

South Fork of the Licking River Rapid Watershed Assessment

Hydrologic Unit Codes (HUC) 05100102

October 2008

USDA-NRCS, Lexington, Kentucky



South Fork of the Licking River near Cynthiana, KY Photo: Tom Leith, USDA



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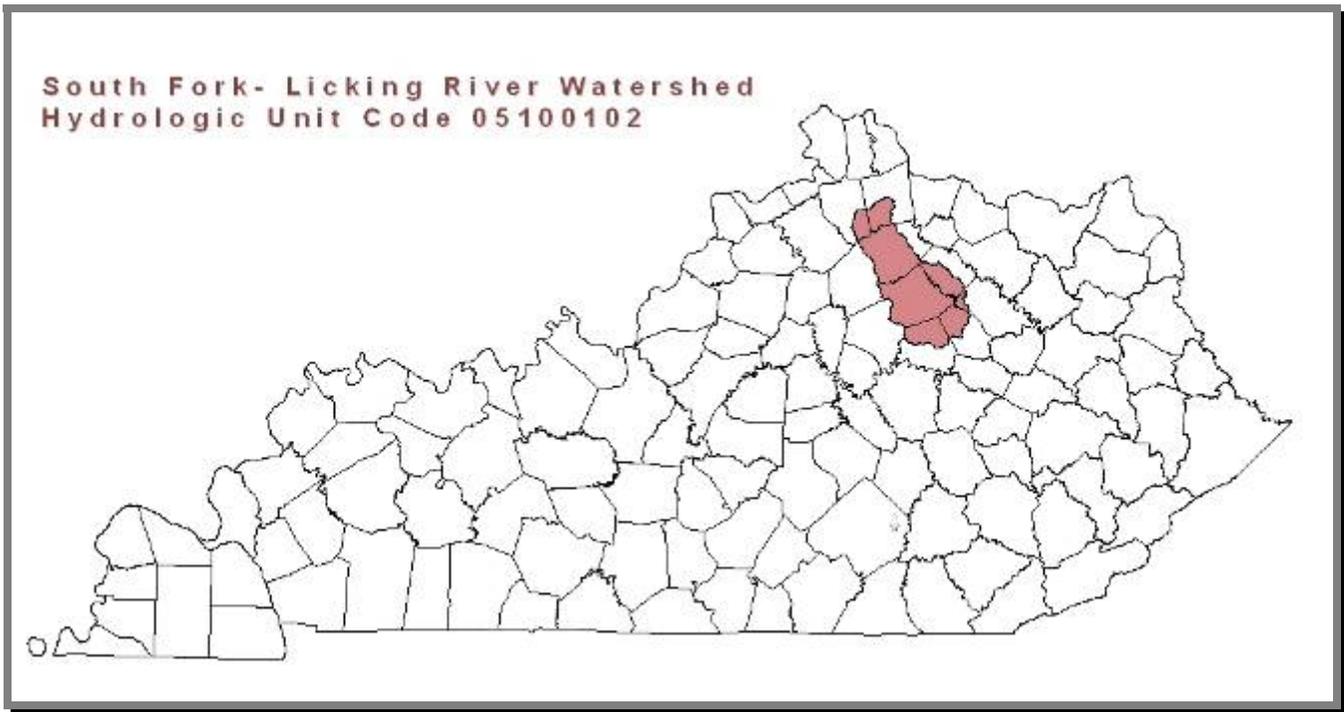
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Introduction

The South Fork of the Licking River Watershed is located in north-central Kentucky and encompasses all or part of eight counties. Containing 593,802 acres or approximately 928 square miles, this watershed is characterized by fertile pastureland, productive soils, and livestock production. This watershed includes a portion of the “bluegrass region”, which is known worldwide for producing some of the finest thoroughbred horses.

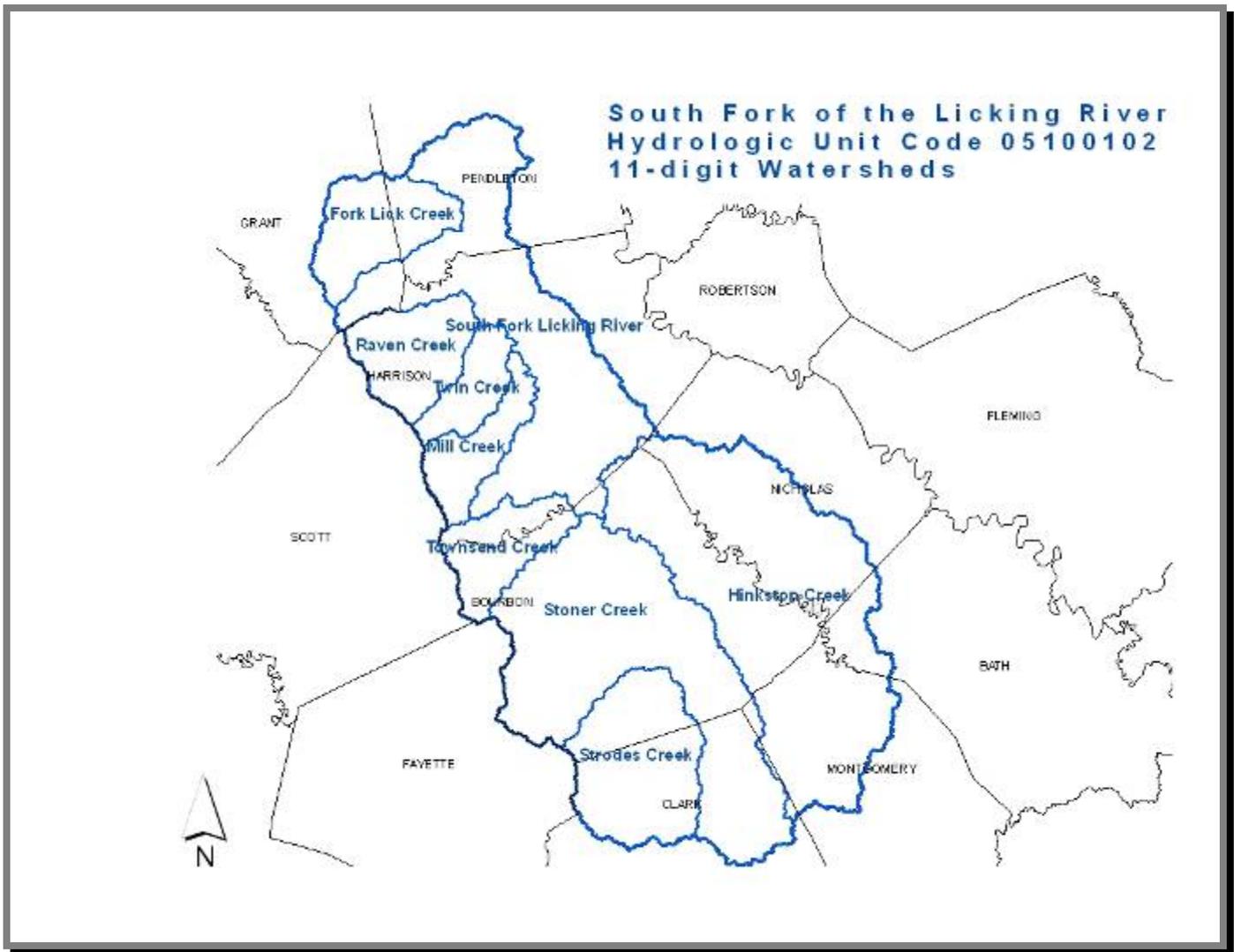


South Fork of the Licking Watersheds, Kentucky



photo: KDOW

Strodes Creek Watershed, main headwater stream of the South Fork, Licking River

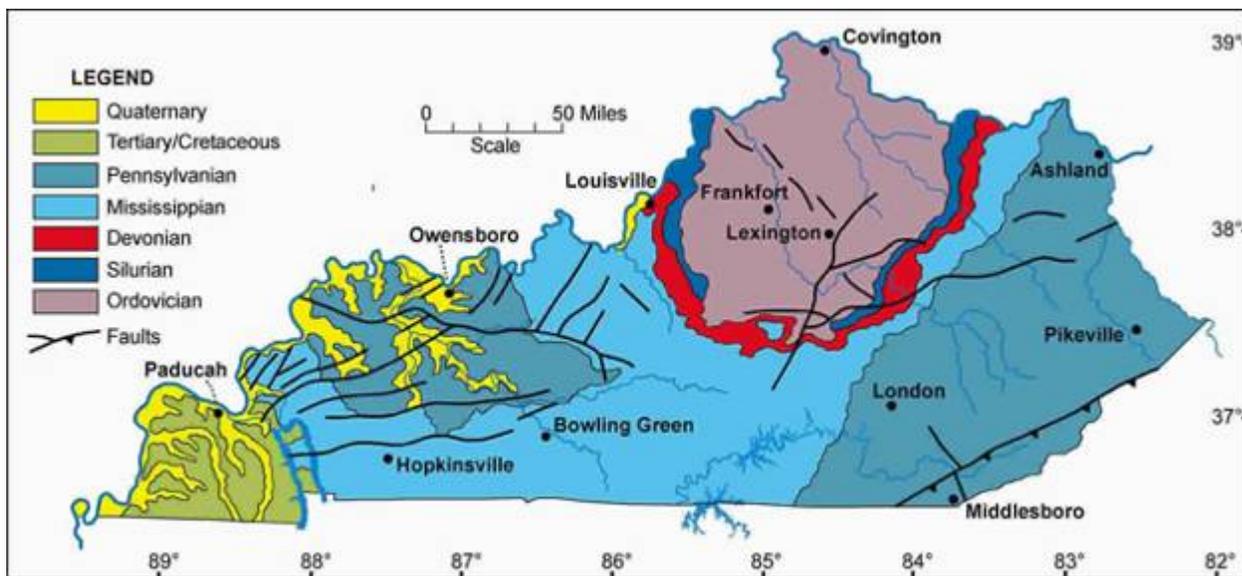


The eleven digit watershed that make up the South Fork, Licking River Watershed, HUC 05100102

The 11-digit hydrologic unit codes (HUCs) within HUC 05100102 vary in size from 16,862 acres in Twin Creek Watershed to nearly 167,000 acres in the Hinkston Creek Watershed.

South Fork of the Licking River Sub-Watersheds			
HUC 11	HUC Name	Acres	Square Miles
05100102040	South Fork Licking River	117651.8	183.8
05100102090	Fork Lick Creek	33181.6	51.8
05100102080	Raven Creek	30552.0	47.7
05100102070	Twin Creek	16862.4	26.3
05100102060	Mill Creek	21603.6	33.8
05100102010	Hinkston Creek	166632.9	260.4
05100102050	Townsend Creek	25757.4	40.2
05100102020	Stoner Creek	128250.2	200.4
05100102030	Strodes Creek	53301.8	83.3

Geology and Soils Known as the “Blue Grass State”, Kentucky is in reality made up of multiple geologic and physiographic regions and the actual Bluegrass physiographic region is limited to the central part of the State which is characterized by limestones and shales from the Ordovician Period (510 to 440 million years ago).



Map source: <http://www.uky.edu/KGS/geoky/>

HUC 05100102 is underlain by Ordovician limestone which has created fertile soils due to weathering. The Ordovician limestone contains phosphate minerals which serve as natural fertilizers to create highly productive fields and stream naturally rich in nutrients. General soils in the project area include Lowell, Faywood, Maury, McAfee, Cynthiana, Eden, and surrounding creeks/river, the Nolin-Elk-Lindsay complex.

The high level of fertility is both a blessing and challenge. Bourbon County is known world-wide as a leader in producing thoroughbred horses, which benefit from grazing on these fertile soils. The calcium and phosphorus content of forage in this area imparts strength to growing bones of young horses. However, the high fertility of the soils along with the now high levels of anthropogenic nutrient inputs (farming, residential, and urban influences) create an overabundance of nutrient loading to streams throughout this region. Nutrient loading from naturally occurring sources and nonpoint/point sources affect aquatic species and humans in the project area.

Water treatment facilities in this watershed have a record of nutrient-related problems. Disinfection byproducts in drinking water supplies are formed when disinfectants used in water treatment plants react with organic matter present in the source water. Disinfection byproducts for which regulations have been established include trihalomethanes, haloacetic acids, bromate, and chlorite. For example, the City of Paris in Bourbon County and the Cynthiana Municipal Water Works in Harrison County have had numerous problems with drinking water violations of haloacetic acids (HAA5). HAA5 are a group of chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with natural occurring organic/inorganic matter in the water. Reduction of nonpoint agricultural pollution in HUC05100102 would benefit these water treatment plants and the residents served.

