

I. WATERSHED SETTING

The Darby Creek Watershed encompasses about 355,000 acres (555 square miles) and is located just west of the City of Columbus. From its headwaters in Logan County to its confluence with the Scioto River near Circleville the watershed flows across seven counties, Logan, Clark, Union, Champaign, Madison, Franklin, and Pickaway. The Darby Creeks traverse rolling hills in the headwaters, large flat expanses in the midsection, and drop into large floodplain valleys near the mouth. Glacial activity created large expanses of relatively flat, poorly drained soils well suited for agriculture with proper drainage throughout most of the watershed.

Big and Little Darby Creeks are designated as National and State Scenic Rivers in Union, Madison, Franklin, and Pickaway Counties. Approximately 84 percent of Big Darby Creek and 46 percent of Little Darby Creek are designated as scenic rivers. A few of the outstanding stream features are the 100 recorded fish species, and 43 mussel species of which 36 are endangered or rare. Many streams in the Darby Creek Watershed are classified as “Exceptional Warmwater Habitats” by the Ohio Environmental Protection Agency (Ohio EPA) and recognized as one of the top streams in biological quality in the Midwest and Nation.

Today, the watershed’s primary use is agriculture, with about 75% in farmland. The rural character of the watershed has helped maintain the creek’s exceptional water quality. However, the sustainability of the watershed is in question as urbanization pressures increase, forested areas along stream corridors are removed, and sediment is not properly controlled. A more detailed look at the multiple problems in the watershed will be examined in the **Community Based Watershed Plan**.

A. Location

The Darby Creek Watershed is located just 25 miles west of downtown Columbus, Ohio, and drains portions of seven counties, Champaign, Clark, Franklin, Logan, Madison, Pickaway and Union counties (See **Map 1**). Data for Clark County has not been included in the Inventory portion of the Watershed Plan because Clark County has only 544 acres (.15% of the watershed) in the watershed. Madison County has the highest percentage of the total watershed area with 31 percent, followed by Union County with 23 percent. Champaign and Franklin Counties both have 15 percent of the watershed followed by Pickaway County with 10 percent and Logan County with 5 percent (See Figure 1).

<i>County</i>	<i>Acres</i>	<i>Percent</i>
Clark	545	0.15%
Logan	16,838	4.74%
Pickaway	35,780	10.06%
Franklin	53,825	15.13%
Champaign	55,421	15.58%
Union	83,081	23.37%
Madison	110,118	30.97%
Totals	355,608	100%

The main stem, Big Darby Creek, originates in Logan County and flows 82.5 miles in a southeasterly direction to its confluence with the Scioto River, just north of Circleville, Ohio. Principle tributaries include Flat Branch, Spain Creek, Buck Run, Treacle Creek, Sugar Run, Little Darby Creek, Hellbranch Run, Spring Fork, and Robinson Run.

B. Geology

The Darby Watershed like many watersheds was shaped through glaciation. The underlying bedrock of the watershed is either limestone or dolomite of Silurian or Devonian age. Very few bedrock outcrops occur in the watershed because of the thick glacial deposits that blanketed the area. The glacial till ranges from 700 feet thick to only a few feet in the headwaters area and in western Franklin County. The glacial setting in the watershed is illustrated in **Map 2**. A short narrative for each glacial setting will be provided on the map.

The terrain of the watershed varies considerably from the mouth to the headwaters. In the headwaters, the Bellefontaine Outlier and the Cable Moraine Complex created rolling hills and steeper slopes than found in much of the watershed. From the headwaters the terrain levels off into the Darby Plains. The Darby Plains is the most significant geological feature within the watershed. The Darby Plains is well suited to agriculture and has a fertile top soil that is up to two feet thick in some areas. The large amount of melt water and moraines shaped the path of the Darby Creeks.

PRE-GLACIAL

The pre-glacial geology of the Darby Watershed is for the most part buried under glacial deposits and has little impact on the modern drainage of the watershed. Through several geologic periods several warm, shallow seas advanced and retreated over the Ohio landscape (National Park Service, 1993). During the Silurian and Devonian periods (435-345 million years ago) a retreat of a sea deposited a thick layer of carbonate sediments which are now important in Ohio's lime industry (National Park Service, 1993).

GLACIAL

Approximately 20,000 years ago, the Wisconsinan glacier began to advance south through Ohio. In the Bellefontaine area the glacier ran into a high area called the Bellefontaine Outlier which caused the glacier to continue advancing in two separate lobes. The lobe that traveled to the west of the Bellefontaine Outlier advanced through Troy, Dayton and Xenia areas of Ohio until it stopped around the Hamilton and Butler county border. The lobe that advanced to the east of Bellefontaine traveled through the Darby Watershed and east into the middle of Knox, Licking, and Fairfield counties and then south to the Hillsboro area. The point at which the glacier stopped is represented on the map by the farthest solid dark line between the tan/yellow areas and the light green (**Map 3**). This event represents the Early Wisconsinan glacier in Ohio.

