FULL	
Trib. to Horse Run (confluence @ RM 2.25) (06-347) 2000 (WAP) - WWH (proposed)						
0.1/HeadWest 25	44	--	MG ^{ns}	50.5	FULL	

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

River Mile/Site ID	IBI	MIwb	ICI ^a	QHEI	Attainment Status ^b	Site Location
Patty Creek (06-368) 2000 (WAP) - EWH (proposed)						
0.1/HeadWest 23	58	--	E	75	FULL	
Salt Run (06-362) 2000 (WAP) - WWH (existing)						
2.1/HeadWest 21	42 ^{ns}	--	MG ^{ns}	55	FULL	
0.9/HeadWest 20	42 ^{ns}	--	MG ^{ns}	46.5	FULL	
0.2/	--	--	MG ^{ns}	66	(FULL)	
Warren Run (06-343) 2000 (WAP) - LWH (existing); WWH (proposed)						
0.1/HeadWest 22	31*	--	F*	52	NON	irregular pulse AMD/bugs recovering

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI Headwaters	IBI Wading	IBI Boat	MIwb Wading	MIwb Boat	ICI (all sites)
EWH Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH	24	24	24	6.2	5.8	22
LRW	18	18	18	4.0	4.0	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Background Statement: The Headwaters of West Fork Duck Creek Subwatershed (HUC 05030201-120-020) is not meeting water quality use designations due to organic enrichment/low DO levels, high levels of E.Coli, Fecal Coliform, ammonia and bacteria from failing HSTS's and sewer overflows, as well as aluminum from unreclaimed surface mining, and siltation from pasturelands and lack of riparian vegetation. The Headwaters of West Fork Duck Creek Subwatershed has the third lowest percentage of riparian buffer of all 9 subwatersheds. For example, only 56% of this subwatershed's stream miles have a riparian buffer of 50-feet on each side of the stream.

Problem Statement 1 of 5: Organic enrichment/low DO and elevated levels of E. Coli and Fecal Coliform are negatively affecting water quality along the West Fork of Duck Creek, from RM 20.7 to 30.0. This segment was not found to be impaired in OEPA's TMDL but it is considered a health concern by the Noble County Health Department and the Regulatory Division of OEPA. Wolf Run, however, from RM 0.5 to RM 2.5 was found to be non-attaining by OEPA's TMDL because of organic enrichment/low DO problems. According to the Noble County Health Department and the OEPA the source of these impairments is septic runoff from Belle Valley and subdivisions between Belle Valley and Caldwell. The Noble County Health Department estimates that 70% of the 500 homes with Home Sewage Treatment Systems (HSTS) within the Village of Belle Valley and the subdivisions between Belle Valley and Caldwell are failing. The 350 homes with failing HSTS systems are contributing to the threatened status of this stream segment. We have estimated the potential amount of effluent entering the stream to be 24,157,525 gallons/year. The Village of Caldwell agreed, in 2001, to the Caldwell-Belle Valley Sanitary Sewer Improvements Project. This project includes the construction of a collection system along State Route 821; to serve the Village of Belle Valley and areas located between the Village of Belle Valley and the Village of Caldwell. These areas include the unincorporated areas of Slaters, Florence, Maple Heights, Bronze Heights and South Acres. This agreement would allow Belle Valley and surrounding subdivisions to use Caldwell's wastewater treatment plant, significantly reducing the septic issue for this subwatershed. There is a disagreement, however, between local groups and the agreement stalled and is locked in a stalemate. There is some urgency to get this solved because the situation is currently under review by Max Schapiro in the Legal Division of OEPA for findings and orders from OEPA's legal team in Columbus; fines will be coming in the near future.

In addition, Caldwell's Combined Sewer System has 15-17 overflows throughout their system that flushes sewage into the West Fork during precipitation events. According to Jeff Antil, Village of Caldwell Sewer Department, the Village is in the process of converting its entire system to separate systems for sewage and stormwater; therefore this issue is not addressed in the table below. Currently, approximately half of the system is a Combined Sewer System.

Goals:

1. Over the next two years, work with the Noble County Health Department to develop a County Wide HSTS Plan.
2. Over the next year, facilitate the implementation of the Caldwell-Belle Valley Sanitary Sewer Improvements Project. When implemented 100% of the estimated 350 homes with failing HSTSs will be sewerred, preventing 24,157,525 gallons/year of effluent from entering the stream.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Objective	Resources	How	Time Frame	Performance Indicators
Develop County Wide HSTS Plan to assist in replacing	SWCD's assist local Health Department in writing HSTS Plan.	Writing HSTS Plan to provide guidelines to those upgrading or repairing systems. In addition, the Health Department would establish inspection and maintenance protocol.	2005 to 2006	Plan is developed, approved and implemented.
Resolve disagreement and deep distrust between involved parties; work towards consensus.	Desire for all stakeholders to participate in public dispute resolution. Meeting place, refreshments, and time. Possibly an outside facilitator if watershed coordinator is not able to facilitate meetings and reach a consensus.	Set up a roundtable discussion with all stakeholders to resolve disagreements and deep distrust between involved parties; work towards consensus.	2004	Agreement is reached between parties to follow through with Caldwell-Belle Valley Sanitary Sewer Improvements Project.
Implementation of the Caldwell-Belle Valley Sanitary Sewer Improvements Project.	Customer tap fees: \$158,550 CDBG W&S Grant: \$ 500,000 ARC Grant: \$200,000 OPWC Grant: \$200,000 USDA Rural Develop Grant: \$1,692,435 USDA Rural Develop Loan: \$3,949,015 Section 594 Env. Infrastructure (Army Corps): \$1,000,000	All funds are secured except Section 594 money (\$1,000,000). We requested appropriations from Senator DeWine and Congressman Strickland for FY2005 (outcome is pending).	2005-2006	Caldwell-Belle Valley Sanitary Sewer Improvements Project is implemented and sewage is not entering into stream.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Problem Statement 2 of 5: Along Dog Run, siltation from unrestricted livestock access in pasturelands is causing non-attainment from RM 1.0 to RM 2.6 and partial attainment from RM 2.6 to 4.25. According to the TMDL performed by OEPA on Duck Creek this tributary is not meeting WWH use designation because of the 29,789 lb/year of sediment entering the stream.

Goals:

1. Reduce siltation loadings from 29,789 lb/yr to 15,577 lb/yr (14,212-lb/yr reduction) in this stream by restricting livestock access to the stream and providing alternative watering resources. Inventory conducted by watershed coordinator and SWCD technicians indicates that 38% of the streams in this subwatershed have unrestricted livestock access, therefore, 38% of 3.25 total miles impaired is 1.2 miles.
2. Install 1.3 miles of riparian buffer to designated area along the non-attaining segment (RM 1.0 to RM 2.6) and 2.6 miles of riparian buffer to designated areas along partially attaining segment (RM 2.6 to RM 4.25). The created buffer areas will total 3.9 miles and should be 50-foot wide on each side of the stream. This will work in tandem with the livestock exclusion system to help reduce siltation loads from 29,789 lb/yr to 15,577 lb/yr (14,212-lb/yr reduction).

Objective	Resources	How	Time Frame	Performance Indicators
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. Total cost is approximately \$10,138 for establishing 1.2 miles (6,336t.) of fence @ \$1.60/lineal feet. Landowner gets 75% in grant cost share money totaling \$7,604; remaining 25% is accounted for in cash or in-kind services.	Install livestock exclusion fencing on 1.2 miles of the 3.25 miles of streambank with unlimited access.	2004 to 2007 (319 grant)	Streambank fencing installed on 1.2 miles of stream bank.
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. 2-3 tanks @ \$500 per tank, pipe is \$1.40/ft. (75% cost shared, 25% landowner expenses)	Install 2-3 alternative watering systems on non-confined livestock operations.	2004 to 2007 (319 grant)	2-3 alternative watering systems provided to non-confined livestock operators.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

<p>Livestock Exclusion (Fencing and Alternative Water Systems)</p>	<p>Any additional landowners that do not participate in 319 grant funding are able to sign up for EQIP and receive 50% cost share on all livestock exclusion systems</p>	<p>Sign up for EQIP at NRCS.</p>	<p>2004 to 2007</p>	<p>Additional landowners signed up, approved and implemented livestock exclusion systems.</p>
<p>Establish 50-foot wide riparian corridor on each side of stream along the designated 3.9 miles (47.3 acres of buffer to be created).</p>	<p>Total cost is approximately \$21,758 for establishing 47.3 acres of riparian buffer @ \$460/acre. Landowner gets 50% in EQIP and/or CRP cost share money totaling \$10,879; remaining funds accounted for in cash or in-kind services.</p>	<p>Watershed Coordinator, NRCS, district conservationist and volunteers to visit landowners and inform them of financial, water quality and wildlife benefits of riparian buffers. Sign up willing landowners for CRP and/or EQIP program.</p>	<p>August 2005 to August 2009</p>	<p>3.9 miles of riparian buffer set aside and established.</p>
<p>Riparian buffer inventory and the attached riparian buffer map illustrate that on the West Fork of Duck Creek RM 1.0 to RM 2.6, RM 2.6 to RM 4.25 is lacking a 50-foot riparian buffer. These areas, totaling 3.9 miles, will be a priority to restore a 50-foot riparian buffer. We will work with local landowners to identify and create an incentive program that is acceptable to reestablish the riparian corridor.</p>	<p>Watershed Coordinator, SWCD and ODNR staff and resources. CRP, Clean Ohio Fund and EQIP costshare programs are the best possibility.</p>	<p>Set up a meeting with the landowners and then proceed with program sign up, if willing to participate.</p>	<p>August 2005 to August 2009</p>	<p>Measure feet or miles of riparian buffer restored.</p>

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Problem Statement 3 of 5: Along Dog Run, manure and milk house wastes from a dairy feedlot that houses 75 dairy cattle is causing non-attainment from RM 1.0 to RM 2.6. According to Ohio's Version 1.2 Load Reduction Model adapted from Region 5 prior to an animal waste system being installed there is 3,329 lb/yr of BOD5, 328 lb/yr of phosphorous, and 3,407 lb/yr of nitrogen entering the stream. In addition, there are an estimated 2,520 tons/year of manure that must be collected, stored and properly land applied by the landowner (Bulletin 604: Ohio Livestock Manure and Wastewater Management Guide).

Goal:

1. Install an animal waste storage system at this site to reduce BOD5 by 3,329 lb/yr, phosphorous by 328 lb/yr and nitrogen by 3,407 lb/yr.

Objective	Resources	How	Time Frame	Performance Indicators
Install animal waste storage structure, milkhouse holding tank, runoff diversion, roof runoff control, filter strip, settling basin and pickets to eliminate wastes and milk house wastes entering the stream.	Concrete structure w/out roof: \$1,350/1,000 cu.ft. Milkhouse holding tank: \$7.50/cu.ft. Runoff diversion: \$2.50/ft Roof runoff control: \$4.10/ft Filter strip: \$1.50/sq.ft. Settling basin: \$12/sq.ft. Wooden Pickets: \$1,000 Cost Share for ODNR Pollution Abatement Costshare Program is 75% costshare-25% owner pays.	ONDR-Pollution Abatement Costshare Program. Resource Management Specialist is working with Noble SWCD and Watershed Coordinator to implement.	2005	Animal waste storage system installed, maintained and eliminating wastes from entering stream.
Landowner collects, stores and properly land applies 2,520 tons/year of manure.	Landowner time and resources. Abiding by Pollution Abatement Costshare Program Rules.	Landowner time and resources. Abiding by Pollution Abatement Costshare Program Rules.	2005	Site visits to ensure landowner is operating and maintaining system.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Problem Statement 4 of 5: Siltation, flow alteration and channelization are negatively affecting the water quality along Salt Run, from RM 0.5 to 1.4. The source of the impairments is ongoing development of the floodplain that includes filling of the floodplain, culverts placed in the stream and removal of riparian vegetation. According to the NRCS's Revised Universal Soil Loss Equation (RUSLE) provided in Ohio's Version 1.2 Load Reduction Model adapted from Region 5, the average annual soil loss for this site is approximately 18 tons/acre/year.

Goals:

1. Reduce sediment loadings by an estimated 20 tons/year (ODNR-DSWC bank stabilization equation) by establishing a riparian buffer 0.5-mile upstream and downstream of the floodplain development, 1.0 mile of buffer to be created (12.1 acres).
2. Facilitate a one-day floodplain development and floodplain filling informative workshop for developers, contractors, homeowners, landowners, city, county, and township officials and other interested stakeholders to inform them of BMP's, laws and regulations, water quality impacts, flooding and drainage impacts, etc.

Objective	Resources	How	Time Frame	Performance Indicators
Using the Clean Ohio Fund, establish a conservation easement for a 50-foot wide riparian corridor on each side of stream from RM 0.0 to RM 0.5 and RM 1.4 to RM 1.9 along the designated 1.0-mile area (12.1 acres of buffer to be created).	Total cost is approximately \$5,566 for establishing 12.1 acres of riparian buffer @\$460/acre. Landowner gets 75% in Clean Ohio Fund cost share money totaling \$4,175; remaining funds accounted for in cash or in-kind services.	Watershed Coordinator, NRCS, district conservationist and volunteers to visit landowners and inform them of financial, water quality and wildlife benefits of riparian buffers. Sign up willing landowners for Clean Ohio Fund program.	2005 to 2006	1.0 miles of riparian buffer set aside and established.
Riparian buffer inventory and the attached riparian buffer map illustrate that on the Salt Run of Duck Creek from RM 0.0 to RM 0.5 and RM 1.4 to RM 1.9 is lacking a 50-foot riparian buffer. These areas, totaling, 1.0 mile, will be a priority to restore a 50-foot riparian buffer. We will work	Watershed Coordinator, SWCD and ODNR staff and resources. CRP, Clean Ohio Fund and EQIP costshare programs are the best possibility.	Set up a meeting with the landowners and then proceed with program sign up, if willing to participate.	2005 to 2006	Measure feet or miles of riparian buffer restored.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

<p>with local landowners to identify and create an incentive program that is acceptable to reestablish the riparian corridor.</p>				
<p>Facilitate a one-day floodplain development and floodplain filling informative workshop.</p>	<p>OSU Extension, SWCD, NRCDS, ODNR, OEPA, Army Corps of Engineers, developers, contractors, homeowners, landowners, city, county, and township officials and other interested stakeholders time, resources and existing program literature.</p>	<p>Conduct one-day workshop for developers, contractors, homeowners, landowners, city, county, and township officials and other interested stakeholders to inform them of BMP's, laws and regulations, water quality impacts, flooding and drainage impacts, etc.</p>	<p>2005</p>	<p>Workshop held and evaluated.</p>

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Problem Statement 5 of 5: Aluminum concentrations from unreclaimed strip mining are causing non-attainment in Warren Run, from RM 0.1 to RM 1.85. According to the OEPA's TMDL on Duck Creek Warren Run is in non-attainment because of the 6,339 lb/year of aluminum that is entering the stream. To meet WWH use designation proper mining BMP's such as remining, reclamation and tree planting must be implemented.