Threatened and Endangered Species

Federally-listed mammal, plant and mussel species are found within the RWA project area and are listed by county in the table below. Kentucky state-listed species are not included but that information can be found on the Kentucky State Nature Preserves Commission (KSNPC) at webpage at: <http://www.naturepreserves.ky.gov/>. KSNPC has also released a new county by county report of all monitored species statewide which can be access at: http://www.naturepreserves.ky.gov/inforesources/reports_pubs.htm.

Federally-Listed Species Located in RWA Project Counties			
County	Species Type	Species Name	Federal Status
Bourbon	Plant	Running Buffalo Clover	Endangered
		Short's Bladderpod	Candidate
Clark	Plant	Running Buffalo Clover	Endangered
		Short's Bladderpod	Candidate
Grant	-	-	-
Harrison	Plant	Running Buffalo Clover	Endangered
Montgomery	Mammal	Indiana Bat	Endangered
	Plant	Running Buffalo Clover	Endangered



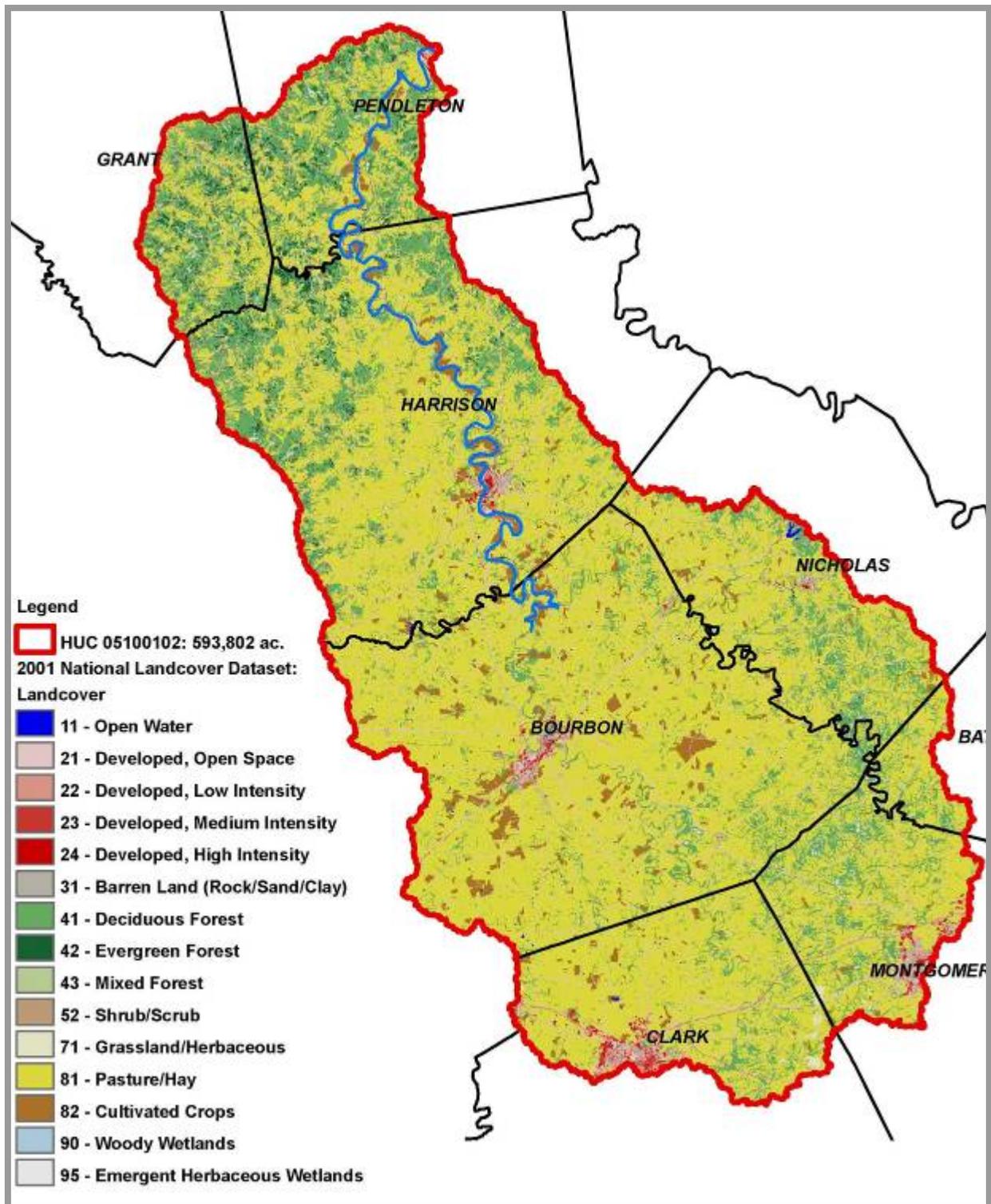
*Running buffalo clover, a federally listed species – found in Harrison and Montgomery Counties. (www.ppd.l.purdue.edu)
The endangered Indiana bat is found hibernating in caves during the winter and roosting in trees during the summer.
(photos: USFWS)*

Indiana Bat Protection in Kentucky

Human disturbance of caves where bats are hibernating continues to be a major cause in the decline of most cave-dwelling bats, including the Indiana bat. Indiana bats roost under loose bark of trees from spring to fall, so removal of trees during these months may cause bat mortality. US Fish and Wildlife Service recommends removal of trees during the winter months, when bats are hibernating in caves. Disturbance during hibernation also causes elevated mortality rates as premature arousal from hibernation consumes critical stored energy reserves of the bats. Through the Wildlife Habitat Improvement Program (WHIP), NRCS can assist landowners with the purchase and installation of cave gates to protect bats from disturbance. The WHIP provides technical and financial assistance to landowners to develop upland, wetland, riparian and aquatic habitat areas on their property.

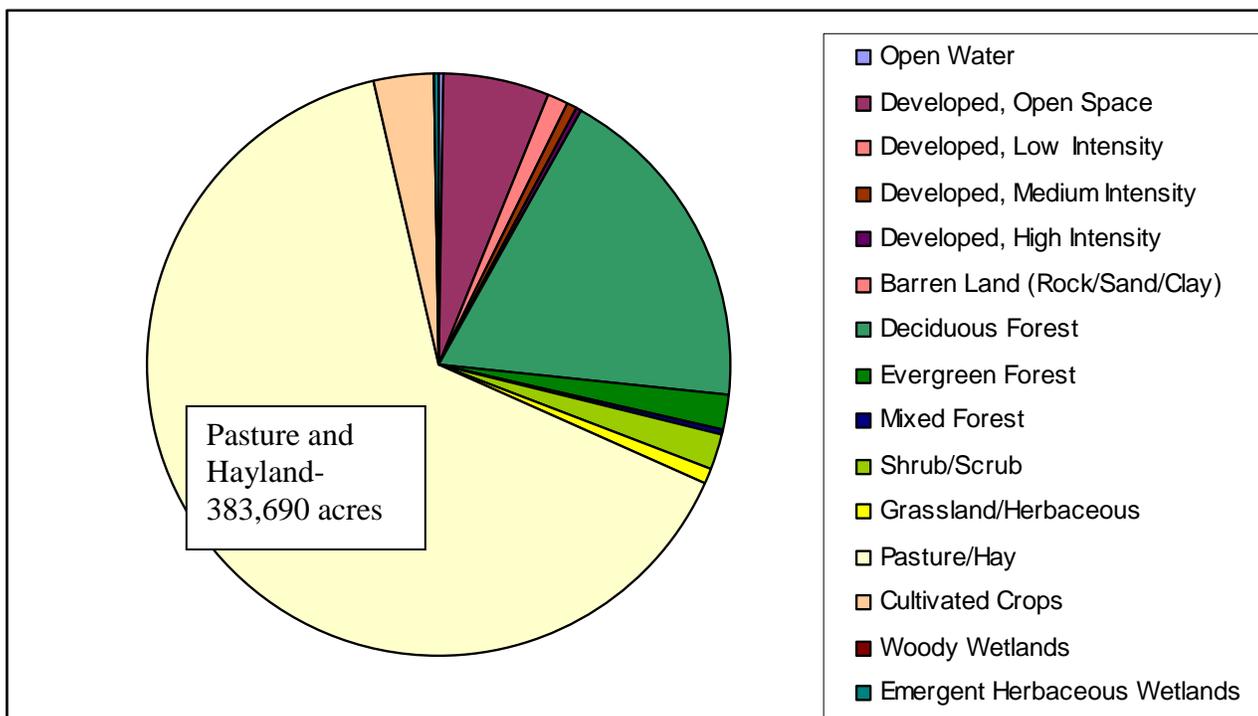
2001 Land Use / Land Cover

The primary land use in this RWA project is pasture, hay, and grasslands for livestock utilization. Forestlands are the secondary land use with some sizable wooded tracts in Grant, Pendleton, and Harrison counties. The majority of the developed acreages are clustered around small cities including Winchester (Clark County), Paris (Bourbon County), and Cynthiana (Harrison County).



Land Cover Class- HUC 05100102	Acres	Percent
Open Water	1,834	0.3
Developed, Open Space	34,491	5.8
Developed, Low Intensity	7,289	1.2
Developed, Medium Intensity	2,609	0.4
Developed, High Intensity	984	0.2
Barren Land (Rock/Sand/Clay)	632	0.1
Deciduous Forest	110,447	18.6
Evergreen Forest	10,937	1.8
Mixed Forest	2,772	0.5
Shrub/Scrub	11,274	1.9
Grassland/Herbaceous	4,866	0.8
Pasture/Hay	383,690	64.6
Cultivated Crops	21,037	3.5
Woody Wetlands	89	0.0
Emergent Herbaceous Wetlands	850	0.1
Totals:	593,802	

Agricultural lands (pasture, hay, grassland, and crops) are the primary cover class totaling 409,952 acres. Forestlands (evergreen, deciduous, and mixed) comprise 124,156 acres. Developed acreage (open space, low intensity, medium intensity, and high intensity) totals 45,374 which is less than 10% of the total watershed.



County Data

The 2008 Kentucky RWA project area spans all or part of eight counties in central Kentucky. County data information on agricultural production and farm demographics are listed below. A comparison of 1997 and 2002 data shows that government payments (all federal programs) has increased substantially in all counties. Cropland during this time period has declined overall in the watershed, but increased slightly in Nicholas County.

County	Land in Farms, Acres	No. of Farm	Average Size of Farms	Gov. Payments (1997)	Gov. Payments (2002)	Percent Change, Gov. Payments	Cattle/ Calves, no.	Forage, acres)
Bath	107,574	692	155	\$131,000	\$362,000	Up 176%	24,505	22,949
Bourbon	184,580	913	202	347,000	\$1,052,000	Up 203%	57,832	45,903
Clark	143,171	861	166	188,000	\$473,000	Up 152%	48,214	34,515
Grant	116,454	1,020	114	67,000	\$146,000	Up 118%	15,344	23,735
Harrison	158,980	1,085	147	\$158,000	\$374,000	Up 137%	33,013	39,840
Montgomery	90,951	676	135	\$168,000	\$259,000	Up 54%	27,540	21,459
Nicholas	105,524	582	181	\$73,000	\$216,000	Up 196%	22,467	26,069
Pendleton	132,402	964	137	\$105,000	\$219,000	Up 109%	15,879	28,089
	1,039,636	6,793		\$1,237,000.	\$3,101,000		244,794	242,559

NASS, 2002 and 1997 Data

County	1997 Total Cropland (acres)	2002 Total Cropland (acres)	2002 Corn for Grain (acres)	2002 Corn for Silage (acres)	2002 Tobacco (acres)	2002 Soybeans (acres)	2002 Market Value Production, average/farm
Bath	81,680	67,380	2,006	524	1,548	1,506	\$107,129
Bourbon	141,153	126,937	2,710	1,132	2,831	2,737	\$107,129
Clark	102,040	90,068	1,773	490	1,687	450	\$29,367
Grant	71,380	62,453	153	223	1,318	No report	\$12,940
Harrison	115,561	102,821	2,350	869	2,285	2,371	\$19,393
Montgomery	77,087	56,354	779	430	1,407	93	\$23,146
Nicholas	66,734	68,154	678	389	1,516	n/a	\$20,404
Pendleton	70,219	69,306	376	n/a	1,148	500	\$9,130
	725,854	643,473	10,825	1,380,152	13,740		\$328,638.00

Stakeholder Participation and Conservation Needs

Numerous agencies and private organizations, as well as local landowners and officials, provided input on this project during the development process. On June 17, 2008 NRCS hosted a meeting for federal/state agencies and conservation organizations to share information and obtain input on resource issues and concerns throughout the Licking River Basin. Stakeholder agencies participating in this meeting by attending or filling out questionnaires include the Kentucky Division of Water (KDOW), U.S. Fish and Wildlife Service (USFWS), Kentucky Department of Fish and Wildlife Resources, Kentucky State Natures Preserves Commission, Kentucky Division of Forestry, Licking River Valley Resources Conservation and Development, Kentucky Waterways Alliance, The Nature Conservancy, and Kentucky Department of Agriculture.