The Early Wisconsin Glacier then retreated to an unknown distance and then traveled south again. The Late Wisconsin Glacier again advanced to the Bellefontaine Outlier and then separated into two lobes that travel similar paths but both stop at an area just north of the previous glacial advance. Inside the light green areas of the map (Wisconsinan Glacial event) a solid dark line represents the farthest advance of the Late Wisconsinan Glacial advance (**Map 3**). The retreat of the eastern lobe formed the majority of the present landscape in the Darby Watershed.

As the eastern lobe retreated it remained over different areas for periods of 50-100 years then continued to retreat. As it retreated end moraines formed representing a temporary glacial stopping point. End moraines are today evident as broad, hummocky ridges of glacial debris (marked by darker green arcs over the light green). Several end moraines exist within the Darby Watershed from the Late Wisconsinan Glacial event.

Reesville Moraine - This moraine intersects the Big Darby Creek as it enters into the Scioto River in Circleville (See **Map 3**).

London Moraine – This end moraine forms a ridge through northwest Madison County, through London, and then along the Franklin and Pickaway County boundaries (See **Map 3**). The significance of this moraine on the Darby Creeks is unknown (ODNR, 1992).

Cable Moraine Complex – This moraine is referred to as a complex because a wide variety of glacial activities are occurring in an area between Bellefontaine and Urbana. On **Map 3** different colors represent a wide variety of glacial activities. This complex glacial environment is likely a result of the fact that the ice in this area remained for a long time and moved very little because of the Bellefontaine Outlier holding it in place (Brockman, Personal Communication). This formed a more rugged terrain with rolling hills and steeper slopes in comparison to the remainder of the Watershed. This area formed the headwaters of the Big and Little Darby Creeks.

Powell Moraine - The northernmost portion of the Darby Watershed in Union County experienced an additional glacial event as the Late Wisconsinan glacier retreated for a second time north of the Lake Erie Basin. The glacier's third advance was likely over the freshly deposited clayey lake deposits in the Lake Erie Basin which explains the higher concentration of clay in soils in Union County than soils from the second glacial advance in the remainder of the watershed (Brockman, Personal Communication, 2003). The third glacial advance again hit the Bellefontaine Outlier and split into two lobes; Miami and Scioto. The Scioto lobe dipped into Union County and then formed the Powell Moraine which represents the southernmost glacial advance. The Powell Moraine was the first of a series of end moraines formed by the third glacial retreat represented by a grayish area on the map.

The remainder of the land in the watershed is largely referred to as a ground moraine (light green areas on **Map 3**), or simply as the material that the glacier left behind as it slowly retreated north. The material is a mixture of clay, silt, and sand with some areas of pebbles, cobbles, and

boulders. Areas with a higher concentration of boulders are represented by red dots on the map (See **Map 3**).

FORMATION OF DARBY CREEKS

The Darby Creeks were formed by the melting of the glaciers. The Creeks flowed as a braided stream from the large amount of glacial melt water. Braided streams typically transport a large amount of sediment and form shallow and wide stream channels. During each of the three glacial retreats the Darby Creeks were actively transporting a large amount of debris. The glacial debris was suspended in the stream as it flowed away from the ice but the debris was dropped as the stream lost velocity. This material, referred to as outwash, consists of poorly compacted sand and gravel and forms the broad, flat plains adjacent to the streams. As the melt water stopped, the Darby Creeks became entrenched in single channels and began active erosion of the newly deposited glacial material or outwash. The erosion of the streams ultimately formed the high-level terraces that are present along the creeks especially south of US Route 40. The present day flood plains of the Darby Creeks represent the former width of the braided streams during the melting of the glaciers (Brockman, Personal Communication, 2003).

Big Darby

The Big Darby Creek was formed by the melting of the glacial retreats. The final glacial retreat formed the Powell Moraine which directed the flow of melt water along its front edge (See **Map 3**). The melt water followed a path that forms the present day course of the Big Darby Creek through Union County. The Big Darby Creek followed the front edge of the Powell Moraine until it reached the present day area of Plain City and ran into a slightly higher area which was enough to divert the stream flow south (Brockman, Personal Communication, 2003).

Little Darby Creek

The headwaters of the Little Darby Creek began within the Cable Moraine Complex. As water was melting from the glacier, it was directed toward present day Mechanicsburg but glacial ice forced the water to drain towards the Miami River Basin. Once the ice melted the water was then able to follow the present day topography and drain into the Darby Watershed (Brockman, Personal Communication, 2003).

DARBY PLAINS

The Darby Plains are a significant glacial remnant that is primarily located between the Big and Little Darby Creeks. Prior to glaciation the Darby Plains was a moderately rolling upland that was cut by tributaries of the Teays River. The glaciers buried these valleys which are now up to 700 feet below the surface. In most areas of Ohio, glacial till has increased the surface relief but very little erosion has occurred in the Darby Watershed. The huge mass of ice, often referred to as Darby Ice, sat over the watershed and slowly percolated through the glacial sediments as it

melted, rather than being removed through stream creation. In turn this created one of the flattest areas in central Ohio instead of the more common dissected drainage topography in Ohio (ODNR, 1992). The Darby Plains are not completely flat; they have a somewhat hummocky topography with small rises and falls between two to seven feet. This topography is likely a result of the flat topography before glaciation and the length of time the ice remained over the area. (Brockman, Personal Communication, 2003)

C. Soils

Soils are an important natural resource in the Darby Watershed. Soils in Ohio have been analyzed on varying levels of detail since the late 1800s. Soils in this portion of this document will be analyzed broadly for the entire state, as generalized soils units for the Darby Watershed, and then by detailed soils units. The soils data is from both the Ohio Department of Natural Resources (ODNR) and United States Department of Agriculture (USDA).