Goal:

1. Within four years, reduce the aluminum load from 6,339 lb/yr to 4,965 lb/yr (1,374-lb/yr reduction) to allow Warren Run to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Warren Run Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005	Potential reclamation sites are identified and prioritized.
Plant PT trees on 75 acres on unreclaimed surface minelands.	\$48,750 to plant 75 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	2006 to 2008	Trees planted and survive.
Reclaim 75 acres of unreclaimed surface minelands.	\$525,000 to reclaim 75 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2006 to 2008	Grant awarded and implemented. Meets WWH use designation.

Headwaters West Fork of Duck Creek, HUC: 05030201-120-010

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Landuse/Landcover

Land Use	Area	
	(acres)	%
Deciduous Forest	13,587	67.2
Pasture/Hay	5,333	26.4
Evergreen Forest	275	1.4
Row Crops	554	2.7
Mixed Forest	220	1.1
Low Intensity Residential	8	0.04
Open Water	33	0.2
Commercial/Industrial/Transpo.	0.9	0.004
Quarries	209	1.0
Transitional	6	0.03
Woody Wetlands	1	0.005
Emergent Herbaceous Wetlands	2	0.01
Total	20,229	100.0

Basic Statistics

Size: 20,249.7 acres (31.6 mi²)
 Location: Noble & Monroe Counties
 Avg. Flow: 30.97 cfs, Stream Mi.: 48.02
 Aquatic Life Use Designation: Warm Water Habitat
 Attainment Miles: 16.6 full, 0.0 threat, 1.4 partial, 3.7 non, 31.6 unmonitored
 Monitoring Sites: 12

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
Headwaters East Fork	7.83	12.5	3
Wolfpen Run	2.25	98.8	None
West Branch East Fork Duck Creek	2.87	78.4	2
Greasy Run	2.07	92.4	2
Elk Fork	4.19	70.7	3
Barnes	4.71		2
McBride Run	2.07	121.7	None
19 Unnamed Streams	27.27	N/A	None
Total	53.26	N/A	12

Agricultural Statistics

Agriculture=29% (5,887 acres) 94% Pastureland
 6% Crop land

Croptype: 97% hay, 2% corn, small grains 1%

Tillage: 40% conventional, 60% no-till

Rotations: 5 yrs. of hay with 1 year of corn or soy beans

Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U.	
			Confined	Non-confined
Beef	26	1,045	200	945
Dairy	1	150	75	75
Horses	16	82	0	82
Swine	0	0	0	0
Sheep	7	95	0	95
Other	6	55	0	55
Total	56	1,427	275	1,252

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
0.07	0.05	254	779	0	254	152	60

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	#Head East Sites: 3, 4, 5, 6, 7	51.4 (97%)	21.1 (40%)	0	0		Greasy Run @ RM 1.2 Elk Fork @ RM 1.8

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
152 (60%)	3/275	53/1,252	18,833**** (93%)	none

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
2	4	none	11	0

Industry Statistics
Oil & Gas Wells: 238
Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the Headwaters of East Fork of Duck Creek.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)			
30.3/HeadEast 12	FULL	--	--
28.4/HeadEast 2	FULL	--	--
26.3/HeadEast 1	FULL	--	--
West Fork East Fork Duck Cr. (06-335) 2000 (WAP) – LWH (existing); WWH (proposed)			
1.4/HeadEast 9	FULL	--	--
0.1/HeadEast 3	FULL	--	--
Barnes Run (06-334) 2000 (WAP) - LWH (existing); WWH (proposed)			
1.5/HeadEast 10	FULL	--	--
0.1/HeadEast 4	FULL	--	--
Greasy Run (06-332) 2000 (WAP) - LWH (existing); WWH (proposed)			
1.2/HeadEast 8	PARTIAL	Siltation	Pastureland
0.7/HeadEast 7	PARTIAL	Siltation	Pastureland
Elk Fork (06-331) 2000 (WAP) - LWH (existing); WWH (proposed)			
2.2/HeadEast 11	NON	Aluminum & Manganese	AMD: surface mining
1.8/HeadEast 6	FULL	--	--
0.1/Head East 5	NON	Nutrients	Pastureland

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Aquatic life use attainment status of sites sampled in the Headwaters of *East Fork Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)						
30.3/HeadEast 12	44	--	E	66.5	FULL	adj. CR 6
28.4/HeadEast 2	42 ^{ns}	--	G	56	FULL	adj. CR 6
26.3/HeadEast 1	44	--	40	46.5	FULL	from SR 78
West Fork East Fork Duck Cr. (06-335) 2000 (WAP) - LWH (existing); WWH (proposed)						
1.4/HeadEast 9	30*	--	MG ^{ns}	40.5	FULL	
0.1/HeadEast 3	48	--	G	61.5	FULL	
Barnes Run (06-334) 2000 (WAP) - LWH (existing); WWH (proposed)						
1.5/HeadEast 10	48	--	VG	65	FULL	
0.1/HeadEast 4	52	--	G	47.1	FULL	
Greasy Run (06-332) 2000 (WAP) - LWH (existing); WWH (proposed)						
1.2/HeadEast 8	38*	--	MG ^{ns}	62.5	PARTIAL	
0.7/HeadEast 7	56	--	F*	35	PARTIAL	NPS agri., open canopy/open pasture
Elk Fork (06-331) 2000 (WAP) - LWH (existing); WWH (proposed)						
2.2/HeadEast 11	50	--	F*	61	NON	pulsed AMD from 1 mi. ² trib ust.
1.8/HeadEast 6	48	--	MG ^{ns}	55	FULL	
0.1/Head East 5	50	--	P*	59	NON	NPS nutrients & poss. AMD(coal dust)

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI		MIwb		ICI (all sites)
	Headwaters	Wading	Wading	Boat	
EWH Habitat	50	50	9.4	48	46
WWH Habitat	44	44	8.4	40	36
MWH	24	24	6.2	24	22
LRW	18	18	4.0	18	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Background Statement: The Headwaters of East Fork Duck Creek Subwatershed (HUC 05030201-110-010) is not meeting water quality use designations due to siltation from pastureland, high levels of aluminum and manganese from surface mining and high nutrient levels from pastureland.

Problem Statement 1 of 3: Along Greasy Run, siltation from unrestricted livestock access in pasturelands is causing partial attainment from RM 0.7 to RM 2.07. According to the TMDL performed by OEPA on Duck Creek this tributary is not meeting WWH use designation because of the 169,446 lb/year of sediment entering the stream. Inventory conducted by watershed coordinator and SWCD technicians indicates that 40% of the streams in this subwatershed have unrestricted livestock access, therefore, 40% of 1.37 total miles impaired is 0.55 miles.

Goal:

1. Reduce siltation loadings from 169,446 lb/yr to 108,720 lb/yr (60,726-lb/yr reduction) in this stream by restricting livestock access to the stream and providing alternative watering resources.

Objective	Resources	How	Time Frame	Performance Indicators
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. Total cost is approximately \$4,646 for establishing 0.55 miles (2,904ft.) of fence @ \$1.60/lineal feet. Landowner gets 75% in grant cost share money totaling \$3,485; remaining 25% is accounted for in cash or in-kind services.	Install livestock exclusion fencing on 0.55 miles of the 1.4 miles of streambank with unlimited access.	2004 to 2007 (319 Grant)	Streambank fencing installed on 0.55 miles of stream bank.
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. 1-2 tanks @ \$500 per tank, pipe is \$1.40/ft. (75% cost shared, 25% landowner expenses)	Install 1-2 alternative watering systems on non-confined livestock operations.	2004 to 2007 (319 Grant)	1-2 alternative watering systems provided to non-confined livestock operators.
Livestock Exclusion (Fencing and Alternative Water Systems)	Any additional landowners that do not participate in 319 grant funding are able to sign up for EQIP and receive 50% cost share on all livestock exclusion systems	Sign up for EQIP at NRCS office.	2007 and beyond	Additional landowners signed up, approved and implemented livestock exclusion systems.

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Problem Statement 2 of 3: Along Elk Fork, high nutrient, BOD5 and ammonia levels along with low DO levels from unrestricted livestock access in pasturelands are causing non-attainment from RM 0.1 to RM 1.8. According to the OEPA's TMDL on Duck Creek Elk Fork is not meeting WWH use designation because of nutrients produced by unrestricted livestock access. The nutrients are causing impaired water quality such as 4,930 kg/d of BOD5, 502 kg/d of ammonia and 0.0 mg/l of DO. Inventory conducted by watershed coordinator and SWCD technicians indicates that 40% of the streams in this subwatershed have unrestricted livestock access. Therefore, 40% of 1.8 impaired miles is 0.72 miles that have unrestricted livestock access along this stream segment.

1. Reduce the BOD5 from 4,930 (kg/d) to 462 (kg/d), ammonia from 502 (kg/d) to 51 (kg/d) and increase DO from 0.0 (mg/l) to 5.05 (mg/l) by restricting livestock access to the stream and providing alternative watering resources.

Objective	Resources	How	Time Frame	Performance Indicators
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. Total cost is approximately \$6,083 for establishing 0.72 miles (3,802ft.) of fence @ \$1.60/lineal feet. Landowner gets 75% in grant cost share money totaling \$4,562; remaining 25% is accounted for in cash or in-kind services.	Install livestock exclusion fencing on 0.72 miles of the 1.8 miles of streambank with unlimited access.	2004 to 2007 (319 Grant)	Streambank fencing installed on 0.72 miles of stream bank.
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. 2 tanks @ \$500 per tank, pipe is \$1.40/ft. (75% cost shared, 25% landowner expenses)	Install 2 alternative watering systems on non-confined livestock operations.	2004 to 2007 (319 Grant)	2 alternative watering systems provided to non-confined livestock operators.
Livestock Exclusion (Fencing and Alternative Water Systems)	Any additional landowners that do not participate in 319 grant funding are able to sign up for EQIP and receive 50% cost share on all livestock exclusion systems	Sign up for EQIP at NRCS office.	2004 to 2007 and beyond	Additional landowners signed up, approved and implemented livestock exclusion systems.

Headwaters East Fork of Duck Creek Subwatershed, HUC: 05030201-110-010

Problem Statement 3 of 3: Aluminum and manganese concentrations from unreclaimed strip mining are causing non-attainment in Elk Fork, from RM 2.2 to RM 4.2. According to the OEPA's TMDL on Duck Creek Warren Run is in non-attainment because of the 6,324 lb/year of aluminum and the 4,504 lb/yr of manganese that is entering the stream. To meet WWH use designation proper mining BMP's such as remining, reclamation and tree planting must be implemented.

Goal:

1. Within five years, reduce the aluminum load from 6,324 lb/yr to 4,427 lb/yr (1,897-lb/yr reduction) and the manganese load 4,504 lb/yr to 3,106 lb/yr (1,398-lb/yr reduction) to allow Elk Fork to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Elk Fork Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005	Potential reclamation sites are identified and prioritized.
Plant PT trees on 50 acres of unreclaimed surface minelands.	\$32,500 to plant 50 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	2006 to 2008	Trees planted and survive.
Reclaim 75 acres of unreclaimed surface minelands.	\$525,000 to reclaim 75 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	200 to 2008	Grant awarded and implemented. Meets WWH use designation.