The priority concern identified during the June meeting was water quality issues including non-point pollution, stream sedimentation, and bank erosion. Associated with water quality was the need to protect mussel beds in the lower Licking River. The number one need identified was additional program funding and increased incentives for farmer to exclude cattle from streams, provide proper cattle crossings and install stream buffers. The stakeholders would also like to see the expanded use of NRCS' Wetland Reserve Program, especially targeting watersheds in tributaries upriver from known mussel beds.

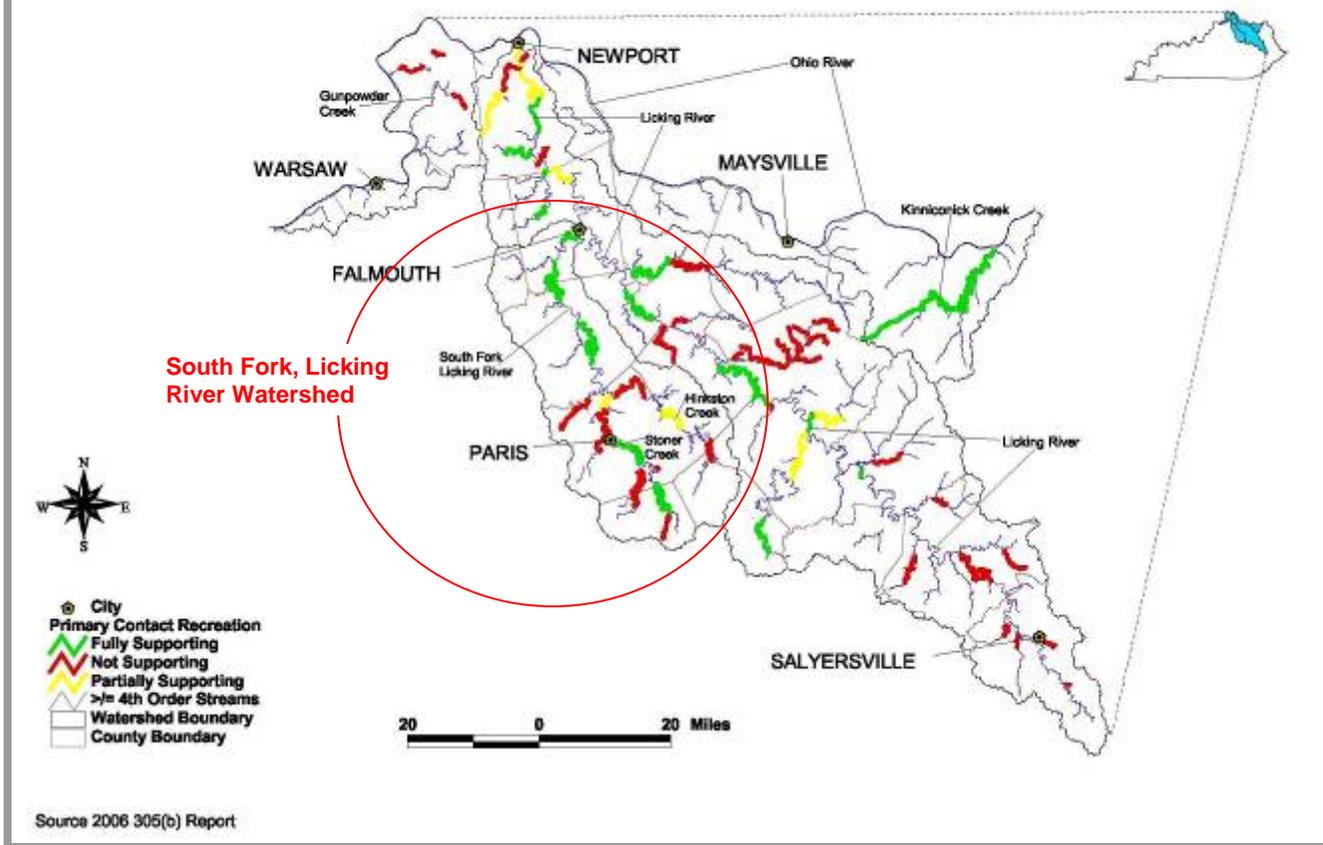
In May -July 2008, local conservation districts were provided a questionnaire asking their opinions on current resource concerns and farmer/landowner needs in the Licking Basin. The following table shows the resource concern and the percentage of respondents that had those concerns.

Licking Basin Identified Resource Concerns RC&D 2008 survey of Conservation District Members	Percent
Uncontrolled runoff/ erosion	72%
Streambank erosion /sedimentation of streams	68%
Noxious weeds	48%
Poor water quality	43%
Inadequate water quantity	33%
Poor pasture conditions/ inadequate forage	31%
Management of animal waste	27%
Flooding	10%
Lack of adequate septic systems	8%

Bourbon and Clark Counties have the largest population of cattle within HUC 05100102. A comparison of 1992, 1997 and 2002 NASS data shows that milk cow populations in HUC 05100102 have declined while beef cow populations have increased steadily. Stream exclusion fencing, stream crossing, watering facilities, and buffer strips are conservation practices that are critically needed throughout the watershed.

Multiple stream segments in Bourbon County were identified by the KDOW in their 2006 305(b) report to Congress as exceeding primary contact recreation (PCR) standards for contaminants (bacteria). Stream segments in Clark, Montgomery, and Harrison counties also were not supporting for PCR. Not coincidentally, the majority of stream segment identified are in the counties with the high recorded cow populations. This highlights the need for additional funding of agricultural conservation programs for this watershed such as installing stream buffers, fencing to exclude cattle from streams, livestock watering facilities, and livestock stream crossings. Installation of these practices in the targeted sub-watersheds would reap water quality benefits in this RWA project area and also in the main stem of the Licking River Watershed.

Figure B12. Reach indexing results of streams assessed in the Licking River Basin and adjacent Ohio River minor tributaries for Primary Contact Recreation Use.



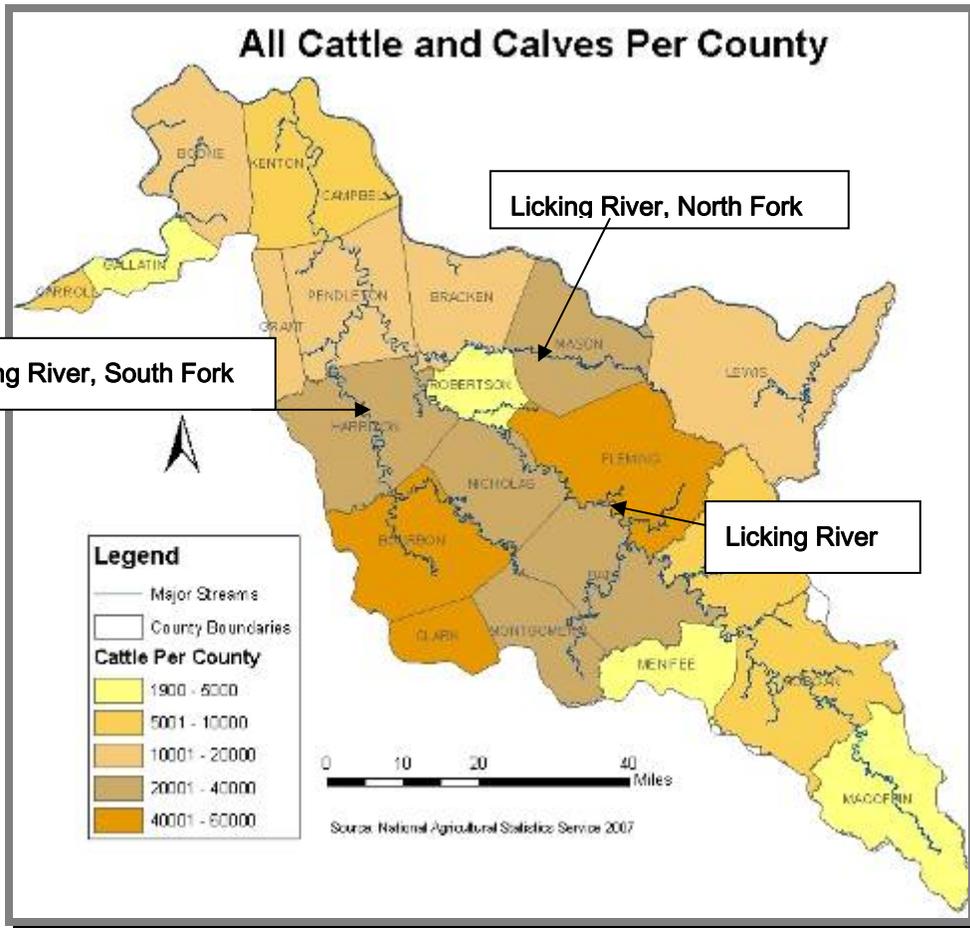
Source 2006 305(b) Report

Map: Kentucky Division of Water, 305(b) Report, 2006



Upper tributary to the South Fork in Bourbon County
 This site would benefit from installation of a stream crossing and exclusion fencing for the cattle.

Photo: Mason Howell, NRCS



Map: Kentucky Division of Water



Photo: Tom Leith, USDA

Livestock with open access to stream is the norm throughout the watershed resulting in streambank erosion and water quality impacts.



Photo: Mason Howell, NRCS

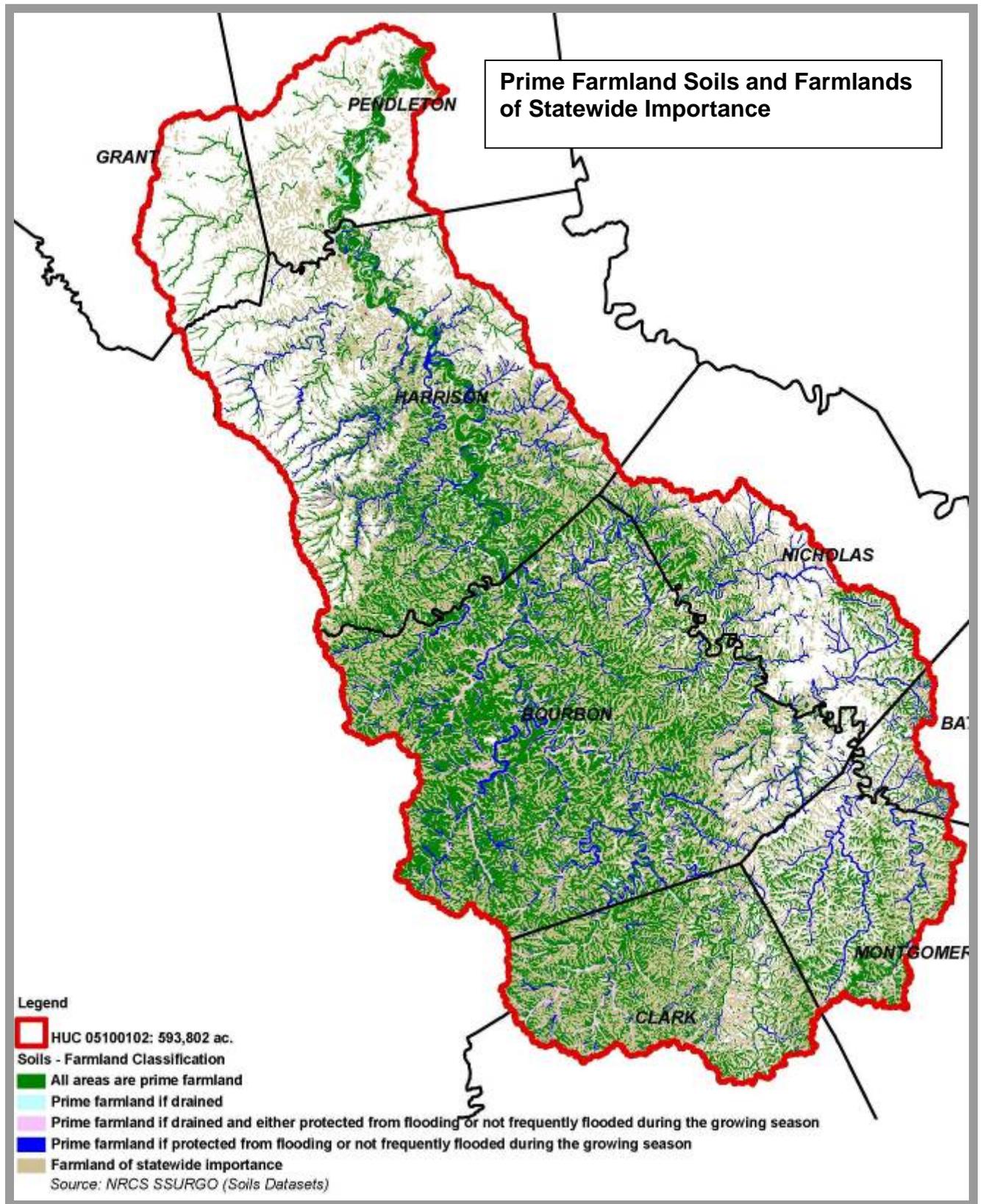
This photo shows successful conservation practices in place. The exclusion fencing and resulting buffer strip protects soil, improves water quality, and provides habitat for wildlife. The cattle have access to clean water via a installed watering system. The site is located on a tributary to the South Fork, Licking River in Bourbon County.