OHIO SOIL REGIONS

The Ohio Department of Natural Resources generalized the soils in the state into twelve soils regions (See Figure 2 on following page). Most of the watershed is within Region four, referred to as Miamian-Kokomo-Eldean. Only a small part of the watershed lies within the third Region, Blount-Pewamo-Glynwood. These names are given to the soil regions because they represent common soil series in the described region. Both Regions 3 and 4 are entirely within the Indiana and Ohio Till Plain. Soils north of Big Darby Creek in Union County are in Region 3 which have higher clay, lime, and organic content than soils to the south in Region 4 which are coarser in texture and contain more well-drained soils. Figure 3 summarizes the differences between soil regions in Ohio.

Percentage of Soils in Regions with Selected Characteristics												
Characteristic	Region Number & Corresponding Color											
	1	2	3	4	5	6	7	8	9	10	11	12
More than 8% Slope	1%	7%	6%	19%	12%	17%	38%	65%	83%	79%	68%	88%
More than 3% Organic Matter in the upper 10 inches	63%	8%	32%	20%	14%	2%	<1%	<1%	5%	<1%	2%	<1%
More than 27% Clay in the topsoil	61%	11%	32%	22%	11%	2%	2%	<1%	38%	1%	3%	40%
Seasonal high water table less than 1 foot below the surface	63%	24%	31%	17%	17%	15%	20%	2%	<1%	1%	3%	<1%
Bedrock less than 40 inches below the surface	<1%	11%	1%	2%	<1%	3%	7%	26%	49%	25%	14%	19%

Figure 3: ODNR, Division of Soil and Water. 2003. *Soil Regions in Ohio*, Website

STATSGO SOILS

The Darby Creek Watershed is entirely within the Eastern Corn Belt Ecoregion of Ohio. The soils in the region can also be divided into more detailed units referred to as STATSGO (State Soils Geographic Database) soils. The glacially created soils in the Darby Watershed can be generalized into ten soil associations (See Figure 4). The name of the soil association defines the predominate soil types within the region. The table below defines the soil associations and their frequency within the watershed. The **Map 4** illustrates where the soil associations are found within the watershed.

Figure 4: Darby Creek Watershed Soil Associations							
<i>Map Unit ID</i>	<i>Soil Association Name</i>				<i>Acres</i>	<i>Percent</i>	
OH031	Kokomo	-	Crosby	-	Miamian	99,521	28.0
OH033	Miamian	-	Celina	-	Crosby	72,374	20.3
OH023	Brookston	-	Crosby	-	Celina	57,938	16.3
OH025	Crosby	-	Miamian	-	Brookston	42,306	11.9
OH021	Blount	-	Glynwood	-	Morley	36,179	10.2
OH016	Nappanee	-	St. Clair	-	Paulding	21,278	6.0
OH028	Eldean	-	Ockley	-	Sleeth	17,921	5.0
OH022	Blount	-	Pewamo	-	Glynwood	4,736	1.3
OH029	Eldean	-	Westland	-	Patton	2,721	0.77
OH034	Miamian	-	Eldean	-	Crosby	634	0.18
					Total Acres	355,608	100%

In the STATSGO soil associations there are five dominant soils, Crosby, Brookston, Miamian, Blount, and Kokomo, making up 70 percent of the watershed. The most extensive soil unit of the Darby Plains is the Kokomo silty clay loam; a very poorly drained soil with nearly level topography. It has moderately slow permeability and has very slow to ponded runoff. Kokomo soils were the primary “prairie soil” that supported most wet prairies in the Darby Plains during early settlement (Gordon and Simpson, 1994). The Crosby is a somewhat poorly drained silt loam with nearly level to gently sloping topography. It has slow permeability and slow to medium runoff. Crosby soils, second most extensive in the Darby Plains, supported the mixed oak forests at the time of early settlement (Gordon and Simpson, 1994). Brookston is a very poorly drained silty clay loam with level to nearly level topography and slow permeability. Miamian soils are a well drained silt loam on gently sloping to very steep topography. They have moderately slow permeability and medium to very rapid runoff. Blount is a somewhat poorly drained silt loam on nearly level to gently sloping topography with slow to moderate permeability and runoff. Fieldwork is delayed in spring due to wetness for many of the soil types. To counteract this, much of the landscape has been drained by ditches and tiles. Other soils found in the watershed include Celina, Eldean, Glynwood, Morley, Nappanee, Ockley, Patton, Paulding, Pewamo, Sleeth, St. Clair, and Westland.