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Landuse/Landcover

Land Use	Area	%
Deciduous Forest	5,564	60.5
Pasture/Hay	1,965	21.4
Evergreen Forest	44	4.8
Row Crops	628	7.0
Mixed Forest	171	1.9
Low Intensity Residential	41	0.4
Open Water	76	0.8
Transitional	274	3.0
Commercial/Industrial/Transpo	2	0.02
Woody Wetlands	9	0.1
Emergent Herbaceous Wetlands	7	0.08
Total	8,781	100.0

Basic Statistics

Size: 9,176.4 acres (14.3 mi²)
 Location: Noble & Washington Counties
 Avg. Flow: 13.9 cfs, Stream Miles: 26.27
 Aquatic Life Use Designation: Warm Water Habitat
 Attainment Miles: 3.2 full, 1.0 threat, 6.9 partial, 6.2 non, 8.9 unmonitored
 Monitoring Sites: 4

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
East Fork below Middle Fork	7.64	12.5	2
9 Unnamed Streams	18.63	N/A	2
Total	26.27	N/A	4

Agricultural Statistics

Agriculture=28.3 (2,593 acres) 76% Pastureland
 24% Crop land

Croptype: 80% hay, 10% corn, small grains 10%
 Tillage: 80% conventional, 10% minimal tillage, 10% no-till
 Rotations: 5 yrs. of hay with 1 year of corn or soy beans
 Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U.	
			Confined	Non-confined
Beef	11	188	0	188
Dairy	1	10	0	10
Horses	6	33	0	33
Swine	0	0	0	0
Sheep	0	0	0	0
Other	3	65	0	65
Total	21	296	0	296

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
3.5	2.5	133	351	0	133	86	65

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	#East Below Sites: 2, 3, 4	20.3 (77%)	8.5 (32%)	0	Ales Run Wildlife Area		Trib. to E. Fork Confluence @ RM 4.15 Trib to E. Fork Confluence @ RM 5.73

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
86 (65%)	0/0	21/296	7,5240 (82%)	none

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
1	22	none	6	0

Industry Statistics

Oil & Gas Wells: 223
Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the East Fork below Middle Fork of Duck Creek Subwatershed.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)			
4.2/EastBelow 2	PARTIAL	Aluminum, Iron, Manganese, Siltation,	AMD: surface mining
0.9/EastBelow 1	FULL	--	--
East Fork Below Middle: RM 1.3 to 0.1	Threatened	Organic enrichment/DO, Nutrients, Bacteria	NPS stormwater and/or urban runoff from the Village of Lower Salem
Trib. to East Fork Duck Cr. (confluence @ RM 5.73) (06-353) 2000 (WAP) - WWH (proposed)			
0.1/EastBelow 3	NON	Aluminum, Manganese, Iron, Siltation	AMD: surface mining
Trib. to East Fork Duck Cr. (confluence @ RM 4.15) (06-352) 2000 (WAP) - WWH (proposed)			
0.1/EastBelow 4	PARTIAL	Siltation & Aluminum	AMD: surface mining

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Aquatic life use attainment status of sites sampled in the *East Fork below Middle Fork of Duck Creek Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

River Mile/Site ID	IBI	MIwb	ICI ^a	QHEI	Attainment Status ^b	Site Location
East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)						
4.2/EastBelow 2	40 ^{ns}	6.6*	46	42.5	PARTIAL	ust. TR 313
0.9/EastBelow 1	46	8.4	G	51	FULL	ust. SR 821 & dst. Pawpaw Cr. confl
East Fork Below Middle: RM 1.3 to 0.1	-	-	-	-	Threatened	NPS stormwater and/or urban runoff from the Village of Lower Salem
Trib. to East Fork Duck Cr. (confluence @ RM 5.73) (06-353) 2000 (WAP) - WWH (proposed)						
0.1/EastBelow 3	<u>12</u> *	--	<u>VP</u> *	40	NON	AMD & NPS siltation & w'coal fines
Trib. to East Fork Duck Cr. (confluence @ RM 4.15) (06-352) 2000 (WAP) - WWH (proposed)						
0.1/EastBelow 4	38*	--	G	57	PARTIAL	NPS siltation, there is coal mining nr.

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI		MIwb		ICI (all sites)
	Headwaters	Wading	Wading	Boat	
<u>EW</u> H Habitat	50	50	9.4	48	46
<u>WW</u> H Habitat	44	44	8.4	40	36
<u>M</u> WH	24	24	6.2	24	22
<u>LR</u> W	18	18	4.0	18	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Background Statement: The East Fork below Middle Fork of Duck Creek Subwatershed (HUC 05030201-110-040) is not meeting water quality use designations due to organic enrichment and low DO levels as well as high levels of aluminum, iron, manganese and siltation from surface mining.

Problem Statement 1 of 3: Organic enrichment/low DO and elevated levels of nutrients are negatively affecting water quality along the East Fork of Duck Creek from RM 0.1 to RM 1.0. According to the Washington County Health Department the source of this impairment is septic runoff from the Village of Lower Salem. The Washington County Health Department estimates that 65% of the 78 homes with Home Sewage Treatment Systems (HSTS) within the Village of Lower Salem are failing. The 51 homes with failing HSTS systems are contributing to the threatened status of this stream segment. We have estimated the potential amount of effluent entering the stream to be 2,861,498 gallons/year.

Goals:

1. Over the next two years, work with the Washington County Health Department to develop a County Wide HSTS Plan.
2. Over the next four years, work with the Washington County Health Department to determine which of the 78 homes are failing.
3. Over the next six years, work with the Washington County Health Department to upgrade/replace 90% of the failing systems, which will potentially prevent 2,575,348 gallons/year of effluent from entering the stream.

Objective	Resources	How	Time Frame	Performance Indicators
Develop County Wide HSTS Plan to assist in replacing	SWCD's assist local Health Department in writing HSTS Plan.	Writing HSTS Plan to provide guidelines to those upgrading or repairing systems. In addition, the Health Department would establish inspection and maintenance protocol.	2005 to 2006	Plan is developed, approved and implemented.
Work with the county Health Department to determine which of the 78 systems are failing.	Health Department Inspectors time to inspect systems.	Inspect all 78 systems as time allows.	2005 to 2008	Failing on-site report with addresses generated.
Replace and/or upgrade failing systems.	Apply for approximately \$63,750 in 319 funds to address failing HSTS problem (@ \$2,500 a system).	Apply for a 319-Non Point Source Pollution (NPSP) Grant to cost share on-site HSTS repair, replacement or pumping.	2006 to 2008	319-NPSP Grant is obtained and implemented.
Replace and/or upgrade failing systems.	Apply for approximately \$63,750 in DEFA funds for to address failing HSTS problem (@ \$2,500 a system).	County to apply for DEFA for a low interest on-site loan program for the county.	2006 to 2008	DEFA low interest loan program obtained and implemented in county targeting known failing systems.

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Replace and/or upgrade failing systems.	Local Health Department and Ohio EPA agency officials and inspectors.	Approve and install Demonstration & Alternative Home Sewage Treatment Facilities.	2006 to 208	DEFA low interest loan program obtained and implemented in county targeting known failing systems.
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East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Problem Statement 2 of 3: Along an unnamed tributary to the East Fork with its confluence at RM 5.73, aluminum, iron, manganese and siltation concentrations from unreclaimed strip mining are causing non-attainment from RM 0.1 to RM 6.23. According to the OEPA's TMDL on Duck Creek this tributary is not in attainment because of the 8,060 lb/year of aluminum, the 6,803-lb/yr of iron, the 5,337 lb/yr of manganese and the 100,650 lb/yr of sediment that are entering the stream. To meet WWH use designation proper mining BMP's such as remining, reclamation and tree planting must be implemented.

Goal:

1. Within three years, reduce the aluminum load from 8,060 lb/yr to 3,224 lb/yr (4,836-lb/yr reduction), the iron load from 6,803 lb/yr to 5,020 lb/yr (1,783-lb/yr reduction), the manganese load from 5,337 lb/yr to 2,427 lb/yr (2,910 lb/yr reduction) and the sediment load from 100,650 lb/yr to 22,770 lb/yr (77,880 lb/yr reduction) to allow this unnamed tributary to meet WWH use designation. This will be accomplished by following through with constructing 10 sediment control structures as spelled out in the Duck Creek 319-NPSP Implementation Grant that begins in July, 2004.

Objective	Resources	How	Time Frame	Performance Indicators
Plant PT trees on 150 acres of unreclaimed surface minelands.	319 Grant: \$97,500 to plant 150 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	July 2004 to June 2007	Trees planted and survive.
Aerial Photography and Mapping of 1,690 acres at 2 foot contours.	319 Grant: \$15,835 for ODNR to fly and map subwatershed.	Implement 319- Non Point Source Pollution Grant that will begin July 2004.	July 2004 to June 2007	Aerial photography completed and utilized.
Pre and post construction educational tour.	319 Grant: \$400 in supplies	Implement 319- Non Point Source Pollution Grant that will begin July 2004.	July 2004 to June 2007	Tours conducted and evaluated.
Design and construct 10 sediment control structures approximately 1 acre in size	319 Grant: \$344,240 for design and construction of 10-1 acre sediment control structures.	Implement 319- Non Point Source Pollution Grant that will begin July 2004.	July 2004 to June 2007	Grant awarded and implemented. Meets WWH use designation.

East Fork below Middle Fork of Duck Creek, HUC: 05030201-110-040

Problem Statement 3 of 3: Along an unnamed tributary to the East Fork with its confluence at RM 4.2, aluminum and siltation concentrations from unreclaimed strip mining are causing non-attainment from RM 0.1 to RM 3.4. According to the OEPA's TMDL on Duck Creek this tributary is not in attainment because of the 3,573 lb/year of aluminum and the 100,636 lb/yr of sediment that are entering the stream. According to the OEPA's TMDL on Duck Creek, however, reduction of aluminum loadings will be sufficient to bring this tributary of East Fork into WWH attainment. To meet WWH use designation proper mining BMP's such as reining, reclamation and tree planting must be implemented.

Goal:

1. Within six years, reduce the aluminum load from 3,573 lb/yr to 2,501 lb/yr (1,072-lb/yr reduction) to allow this unnamed tributary to the East Fork with its confluence at RM 4.2 to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Road Fork Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005	Potential reclamation sites are identified and prioritized.
Reclaim 60 acres of unreclaimed surface minelands.	\$420,000 to reclaim 60 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2007 to 2009	Grant awarded and implemented. Meets WWH use designation.

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Landuse/Landcover

Land Use	Area (acres)	%
Deciduous Forest	2,896	24.5
Pasture/Hay	5,323	45.0
Evergreen Forest	1,953	16.3
Row Crops	382	3.2
Mixed Forest	387	3.3
Low Intensity Residential	247	2.1
Open Water	127	1.1
High Intensity Residential	70	0.6
Other Grasses	138	1.2
Commercial/Industrial/Transpo	294	2.5
Woody Wetlands	18	0.15
Emergent Herbaceous Wetlands	2	0.02
Total	11,837	100.0

Basic Statistics

Size: 11,855.7 acres (18.5 mi²)
 Location: Washington County
 Avg. Flow: 18.04 cfs, Total Stream Miles: 22.81
 Aquatic Life Use Designation: Warm Water Habitat
 Attainment Miles: 12.08 full, 0.0 threat, 1.3 partial, 1.4 non, 2.5 in recovery
 Monitoring Sites: 8

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
Lower Duck Creek Mainstem	10.79	8.2	6
Sugar Creek	4.16	69.2	1
African American Run	0.6	238.6	N/A
Brush Run	1.92	N/A	N/A
Killwell Run	2.33	105.3	1
Hoff Run	1.39	N/A	N/A
3 unnamed streams	1.62	N/A	N/A
Total	22.81	N/A	8

Agricultural Statistics

Agriculture=48.2% (5,705 acres) 93% Pastureland
 7% Crop land

Croptype: 35% hay, 45% corn, small grains 5%, soy beans 15%
 Tillage: 5% conventional, 25% minimal tillage, 70% no-till
 Rotations: 2 yrs. corn, 1 yr. beans, 1 yr. small grain, 3 yrs. hay
 Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U.	
			Confined	Non-confined
Beef	8	255	0	255
Dairy	2	800	800	0
Horses	0	0	0	0
Swine	0	0	0	0
Sheep	0	0	0	0
Other	0	0	0	0
Total	10	1,055	800	255

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
5.2	3.6	1,470	3,704	733	737	442	60

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	#Lower Sites: 2, 5	8.7 (38%)	5.8 (25%)	1*	0	2004: 14 lot subdivision being constructed, landslide CR 16, bridge replacement SR 26, erosion protection SR 26 2006: resurfacing I-77	Confluence of Ohio River to RM 2.2

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
442 (60%)	2/800	8/255	9,366 (79%)	1/na

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
0	56	1- animal waste	6	3

Industry Statistics
Oil & Gas Wells: 165
Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.
Manufacturing/Factory/Service Industry: Broughtons Dairy, Vanguard Paints, FlexMag Industries, Zides Sports Screen Printing, Richardson's Printing, Grae-Con Construction, Midwest Pipe and Supply, United Parcel Service, Master Mag East, Metal Tech: Steel Corp, Siding Window Solutions, Ohio Valley Apparatus & Machine, Hi-Vac Corporation, OhioValley Specialty Chemical Co., Ciscamp Inc.

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the Lower Duck Creek Subwatershed.

River Mile/Site ID	Attainment Status^b	Causes of Impairment	Sources of Impairment
Duck Creek (06-300) 2000 Western Allegheny Plateau (WAP) - WWH (existing)			
11.2/Lower 4	FULL	--	--
5.5/Lower 3	PARTIAL	Organic Enrichment/DO: in recovery	Agriculture: in recovery
3.2/Lower 8	FULL		
2.5/Lower 2	NON	DDT, contaminated sediments (metals), flow alterations	Hazardous waste: leaks and spills from waste storage ponds, and land disposal
1.8/Lower 1	NON	DDT, contaminated sediments (metals), flow alterations	Hazardous waste: leaks and spills from waste storage ponds, and land disposal
0.5/Lower 5	PARTIAL	Siltation, embedded conditions, DDT, Organic enrichment/DO	Hazardous waste leaks and spills from waste storage ponds NPS stormwater and/or urban runoff
Sugar Creek (06-304) 2000 (WAP) - WWH (existing)			
0.1/Lower 6	FULL	--	--
Killwell Run (06-301) 2000 (WAP) - WWH (existing)			
0.1/Lower 7	FULL	--	--

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Aquatic life use attainment status of sites sampled in the *Lower Duck Creek Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

River Mile/Site ID	IBI	MIwb	ICI ^a	QHEI	Attainment Status ^b	Site Location
Duck Creek (06-300) 2000 Western Allegheny Plateau (WAP) - WWH (existing)						
11.2/Lower 4	51	9.3	48	72.5	FULL	
5.5/Lower 3	43 ^{ns}	6.7*	44	59.5	PARTIAL	manure spill
3.2/Lower 8	43	8.5	--	60	FULL	influenced by Ohio R dam & barge traffic
2.5/Lower 2	--	--	F*		NON	ust. Amer. Cyanimid "impounded"
1.8/Lower 1	38	6.3*	P*	59.5	NON	dst. Amer. Cyanimid "impounded"
0.5/Lower 5	42	7.6*	--	57.5	PARTIAL	near mouth / recovery
Sugar Creek (06-304) 2000 (WAP) - WWH (existing)						
0.1/Lower 6	48	--	E	61	FULL	
Killwell Run (06-301) 2000 (WAP) - WWH (existing)						
0.1/Lower 7	44	--	VG	47.5	FULL	

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI Headwaters	IBI	IBI	MIwb	MIwb	ICI (all sites)
		Wading	Boat	Wading	Boat	
EWH Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH	24	24	24	6.2	5.8	22
LRW	18	18	18	4.0	4.0	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Background: The main stem of Duck Creek in the Lower Duck Creek Subwatershed (HUC 05030201-120-040) is partially meeting water quality use designation due to excessive concentrations of DDT, organic enrichment/low dissolve oxygen levels and excessive sedimentation.