Prime Farmland Soils

Prime farmland soils are defined by NRCS as, ...”land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods.” Nearly 60% of this project area is prime farmland or farmland of statewide importance.

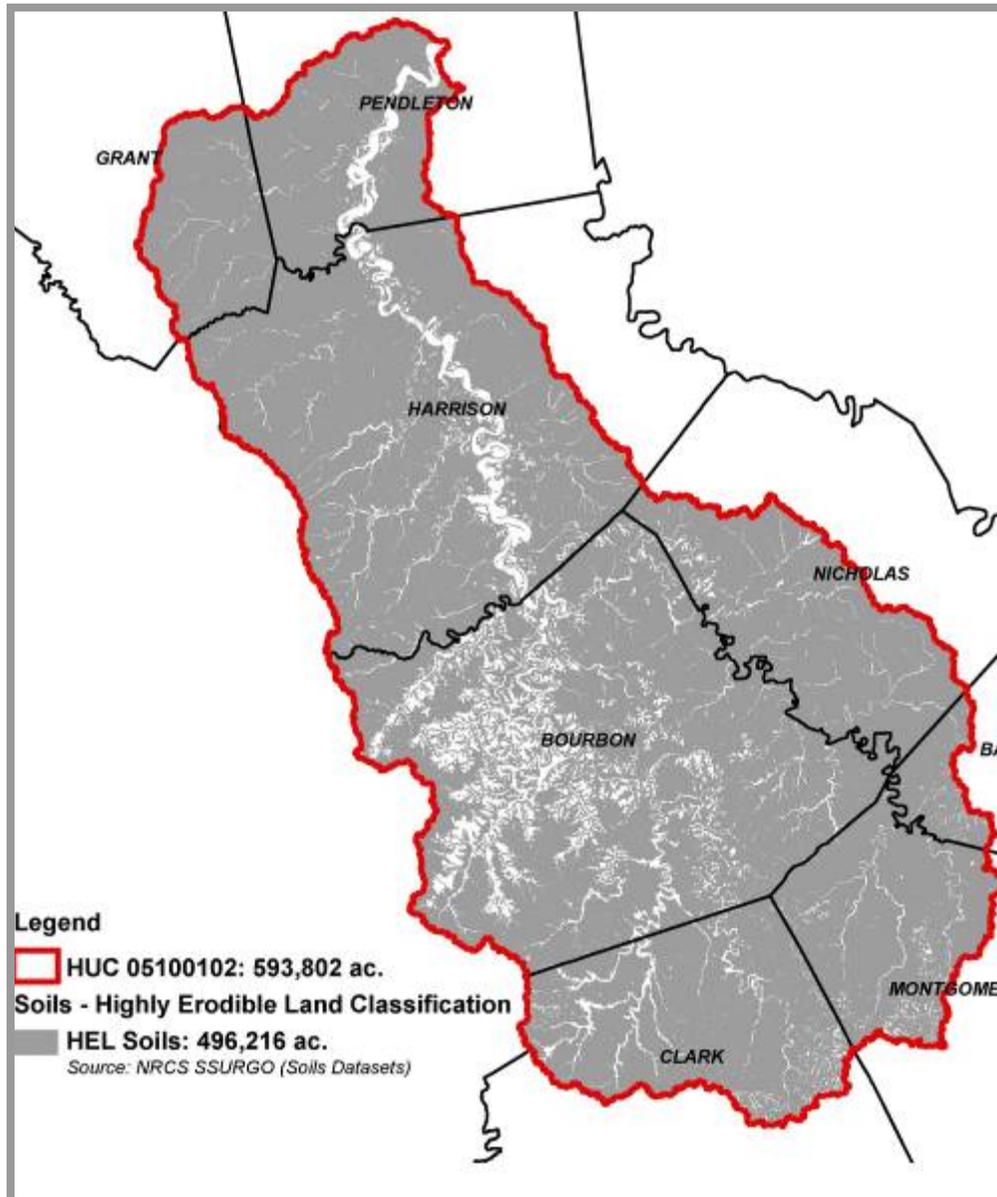
Farmland Classification HUC 05100102	Sum Acres	Percent
All areas are prime farmland	150,514	25.3
Prime farmland if drained	1,657	0.3
Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	5,432	0.9
Prime farmland if protected from flooding or not frequently flooded during the growing season	24,572	4.1
Subtotal (Prime):	182,175	30.7
Farmland of statewide importance	166,737	28.1
Subtotal: (Prime or Statewide):	348,912	58.8
Not prime farmland	244,890	41.2

Clark, Bourbon and Harrison have the majority of the prime farmland/ farmland of statewide importance within the project area.



Highly Erodible Land or HEL

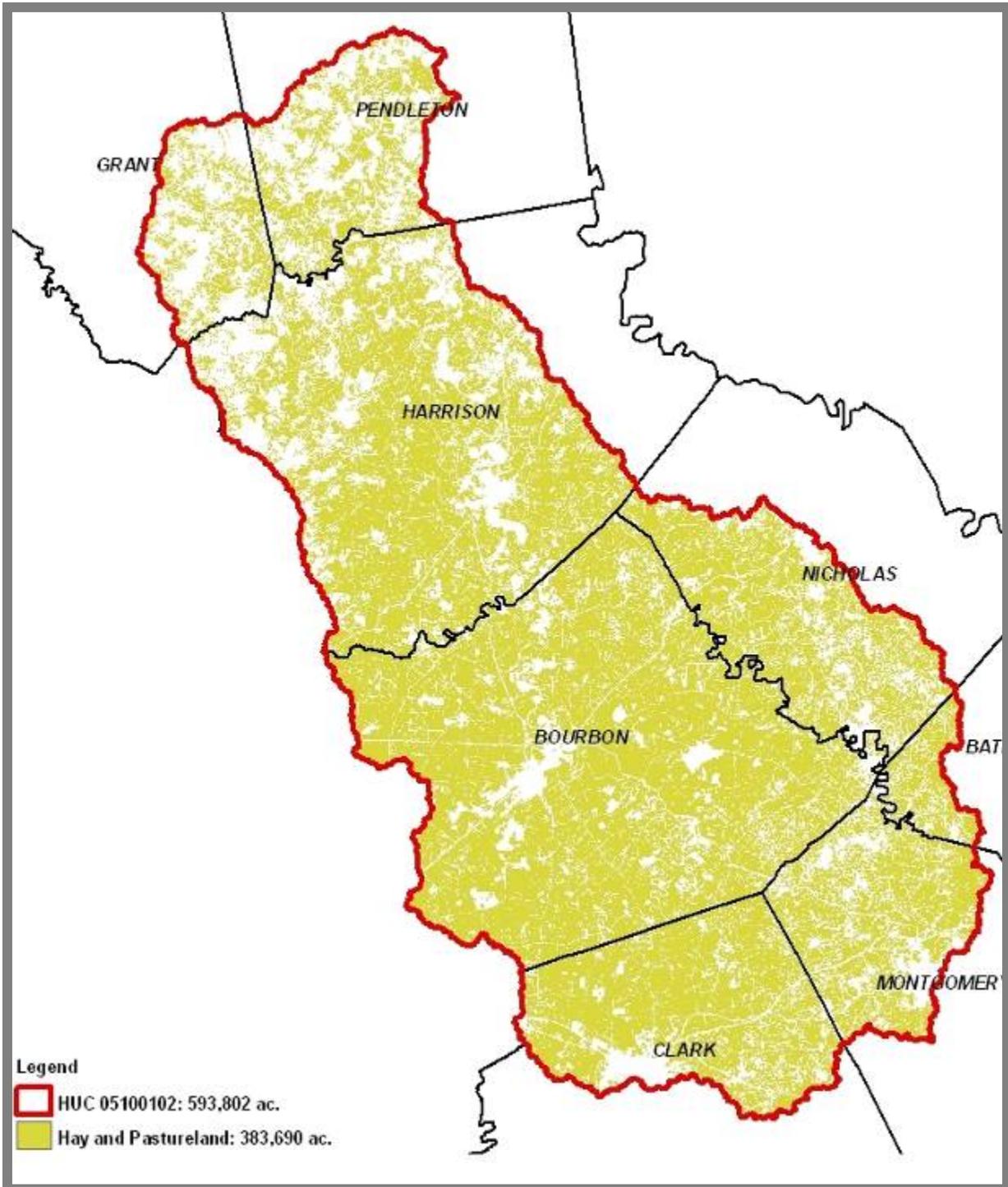
Eighty-four percent of this RWA project area is highly erodible soils. The erodibility index (EI) for a soil is determined by dividing the potential erodibility by the soil loss tolerance (T) value. A soil map unit with an EI of 8 or greater is considered to be Highly Erodible Land (HEL). Potential erodibility is based on default values for rainfall amount and intensity, percent and length of slope, surface texture and organic matter, permeability, and plant cover.



HEL Classification- HUC 05100102		
Class	Acres	Percent
Highly erodible land	496,216	83.6
Not highly erodible land	91,587	15.4
Not rated (primarily water)	5,999	1.0
Totals:	593,802	100.0

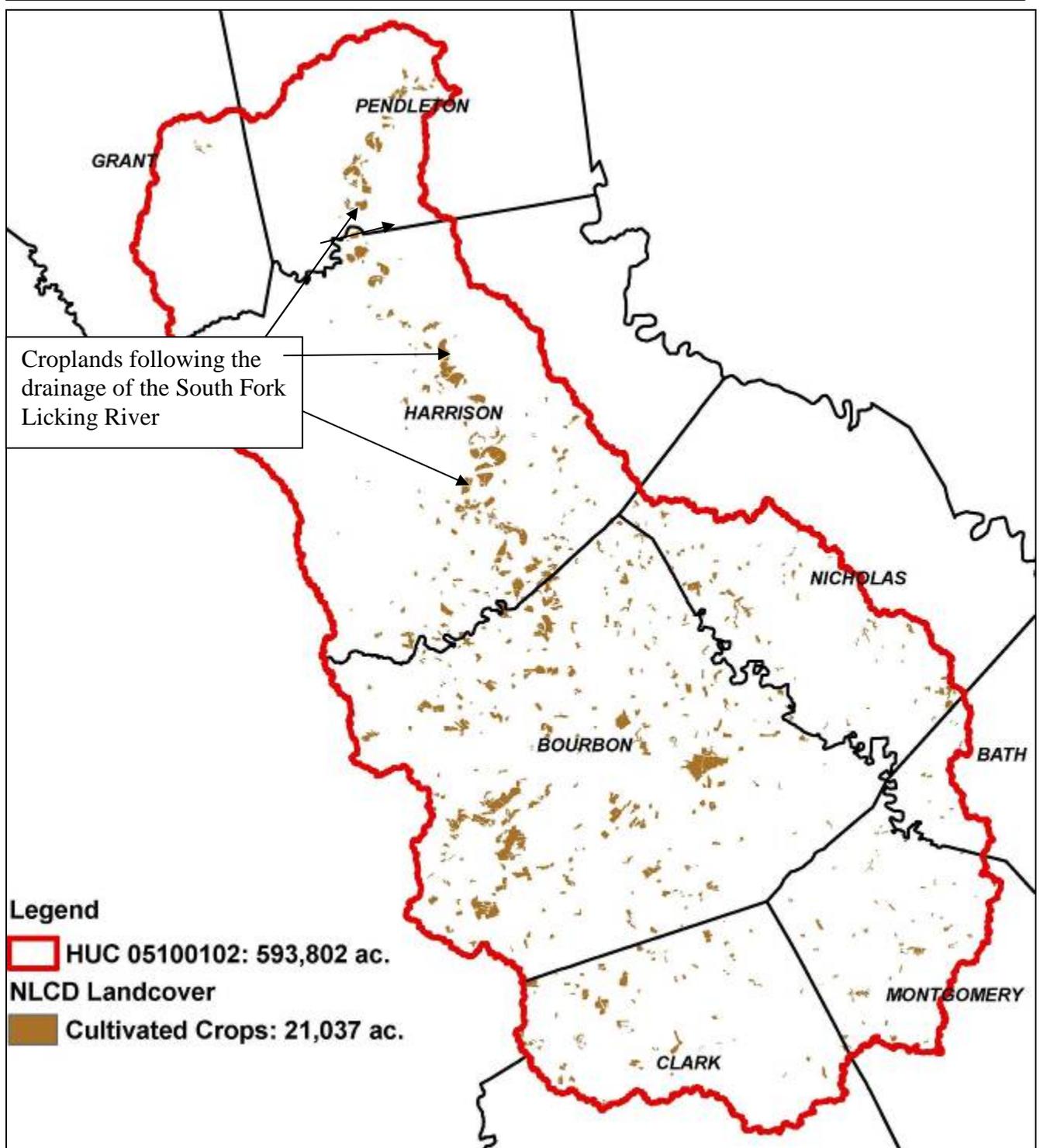
Hay and Pasturelands

Livestock and hay production is the primary agricultural use within this watershed. The combination of geology, soils, rainfall, and climate provide highly productive pastures when well managed, and grasslands total 383,690 acres or approximately 65% of the project area.