Kokomo-Crosby-Miamian

The most abundant soil association in the watershed is Kokomo-Crosby-Miamian with more than 99,000 acres covering nearly 28 percent of the watershed. These soils are found on ground moraines with little slope. Kokomo soils are on broad flats, are very poorly drained, and have a high water table. Crosby soils are on the slopes of knolls and ridges, are somewhat poorly drained, and are prone to seasonal wetness. Crosby soils generally require artificial drainage to render them suitable for agriculture. Miamian soils are well drained soils on gently sloping to moderately steep soils found on knolls and hills.

Miamian-Celina-Crosby

The next most abundant association is Miamian-Celina-Crosby with over 72,000 acres, just over 20 percent of the Darby Creek Watershed. Celina soils are found on nearly level to gently sloping topography and are moderately well drained. Crosby soils can be found interspersed in low areas of Celina soils and Miamian soils are found on knolls in this association.

Brookston-Crosby-Celina

The Brookston-Crosby-Celina association covers nearly 58,000 acres or 16 percent of the watershed. Brookston are naturally wet soils found on uplands in the Darby Plains. The topography is typically level to nearly level with very poor drainage. Crosby and Celina soils are somewhat poorly drained and moderately well drained, respectively, and found on small, low knolls. If properly drained, soils within this association are well-suited for agriculture.

Crosby-Miamian-Brookston

Crosby-Miamian-Brookston soil association makes up the fourth most abundant soil association in the watershed. This association makes up nearly 12 percent of the watershed and covers 42,000 acres. These soils are located in the Darby Plains of the watershed.

Blount-Glynwood-Morley

The fifth most abundant soils association is Blount-Glynwood-Morley association in the watershed. This association makes up 10 percent of the watershed and covers more than 36,000 acres. These soils are found on topography characterized by hills, slopes along streams, and gently sloping areas. Blount soils are somewhat poorly drained and gently sloping whereas Glynwood soils are moderately well drained and sloping. Morley soils are moderately well drained and are gently sloping to very steep.

DETAILED SOIL MAPPING

In order to represent some of the important soil features in the watershed, digital soils data was gathered for all the counties in the watershed and was compiled into one large database. The digital soil polygon data represented in these maps was created from digitization of old soil surveys from the 1970s. The polygon data was then joined with NRCS's Map Unit

Interpretation Record (MUIR) soils tables. Additional data was gathered from the Electronic Field Office Technical Guide on the NRCS webpage. Together these maps and this soils database represents the best digitally available soils data at this point. In several years most counties in Ohio should have a comprehensive digital soils file; SSURGO certified soils. A large number of soils features such as clay percentage, organic content, slope, flooding, septic limitations and others are included in this soils database. Detailed maps and descriptions have been created for the four major watersheds within the Darby Creek Watershed; Headwaters of Big Darby, Middle Big Darby, Lower Big Darby, and Little Darby Creek (See **Map 5** for watershed boundaries). Appendixes A, B, and C will contain data on highly erodible soils, slope, and prime farmland for each of the four major watersheds. General data on highly erodible soils is presented below and in the **Agricultural** section, slope data will be presented in the following section on **Topography**, and prime farmland in the **Agricultural** section.

It is to be noted that not all the data classes were consistent between counties. For example Union County defines soils not considered prime farmland but in continued agricultural production as “Farmland of Local Importance” whereas no other county represents data in this fashion. Another inconsistency in the methodology of data collection is with the slope data as one county may define slopes between 15% and 20% as one category but all the other counties typically define soils in this range between 12% and 18%. Such inconsistencies were resolved through the assistance of ODNR soil scientists.

Highly Erodible Soils

The highly erodible factor was derived from soil surveys from each county. Detailed maps (four) and descriptions of this factor are available in Appendix A. The following figure summarizes the erodibility of all soils and the agricultural lands in the entire Darby Creek Watershed.

Figure 5: Darby Creek Watershed Erodibility Summary		
<i>Erodibility</i>	<i>All Land (Percent)</i>	<i>Only Agricultural Land (Percent)</i>
Highly Erodible	8.75%	6.35%
Not Highly Erodible	59.79%	63.90%
Potentially Erodible	30.90%	29.47%
Water and other Soils	0.57%	0.29%
Totals	100%	100%

The Upper Big Darby had the most highly erodible soils with over 14 percent followed by Little Darby with about 9 percent. Middle Big Darby and Little Darby had the least amount of highly erodible (See Figure 6). For more detail on the erodibility of all soils in each watershed listed below, see Appendix A.