Problem Statement 1 of 4: DDT released from an upstream hazardous waste site is causing partial attainment from RM 0.5 to RM 1.8 and non-attainment from RM 1.8 to RM 3.2 within the Lower Duck Creek Subwatershed. A contract company named Cytex, which made specialty organic chemicals, such as pesticides (DDT), synthetic dyes, a rocket fuel burn regulator, and fire retardants, contributed to a hazardous waste site and was the source of DDT affecting this reach. The facility is no longer in operation and the site has recently been excavated and the contaminated soils removed as part of the OEPA Superfund Program. The OEPA's report states that DDT was found in the water column, sediments and floodplain soil. Water quality standards are exceeded (impaired) and DDT is negatively impacting the aquatic invertebrate structure and there may be a risk of exposure to those using the floodplain. On the aquatics end of this OEPA will be asking CYTEC to remediate to the point that there are no water quality violations and the invertebrate community is performing well (the ICI meets warmwater). OEPA has not estimated a load of DDT that has entered the stream because it is extremely difficult to determine exact loadings (Dan Imhoff, OEPA). Fish sampling was also done in 2000 by Ohio EPA and to date there are no fish advisories for Duck Creek. This clean up work should eliminate the DDT problem from this stream segment of the Lower Duck Creek Subwatershed.

Goal:

1. Determine if the Superfund clean up has eliminated the DDT source.

Objective	Resources	How	Time Frame	Performance Indicators
Work with CYTEC to establish physical, chemical & biological sampling @ Lower Duck 5: RM 0.5 to ensure that the Superfund cleanup has eliminated the DDT source.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, Washington & Noble SWCD staff and volunteers will conduct sampling at this site. Technical assistance provided by ODNR & OEPA	2005-2008	Lack of DDT in chemical analysis will indicate that the cleanup was successful. In addition, document QHEI, ICI and chemical sampling results to verify WWH water quality use designation.

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Problem Statement 2 of 4: Organic enrichment and low DO levels is causing partial use attainment in the Lower Duck Creek Subwatershed from RM 0.5 to 1.8. The source of the organic enrichment and low DO levels is failing aerator systems, which are tied directly to storm sewers. The Washington County Health Department estimates that 60% of the 737 homes with Home Sewage Treatment Systems (HSTS) in this subwatershed are failing. The 442 homes with failing HSTS systems are directly contributing to the partial attainment of this stream segment. In collaboration with Bob Mulligan from ODNR we have estimated the potential amount of effluent entering the stream to be 24,800,000 gallons/year.

Goals:

1. Over the next two years work with the Washington County Health Department to develop a County Wide HSTS Plan.
2. Over the next three years work with the Washington County Health Department to determine which of the 737 homes are failing.
3. Over the next four years work with the Washington County Health Department to upgrade/replace 75% of the failing systems. This will potentially prevent 18,600,000 gallons/year of effluent from entering the stream.

Objective	Resources	How	Time Frame	Performance Indicators
Develop County Wide HSTS Plan to assist in replacing	SWCD's assist local Health Department in writing HSTS Plan.	Writing HSTS Plan to provide guidelines to those upgrading or repairing systems. In addition, the Health Department would establish inspection and maintenance protocol.	2005 to 2006	Plan is developed, approved and implemented.
Work with the county Health Department to determine which of the 737 systems are failing.	Health Department Inspectors time to inspect systems.	Inspect all 737 systems as time allows.	2005 to 2007	Failing on-site report with addresses generated.
Replace and/or upgrade failing systems.	Apply for approximately \$552,500 in 319 funds to address failing HSTS problem (@ \$2,500/system).	Apply for a 319-Non Point Source Pollution (NPSP) Grant to cost share on-site HSTS repair, replacement or pumping.	2007-2009	319-NPSP Grant is obtained and implemented.
Replace and/or upgrade failing systems.	Apply for approximately \$552,500 in DEFA funds for entire county to address failing HSTS problem (@ \$2,500/system).	County to apply for DEFA for a low interest on-site loan program for the county.	2007-2009	DEFA low interest loan program obtained and implemented in county targeting known failing systems.
Replace and/or upgrade failing systems.	Local Health Department and Ohio EPA agency officials and inspectors.	Approve and install Demonstration & Alternative Home Sewage Treatment Facilities.	2007-2009	DEFA low interest loan program obtained and implemented in county targeting known failing systems.

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Problem Statement 3 of 4: Siltation and embedded conditions is causing partial use attainment in the Lower Duck Creek Subwatershed from RM 0.5 to 1.8 (near the mouth of the Ohio River). The sources of siltation at this location are a cumulative result of the upstream landuses throughout the entire Duck Creek Watershed and accentuated by the channelization of the river along this segment to allow for Interstate-77 construction (beginning at RM 2.2). Stream channelization has created embedded conditions and an extremely low gradient, which prevents Duck Creek from obtaining natural channel morphology, therefore preventing the deposition of sediment in the floodplain during flood events. Additionally, the combined sediment from upstream landuses settles out into the bottom of the stream beginning at the low gradient, channelized segment of the stream. Sediment loading amounts cannot be obtained for this particular site due to the lack of sediment entering the stream directly upstream of the sampling site, channelization, embedded conditions, the proximity to the confluence with the Ohio River and the cumulative sediment from the entire watershed (Bob Mulligan ODNR, Gordon Gilmore NRCS Soil Scientist and Kevin Wagner Washington SWCD). However, TSS, QHEI and riparian buffer sampling results are available and will be used to determine the future attainment status of this stream segment. Sampling at Duck Creek Site: Lower 5, RM 0.5 indicates an average TSS of 14 mg/l (8 mg/l is desired for WWH attainment) and an average QHEI score of 57.5 (60 is desired for WWH attainment). In addition, only 38% of this subwatershed’s stream miles have a riparian buffer of 50-feet on each side of the stream. The Lower Duck Creek Subwatershed has the lowest percentage of riparian buffer of all 9 subwatersheds in the Duck Creek Watershed.

Goal:

1. Increase the 50-foot wide riparian buffer on each side of the stream from 38% to 70%; increase average QHEI score to 60.

Objective	Resources	How	Time Frame	Performance Indicators
Riparian buffer inventory and the attached riparian buffer map illustrates RM 0.0 to RM 2.0, RM 5.0 to RM 8.7 and RM 9.4 to RM 11.0 is lacking a 50-foot riparian buffer. This 7.3 mile area will be a priority to restore a 50-foot riparian buffer. We will work with local landowners to identify and create an incentive program that is acceptable to reestablish the riparian corridor.	Watershed Coordinator, SWCD and ODNR staff and resources. CRP, Clean Ohio Fund and EQIP costshare programs are the best possibility.	Set up a meeting with the landowners and then proceed with program sign up, if willing to participate.	2006-2007	Measure feet or miles of riparian buffer restored.

Lower Duck Creek Subwatershed, HUC: 05030201-120-040

<p>Establish 50-foot wide riparian corridor on each side of stream along an additional 7.3 miles (88.5 acres of buffer to be created). Totaling 70% of the subwatershed.</p>	<p>Total cost is approximately \$40,710 for establishing 88.5 acres of riparian buffer @ \$460/acre. Landowner gets 50% n EQIP and/or CRP cost share money totaling \$20,355; remaining funds accounted for in cash or in-kind services.</p>	<p>Watershed Coordinator, NRCS district conservationist and volunteers to visit landowners and inform them of financial, water quality and wildlife benefits of riparian buffers. Sign up willing landowners for CRP and/or EQIP program.</p>	<p>2006-2007</p>	<p>Miles of riparian buffer set aside and established and improved QHEI scores.</p>
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Lower Duck Creek Subwatershed, HUC: 05030201-120-040

Problem Statement 4 of 4: Organic enrichment and low DO levels was causing partial use attainment (at the time of sampling) in the Lower Duck Creek Subwatershed, from RM 5.5 to 8.0. The source of the organic enrichment and low DO levels was a manure spill that occurred at the time of sampling. According to the OEPA this stream segment was partially impaired and is now “in-recovery” because of the voluntary, cost share agricultural BMP’s implemented by the adjacent landowner to prevent further manure from entering the stream. These BMP’s include 2 filter strips and 3 settling basins. The amount of manure that entered the stream was not calculated because of the voluntary efforts of the landowner and the “in-recovery” status of the stream segment. OEPA is recommending Warm Water Habitat (WWH) use designation as long as the manure is prevented from entering the stream.

Goal:

1. Determine if the stream has recovered to meet WWH water quality use designation and to protect the WWH designation once it is achieved.

Objective	Resources	How	Time Frame	Performance Indicators
Establish physical, chemical & biological sampling @ Lower 3: RM 5.5 to ensure that WWH water quality use designation has been attained.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries.	Watershed coordinator, Washington & Noble SWCD staff and volunteers will conduct sampling at this site. Technical assistance provided by ODNR & OEPA.	2005-2006	Document physical, chemical and biological scores for WWH attainment.

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Landuse/Landcover

Land Use	Area	
	(acres)	%
Deciduous Forest	19,922	77.3
Pasture/Hay	3,854	14.9
Evergreen Forest	757	3.0
Row Crops	497	1.9
Mixed Forest	367	1.40
Low Intensity Residential	28	0.11
Open Water	141	0.55
High Intensity Residential	1	0.004
Transitional	175	0.69
Commercial/Industrial/Transpo	6	0.02
Woody Wetlands	22	0.09
Emergent Herbaceous Wetlands	7	0.03
Total	25,777	100.0

Basic Statistics
Size: 25,783.6 acres (40.3 mi ²)
Location: Noble & Monroe Counties
Avg. Flow: 39.6 cfs, Stream Mi.: 62.17
Aquatic Life Use Designation: Warm Water Habitat
Attainment Miles: 24.5 full, 0.0 threat, 3.7 partial, 0.43 non, 31.44 unmonitored
Monitoring Sites: 11

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
East Fork above Middle Fork	15.05	12.5	3
Schwab Run	2.91	82.2	1
Creighton Run	3.37	114.2	1
Road Fork	2.8	56.1	3
Flag Run	2.93	83.7	3
Rocky Run	2.68	108.1	None
17 Unnamed Streams	28.76	n/a	None
Total	58.5	n/a	11

Agricultural Statistics				
Agriculture=16.8%		89% Pastureland		
(4,350 acres)		11% Crop land		
Croptype: 96% hay, 3% corn, small grains 1%				
Tillage: 65% conventional, 35% no-till				
Rotations: 5 yrs. of hay with 1 year of corn or soy beans				
Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel				
Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U. Confined	# of A.U. Non-confined
Beef	25	480	0	480
Dairy	0	0	0	0
Horses	16	112	0	112
Swine	0	0	0	0
Sheep	0	0	0	0
Other	8	56	0	56
Total	49	648	0	648

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
0.81	0.6	301	918	0	301	181	60

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	#East Above Sites: 4, 5, 6, 7	58.4 (99%)	19.5 (33.3)	1*	Wayne National Forest**		Road Fork @ Rm 1.5 Flag Run @ 1.0 Schwab Run @ RM 2.8

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
181 (60%)	0/0	49/648	24,237 (94%)	1/.09

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants*	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
2	11	none	14	0

Industry Statistics
Oil & Gas Wells: 926
Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

*see Potential Contaminant Appendix ?

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the East Fork above Middle Fork Subwatershed of Duck Creek.

East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)			
20.7/EastAbove 3	FULL	--	--
14.2/EastAbove 2	FULL	--	--
9.6/EastAbove 1	FULL	--	--
Schwab Run (06-330) 2000 (WAP) - LWH (existing); WWH (proposed)			
3.0/EastAbove 7	PARTIAL	Siltation	Pastureland
Creighton Run (06-327) 2000 (WAP) - LWH (existing); EWH (proposed)			
0.8/EastAbove 8	FULL		
Flag Run (06-329) 2000 (WAP) - LWH (existing); WWH (proposed)			
2.5 EastAbove 11	NON	Aluminum & Iron	AMD: surface mining
0.9/EastAbove 9	PARTIAL	Aluminum & Iron	AMD: surface mining
0.4/	FULL	--	--
0.1/EastAbove 4	FULL	--	--
Road Fork (06-328) 2000 (WAP) - LWH (Existing); CWH (proposed)			
2/EastAbove 10	FULL	--	--
		WWH (proposed)	
1.4/EastAbove 6	PARTIAL	Siltation Aluminum, Iron & Manganese	Pastureland AMD: surface mining
0.7/EastAbove 5	FULL	--	--

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Aquatic life use attainment status of sites sampled in the *East Fork above Middle Fork Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

East Fork Duck Creek (06-320) 2000 (WAP) - LWH (existing); WWH (proposed)						
20.7/EastAbove 3	55	9.7	40	80	FULL	dst. TR 263
14.2/EastAbove 2	46	7.9 ^{ns}	VG	68.5	FULL	dst. CR 48
9.6/EastAbove 1	53	9	E	72	FULL	CR 47 (Harrietsville)
Schwab Run (06-330) 2000 (WAP) - LWH (existing); WWH (proposed)						
3.0/EastAbove 7	28*	--	E	56	PARTIAL	NPS ag. siltation/ open cow pasture
Creighton Run (06-327) 2000 (WAP) - LWH (existing); EWH (proposed)						
0.8/EastAbove 8	50	--	E	62	FULL	
Flag Run (06-329) 2000 (WAP) - LWH (existing); WWH (proposed)						
2.5 EastAbove 11	30*	--	--	54.5	NON	
0.9/EastAbove 9	36*	--	VG	54.5	PARTIAL	gas line const. ust./ old mining area
0.4/	--	--	E	54	(FULL)	
0.1/EastAbove 4	40 ^{ns}	--	E	58.5	FULL	
Road Fork (06-328) 2000 (WAP) - LWH (Existing); CWH (proposed)						
2/EastAbove 10	42 ^{ns}	--	E	60.5	FULL	
					WWH (proposed)	
1.4/EastAbove 6	34*	--	G	63	PARTIAL	past mining/coal fines,silt/gravel load
0.7/EastAbove 5	48	--	E	61.5	FULL	

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type	IBI	IBI	IBI	MIwb	MIwb	ICI
INDEX	Headwaters	Wading	Boat	Wading	Boat	(all sites)
EWH Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH	24	24	24	6.2	5.8	22
LRW	18	18	18	4.0	4.0	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Background Statement: The East Fork above Middle Fork of Duck Creek Subwatershed (HUC 05030201-110-020) is not meeting water quality use designations due to siltation from pastureland as well as high levels of aluminum, iron and manganese from surface mining.