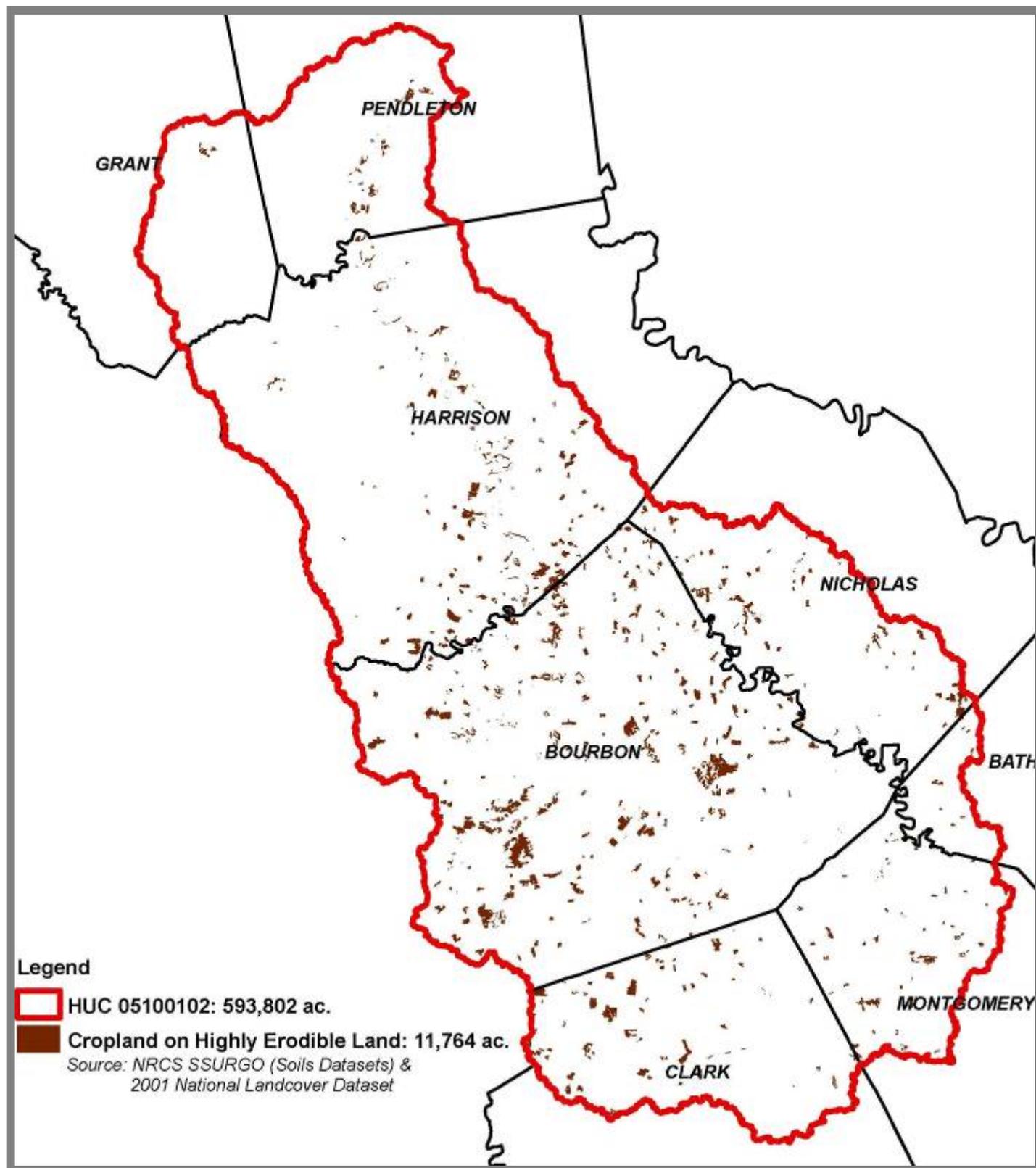
Cropland

Cultivated Cropland is 21,037 acres or less than 4% of the project area; however the majority of cropland in Harrison and Pendleton counties is along the South Fork, which makes these acres a target area for conservation practices. According to 2002 NASS data, cropland acres are a mix of different grains and tobacco. For example, the Bourbon County data for that year was: 2,831 acres in tobacco, 3,842 acres in corn, 2,737 acres in soybeans and 1,906 acres in wheat.



Croplands on highly erodible lands (HEL)

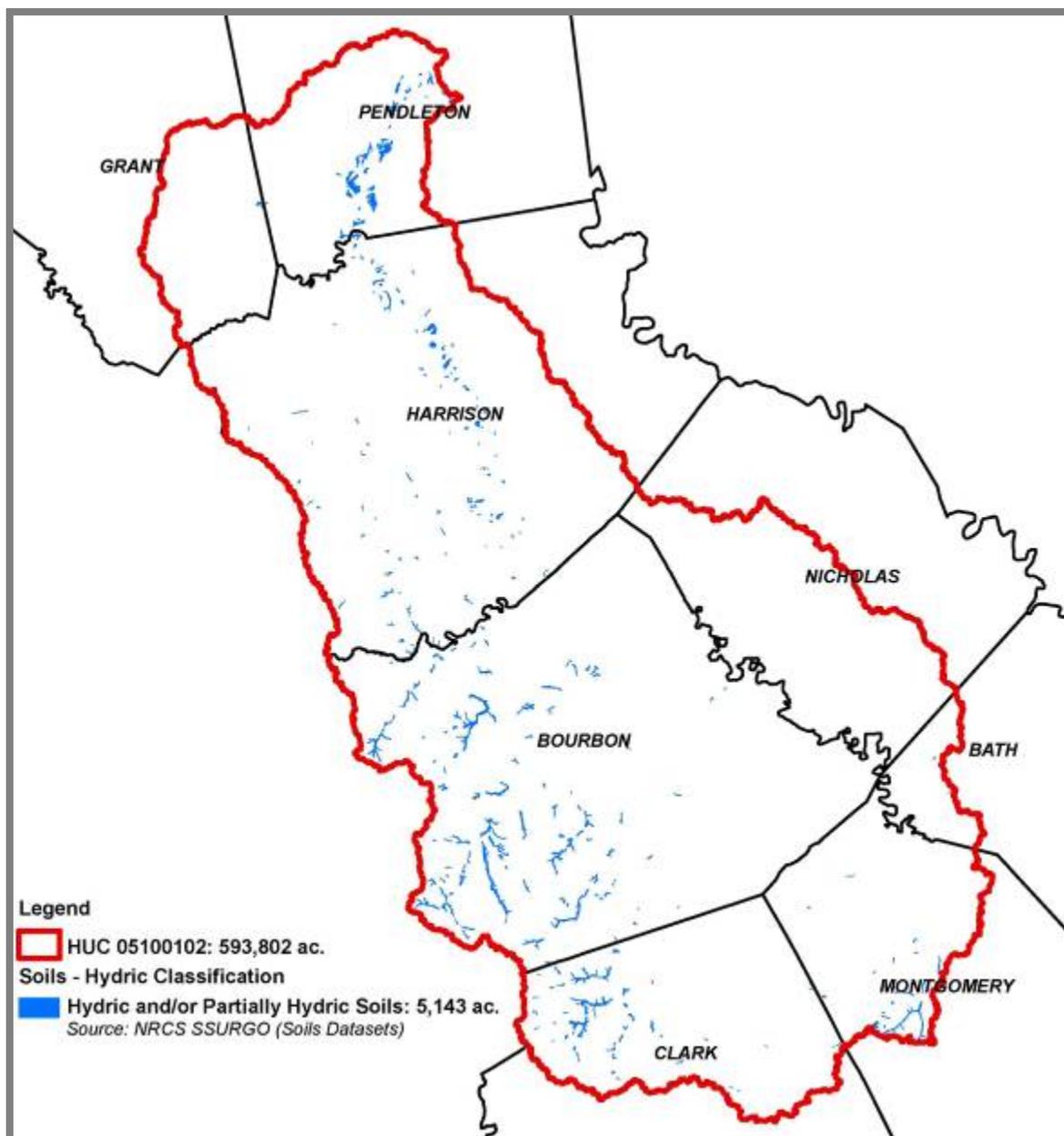
Croplands on HEL compose less than 2% of the project area; however, many of these fields are adjacent or near the South Fork of the Licking or an upper unnamed tributary.



Hydric and Partially Hydric Soils

There are 5,134 acres of hydric or partially hydric soils in the watershed. Hydric soils are as “soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (Federal Register 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

Soils - Hydric Classification- HUC 05100102		
Hydric Classification	Sum Acres	Percent
All hydric	3,412	0.6
Partially hydric	1,731	0.3
Subtotal (Hydric or P. Hydric):	5,143	0.9
Not hydric	585,215	98.6
Not rated	3,444	0.6



The Wetland Reserve Program (WRP) A Partnership between NRCS and Landowners



The Wetlands Reserve Program or “WRP” is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation, wildlife habitat and wetland protection.

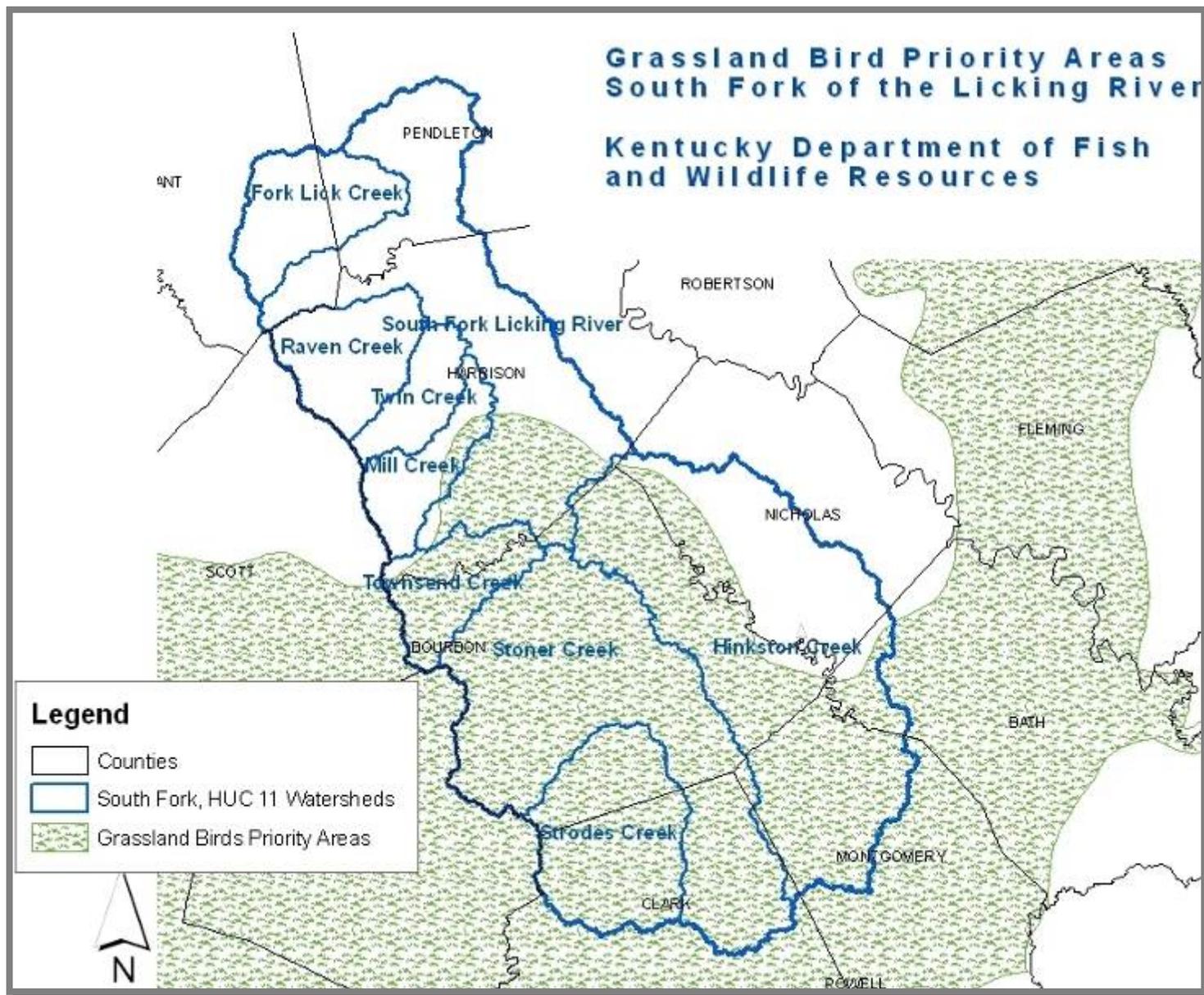
Landowners who choose to participate in WRP may sell a conservation easement or enter into a cost-share restoration agreement with USDA to restore and protect wetlands. The landowner voluntarily limits future use of the land, yet retains private ownership. With landowner input, NRCS develops a plan for the restoration and maintenance of the wetland. The program offers landowners three options: permanent easements, 30-year easements, and restoration cost-share agreements of minimum 10-year duration. A landowner continues to control access to the land--and may lease the land--for hunting, fishing, and other undeveloped recreational activities. There is currently one WRP site in this RWA project area – a 37.5 acre site in Pendleton County. WRP program staff hope to increase landowner awareness of WRP and enrollments in 2009.