Figure 6: Erodibility of Soils by Major Subwatershed

<i>Subwatershed</i>	<i>Highly Erodible</i>	<i>Not Highly Erodible</i>	<i>Potentially Erodible</i>	<i>Water and Other Soils</i>
Upper Big Darby	14.20%	57.87%	27.43%	0.50%
Middle Big Darby	2.05%	77.17%	20.03%	0.75%
Lower Big Darby	5.25%	54.84%	38.81%	1.10%
Little Darby Creek	8.69%	57.60%	33.53%	0.18%

D. Topography

The terrain of the watershed is generally flat with slopes between zero and two percent for approximately two thirds of the watershed. The remaining area varies from gently rolling with slopes between two and six percent and occasional slopes above six percent. Greater differences in elevations are a result of glacial features such as moraines, eskers, and kames. One such area with steep slopes relative to the surrounding area is in the headwater region in Logan and Champaign Counties of the watershed in which slopes greater than 12 percent exist. The following map displays the gradient and topography of the watershed (See **Map 6**).

In order to examine slope in more detail, four maps were created based on subwatersheds in the Darby Creek Watershed which are displayed in Appendix B. For more information on the creation of the maps see *Detailed Soil Mapping* in the previous section. Figure 7 summarizes slope for the entire Darby Creek Watershed.

Figure 7: Darby Creek Watershed Slope Summary

<i>Erodibility</i>	<i>All Land (Percent)</i>	<i>Only Agricultural Land (Percent)</i>
0 - 2%	59.49%	63.05%
2% - 6%	31.33%	30.61%
6% - 12%	7.68%	4.91%
12% - 18%	0.03%	0.97%
18% - 25%	0.40%	0.14%
25% - 50%	0.90%	0.12%
Water and Other Soils	0.18%	0.20%
Totals	100%	100%

The slope of soils in each Little Darby, Upper Big Darby, and Lower Big Darby Creek subwatersheds shared similar slopes. The Middle Big Darby Creek subwatershed had the most level topography with approximately 78 percent of agricultural land sloping between 0 and 2 percent as seen in Figure 8 below. For more detail on the slope of soils in each watershed below, see Appendix B.

Figure 8: Percent Slope by Major Subwatershed							
Watershed	0 -2%	2-6%	6 -12%	12 -18%	18 -25%	25 -50%	Water and Other Soils
Upper Big Darby	56.45%	33.00%	7.95%	1.78%	0.22%	0.14%	0.46%
Middle Big Darby	78.07%	18.79%	1.26%	0.62%	0.75%	0.52%	0.00%
Lower Big Darby	56.41%	33.48%	7.43%	1.98%	0.38%	0.22%	0.11%
Little Darby Creek	56.66%	33.69%	4.57%	1.44%	0.45%	3.18%	0.00%

E. Infrastructure

COUNTY MAINTAINED DITCHES

Ditches are constructed to remove excess water from the land especially during rain events or snow melts. Ditches and other drainage outlets provide farmers with the ability to farm land that would normally be considered unproductive. Within the Darby Watershed, a large number of ditches exist, all with varying levels of maintenance. A considerable number of these ditches are managed and maintained by the county (See **Map 7**). The actions performed on these ditches are documented by each county (See Figure 9). Each year all county maintained ditches are evaluated on an individual basis to determine the necessary action to maintain the functionality of the drainage ditch. Typically maintenance programs include mowing, spraying, and removing vegetation from the stream channel to allow for an efficient removal of water.

Figure 9: Recent Maintenance on County Petitioned Ditches			
County	Number of Ditches	Easement Distance	Recent Actions
Pickaway	3	10 ft.	<p>Greenbriar – maintained through snag removal, brush cleared, spray as needed</p> <p>Georges Run – channel excavated, maintained through snag removal, brush cleared, spray as needed</p> <p>Spring Water – cleared of trash and a log jam in 1999. Maintained through snag removal, brush cleared, sprayed as needed</p>
Champaign	4	10 ft.	<p>Jumping Run – minor cleaning, mowing, and spraying</p> <p>McMullen Ditch – mow entire ditch, clean bottom of channel, spraying, place rip-rap to stabilize banks as needed.</p> <p>Fullington Ditch – mowing, brush/vegetation control, repair washes, and place rip rap to control steep gravelly slopes, reconstruct and reshape channel and berm at different locations.</p>

Champaign	4	10 ft.	Crowder Ditch – rip-rap at outlet of ditch to Glendenning Rd., replace old failing tile, mowing and spraying
Union	8	15 ft.	All Ditches – either sprayed or mowed each year. Prairie Run – Switch Grass planted in 2001.
Madison	58	10 ft.	All Ditches - “Dig-Out,” to re-establish 4 ft. depth every 10-15 years the material is put back on farm land on a temporary 75 ft. easement - mow or spray twice a year

The following table summarizes all county maintained ditches and the total length in miles. (See Figure 10). Madison County has one of the largest number of maintained ditches in the state, and has a total of 24 within the watershed. Union County has a total of eight maintained ditches while Champaign County has four and Pickaway County has three. Logan County has no maintained ditches in the watershed and Franklin County does not maintain any ditches at the present time (See Appendix D for a complete inventory of Ditches).