Problem Statement 1 of 4: Along Schwab Run, siltation from unrestricted livestock access in pasturelands is causing partial attainment from RM 2.0 to RM 4.53. According to the TMDL performed by OEPA on Duck Creek this tributary is not meeting WWH use designation because of the 130,214 lb/year of sediment entering the stream. Inventory conducted by watershed coordinator and SWCD technicians indicates that 33% of the streams in this subwatershed have unrestricted livestock access. Therefore, 33% of 2.53 impaired miles is 0.83 miles that have unrestricted livestock access along this stream segment.

Goal:

1. Reduce siltation loadings from 130,214 lb/yr to 108,720 lb/yr (21,494-lb/yr reduction) in this stream by restricting livestock access to the stream and providing alternative watering resources.

Objective	Resources	How	Time Frame	Performance Indicators
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. Total cost is approximately \$7,012 for establishing 0.83 miles (4,382ft.) of fence @ \$1.60/lineal feet. Landowner gets 75% in grant cost share money totaling \$5,259; remaining 25% is accounted for in cash or in-kind services.	Install livestock exclusion fencing on 0.83 miles of the 2.53 miles of streambank with unlimited access.	2004 to 2007 (319 Grant)	Streambank fencing installed on 0.55 miles of stream bank.
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. 2 tanks @ \$500 per tank, pipe is \$1.40/ft. (75% cost shared, 25% landowner expenses)	Install 2 alternative watering systems on non-confined livestock operations.	2004 to 2007 (319 Grant)	2 alternative watering systems provided to non-confined livestock operators.
Livestock Exclusion (Fencing and Alternative Water Systems)	Any additional landowners that do not participate in 319 grant funding are able to sign up for EQIP and receive 50% cost share on all livestock exclusion systems	Sign up for EQIP at NRCS office.	2004 to 2007	Additional landowners signed up, approved and implemented livestock exclusion systems.

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Problem Statement 2 of 4: Along Flag Run, Aluminum and iron concentrations from unreclaimed strip mining are causing partial attainment from RM 0.9 to RM 2.5 and non-attainment from RM 2.5 to RM 3.65. According to the OEPA's TMDL on Duck Creek Flag Run is not in attainment because of the 7,313 lb/year of aluminum and the 6,113 lb/yr iron that are entering the stream. To meet WWH use designation proper mining BMP's such as remining, reclamation and tree planting must be implemented.

Goal:

1. Within five years, reduce the aluminum load from 7,313 lb/yr to 2,193 lb/yr (5,120-lb/yr reduction) and the iron load from 6,113 lb/yr to 4,322 lb/yr (1,791-lb/yr reduction) to allow Elk Fork to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Flag Run Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005-2006	Potential reclamation sites are identified and prioritized.
Plant PT trees on 50 acres of unreclaimed surface minelands.	\$32,500 to plant 50 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	2008 to 2010	Trees planted and survive.
Reclaim 100 acres of unreclaimed surface minelands.	\$700,000 to reclaim 75 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2008 to 2010	Grant awarded and implemented. Meets WWH use designation.
Apply for Office of Surface Mining Appalachian Clean Streams Grant	\$100,000 to offset reclamation costs	Watershed coordinator to apply for Appalachian Clean Streams Grant	2008	Grant awarded and implemented.

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Problem Statement 3 of 4: Along Road Fork, siltation from unrestricted livestock access in pasturelands is causing partial attainment from RM 2.0 to RM 4.16. According to the TMDL performed by OEPA on Duck Creek this tributary is not meeting WWH use designation because of the 3,578 lb/year of sediment entering the stream. Inventory conducted by watershed coordinator and SWCD technicians indicates that 33% of the streams in this subwatershed have unrestricted livestock access. Therefore, 33% of 2.16 impaired miles is 0.71 miles that have unrestricted livestock access along this stream segment.

Goal:

1. Reduce siltation loadings from 3,578 lb/yr to 996 lb/yr (2,582-lb/yr reduction) in this stream by restricting livestock access to the stream and providing alternative watering resources.

Objective	Resources	How	Time Frame	Performance Indicators
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. Total cost is approximately \$5,998 for establishing 0.71 miles (3,749ft.) of fence @ \$1.60/lineal feet. Landowner gets 75% in grant cost share money totaling \$4,499; remaining 25% is accounted for in cash or in-kind services.	Install livestock exclusion fencing on 0.71 miles of the 2.16 miles of streambank with unlimited access.	July 2004 to June 2007	Streambank fencing installed on 0.72 miles of stream bank.
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. 2 tanks @ \$500 per tank, pipe is \$1.40/ft. (75% cost shared, 25% landowner expenses)	Install 2 alternative watering systems on non-confined livestock operations.	July 2004 to June 2007	2 alternative watering systems provided to non-confined livestock operators.
Livestock Exclusion (Fencing and Alternative Water Systems)	Any additional landowners that do not participate in 319 grant funding are able to sign up for EQIP and receive 50% cost share on all livestock exclusion systems	Sign up for EQIP at NRCS office.	2007 and beyond	Additional landowners signed up, approved and implemented livestock exclusion systems.

East Fork above Middle Fork Duck Creek Subwatershed, HUC: 05030201-110-020

Problem Statement 4 of 4: Along Road Fork, aluminum, iron and manganese concentrations from unreclaimed strip mining are causing partial attainment from RM 2.0 to RM 4.6. OEPA's TMDL on Duck Creek concluded that Flag Run is not in attainment because of the 665 lb/year of aluminum, 338 lb/yr of iron and 490 lb/yr of manganese that are entering the stream. According to the OEPA's TMDL on Duck Creek, however, reduction of aluminum loadings will be sufficient to bring Road Fork into WWH attainment. In order to meet WWH use designation proper mining BMP's such as remining, reclamation and tree planting must be implemented.

Goal:

1. Within six years, reduce the aluminum load from 665 lb/yr to 238 lb/yr (427-lb/yr reduction) to allow Elk Fork to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Road Fork Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2008 to 2010	Potential reclamation sites are identified and prioritized.
Reclaim 50 acres of unreclaimed surface minelands.	\$350,000 to reclaim 50 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2008 to 2010	Grant awarded and implemented. Meets WWH use designation.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Landuse/Landcover

Land Use	Area (acres)	%
Deciduous Forest	10,419	61.3
Pasture/Hay	4,796	28.3
Evergreen Forest	258	1.5
Row Crops	624	3.7
Mixed Forest	142	0.84
Low Intensity Residential	143	0.84
Open Water	103	0.6
High Intensity Residential	0.44	0.003
Quarries	164	0.97
Transitional	308	1.80
Commercial/Industrial/Transpo	4	0.02
Woody Wetlands	15	0.09
Emergent Herbaceous Wetlands	10	0.06
Total	16,986	100.0

Basic Statistics

Size: 16,982.7 acres (26.5 mi²)
 Location: Noble County
 Avg. Flow: 25.9 cfs, Stream Miles: 36.31
 Aquatic Life Use Designation: Warm Water Habitat
 Attainment Miles: 5.3 full, 0.0 threat, 10.6 partial, 5.7 non, 14.8 unmonitored
 Monitoring Sites: 7

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
Middle Fork	14.58	31.6	5
Otterslide Run	3	115.4	1
Mare Run	3.95	84.4	1
Camp Run	2.62	110.1	None
8 Unnamed Streams	12.16	N/A	None
Total	36.31	N/A	7

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
2.7	1.9	166	515	0	166	100	60

Agricultural Statistics

Agriculture=31.9% 89% Pastureland
 (5,420 acres) 11% Crop land

Croptype: 96% hay, 3% corn, small grains 1%
 Tillage: 20% conventional, 80% no-till
 Rotations: 5 yrs. of hay with 1 year of corn or soy beans
 Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U. Confined	# of A.U. Non- confined
Beef	25	1,067	50	1,017
Dairy	0	0	0	0
Horses	18	66	0	66
Swine	0	0	0	0
Sheep	0	0	0	0
Other	10	65	0	65
Total	53	1,198	50	1,148

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	#Middle sites: 1, 2, 3, 4, 6	29.5 (81%)	16.2 (45%)	6*	0		Middle Fork @ RM 10.3 Mare Run @ RM 0.1

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
100 (60%)	1/50	53/1,148	14,775 (87%)	6/.41

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
0	15	none	7	0

Industry Statistics

Oil & Gas Wells: 1,097

Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the Middle Fork Subwatershed of Duck Creek.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
Middle Fork Duck Creek (06-322) 2000 (WAP) - WWH (existing)			
11.8/Middle 4	FULL	--	--
10.8/Middle 3	FULL	--	--
10.4/Middle 3	NON	Aluminum, Iron, Manganese,	AMD: surface mining
9.8/Middle 2	FULL		
5.4/Middle 1	PARTIAL	Aluminum, Iron, Manganese,	AMD: surface mining
0.1/Middle 5	NON	Aluminum, Iron, Manganese,	AMD: surface mining
Otterslide Run (06-301) 2000 (WAP) - LWH (existing); WWH (proposed)			
0.1/Middle 7	PARTIAL	Aluminum, Iron, Manganese,	AMD: surface mining
Mare Run (06-324) 2000 (WAP) - LWH (existing); WWH (proposed)			
0.7/Middle 6	PARTIAL	Aluminum & Siltation Nutrients & Siltation	AMD: surface mining Pastureland & Removal of Riparian Veg.
0.1/	FULL	--	--

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Aquatic life use attainment status of sites sampled in the *Middle Fork Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

River Mile/Site ID	IBI	MIwb	ICI ^a	QHEI	Attainment Status ^b	Site Location
Middle Fork Duck Creek (06-322) 2000 (WAP) - WWH (existing)						
11.8/Middle 4	44	--	G	37.5	FULL	adj. SR 564
10.8/Middle 3	48	--	E	44	FULL	SR 564 and CR 15
10.4/Middle 3	--	--	<u>P*</u>		(NON)	adj. SR 564 (new road construction)
9.8/Middle 2	40 ^{ns}	--	VG	60.5	FULL	SR 564
5.4/Middle 1	26*	--	48	50	PARTIAL	ust. SR 564 (Middleburg)
0.1/Middle 5	32*	--	<u>P*</u>	54	NON	SR 564 & SR 145 (AMD trib. ust. & NPS)
Otterslide Run (06-301) 2000 (WAP) - LWH (existing); WWH (proposed)						
0.1/Middle 7	34*	--	G	65	PARTIAL	mined/had mining recovery, roadwork
Mare Run (06-324) 2000 (WAP) - LWH (existing); WWH (proposed)						
0.7/Middle 6	48	--	F*	42.5	PARTIAL	NPS nutrients enriched,silt/cows open
0.1/	--	--	G		(FULL)	

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI Headwaters	IBI Wading	IBI Boat	MIwb Wading	MIwb Boat	ICI (all sites)
<u>EW</u> H Habitat	50	50	48	9.4	9.6	46
<u>W</u> WH Habitat	44	44	40	8.4	8.6	36
<u>M</u> WH	24	24	24	6.2	5.8	22
<u>L</u> RW	18	18	18	4.0	4.0	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Background Statement: The Middle Fork of Duck Creek Subwatershed (HUC 05030201-110-030) is not meeting water quality use designations due to aluminum, iron, manganese and siltation concentrations from surface mining and nutrients and siltation from pastureland and removal of riparian vegetation.

Problem Statement 1 of 4: Along Mare Run aluminum concentrations from unreclaimed strip mining are causing partial attainment from RM 0.7 to RM 3.25. According to the OEPA's TMDL on Duck Creek, Mare Run is not in attainment because of the 1,294 lb/year of aluminum that is entering the stream. To meet WWH use designation proper mining BMP's such as re-mining, reclamation and tree planting must be implemented.

Goal:

1. Within six years, reduce the aluminum load from 1,294 lb/yr to 1,0381 lb/yr (257-lb/yr reduction) to allow Mare Run to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Mare Run to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005	Potential reclamation sites are identified and prioritized.
Reclaim 40 acres of unreclaimed surface minelands.	\$280,000 to reclaim 40 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2009 to 2011	Grant awarded and implemented. Meets WWH use designation.
Apply for Office of Surface Mining Appalachian Clean Streams Grant	\$100,000 to offset reclamation costs	Watershed coordinator to apply for Appalachian Clean Streams Grant	2009	Grant awarded and implemented.
Plant PT trees on 50 acres of unreclaimed surface minelands.	\$32,500 to plant 50 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	2009 to 2011	Trees planted and survive.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Problem Statement 2 of 4: Along Middle Fork aluminum, iron and manganese concentrations from unreclaimed strip mining are causing non-attainment from RM 0.1 to RM 5.4 and RM 10.4 to RM 10.8, as well as partial attainment from RM 5.4 to RM 9.8. According to the OEPA's TMDL on Duck Creek, Middle Fork is not in attainment because of the 8,235 lb/yr of aluminum, 7,227 lb/yr of iron, 9,653 lb/yr of manganese that is entering the stream. B&N Coal plans to remine (extract all remaining coal and reclaim) the 200-acre project to reduce aluminum, iron and manganese loadings in this subwatershed to meet the recommended water quality targets for WWH use designation.