Planting of native vegetation on the WRP site in Pendleton County, KY

Grassland Bird Priority Areas

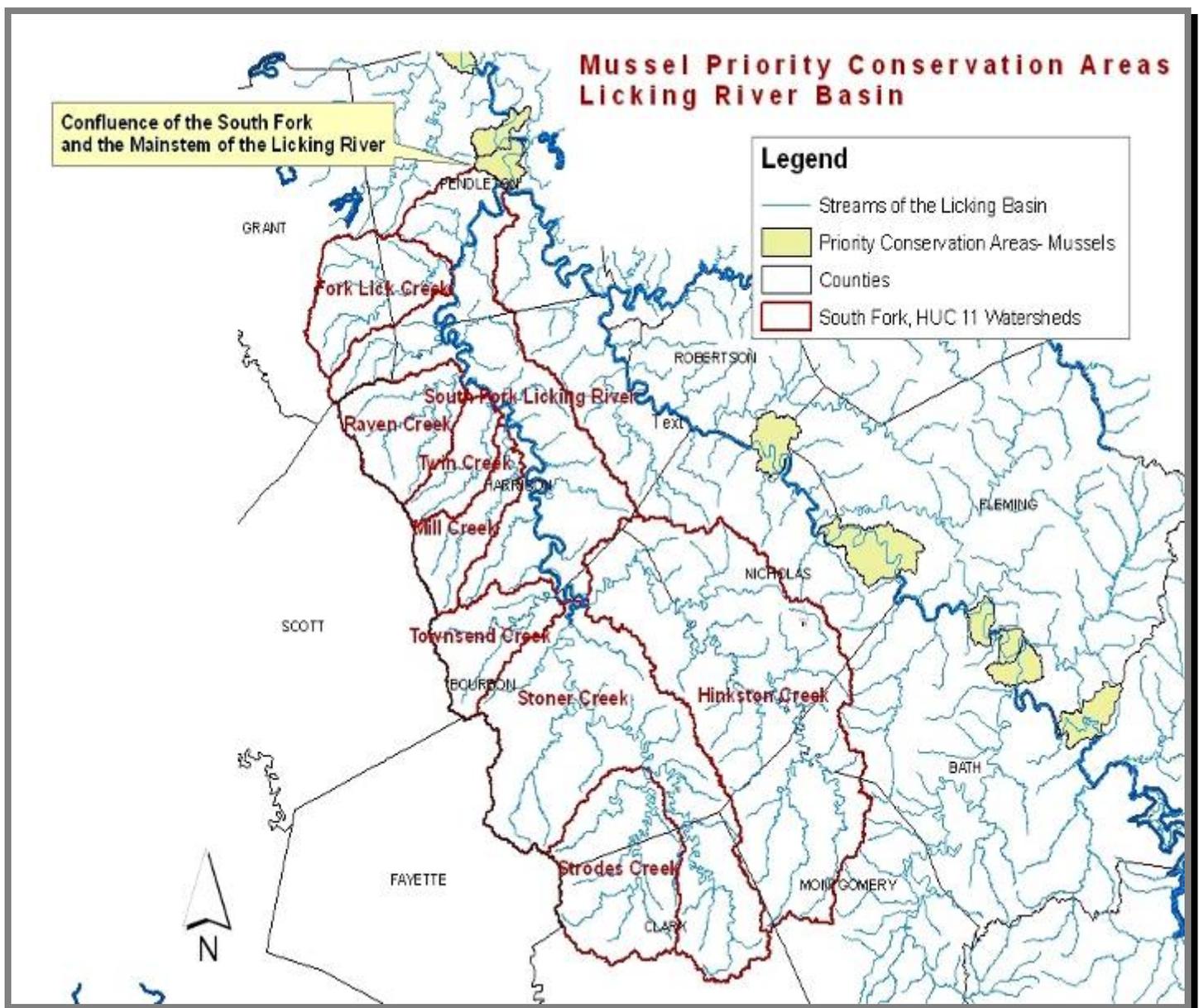
In a 2005 report, the Kentucky Department of Fish and Wildlife Resources (KDFWR) identified geographic areas for the purpose of focusing conservation efforts that would benefit the largest number of species with greatest conservation need. These areas represent priority conservation areas (PCA's), and the KDFWR has included portions of the RWA project area as a grassland bird PCA.



According to the Wilson Journal of Ornithology, grassland birds have experienced greater population declines nationwide than any other group of birds monitored by the North American Breeding Bird Survey. Grassland bird species monitored by the Kentucky State Nature Preserves Commission and found in this watershed include bobolink, savannah sparrow, vesper sparrow, upland sandpiper, meadowlark, and Henslow's sparrow. Conservation practices such as buffer strips, waterways, and Conservation Reserve Program (CRP) acres provide critical habitat for these species.

Freshwater Mussel Priority Areas

The Kentucky Department of Fish and Wildlife Resources has identified areas in the Licking River Basin as Bivalve Priority Conservation Areas. The Licking River Basin provides a unique and fragile habitat for multiple species of freshwater mussels including multiple state and federally listed species. The U.S. Fish and Wildlife Service (USFWS) has documented that the Licking River is one of the last and best populations of federally listed Fanshell mussels (*Cyprogenia stegaria*). The USFWS is one of many agencies working to improve water quality and aquatic species in the Licking Basin. Although the designated mussel conservation areas are on the main stem of the Licking River (HUC 05100101) the South Fork of the Licking joins the mainstem of the River exactly at a freshwater mussel priority conservation site. Targeted efforts of implementing conservation in this RWA project area will improve water quality in the South Fork of the Licking and also protect endangered mussels in the Licking River.



Water Resources

Licking River Watershed Watch Group

The Licking River Watershed Watch (LRWW) is a non-profit organization that tracks water quality throughout the Licking River Watershed multiples times per year. Sampling includes testing for *E. coli* bacteria. *E. coli* is short for *Escherichia coli*, a bacterium that normally resides in the colon of humans and animals. Because *E. coli* are always present in human and animal feces, they are used as an indicator of fecal pollution in the microbiological surveillance of water quality. Several strains of this bacterium are known to produce toxins in humans that can cause moderate to severe diarrhea. One strain of *E. coli* called “O157” can cause severe diarrhea and kidney damage in humans. Sources of bacteria in the Licking RWA project area include livestock (run off from pastures or direct access to streams), failing septic systems, straight-pipes, and discharges from municipal sewage plants. Exceedences ranged from 240 colonies per milliliter to over 31,000 colonies per ml. Additional LRWW water quality information can be found at: <http://www.lickingriver.org/>.

Licking River Watershed Watch			
<i>E. coli</i> Sampling Results for Counties in the RWA Project Area			
Sampling Dates: May 2006 & 2007, July 2006 & 2007, Sept. 2006 & 2007			
County	No. Samples	Number of Samples Showing Exceedences of <i>E. coli</i> bacteria	Percent Exceedences
Bath	16	2	12.50%
Bourbon	47	16	34.04%
Clark	22	16	72.73%
Harrison	15	3	20.00%
Montgomery	11	11	100.00%
Nicholas	32	6	18.75%
Pendleton	33	5	15.15%

Data: Licking River Watershed Watch

Kentucky Division of Water 319 Program

State and federal agencies are working together to focus conservation efforts within the Licking Basin, and Kentucky Division of Water has taken a lead in implementing projects to improve water quality. KDOW has supported multiple projects using the Clean Water Act, Section 319 funding. In 1987, Congress amended the Clean Water Act (CWA) to include the Section 319 Nonpoint Source Management Program. Under this program, states receive grant money to measure the success of non-point pollution projects. Activities include technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring.

Eleven-digit hydrologic units with 319 projects in this project area include: **Strodes, Hinkston, and Townsend Creeks**. Projects include watershed based planning and BMP implementation as well as agricultural BMP demonstrations. Under a 60% federal/ 40% non-federal match, the 319 projects in this RWA project area have a total budget in excess of \$ 4 million.



Photo: Mason Howell, NRCS

Buffer strips are a key conservation practice to improve water quality and reduce non-point pollution of streams. This photos shows a conservation buffer strip adjacent to an unnamed tributary of the South Fork, Licking River in Bourbon County

Kentucky Impaired Waters List - 72% of the identified impaired waterbody segments in this RWA project area have agriculture as the suspected source.

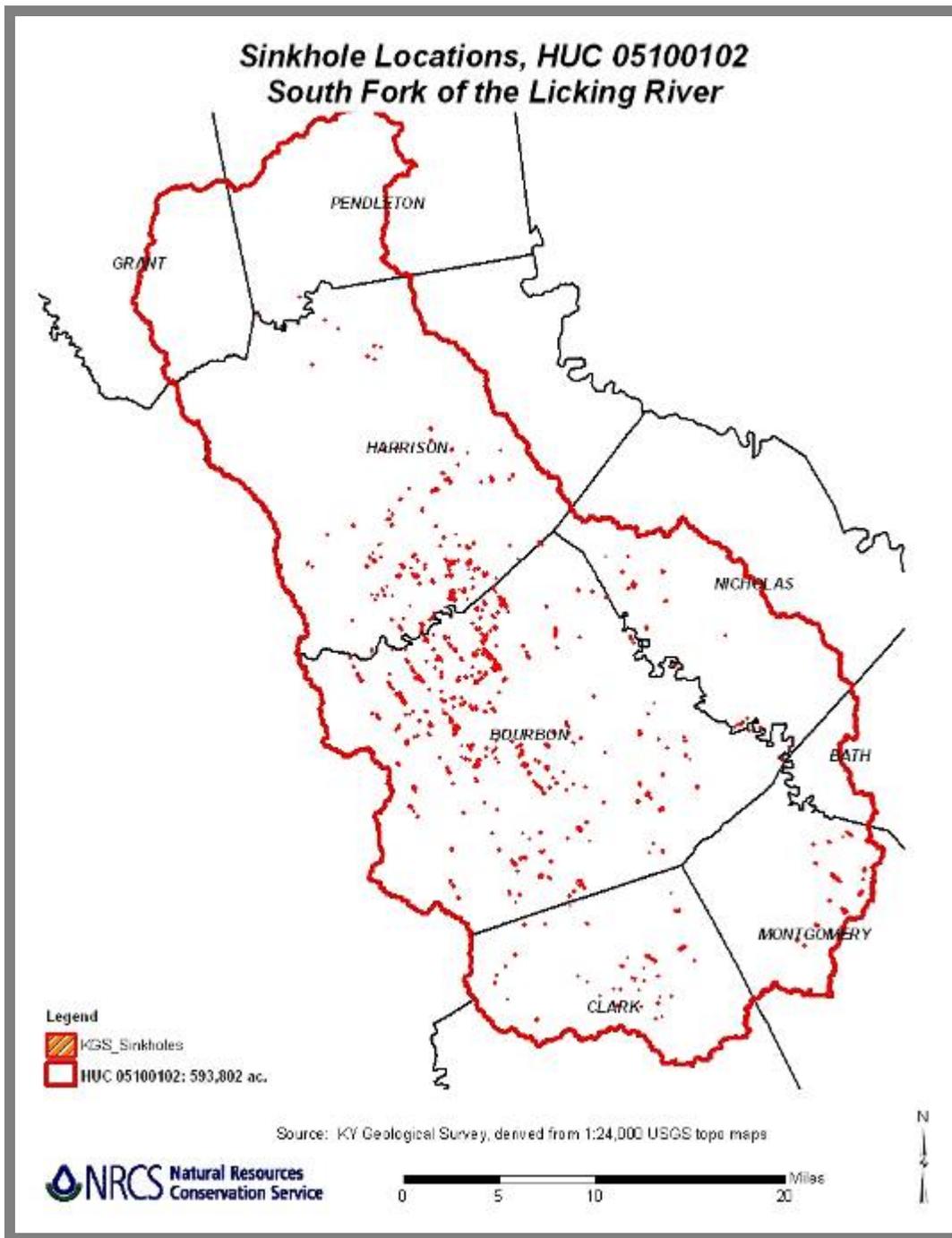
Agricultural impairments to water quality are well documented and widespread in this watershed and the following tables highlight the need for conservation funding in this watershed. Section 303(d) of the Clean Water Act states that water bodies with impaired uses must be placed on a state impaired waters list. The 303(d) portion of the Kentucky Division of Water’s bi-annual report is lists assessed waters including all waters not supporting one or more designated uses and requiring the future development of a Total Maximum Daily Load (TMDL). The following pages list stream segments within the RWA project area that are impaired and the suspected causes of impairment. KDOW has compiled a huge amount of water quality data for not only the Licking Basin but also state-wide. This information includes 303d reports and can be accessed at: <http://www.water.ky.gov/sw/tmdl/303d.htm>. The following 2 pages of tables were taken from the Kentucky Division of Waters draft 2008 Section 303(d) list of impaired waters, and the abbreviations for the designated uses column (“Uses”) are: WAH - Warm Water Aquatic Habitat; CAH - Aquatic Habitat; PCR - Primary Contact Recreation; SCR - Secondary Contact Recreation; FC - Fish Consumption; and DWS -Domestic Water Supply.