Figure 10: County Maintained Ditches			
<i>County</i>	<i>Number</i>	<i>Miles</i>	<i>Notes</i>
Champaign	4	7.47	
Madison	24	48.58	Estimation based on GIS data
Pickaway	3	4.92	
Union	8	17.21	
Totals	39	78.18	

LOW HEAD DAMS

The Darby Watershed is a free flowing stream except for two low-head dams. The dams were all built in the middle 1900s in order to create small recreational pools (ODNR, 1992). The first low-head dam, Galbraith Dam is located on Darby Dan Farms just upstream from Batelle-Darby Metro Park at RM 37.55 and is approximately 10 feet in height. This dam does not severely impact the environmental quality of Big Darby Creek but has affected the diversity of fish species. Just downstream from the dam, a population of fish exist that are not found anywhere upstream of the dam which, according to local residents, were found there in the past (i.e. flathead catfish) (Smith, Personal Communication, 2003). The second low-head dam is located inside the corporation limits of Milford Center at RM 66.30. This dam has been partially breached but pooling exists upstream of the dam.

Two dams have been removed since 1990. A dam existed near the mouth of the Little Darby at RM 0.7 which was removed and the stream was restored in 1990. In addition the Nature Conservancy acquired land around RM 38.95 and removed the dam on this property in the early 1990s.

ROADS

The Darby Watershed has two major interstates which travel through the watershed (**Map 1**). Interstate 70 travels east and west through Madison and Franklin Counties in the watershed while Interstate 71 travels through portions of Pickaway and Franklin Counties in the watershed. Other major routes are U.S. 40, U.S. 62, and U.S. 33 which all lead to Columbus and U.S. 42 which cuts through the watershed in a north/south manner between London, Plain City, and Delaware.

F. Climate and Precipitation

The Darby Creek Watershed lies in the temperate climate of Central Ohio. The Midwestern Regional Climate Center (MRCC) collects historical climate data from various observer stations throughout the Midwest. In the Darby Creek Watershed, these stations are located in Irwin, Marysville, and Circleville. Data from the Irwin, Ohio, station is represented in Figure 11 as a representation of the climate in the Darby Watershed.

Figure 11: Irwin, Ohio Station		
<i>Data collected between 1991 and 1997</i>		
<i>Temperature Range</i>		
Temperature Range	<i>(January)</i> 27.0 (F)	<i>(July)</i> 74.1 (F)
Mean Temperature	52.2 (F)	
<i>Growing Season</i>		
Growing Season Range	<i>(Shortest)</i> 123 days	<i>(Longest)</i> 197 days
Median Growing Season	151 days	
Earliest Frost	September 13 th	
Latest Frost	May 28 th	
<i>Precipitation</i>		
Precipitation Range	<i>(February)</i> 1.95"	<i>(July)</i> 4.65"
Average Annual Rainfall	38.14"	

For the years 1991 to 1997, there was a mean temperature range of 27 degrees Fahrenheit (F) in January and 74.1 degrees F in July, with an annual mean temperature of 52.2 degrees. During the same period of time the growing season had a median of 151 days, with the shortest being 123 days and the longest 197 days. The median start date for planting was May 5 and for harvest was October 3. The earliest frost occurred on September 13 and the latest May 28. Normal precipitation for the area ranges from 1.95 inches in February to 4.65 inches in July with the heaviest normal rainfall occurring in June and July. The average annual rainfall is 38.14 inches.

G. Water Resources

STREAMS AND SUBWATERSHEDS

Big Darby Creek is approximately 84.5 miles long from its headwaters in Logan County to its confluence with the Scioto River in Circleville (See **Map 1**). The major streams within the watershed are highlighted in the figure below.

Figure 12: Darby Creek Watershed Tributary Data

Stream Name	Length (miles)	Flows into	Mouth in County	Drains Sq. Mile	Acres
Big Darby Creek	84.5	Scioto River	Pickaway	555.0	355,608
Little Darby Creek	43.7	Big Darby Creek	Franklin	178.0	113,920
Spring Fork	19.4	Little Darby Creek	Madison	37.9	24,256
Treacle Creek	15.3	Little Darby Creek	Union	37.1	23,744
Buck Run	14.1	Big Darby Creek	Union	29.8	19,072
Hellbranch Run	13.3	Big Darby Creek	Franklin	37.7	24,128
Sugar Run	10.3	Big Darby Creek	Madison	19.5	12,480
Robinson Run	8.4	Big Darby Creek	Union	2.7	1,728
Greenbrier Creek	8.4	Big Darby Creek	Pickaway	9.8	6,272
Pleasant Run	7.9	Big Darby Creek	Champaign	9.5	6,080
Proctor Run	7.4	Treacle Creek	Union	10.4	6,656
Barron Creek	5.3	Little Darby Creek	Madison	6.3	4,032
Flat Branch	5.3	Big Darby Creek	Logan	13.6	8,704
Lake Run	4.7	Little Darby Creek	Champaign	7.0	4,493
Little Darby Creek	3.9	Big Darby Creek	Logan	7.2	4,608
Clover Run	3.9	Little Darby Creek	Champaign	2.1	1,344
Hay Run	3.7	Big Darby Creek	Union	5.8	3,712
Howard Run	3.7	Treacle Creek	Union	10.9	6,976
Jumping Run	3.2	Lake Run	Champaign	2.5	1,600
Springwater Run	3.1	Big Darby Creek	Pickaway	3.5	2,240
Prairie Run	2.2	Big Darby Creek	Union	3.0	1,920
Georges Creek	1.7	Big Darby Creek	Pickaway	1.2	768

Source: Adapted From - ODNR, *Ohio Streams Gazetteer*, 2001.