Goal:

1. Within three years, reduce the aluminum load from 8,235 lb/yr to 6,307 lb/yr (1,927-lb/yr reduction), the iron load from 7,227 lb/yr to 5,554 lb/yr (1,673-lb/yr reduction) and the manganese load from 9,653 lb/yr to 7,740 lb/yr (1,913 lb/yr reduction) to allow Middle Fork to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Middle Fork to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005	Potential reclamation sites are identified and prioritized.
Remine entire 200-acre project area.	\$1,000,000 to remine 200-acre project area (@ \$500/acre). Actual cost will be less due to amount of coal mined and AML funds used.	B&N Coal plans to propose a reining project at the 200-acre site. This will involve removing all remaining coal, eliminating the highwall and reclaiming the entire site area to prevent Acid Mine Drainage from entering the stream. They will receive AML funds and coal profits to offset costs.	2008-2011	Entire area is remined and the underground mine water is not entering the stream.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Problem Statement 3 of 4: Along Otterslide Run aluminum, iron and manganese concentrations from unreclaimed strip mining are causing partial attainment from RM 0.1 to RM 2.9. OEPA's TMDL on Duck Creek concluded that Otterslide Run is not in attainment because of the 2,192 lb/year of aluminum, 578 lb/yr of iron and 8,119 lb/yr of manganese that is entering the stream. According to the OEPA's TMDL on Duck Creek, however, reduction of aluminum and manganese loadings will be sufficient to bring this tributary of East Fork into WWH attainment. To meet WWH use designation proper mining BMP's such as remining, reclamation and tree planting must be implemented.

Goal:

1. Within three years, reduce the aluminum load from 2,192 lb/yr to 1,753 lb/yr (439-lb/yr reduction) and the manganese load from 8,119 lb/yr to 6,957 lb/yr (1,162-lb/yr reduction) to allow Otterslide Run to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Otterslide Run Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005	Potential reclamation sites are identified and prioritized.
Reclaim 75 acres of unreclaimed surface minelands.	\$525,000 to reclaim 75 acres @7,000 /acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2009 to 2011	Grant awarded and implemented. Meets WWH use designation.
Plant PT trees on 75 acres of unreclaimed surface minelands.	\$48,750 to plant 75 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	2009 to 2011	Trees planted and survive.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

Problem Statement 4 of 4: Along Mare Run, high nutrient, BOD5 and ammonia levels along with low DO levels and excessive siltation from unrestricted livestock access in pasturelands are causing partial attainment from RM 0.7 to RM 3.25. In addition, the removal of riparian vegetation along adjacent to the stream has increased siltation and decreased DO levels in the stream. According to the OEPA's TMDL on Duck Creek Elk Fork is not meeting WWH use designation because of nutrients produced by unrestricted livestock access. The nutrients are causing impaired water quality such as 415 kg/d of BOD5, 40.5 kg/d of ammonia, 0.0 mg/l of DO and 173,075 lb/yr of sediment. Inventory conducted by watershed coordinator and SWCD technicians indicates that 45% of the streams in this subwatershed have unrestricted livestock access. Therefore, 45% of the 2.55 impaired miles is 1.15 miles that have unrestricted livestock access along this stream segment.

Goals:

1. Reduce the BOD5 from 415 (kg/d) to 175 (kg/d), ammonia from 40.5 (kg/d) to 31 (kg/d), siltation from 173,075 lb/yr to 138,993 lb/yr and increase DO from 0.0 (mg/l) to 5.03 (mg/l) by restricting livestock access to the stream and providing alternative watering resources (OEPA's TMDL on Duck Creek).
2. Install 2.5 miles of riparian buffer, 50-foot wide on each side of the stream, to designated area along the partially attaining segment (RM 0.7 to RM 3.25). This will work in tandem with the livestock exclusion system to help reduce siltation loads from 173,075 lb/yr to 138,993 lb/yr and increased DO levels from 0.0 (mg/l) to 5.03 (mg/l).

Objective	Resources	How	Time Frame	Performance Indicators
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. Total cost is approximately \$9,715 for establishing 1.15 miles (6,072ft.) of fence @ \$1.60/lineal feet. Landowner gets 75% in grant cost share money totaling \$7,286; remaining 25% is accounted for in cash or in-kind services.	Install livestock exclusion fencing on 1.15 miles of the 2.55 miles of streambank with unlimited access.	July 2004 to June 2007 (319 Grant)	Streambank fencing installed on 1.15 miles of stream bank.
Livestock Exclusion (Fencing and Alternative Water Systems)	Use 319-NPSP Grant cost share funds. Grant begins in July of 2004 for the Duck Creek Watershed to provide livestock exclusion. 3 tanks @ \$500 per tank, pipe is \$1.40/ft. (75% cost shared, 25% landowner expenses)	Install 3 alternative watering systems on non-confined livestock operations.	July 2004 to June 2007 (319 Grant)	3 alternative watering systems provided to non-confined livestock operators.
Livestock Exclusion (Fencing and Alternative Water Systems)	Any additional landowners that do not participate in 319 grant funding are able to sign up for EQIP and receive 50% cost share on all livestock exclusion systems	Sign up for EQIP at NRCS office.	2007 and beyond	Additional landowners signed up, approved and implemented livestock exclusion systems.

Middle Fork of Duck Creek Watershed, HUC: 05030201-110-030

<p>Establish 50-foot wide riparian corridor on each side of stream along the designated 2.5 miles (30.3 acres of buffer to be created).</p>	<p>Total cost is approximately \$13,938 for establishing 2.5 miles (30.3 acres) of riparian buffer @ \$460/acre. Landowner gets 50% in EQIP and/or CRP cost share money totaling \$6,969; remaining funds accounted for in cash or in-kind services.</p>	<p>Watershed Coordinator, NRCS, district conservationist and volunteers to visit landowners and inform them of financial, water quality and wildlife benefits of riparian buffers. Sign up willing landowners for CRP and/or EQIP program.</p>	<p>2008 to 2009</p>	<p>2.5 miles of riparian buffer set aside and established.</p>
<p>Riparian buffer inventory and the attached riparian buffer map illustrate that on the Mare Run of Duck Creek from RM 0.7 to RM 3.25 is lacking a 50-foot riparian buffer. These areas, totaling, 2.5 miles, will be a priority to restore a 50-foot riparian buffer. We will work with local landowners to identify and create an incentive program that is acceptable to reestablish the riparian corridor.</p>	<p>Watershed Coordinator, SWCD and ODNR staff and resources. CRP, Clean Ohio Fund and EQIP costshare programs are the best possibility.</p>	<p>Set up a meeting with the landowners and then proceed with program sign up, if willing to participate.</p>	<p>2008 to 2009</p>	<p>Measure feet or miles of riparian buffer restored.</p>

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Landuse/Landcover

Land Use	Area (acres)	%
Deciduous Forest	5,905	37.4
Pasture/Hay	7,126	45.0
Evergreen Forest	1,629	10.3
Row Crops	470	3.0
Mixed Forest	425	2.7
Low Intensity Residential	32	0.2
Open Water	132	0.8
High Intensity Residential	4	0.03
Commercial/Industrial/Transpo	77	0.5
Woody Wetlands	4	0.03
Emergent Herbaceous Wetlands	1	0.006
Total	15,805	100.0

Basic Statistics

Size: 15,817.7 acres (24.7 mi²)

Location: Washington County

Avg. Flow: 24.2 cfs, Stream Miles: 43.8

Aquatic Life Use Designation: Warm Water Habitat

Attainment Miles: 15.5 full, 1.8 threat, 4.0 partial, 0.0 non, 22.4 unmonitored

Monitoring Sites: 5

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
Upper Duck Creek Mainstem	14.35	8.2	2
Reeds Run	1.62	77.4	N/A
New Years Creek	2.11	n/a	N/A
Whipple Run	6.98	62.5	3
12 Unnamed Streams	18.71	n/a	N/A
Total	43.77	n/a	5

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
0.71	0.5	425	1,071	0	425	276	65

Agricultural Statistics

Agriculture=48.1% (7,596 acres) 94% Pastureland
6% Crop land

Croptype: 40% hay, 35% corn, small grains 10%, soy beans 15%

Tillage: 5% conventional, 25% minimal tillage, 70% no-till

Rotations: 2 yrs. corn, 1 yr. beans, 1 yr. small grain, 3 yrs. hay

Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U. Confined	# of A.U. Non-confined
Beef	18	1,643	30	1,613
Dairy	4	330	330	0
Horses	1	10	0	10
Swine	1	5	0	5
Sheep	1	40	0	40
Other	11	32	0	32
Total	36	2,060	360	1,700

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	#Upper Sites: 3, 4, 5	24.0 (55%)	13.2 (30%)	1*	0	2004: earthwork SR 821 2005: major rehab I-77 2008: bridge replacement SR 821	Whipple Run @ RM 0.1

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
276 (65%)	6/360	30/1,700	11,864 (75%)	1/.20

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
0	5	1- oil/gas spill	2	0

Industry Statistics

Oil & Gas Wells: 524

Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for Upper Duck Creek Subwatershed.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
Duck Creek (06-300) 2000 Western Allegheny Plateau (WAP) - WWH (existing)			
21.2/Upper 2	FULL	--	--
16.1/Upper 1	FULL	--	--
Upper Duck Creek: RM 23.0-21.2	Threatened	Organic enrichment/DO, Nutrients, Bacteria, Fecal Coliform, E.Coli	NPS stormwater and/or urban runoff from the Village of Warner
Whipple Run (06-306) 2000 (WAP) - WWH (existing)			
4.6/Upper 5	FULL	--	--
4/Upper 4	FULL	--	--
0.1/Upper 3	PARTIAL	Siltation, Organic Enrichment/DO, Bacteria	Stormwater and septic run off from Whipple

Aquatic life use attainment status of sites sampled in the *Upper Duck Creek Subwatershed* from June-October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

River Mile/Site ID	IBI	MIwb	ICI ^a	QHEI	Attainment Status ^b	Site Location
Duck Creek (06-300) 2000 Western Allegheny Plateau (WAP) - WWH (existing)						
21.2/Upper 2	50	9	48	51.5	FULL	
16.1/Upper 1	53	8.8	50	58	FULL	
Whipple Run (06-306) 2000 (WAP) - WWH (existing)						
4.6/Upper 5	48	--	E	65.5	FULL	
4/Upper 4	52	--	VG	65.5	FULL	
0.1/Upper 3	48	--	F*	63.5	PARTIAL	town of Whipple septic? NPS silt, RR?

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI Headwaters	IBI Wading	IBI Boat	MIwb Wading	MIwb Boat	ICI (all sites)
EWB Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH	24	24	24	6.2	5.8	22
LRW	18	18	18	4.0	4.0	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Background Statement: Whipple Run in the Upper Duck Creek Subwatershed (HUC 05030201-120-030) is partially meeting its water quality use designation due to organic enrichment/low dissolve oxygen levels. In addition, the main stem of Duck Creek in the Upper Duck Creek Subwatershed (HUC 05030201-120-030) is considered threatened due to organic enrichment/low dissolve oxygen levels and excessive nutrient levels. The Upper Duck Creek Subwatershed has the second lowest percentage of riparian buffer of all 9 subwatersheds. For example, only 55% of this subwatershed's stream miles have a riparian buffer of 50-feet on each side of the stream.

Problem Statement 1 of 3: Organic enrichment and low DO is partially impairing the use attainment along Whipple Run, from RM 0.1 to 4.0. The source of the organic enrichment/low DO is stormwater and septic runoff from the town of Whipple. The Washington County Health Department estimates that 65% of the 196 homes with Home Sewage Treatment Systems (HSTS) within the Whipple Run Subwatershed are failing. The 127 homes with failing HSTS systems are contributing to the partial attainment of this stream segment. We have estimated the potential amount of effluent entering the stream to be 7,125,691 gallons/year. According to the OEPA's TMDL on Duck Creek if all but 5% of the flow from failing HSTSs were removed BOD5 would decrease from 5.4 (kg/d) to 0.0149 (kg/d), ammonia would decrease from 1.2 (kg/d) to .000213 (kg/d) and DO would increase from 4.42 (mg/l) to 5.44 (mg/l). The Duck Creek Advisory Committee has decided that reducing all but 5% (as OEPA modeled) of the flow from failing HSTSs is not a realistic goal at this time, therefore we have decided to reduce the failing HSTSs flow by 80%.

Goals:

1. Over the next two years, work with the Washington County Health Department to develop a County Wide HSTS Plan.
2. Over the next three years, work with the Washington County Health Department to determine which of the 196 homes are failing.
3. Over the next four years, work with the Washington County Health Department to upgrade/replace 80% of the failing systems, which will potentially prevent 5,700,552 gallons/year of effluent from entering the stream.

Objective	Resources	How	Time Frame	Performance Indicators
Develop County Wide HSTS Plan to assist in replacing	SWCD's assist local Health Department in writing HSTS Plan.	Writing HSTS Plan to provide guidelines to those upgrading or repairing systems. In addition, the Health Department would establish inspection and maintenance protocol.	2005 to 2006	Plan is developed, approved and implemented.
Work with the county Health Department to determine which of the 196 systems are failing.	Health Department Inspectors time to inspect systems.	Inspect all 196 systems as time allows.	2008 to 2009	Failing on-site report with addresses generated.
Replace and/or upgrade failing systems.	Apply for approximately \$158,750 in 319 funds to address failing HSTS problem (@ \$2,500 a system).	Apply for a 319-Non Point Source Pollution (NPSP) Grant to cost share on-site HSTS repair, replacement or pumping.	2010 to 2010	319-NPSP Grant is obtained and implemented.