HUC 05100102 Impairments, Kentucky Division of Water, 2008

Waterbody & Segment	Total Size	Waterbody ID	County	Use	Impairment	Suspected Source(s)
Blacks Creek 0.0 to 3.4	3.4 miles	KY487421_00	Bourbon	WAH	Nutrient/ Eutrophication Biological Indicators	Livestock (Grazing or Feeding Operations)
Blacks Creek 0.0 to 3.4	3.4 miles	KY487421_00	Bourbon	WAH	Sedimentation/ Siltation	Livestock (Grazing or Feeding Operations)
Boone Creek 0.0 to 5.0	5 miles	KY487686_00	Bourbon	WAH	Nutrient/ Eutrophication Biological Indicators	Livestock (Grazing or Feeding Operations)
Boone Creek 0.0 to 5.0	5 miles	KY487686_00	Bourbon	WAH	Sedimentation/ Siltation	Livestock (Grazing or Feeding Operations)
Cooper Run 0.0 to 10.1	10.1 miles	KY490062_00	Bourbon	WAH	Nutrient/ Eutrophication Biological Indicators	Livestock (Grazing or Feeding Operations)
Flat Run 0.0 to 2.2	2.2 miles	KY492217_00	Bourbon	WAH	Nutrient/ Eutrophication Biological Indicators	Livestock (Grazing or Feeding Operations)
Flat Run 0.0 to 2.2	2.2 miles	KY492217_00	Bourbon	WAH	Sedimentation/ Siltation	Livestock (Grazing or Feeding Operations)
Hinkston Creek 0.0 to 12.6	12.6 miles	KY494298_01	Bourbon	PCR	Fecal Coliform	Source Unknown
Hinkston Creek 20.8 to 31.0	10.2 miles	KY494298_03	Bourbon	PCR	Fecal Coliform	Livestock (Grazing or Feeding Operations)
Hinkston Creek 41.8 to 49.1	7.3 miles	KY494298_05	Bourbon	PCR	Fecal Coliform	Agriculture
Hinkston Creek 41.8 to 49.1	7.3 miles	KY494298_05	Bourbon	WAH	Sedimentation/ Siltation	Agriculture
Hinkston Creek 51.5 to 65.9	14.4 miles	KY494298_06	Montgomery	WAH	Nutrient/ Eutrophication Biological Indicators	Grazing in Riparian or Shoreline Zones
Hinkston Creek 51.5 to 65.9	14.4 miles	KY494298_06	Montgomery	WAH	Sedimentation/ Siltation	Grazing in Riparian or Shoreline Zones

HUC 05100102 Impairments, Kentucky Division of Water, 2008

Waterbody & Segment	Total Size	Waterbody ID	County	Use	Impairment	Suspected Source(s)
Houston Creek 0.0 to 9.0	9 miles	KY494646_01	Bourbon	PCR	Fecal Coliform	Source Unknown
Houston Creek 9.0 to 12.7	3.7 miles	KY494646_02	Bourbon	WAH	Nutrient/ Eutrophication Biological Indicators	Golf Courses
Little Stoner Creek 0.0 to 5.0	5 miles	KY496870_00	Clark	PCR	Fecal Coliform	Source Unknown
Mill Creek 0.0 to 21.6	21.6 miles	KY498263_01	Harrison	WAH	Nutrient/ Eutrophication Biological Indicators	Crop Production (Crop Land or Dry Land), Livestock (Grazing or Feeding Operations)
Mill Creek 0.0 to 21.6	21.6 miles	KY498263_01	Harrison	WAH	Sedimentation/ Siltation	Crop Production, Livestock (Grazing or Feeding Operations), Land Development or Redevelopment
Stoner Creek 0.0 to 5.5	5.5 miles	KY504482_01	Bourbon	PCR	Fecal Coliform	Source Unknown
Stoner Creek 5.5 to 15.0	9.5 miles	KY504482_02	Bourbon	PCR	Fecal Coliform	Source Unknown
Strodes Creek 2.7 to 19.3	16.6 miles	KY504593_00	Bourbon	PCR	Fecal Coliform	Agriculture, Unspecified Urban Stormwater, Municipal Point Source Discharges
Strodes Creek 2.7 to 19.3	16.6 miles	KY504593_00	Bourbon	WAH	Nutrient/ Eutrophication Biological Indicators	Agriculture, Unspecified Urban Stormwater, Municipal Point Source Discharges
Strodes Creek 2.7 to 19.3	16.6 miles	KY504593_00	Bourbon	WAH	Organic Enrichment (Sewage) Biological Indicators	Agriculture, Unspecified Urban Stormwater, Municipal Point Source Discharges
Strodes Creek 2.7 to 19.3	16.6 miles	KY504593_00	Bourbon	WAH	Sedimentation/ Siltation	Agriculture, Unspecified Urban Stormwater, Highways, Roads, Bridges, New Construction, Habitat Modification
Townsend Creek 0.0 to 4.9	4.9 miles	KY505401_01	Bourbon	PCR	Fecal Coliform	Source Unknown



Occurrence of Sinkholes

The South Fork of the Licking River Watershed is underlain with karst, a terrain characterized by subsurface limestone and sinkholes. Karst regions are especially susceptible to rapid groundwater pollution due to the direct connection between surface and subsurface waters. Karst landscapes are also characterized by sinking streams, closed depressions, shallow subterranean drainage, large springs, and caves. There are an estimated 725 sinkholes in HUC 05100101 encompassing 757 acres. These areas provide a critical opportunity to apply ground water protection through the application of NRCS conservation practices.

Demographics The demographic data within this project area is fairly uniform. Population rates are increasing with Montgomery and Grant Counties growing by over 10% in seven years. Household incomes by county are similar, generally within the \$30,000-\$40,000 range. Poverty rates are rates are above the U.S average in all but two counties.

County	Population 1990	Population 2000	Population 2007	Change 1990-2000	Change 2000 - 2007
Bourbon	19,236	19,360	19,756	0.60%	2.00%
Clark	29,496	33,144	35,550	12.40%	7.30%
Grant	15,737	22,384	25,161	42.20%	12.40%
Harrison	16,248	17,983	18,552	10.70%	3.20%
Montgomery	19,561	22,554	25,228	15.30%	11.90%
Nicholas	6,725	6,813	6,889	1.30%	1.10%
Pendleton	12,062	14,390	15,058	19.30%	4.60%

Data: USDA – Economics Research Service, National Agriculture Statistics Service, ThinkKentucky.gov

County	Median household income (1999)	Median Home Price (2000)	Individuals below poverty level
Bourbon	\$35,038	\$84,500	14%
Clark	\$39,946	\$93,700	12.5%
Grant	\$38,438	\$93,100	11%
Harrison	\$36,210	\$83,000	12%
Montgomery	\$36,939	\$96,000	15%
Nicholas	\$35,491	\$62,000	13%
Pendleton	\$42,589	\$77,700	11.5%

Climate

Central Kentucky has a moderate climate, characterized by warm, moist summer conditions and cold winters. Kentucky's weather patterns are influenced by the Gulf of Mexico, especially during summer months. Statistical data shows that precipitation decreases on a statewide level from south to north. Southern Kentucky receives the highest average precipitation, over 50 inches a year, while the northern portions of the state average only 40 inches.

Climate Data Overview for Kentucky Counties in RWA Averaged data from 5 RWA counties (www.thinkkentucky.gov)	
Normal Temperature (30 year record)	55 degrees F
Average Annual, 2006	56 degrees F
Record Highest	103 degrees F
Record Lowest	-20 degrees F
Normal Precipitation (30 year average)	46 inches
Mean Annual Snowfall (30 year average)	17 inches
Total precipitation, 2006	54 inches
Mean number of days precipitation	131
Mean number of days thunderstorms	43
Prevailing Winds	South

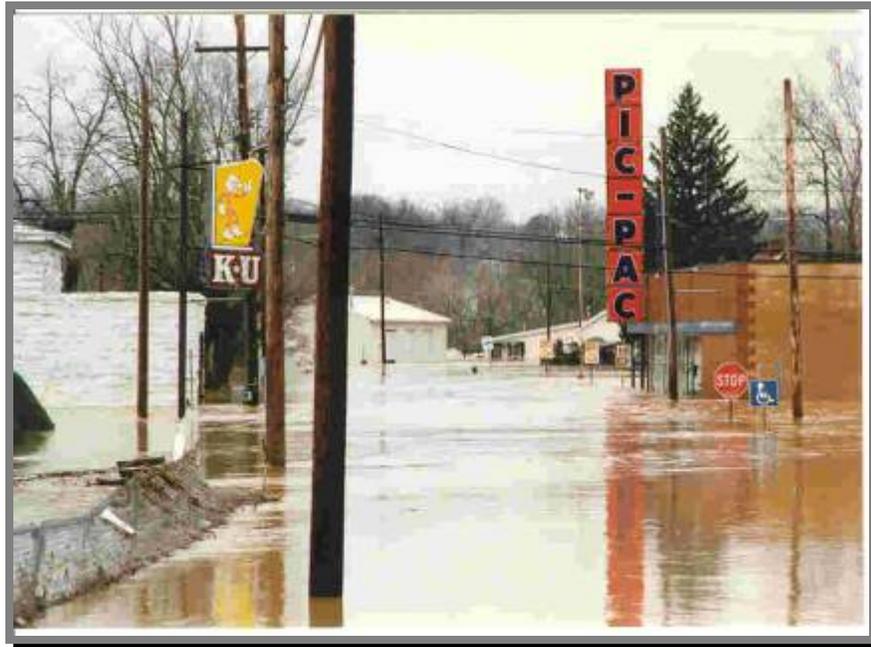


Photo: Tom Leith

Flooding in the city of Cynthiana, 1997

Licking River Flooding

Although the City of Cynthiana in Harrison County has a long record of reoccurring flooding, the spring of 1997 was one of the worst floods recorded along the Licking River and South Fork of the Licking. The event was described by the National Oceanic and Atmospheric Administration (NOAA) as a “powerful storm that had 200% of the normal moisture for that time of year”. Throughout the Licking River Basin, flooding was severe with towns such as Cynthiana (adjacent to the South Fork) and Falmouth hit especially hard. According to the US Army Corps of Engineers, flood damages for the 1997 event was approximately \$45 million and the peak stage recorded at the gage in Cynthiana was 5 feet higher than any recorded level in the last 60 year –this is considered a 500-year flood event. Local governments in the area have been working with the US Army Corps of Engineers to develop solutions to Cynthiana’s flooding problems, but the proposed projects are costly and the lack of local cost-share funds have so far stopped project implementation. The Corps has given the City a plan which proposes construction of large dams on tributaries of the South Fork. Some local landowners have discussed building numerous farm ponds with storage capacity throughout the watershed instead of large “dry” dams. There is also opportunity for some wetland restoration and reforestation projects.