Figure 13: Darby Creek Watershed 14 Digit Subwatershed Drainage Area			
Name	14 digit Subwatershed Description	Acres	Square Miles
1901	Big Darby Creek headwaters to above Flat Branch	3,759	5.87
1902	Flat Branch	8,689	13.58
1903	Big Darby Creek below Flat Branch to Milford Center	40,805	63.76
1904	Big Darby Creek from Milford Center to above Sugar Run	20,968	32.76
1905	Buck Run	19,057	29.78
1906	Robinson Run	6,988	10.92
1907	Sugar Run	12,444	19.44
2001	Big Darby Creek below Sugar Run to High Free Pike	40,114	62.68
2002	Big Darby Creek from High Free Pike to Little Darby Creek	9,184	14.35
2101	Little Darby Creek headwaters above Treacle Creek	19,062	29.78
2102	Treacle Creek headwaters above Proctor Run	12,629	19.73
2103	Proctor Run	6,662	10.41
2104	Treacle Creek below Proctor Run to Little Darby Creek	4,551	7.11
2105	Little Darby Creek below Treacle Creek to above Spring Fork	23,491	36.70
2106	Spring Fork	24,327	38.01
2107	Little Darby Creek below Spring Fork to Big Darby Creek	23,518	36.75
2201	Hellbranch Run	24,181	37.78
2202	Big Darby Creek below Little Darby to above Hellbranch Run	16,042	25.07
2203	Big Darby Creek below Hellbranch Run to Darbyville	25,100	39.22
2204	Big Darby Creek from Darbyville to Scioto River	14,038	21.93
Totals		355,608	555.64

Big Darby Creek Watershed is delineated into several smaller regions called subwatersheds which are individual drainage areas within the larger watershed (See Figure 13). One such example would be Sugar Run in southeast Union County. By identifying subwatersheds, local residents are provided with a more focused understanding of water quality within their own backyard. Within the Darby Creek Watershed, 20 smaller watersheds have been identified, draining an area as large as 40,110 acres and as small as 3,760 acres (See **Map 8**).

100 YEAR FLOODPLAIN

The 100 year floodplain is the area the stream will occupy when a 100 year flood occurs. The hundred year floodplain is an area of land that has a probability of 1:100 of flooding to that point in any given year. In other words, in any given year there is a 1:100 chance that the stream will flood the 100 year floodplain. The 100 year floodplain in the Darby Watershed covers approximately 24,700 acres. **Map 9** displays areas within the watershed that lie in the 100 year floodplain. In recent years portions of the Darby Watershed have seen floods that extend to or beyond the defined 100 year floodplain. The accurate identification of these areas is critical to the protection of human health and well-being as flood intensities and frequency increase.

BOATING ACCESS

The Ohio Department of Natural Resources lists twelve public access areas to the Big Darby Creek. Public access areas are typically located at stream crossings and provide public launching facilities for canoes, fishing frontage, picnic areas, parking, and sometimes campsites. These public access areas range from five to one hundred acres in size. The following table lists boating access locations and in-stream hazards (**Bold**) for Big Darby Creek (See Figure 14). The table is outdated and is due to be updated next year by Ohio Department of Natural Resources, Division of Watercraft.

Figure 14: Boating Access Location and Hazards		
<i>No.</i>	<i>Description of Boating Access or Hazard</i>	<i>County</i>
1	SR 275 bridge east of North Lewisburg, roadside access river left and right	Union
2	Milford Center roadside shelter off SR 4 bridge in Milford Center, access river right	Union
3	DAM - south of Mill Street bridge crossing in Milford Center, portage river left	Union
4	SR 38 bridge southeast of Milford Center, roadside access river right	Union
5	Burns Road and bridge access river left	Union
6	SR 736 and SR 42 bridge (Chillicothe St) roadside rest stop north of Plain City, access river left	Union
7	Old SR 161 bridge of SR 161 east of Plain City, roadside access river left	Madison-Franklin
8	Smith-Calhoun Road and Price-Hilliard Road bridge south of Plain City, roadside access river left	Madison-Franklin
9	Riverside and Darby Drives underneath SR 40 bridge east of W Jefferson, access river right and left	Madison-Franklin
10**	DAM - below the SR 40 bridge east of W Jefferson, portage river right	Madison-Franklin
11	DAM - about 2-3 miles downstream of the SR 40 bridge east of W. Jefferson on private property, portage river left, call ahead for permission to portage from owners	Madison-Franklin
12	DAM - three rock dams just below dam on private property, call for permission	Madison
13	Battelle Darby Creek Metropark Alkire Road, access river left just downstream of Little Darby confluence with Big Darby	Franklin
14	Trapper Johns Canoe Livery in Darbydale off Georgesville-Harrisburg, access river left	Franklin
15	Old Harrisburg Road and SR 62/3 bridge east of Harrisburg, access river left	Franklin
16	SR 762 bridge and Darby Creek Road (Pickaway CR 26), access river right	Pickaway
17	SR 104 bridge northwest of Circleville, access river right	Pickaway

Source: ODNR, Revised 2001. **Dam no longer exists (Peteroski, 2003, Personal Communication).