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Replace and/or upgrade failing systems.	Apply for approximately \$158,750 in DEFA funds for to address failing HSTS problem (@ \$2,500 a system).	County to apply for DEFA for a low interest on-site loan program for the county.	2010 to 2012	DEFA low interest loan program obtained and implemented in county targeting known failing systems.
Replace and/or upgrade failing systems.	Local Health Department and Ohio EPA agency officials and inspectors.	Approve and install Demonstration & Alternative Home Sewage Treatment Facilities.	2010 to 2012	DEFA low interest loan program obtained and implemented in county targeting known failing systems.

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Problem Statement 2 of 3: Organic enrichment/low DO and elevated levels of nutrients are negatively affecting water quality along the main stem of Duck Creek, from RM 21.2 to 23.0. According to the Washington County Health Department the source of these impairments is septic runoff from the town of Warner. The Washington County Health Department estimates that 65% of the 71 homes with Home Sewage Treatment Systems (HSTS) within the Village of Warner are failing. The 46 homes with failing HSTS systems are contributing to the threatened status of this stream segment. We have estimated the potential amount of effluent entering the stream to be 2,580,959 gallons/year.

Goals:

1. Over the next two years, work with the Washington County Health Department to develop a County Wide HSTS Plan.
2. Over the next three years, work with the Washington County Health Department to determine which of the 71 homes are failing.
3. Over the next four years, work with the Washington County Health Department to upgrade/replace 100% of the failing systems, which will potentially prevent 2,580,959 gallons/year of effluent from entering the stream.

Objective	Resources	How	Time Frame	Performance Indicators
Develop County Wide HSTS Plan to assist in replacing	SWCD's assist local Health Department in writing HSTS Plan.	Writing HSTS Plan to provide guidelines to those upgrading or repairing systems. In addition, the Health Department would establish inspection and maintenance protocol.	2005 to 2006	Plan is developed, approved and implemented.
Work with the county Health Department to determine which of the 71 systems are failing.	Health Department Inspectors time to inspect systems.	Inspect all 71 systems as time allows.	2008 to 2009	Failing on-site report with addresses generated.
Replace and/or upgrade failing systems.	Apply for approximately \$57,500 in 319 funds to address failing HSTS problem (@ \$2,500 a system).	Apply for a 319-Non Point Source Pollution (NPSP) Grant to cost share on-site HSTS repair, replacement or pumping.	2010 to 2012	319-NPSP Grant is obtained and implemented.
Replace and/or upgrade failing systems.	Apply for approximately \$57,500 in DEFA funds for to address failing HSTS problem (@ \$2,500 a system).	County to apply for DEFA for a low interest on-site loan program for the county.	2010 to 2012	DEFA low interest loan program obtained and implemented in county targeting known failing systems.
Replace and/or upgrade failing systems.	Local Health Department and Ohio EPA agency officials and inspectors.	Approve and install Demonstration & Alternative Home Sewage Treatment Facilities.	2010 to 2012	DEFA low interest loan program obtained and implemented in county targeting known failing systems.

Upper Duck Creek Subwatershed, HUC: 05030201-120-030

Problem Statement 3 of 3: The Upper Duck Creek Subwatershed has the second lowest percentage of riparian buffer of all 9 subwatersheds. For example, only 55% of this subwatershed’s stream miles have a riparian buffer of 50-feet on each side of the stream. Increasing the 50-foot riparian buffer from 55% (24.0 miles) to 70% (30.6 miles) would increase the overall health and sustainability of this subwatershed by reducing sediment loads, decreasing water temperature while increasing DO levels in the stream.

Goal:

1. Increase the 50-foot wide riparian buffer on each side of the stream from 55% to 70%. This would increase the buffered stream miles from 24.0 to 36.6 miles (6.6-mile increase).

<p>Riparian buffer inventory and the attached riparian buffer map illustrate that on the main stem of Duck Creek RM 11.2 to RM 13.2, RM 14.0 to RM 15.3 and RM 18.4 to RM 19.5 is lacking a 50-foot riparian buffer. In addition, on Whipple Run RM 0.0 to RM 2.2 is lacking a 50-foot riparian buffer. These areas, totaling 6.6 miles, will be a priority to restore a 50-foot riparian buffer. We will work with local landowners to identify and create an incentive program that is acceptable to reestablish the riparian corridor.</p>	<p>Watershed Coordinator, SWCD and ODNR staff and resources. CRP, Clean Ohio Fund and EQIP costshare programs are the best possibility.</p>	<p>Set up a meeting with the landowners and then proceed with program sign up, if willing to participate.</p>	<p>2009-2010</p>	<p>Measure feet or miles of riparian buffer restored.</p>
<p>Establish 50-foot wide riparian corridor on each side of stream along an additional 6.6 miles (79.8 acres of buffer to be created). Totaling 70% of the subwatershed.</p>	<p>Total cost is approximately \$36,708 for establishing 79.8 acres of riparian buffer @ \$460/acre. Landowner gets 50% in EQIP and/or CRP cost share money totaling \$18,354; remaining funds accounted for in cash or in-kind services.</p>	<p>Watershed Coordinator, NRCS district conservationist and volunteers to visit landowners and inform them of financial, water quality and wildlife benefits of riparian buffers. Sign up willing landowners for CRP and/or EQIP program.</p>	<p>2009-2010</p>	<p>6.6 miles of riparian buffer set aside and established and improved QHEI scores.</p>

West Fork of Duck Creek Subwatershed, HUC: 05030201-120-020

Landuse/Landcover

Land Use	Area (acres)	%
Deciduous Forest	13,647	68.7
Pasture/Hay	3,157	15.9
Evergreen Forest	427	2.1
Row Crops	1,381	7.0
Mixed Forest	219	1.10
Low Intensity Residential	217	1.10
Open Water	180	0.9
High Intensity Residential	10	0.05
Quarries	0.44	0.00
Transitional	510	2.60
Commercial/Industrial/Transpo	23	0.12
Woody Wetlands	63	0.32
Emergent Herbaceous Wetlands	28	0.14
Total	19,862	100.0

Basic Statistics

Size: 19,870.6 acres (31.0 mi²)
 Location: Noble County
 Avg. Flow: 30.4 cfs, Stream Mi.: 44.3
 Aquatic Life Use Designation: Warm Water Habitat
 Attainment Miles: 22.6 full, 2.7 threat, 0.0 partial, 2.2 non, 19.6 unmonitored
 Monitoring Sites: 11

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
West Fork	11.5	7.8	4
Buffalo Run	3.25	86.6	2
19 Unnamed Streams	31.04	N/A	5
Total	45.79	N/A	11

Agricultural Statistics

Agriculture=22.8% 70% Pastureland
 (4,538 acres) 30% Crop land

Croptype: 80% hay, 4% corn, small grains 6%
 Tillage: 25% conventional, 25% minimal tillage, 50% no-till
 Rotations: 2 yrs. corn, 1 yr. beans, 1 yr. small grain, 5 yrs. hay
 Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U. Confined	# of A.U. Non- confined
Beef	10	425	0	425
Dairy	0	0	0	0
Horses	15	75	0	75
Swine	0	0	0	0
Sheep	0	0	0	0
Other	0	0	0	0
Total	25	500	0	500

Urban Statistics

Urban%	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
3.8	2.7	454	1,230	0	454	309	68

West Fork of Duck Creek Subwatershed, HUC: 05030201-120-020

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	West Monitoring Sites: 4, 5, 6, 9, 10	41.9 (96%)	13.1 (29%)	0	0	Bridge replacement: Macksburg @ St. Rt. 821	None at this time

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
309 (68%)	0/0	25/500	17,486 (88%)	none

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
1	21	none	9	0

Industry Statistics
Oil & Gas Wells: 2,498
Sawmill/Resource Extraction
 Ames True Temper Sawmill and Dexter Hardwoods Inc. (Dexter City)
 Donald Morris Lumber and Sawmill (Macksburg)
 B&N Coal (Dexter City)
Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

West Fork of Duck Creek Subwatershed, HUC: 05030201-120-020

Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling "Site ID" for the West Fork of Duck Creek.

West Fork Duck Creek (06-340) 2000 (WAP) - WWH (existing)			
9.1/West 3	FULL	--	--
4.6/West 2	FULL	--	--
0.1/West 1	FULL	--	--
West Fork Main: RM 9.5 to RM 8.5	Threatened	Organic enrichment/DO, Nutrients, Bacteria, Fecal Coliform, E.Coli	NPS stormwater and/or urban runoff from the Village of Macksburg
Nelots Creek (06-360) 2000 (WAP) - WWH (proposed)			
1.4/West 8	FULL	--	--
0.1/West 7	FULL	--	--
Trib to West Fork Duck Creek (confl. @ RM 9.35)(Macksburg Run)(06-361)2000 (WAP)			
0.1/West 9	FULL	--	--
Trib to West Fork Duck Creek (confl. @ RM 8.7)(Goose Hollow)			
0.1/West 10	Threatened	Aluminum, Manganese, Iron, Siltation	AMD: surface mining
Buffalo Run (06-342) 2000 (WAP) - LRW (existing); WWH (proposed)			
1.9/West 5	NON	Aluminum	AMD: surface mining
0.1/West 6	FULL	--	--
Trib. to West Fork Duck Cr. (confluence @ RM 3.05) (06-359) 2000 (WAP) - WWH (proposed)			
0.2/West 11	NON	Aluminum, Manganese, Iron, Siltation	AMD: surface mining
Trib. to West Fork Duck Cr. (confluence @ RM 2.30) (06-358) 2000 (WAP) - WWH (proposed)			
0.2/West 4	FULL	--	--

West Fork of Duck Creek, HUC: 05030201-120-020

Aquatic life use attainment status of sites sampled in the *West Fork Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

West Fork Duck Creek (06-340) 2000 (WAP) - WWH (existing)						
9.1/West 3	49	9	42	59	FULL	dst. Macksburg
4.6/West 2	45	8.9	48	75	FULL	
0.1/West 1	49	8.6	E	59	FULL	nr. mouth
Nelots Creek (06-360) 2000 (WAP) - WWH (proposed)						
1.4/West 8	48	--	VG	61.5	FULL	
0.1/West 7	42 ^{ns}	--	G	60.5	FULL	
Trib to West Fork Duck Creek (confl. @ RM 9.35)(Macksburg Run)(06-361)2000 (WAP)						
0.1/West 9	42 ^{ns}	--	E	49.5	FULL	WWH (proposed)
Trib to West Fork Duck Creek (confl. @ RM 8.7)(Goose Hollow)						
0.1/West 10	N/	N/A	N/A	N/A	Threatened	
Buffalo Run (06-342) 2000 (WAP) - LRW (existing); WWH (proposed)						
1.9/West 5	28*	--	26*	53	NON	likely AMD/gray slag/coagulent present on rocks
0.1/West 6	44	--	G	42	FULL	
Trib. to West Fork Duck Cr. (confluence @ RM 3.05) (06-359) 2000 (WAP) - WWH (proposed)						
0.2/West 11	12*	--	F*	49.5	NON	AMD impacts
Trib. to West Fork Duck Cr. (confluence @ RM 2.30) (06-358) 2000 (WAP) - WWH (proposed)						
0.2/West 4	28*	--	E	42	FULL	MH ust.-Wetland/pool-mining repair?

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type	IBI	IBI	IBI	MIwb	MIwb	ICI
INDEX	Headwaters	Wading	Boat	Wading	Boat	(all sites)
EWB Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH	24	24	24	6.2	5.8	22
LRW	18	18	18	4.0	4.0	8

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater sites.

West Fork of Duck Creek, HUC: 05030201-120-020

Background Statement: The West Fork of Duck Creek Subwatershed (HUC 05030201-120-020) is not meeting water quality use designations due to organic enrichment/low DO levels and aluminum, manganese, iron and siltation from surface mining.

Problem Statement 1 of 4: Organic enrichment/low DO and elevated levels of nutrients are negatively affecting water quality along the West Fork of Duck Creek from RM 8.5 to RM 9.5. According to the Washington County Health Department the source of this impairment is septic runoff from the town of Macksburg. The Washington County Health Department estimates that 68% of the 107 homes with Home Sewage Treatment Systems (HSTS) within the Village of Macksburg are failing. The 73 homes with failing HSTS systems are contributing to the threatened status of this stream segment. We have estimated the potential amount of effluent entering the stream to be 4,095,869 gallons/year.

Goals:

1. Over the next two years, work with the Washington County Health Department to develop a County Wide HSTS Plan.
2. Over the next three years, work with the Washington County Health Department to determine which of the 107 homes are failing.
3. Over the next four years, work with the Washington County Health Department to upgrade/replace 85% of the failing systems, which will potentially prevent 3,481,489 gallons/year of effluent from entering the stream.

Objective	Resources	How	Time Frame	Performance Indicators
Develop County Wide HSTS Plan to assist in replacing	SWCD's assist local Health Department in writing HSTS Plan.	Writing HSTS Plan to provide guidelines to those upgrading or repairing systems. In addition, the Health Department would establish inspection and maintenance protocol.	2005 to 2006	Plan is developed, approved and implemented.
Work with the county Health Department to determine which of the 107 systems are failing.	Health Department Inspectors time to inspect systems.	Inspect all 107 systems as time allows.	2009 to 2010	Failing on-site report with addresses generated.
Replace and/or upgrade failing systems.	Apply for approximately \$91,250 in 319 funds to address failing HSTS problem (@ \$2,500 a system).	Apply for a 319-Non Point Source Pollution (NPSP) Grant to cost share on-site HSTS repair, replacement or pumping.	2011 to 2013	319-NPSP Grant is obtained and implemented.
Replace and/or upgrade failing systems.	Apply for approximately \$91,250 in DEFA funds for to address failing HSTS problem (@ \$2,500 a system).	County to apply for DEFA for a low interest on-site loan program for the county.	2011 to 2013	DEFA low interest loan program obtained and implemented in county targeting known failing systems.