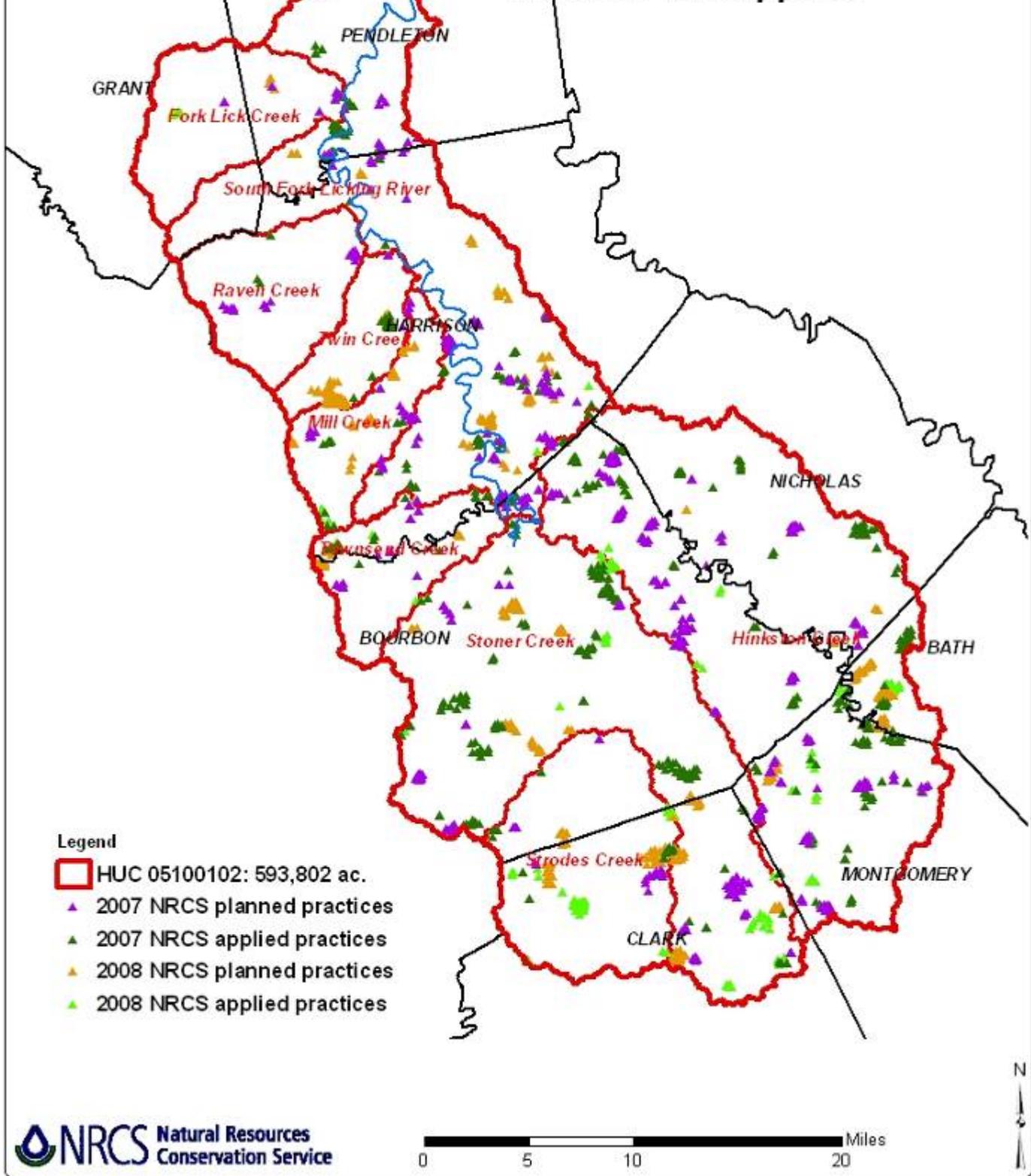
NRCS Conservation Program Data

NRCS tracks implementation of programs in a system called Performance Results System (PRS). This database provides trend data on conservation measures implemented by year. Results by eight-digit HUC for the RWA project area from 2004-2007 are shown in the tables below.

NRCS Performance Results System Summary by Year							
HUC 05100102							
Code	Practice	Units	2004	2005	2006	2007	Totals
313	Waste Storage Facility	no	2		1	2	5
313,317,359	Total Waste Storage	no	2			2	4
327	Conservation Cover	ac	10	149	60	57	276
328	Conservation Crop Rotation	ac	918	1852	1310	276	4356
329	Residue and Tillage Management	ac					0

329A	Residue Management, No-Till/Strip Till	ac	83	1685	711		2479
329B	Residue Management, Mulch Till	ac					0
329A-C	Residue Management	ac	83	1685	711		2479
330	Contour Farming	ac	693	2109	2006	1660	6468
338	Prescribed Burning	ac			5		5
340	Cover Crop	ac	669	131	252	931	1983
342	Critical Area Planting	ac	2	8	10	2	22
344	Residue Management, Seasonal	ac		372	602		974
362	Diversion	ft					0
378	Pond	no	6		2	1	9
382	Fence	ft	78884	26203	70790	55116	230993
383	Filter Strip	ac					0
386	Field Border	ft				15500	15500
391	Riparian Forest Buffer	ac	101	382	57	36	576
393	Filter Strip	ac		262			262
395,644,645	Total Wildlife Habitat Mgmt	ac			251	797	1048
410	Grade Stabilization Structure	no		1	1		2
412	Grassed Waterway	ac	51	115	8		174
472	Use Exclusion	ac				73	73
490	Tree/Shrub Site Preparation	ac					0
511	Forage Harvest Management	ac	148	143	656	557	1504
512	Pasture and Hay Planting	ac	87	215	150	73	525
516	Pipeline	ft	28462	34729	33888	55380	152459
528	Prescribed Grazing	ac		440	2975	872	4287
528A	Prescribed Grazing	ac	2978	1462	2391	2169	9000
558	Roof Runoff Structure	no					0
560	Access Road	ft					0
562	Recreation Area Improvement	ac					0
561	Heavy Use Area Protection	ac	3	170	4		177
570	Runoff Management System	ac					0
574	Spring Development	no		2	3	1	6
575	Animal Trails and Walkways	ft			305	574	879
580	Streambank and Shoreline Protection	ft		3650			3650
590	Nutrient Management	ac	2160	3016	3867	1851	10894
595	Pest Management	ac	5190	2682	2598	2387	12857
606	Subsurface Drain	ft					0
612	Tree/Shrub Establishment	ac		14		20	34
614	Watering Facility	no	44	41	67	85	237
633	Waste Utilization	ac	87			30	117
634	Manure Transfer	no					0
642	Water Well	no					0
644,645	Total Wildlife Habitat	ac	143	180			323
645	Upland Wildlife Habitat Management	ac	143	180	251	797	1371
648	Wildlife Watering Facility	no					0
655	Heavy Use Area Protection	ac			4		4
666,612	Forest Re-established or improved	ac		211		20	231

NRCS 2007-2008 Conservation Practices Planned and Applied



A Bluegrass Conservation Success Story

Bourbon County, Kentucky is known worldwide for thoroughbred breeding farms. These farms produce some of the finest racehorses in the world, and also create tons of waste taken from horse stalls and paddocks. This waste is usually a mixture of manure and straw and is often stored in less than ideal conditions with regards to water quality protection.

NRCS and Resource Conservation and Development (RC&D) staffs have worked together to address this issue. Initially funded by a grant through the Environmental Protection Agency's 319 Program, this program has become a highly successful example of USDA working with landowners to implement much needed conservation practices.



*Rows of compost material, Claiborne Farm, Bourbon County
Photo: Tom Leith, USDA*

The overall goal of this project was to reduce the disposal of horse stable muck that was being deposited in sink holes and adjacent to streams. This disposal method is commonplace on many horse farms and is a potentially major source of water quality impairment. A secondary goal of the project was to transform the muck into a beneficial soil amendment that could be returned to the land. As a result of these efforts many bluegrass horse farms are now composting their waste and spreading the material to improve soil organic content on their property.



Turning rows of muck, Claiborne Farms, Bourbon County photo: Tom Leith, USDA

This watershed offers an array of additional opportunities for NRCS to work with landowners, state agencies, private organizations, and local officials to improve water and soil resources. Through partnerships and cooperation with other stakeholders, USDA will continue to provide technical and financial assistance to implement on-the-ground conservation.

Information Sources

Web Sites

Geology

U.S. Geological Survey at www.usgs.gov

Kentucky Geological Survey at <http://www.uky.edu/KGS/geoky/>

Kentucky Division of Water TMDL data, Impaired Streams, Exceptional and High Quality Streams, Exceptional Value and Special Use Waters

<http://www.water.ky.gov>

www.watersheds.ky.gov/basins/licking/

Water quality, monitoring, and treatment information

<http://www.lickingriver.org>

<http://www.watersheds.ky.gov/basins/licking/>

<http://www.kwalliance.org>

<http://www.watersheds.ky.gov/basins/licking/>

<http://www.epa.gov>

<http://www.scorecard.org/env-releases/water>

Land Use / Land Cover 2001 information

<http://landcover.usgs.gov/>

National Elevation Dataset (NED) information

<http://ned.usgs.gov/>

Wildlife, Federally Threatened and Endangered Species, Species Recovery Information, National Wetlands Inventory, Conservation Priority Areas

<http://www.fws.gov>

<http://www.kdfwr.state.ky.us>

State Threatened and Endangered Species, Kentucky State Nature Preserves Commission-

<http://www.naturepreserves.ky.gov/>

The Nature Conservancy

<http://www.nature.org/>,

<http://www.nature.org/wherewework/northamerica/states/kentucky/preserves/art10920.html>

Social and Census Data

http://www.nass.usda.gov/Census_of_Agriculture/index.asp

<http://www.census.gov>

<http://thinkkentucky.com>

www.city-data.com

www.epodunk.com/

Soil Survey spatial and tabular data

<http://soildatamart.nrcs.usda.gov/>

<http://www.nrcs.gov>

<http://www.nrcs.gov/Kentucky>,

Area background, history, flooding, and general information on the watershed

http://en.wikipedia.org/wiki/Licking_River
www.britannica.com/EBchecked/topic/339733/Licking-River
www.encyclopedia.com
www.gopaddling.com/
www.answers.com/topic/licking-river-kentucky
www.nkyviews.com/campbell/newport_licking_scenes.htm
www.trails.com
www.answers.com/topic/licking-river
www.newweb.erh.noaa.gov/
www.nku.edu
www.trailsrus.com/wildlife/licking_river.html
www.placenames.com
www.treesearch.fs.fed.us/pubs/10468
www.lickingriveroutfitters.com
www.kentuckycrosswords.com/Learn/Rivers.htm
www.watersheds.ky.gov/homepage_repository/
www.fs.fed.us/r8/boone/resources/water/watershed.shtml
www.uky.edu/WaterResources/Watershed
www.kyppa.org/Features.htm
www.kwalliance.org
www.kyhometown.com
www.city-data.com
www.falmouthkentucky.com
www.falmouthoutlook.com
www.cynthianaky.com
www.epodunk.com/
www.kywebcams.com

NRCS Performance Results System

<http://ias.sc.egov.usda.gov/prshome/>
www.nrcs.usda.gov/programs
www.nrcs.usda.gov/Kentucky/programs

Climate and weather information

www.weather.gov
www.noaa.gov
www.wunderground.gov
www.weatherchannel.gov
www.thinkkentucky.gov
www.kentucky.gov

Reports:

The Licking River Region in Kentucky, Status and Trends, Kentucky Division of Water, 1998

303(d) List of Waters, Kentucky Division of Water, 1998

303(d) List of Waters, Kentucky Division of Water, 2002

303(d) List of Waters, Kentucky Division of Water, 2004

2006 Integrated Report to Congress on the Condition of Water Resources in Kentucky Volume II, 303(d) List of Surface Waters, Kentucky Division of Water, 2006

2008 Integrated Report to Congress on the Condition of Water Resources in Kentucky Volume II, 303(d) List of Surface Waters, Kentucky Division of Water, 2008

B.E. Daniels and G.A. Schuster. 2000. Assessment of a freshwater mussel (Mollusca: Bivalvia) community in the Licking River, at Butler, Pendleton County, Kentucky. Kentucky. Kentucky Division of Water

Giocomo, James J.; Moss, E. Daniel; Buehler, David A.; Minser, William G. 2008. The Wilson Journal of Ornithology

S. E. McMurray and G.A. Schuster. 1996. Reproduction in a freshwater unionid (Mollusca: Bivalvia) community downstream of Cave Run Reservoir in the Licking River at Moores Ferry, Kentucky