GROUNDWATER

Groundwater is an important source of drinking water for many of the rural residents in Ohio and is no exception in the Darby Watershed. In Ohio, more than 40 percent of the population depends on groundwater to meet its daily water needs. In the Darby Watershed, most of the population uses groundwater as their source of drinking water. Groundwater is water that has infiltrated the earth's surface and is temporarily stored in the pores of soil or rock. Larger

amounts of groundwater are typically found in porous geologic formations such as sand, gravel, or bedrock. Geologic formations that produce usable amounts of groundwater are referred to as aquifers. The most productive aquifers in Ohio are typically buried valley aquifers that consist of thin layers of glacially deposited sand and gravel surrounded by bedrock. Buried valleys in the Darby Watershed are likely to be remnants of Wisconsinan glacial activities and possibly tributaries to Teays River which cut through parts of Madison, Franklin and Pickaway Counties within the Darby Watershed (See **Map 10**). The buried valley follows the present day course of the southern part of the Little Darby Creek and then follows the Big Darby Creek south to Circleville. Another area that contributes a large amount of groundwater is an area in Champaign County, in the headwaters of the Little Darby Creek (See **Map 10**). This area is another buried valley of a tributary to the Mad River. The yields in the remainder of the watershed are largely dependant on the thickness of the glacial deposits and the presence of the highly porous areas of sand and gravel.

Though sand and gravel deposits are excellent sources of groundwater, many wells in the Darby Watershed extend to layers of porous Devonian and Silurian age limestone. The depth to the limestone or bedrock varies across the watershed. Domestic wells in the Darby Watershed typically yield between 20 to 30 gallons per minute depending on the type of limestone, number of fractures, and proximity to streams. At well depths of greater than 100 feet Silurian age bedrock in most of the watershed can yield greater than 100 gallons per minute (Angle, Personal Communication, 2003).

Areas within the watershed that have minimal groundwater supplies are those that lack sand and gravel lenses. In western Franklin County, well logs reported fewer sand and gravel lenses accounting for the lower groundwater yields in Map 9 (Angle, Personal Communication, 2003).

Groundwater is not only an important source of drinking water but is a major source of water to surface water. Groundwater is only temporarily stored beneath the earth's surface because it moves from areas of recharge (places groundwater enters the earth) to areas of discharge such as surface water. Groundwater is the essential source of water for streams during prolonged dry spells. The large amount of groundwater flow in streams in the watershed is believed to be one reason why the Darby Creeks achieve high levels of water quality. Ohio EPA documented noticeable groundwater contributions from the Cable Moraine Complex in Logan, Champaign, and Madison County to portions of Upper Big Darby Creek, Little Darby Creek, Clover Run, Hay Run, Pleasant Run, and Spain Creek. The London Moraine influences groundwater flow to Gay Run, Smith Ditch, and Springwater Run in eastern Madison and southern Franklin counties (See **Map 3**). The influence of cool groundwater into these streams has allowed coldwater species the ability to survive in streams that would not normally harbor such species. Ohio EPA has designated a few of these streams as both a warmwater and coldwater habitat (See Section IV, B. Water Quality Data, Aquatic Life Standards).

GROUNDWATER POLLUTION POTENTIAL (DRASTIC MAPPING)

Groundwater pollution potential, or DRASTIC, was developed in 1987 as a method to define the vulnerability of areas within a county to contaminated surface water. Seven physical characteristics effecting groundwater pollution were identified.

D – Depth from ground surface to water table

R – Recharge is the total amount of water that reaches the earth’s surface and infiltrates the aquifer.

A – Aquifer Media or the rock material capable of yielding sufficient quantities of water for use.

S – Soil Media or the upper six of unsaturated soil or rock

T – Topography or slope of the landscape

I – Impact of the vadose zone or the area below the soil horizon and above the aquifer that is unsaturated or not always saturated.

C – Conductivity (Hydraulic) which is a measure of the ability of the aquifer to transmit water.

Each of these factors do not equally influence groundwater pollution. To account for this, each factor is weighted to give more value to factors with more importance in determining groundwater pollution. The two most influential factors are the depth to water and the impact of the vadose zone.

The DRASTIC maps for each county in the watershed illustrate that most areas have low to moderate groundwater pollution potential. Areas most vulnerable in the watershed are in the floodplain areas along both Big and Little Darby Creeks. These areas are composed of permeable layers of sand and gravel which are excellent sources of groundwater but highly susceptible to groundwater pollution. The recharge rates in the watershed are largely between four and seven inches a year with values up to ten inches per year along Big and Little Darby Creeks. DRASTIC maps are in the process of being converted into GIS files and will be available at a later date for mapping purposes.