West Fork of Duck Creek, HUC: 05030201-120-020

Replace and/or upgrade failing systems.	Local Health Department and Ohio EPA agency officials and inspectors.	Approve and install Demonstration & Alternative Home Sewage Treatment Facilities.	2011 to 2013	DEFA low interest loan program obtained and implemented in county targeting known failing systems.
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Problem Statement 2 of 4: Excessive iron loading and acidic water is negatively affecting water quality at RM 0.1 of a tributary that has its confluence with West Fork at RM 8.7. The source of the impairment is from an old underground mine that, prior to reclamation, flowed over into a mine pit. The 250-acre mine site was then surface mined and reclaimed. The old underground mine water, however continues to flow out from an auger hole, along the highwall and enters into the stream. According to ODNR Division of Mineral Resource Management and Roger Osborne (B&N Coal) the exact loading amounts of iron and acidic water entering the stream have not yet been calculated. Flow and water quality data is currently being taken and will be utilized when available. According to Roger Osborne from B&N Coal this is a complex problem and the most likely solution will be to remine the 250-acre project area. Remining (extract all remaining coal and reclaim) the project area will reduce iron and acid loadings to meet the recommended water quality targets for WWH use designation.

Goal:

1. Within 3 years, work with B&N Coal and ODNR Division of Mineral Resource Management to reduce iron and acidity loadings to allow this tributary to meet the recommended water quality targets for WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Remine entire 250-acre project area.	\$1,250,000 to remine 250-acrea project area (@ \$500/acre). Actual cost will be less due to amount of coal mined and AML funds used.	B&N Coal plans to propose a remining project at the 250-acre site. This will involve removing all remaining coal, sealing up old underground mine and reclaiming the entire site to prevent Acid Mine Drainage from entering the stream. They will receive AML funds and coal profits to offset costs.	2009-2012	Entire area is remined and the underground mine water is not entering the stream.

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Problem Statement 3 of 4: Aluminum concentrations from unreclaimed strip mining are causing non-attainment in Buffalo Run, from RM 1.9 to RM 3.25. According to the OEPA's TMDL on Duck Creek Buffalo Run is in non-attainment because of the 2,046 lb/year of aluminum that is entering the stream. To meet WWH use designation proper mining BMP's such as remining or reclamation must be implemented.

Goal:

1. Within four years, reduce the aluminum load from 2,046 to 530 lb/yr (1,516 lb/yr reduction) to allow Buffalo Run to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Buffalo Run Subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005-2006	Potential reclamation sites are identified and prioritized.
Plant PT trees on 50 acres on unreclaimed surface minelands.	\$32,500 to plant 50 acres of PT trees (@\$650/acre)	ODNR Division of Mineral Resource Management Tree Planting Program.	2011-2013	Trees planted and survive.
Apply for Office of Surface Mining Appalachian Clean Streams Grant	\$100,000 to offset reclamation costs	Watershed coordinator to apply for Appalachian Clean Streams Grant	2011	Grant awarded and implemented.
Reclaim 50 acres of unreclaimed surface minelands.	\$350,000 to reclaim 50 acres @ \$7,000/acre	Watershed Coordinator to apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2011-2013	Grant awarded and implemented. Meets WWH use designation.

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Problem Statement 4 of 4: Aluminum, iron, manganese and siltation loadings from unreclaimed strip mining are causing non-attainment in a West Fork Tributary (confluence @ RM 3.05 of West Fork) from RM 0.1 to RM 1.0. According to the OEPA's TMDL on Duck Creek this tributary is in non-attainment because of the 5,281 lb/year of aluminum, 4,438 lb/yr of iron, 5,458 lb/yr of manganese and 424 lb/yr of siltation that is entering the stream. To meet WWH use designation proper mining BMP's such as remining or reclamation must be implemented.

Goal:

1. Within 5 years, reduce the aluminum load from 5,281 lb/yr to 2,443 lb/yr (2,838 lb/yr reduction), the iron load from 4,438lb/yr to 2,056 lb/yr (2,383 lb/yr reduction), the manganese load from 5,458 lb/yr to 2,529 lb/yr (2,929 lb/yr reduction) and the siltation load from 424 lb/yr to 59 lb/yr (365 lb/yr reduction) will allow the Tributary to West Fork @ RM 3.05 to meet WWH use designation.

Objective	Resources	How	Time Frame	Performance Indicators
Inventory of Tributary to West Fork @ RM 3.05 subwatershed to identify and prioritize reclamation sites.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, volunteers and ODNR staff time.	2005-2006	Potential reclamation sites are identified and prioritized.
Plant PT trees on 50 acres on unreclaimed surface minelands.	\$32,500 to plant 50 acres of PT trees @\$650/acre	ODNR Division of Mineral Resource Management Tree Planting Program.	2012 to 2014	Trees planted and survive.
Reclaim 100 acres of unreclaimed surface minelands.	\$700,000 to reclaim 100 acres @ \$7,000/acre	Apply for 319- Non Point Source Pollution Grant targeting this subwatershed.	2012 to 2014	Grant awarded and implemented. Meets WWH use designation.
Apply for Office of Surface Mining Appalachian Clean Streams Grant	\$100,000 to offset reclamation costs	Watershed coordinator to apply for Appalachian Clean Streams Grant	2012	Grant awarded and implemented.

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Paw Paw Creek Subwatershed, HUC: 05030201-11-050

Landuse/Landcover

Land Use	Area (acres)	%
Deciduous Forest	10,311	68.8
Pasture/Hay	3,452	23.0
Evergreen Forest	550	3.7
Row Crops	330	2.2
Mixed Forest	326	2.20
Low Intensity Residential	0.44	0.003
Open Water	12	0.08
High Intensity Residential	0.22	0.001
Transitional	0.44	0.003
Quarries	0.44	0.003
Commercial/Industrial/Transpo	0.89	0.006
Woody Wetlands	1	0.007
Emergent Herbaceous Wetlands	0.22	0.001
Total	14,985	100.0

Basic Statistics

Size: 14,996.4 acres (23.4 mi²)
 Location: Washington, Noble & Monroe Counties
 Avg. Flow: 22.9 cfs, Stream Miles: 43.8
 Aquatic Life Use Designation: Exceptional Warm Water Habitat
 Attainment Mis: 5.9 full, 0.0 threat, 4.4 in recovery, 0.0 non, 33.4 unmonitored
 Monitoring Sites: 4

Agricultural Statistics

Agriculture=25.2% (3,782 acres) 91% Pastureland
 9% Crop land

Croptype: 89% hay, 6% corn, small grains 4%
 Tillage: 80% conventional, 10% minimal tillage, 10% no-till
 Rotations: 5 yrs. of hay with 1 year of corn or soy beans mixed in
 Chemicals used: 24-D, Round Up, Atrazine Mixtures, Rodeo & Banvel

Stream Statistics

Stream Names	Length (mi.)	Gradient (ft./mi.)	Sample Sites
Paw Paw Creek	10.37	38	4
Coon Run	2.14	N/A	None
19 Unnamed Streams	31.26	N/A	None
Total	43.77	N/A	4

Livestock Species	Total # of Operations	Total # of A.U./Species	# of A.U. Confined	Non-confined
Beef	17	428	0	428
Dairy	0	0	0	0
Horses	7	28	0	28
Swine	0	0	0	0
Sheep	0	0	0	0
Other	0	0	0	0
Total	24	456	0	456

Urban Statistics

Urban %	Impervious %	Total # Homes	Population	# Homes w/ Public Sewage	# Home Sewage Treatment Systems	Failing Systems	% Total Systems Failing
0.01	0.007	260	680	0	260	156	60

Paw Paw Creek Subwatershed, HUC: 05030201-11-050

Physical Attributes of Streams

Floodplain Connectivity	Eroding Locations	Riparian Buffer (50ft.) # of stream mis. (% of total stream mis.)	Livestock access # stream mis. (% of total stream mis.)	# of Dams	Permanent Protection # & Location	Expected # of Road, Building, Bridge and Slip Construction	Channelization & Hydromodification
yes	none at present time	40.71 (93%)	12.8 (29%)	0	0	2004: landslide CR 15, bridge replacement Salem TR 321	Paw Paw Creek @ RM 3.8

Non Point Source Pollution

# Failing HSTS (% of Total Systems)	# of Confined Livestock Operations /Animal Units	# of Non-Confined Livestock Operations /Animal Units	Acres Highly Erodible Soil (% of Total Acres)	# of Dams/ # of Stream Miles Dammed
156 (60%)	0/0	24/456	14,246 (95%)	none

Point Source Pollution

NPDES Permits	Potential Groundwater Contaminants	# of Spills and Illicit Discharges	# Open Trash Dumps	# of Super Fund Sites
0	2	none	11	0

Industry Statistics
Oil & Gas Wells: 741
Timber operations: 50 timber operations accounting for approximately 7,400 acres of timber harvested from 2000 to 2003 in the entire Duck Creek Watershed.

Paw Paw Creek Subwatershed, HUC: 05030201-11-050

Table ?. Causes and Sources of Impairment and Aquatic Life Use Attainment Status by River Mile and Sampling “Site ID” for the *Paw Paw Creek Subwatershed*.

River Mile/Site ID	Attainment Status ^b	Causes of Impairment	Sources of Impairment
Pawpaw Creek (06-321) 2000 WAP - EWH (existing)			
11/PawPaw 4	FULL	--	--
9.6/PawPaw 3	FULL	--	--
8.2/PawPaw 2	FULL	--	--
3.8/PawPaw 1	PARTIAL	Siltation: in recovery	Equipment working in and around stream at time of sampling: in recovery

Table ?. Aquatic life use attainment status of sites sampled in the *Paw Paw Creek Subwatershed* from June- October, 2000. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and the Invertebrate Community Index (ICI) are scores based on the performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures the ability of the physical habitat to support a biotic community. Aquatic life uses for the Duck Creek basin were based on biological sampling conducted during June - October 2000.

River Mile/Site ID	IBI	MIwb	ICT ^a	QHEI	Attainment Status ^b	Site Location
Pawpaw Creek (06-321) 2000 WAP - EWH (existing)						
11/PawPaw 4	50	--	E	59.5	FULL	adj. SR 564
9.6/PawPaw 3	56	--	E	66.5	FULL	CR 30 and CR 15
8.2/PawPaw 2	52	--	E	71.5	FULL	from CR 15
3.8/PawPaw 1	44*	--	E	72	PARTIAL	TR 324 or 460 (active “401” during sample)

Biological Criteria for Western Allegheny Plateau (WAP)

Site Type INDEX	IBI Headwaters	IBI Wading	IBI Boat	MIwb Wading	MIwb Boat	ICI (all sites)
EWH Habitat	50	50	48	9.4	9.6	46
WWH Habitat	44	44	40	8.4	8.6	36
MWH	24	24	24	6.2	5.8	22
LRW	18	18	18	4.0	4.0	8

* Significant departure from Ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (<4 IBI or ICI units; <0.5 MIwb units).

a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Marginally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

c Sampled or evaluated in 2000.

NA Not Applicable. The MIwb (Modified Index of Well-being) is not applicable to headwater Sites

Paw Paw Creek Subwatershed, HUC: 05030201-11-050

Background Statement: Paw Paw Creek in the Paw Paw Creek Subwatershed (HUC 05030201-110-050), RM 3.8-8.2, is partially (in recovery) meeting water quality use designation due to excessive siltation in the stream.

Problem Statement: Excessive siltation in the Paw Paw Creek Subwatershed was impairing the use attainment at the time of sampling. The source of the sediment was due to dozer work widening a farm/pasture lane adjacent to the stream, delivering sediment to the stream. According to OEPA this stream segment was in partial attainment due to the dozer work and is currently “in recovery”; therefore the amount of soil delivered to the stream was not calculated. OEPA is recommending Exceptional Warmwater Habitat (EWH) for the Paw Paw Creek Subwatershed as long as the riparian corridor is protected (the only EWH in the entire Duck Creek Watershed).

Goals:

1. Determine if the stream has recovered to meet EWH water quality use designation and to protect the EWH designation once it is achieved.
2. Protect/increase the 93% of the Paw Paw Creek Subwatershed that has a 50-foot riparian buffer on each side of the stream.

Objective	Resources	How	Time Frame	Performance Indicators
Establish physical, chemical & biological sampling @ Paw Paw 1: RM 3.8 to ensure that EWH water quality use designation has been attained.	\$4,000 chemical sampling probe purchased in 2004, \$2,000 per year in salaries	Watershed coordinator, Washington & Noble SWCD staff and volunteers will conduct sampling at this site. Technical assistance provided by ODNR & OEPA	July 2004- July 2006	Document QHEI scores of 60 and above for EWH attainment. Verify total suspended solids, and turbidity results to verify EWH water quality use designation.
Riparian buffer inventory and the attached riparian buffer map illustrates RM 0.0 to RM 2.7 is lacking a 50-foot riparian buffer. This area will be a priority to restore a 50-foot riparian buffer. We will work with local landowners to identify and create an incentive program that is acceptable to reestablish the riparian corridor.	Watershed Coordinator, SWCD and ODNR staff and resources. CRP, Clean Ohio Fund and EQIP costshare programs are the best possibility.	Set up a meeting with the landowners and then proceed with program sign up, if willing to participate.		Measure feet or miles of riparian buffer restored.

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<p>Educational Tour of Paw Paw Creek Subwatershed to demonstrate the benefits of riparian buffers as opposed to non buffered areas. In addition, the tour will highlight cost share and easement programs (CRP & Clean Ohio Fund) available to landowners for buffer installation or protection. Show contrasting sites and the corresponding sampling data to demonstrate the benefits of buffers. Focus on fiscal, water quality and wildlife benefits of riparian buffers.</p>	<p>Community Action of Washington County will donate vans for tour. \$750 in salary time for NRCS, ODNR, OSU Extension and SWCD employees to conduct tour. \$200 in printing fliers and posters to advertise tour and educational handouts during tour.</p>	<p>Washington & Noble SWCD's, Duck Creek Watershed Advisory Committee and the Keepers of Duck Creek will organize and host tour.</p>		<p>Review tour evaluation form. Amount of new CRP and Clean Ohio Fund participants in the Subwatershed. Quantify the amount of riparian buffer preserved or lost throughout the subwatershed.</p>
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