

ENVIRONMENT & NATURAL RESOURCES

Water Resources

Dr. Gary O'Dell

Kentucky is an exceptionally well-watered state. Nearly 90,000 miles of rivers and streams give the Commonwealth more flowing water than any other state except Alaska. Each year more than 100 million tons of commodities, mainly coal and grain, are shipped to and from Kentucky by way of more than 1,000 miles of navigable rivers. Seven hundred miles of streams in the state have been designated as "outstanding resource waters"

wetland area has been reduced by development, from an estimated 1.5 million acres at the time of settlement to less than 640,000 acres today. Groundwater in bedrock and granular aquifers is an important water supply resource for communities and individual households.

RIVERS

All streams within the state are contained within the Ohio River basin, which in turn is part of the Mississippi River system. Excepting only the headwaters of the Cumberland River, which initially flow southward to Tennessee, all of the major rivers in Kentucky flow to the north. The primary drainage basins in Kentucky are those of the Green River, Kentucky River, Cumberland River (upper and lower segments), Licking River, Salt River, Big and Little Sandy rivers, Tradewater River, Tennessee River and Tygarts Creek. In addition, substantial areas parallel to the courses of the Ohio and Mississippi drain



Echo River in Mammoth Cave

Source: Kentucky Department of Libraries & Archives

for their high water quality, and 114 miles in eight streams are protected as "wild rivers" under the provisions of the 1972 Kentucky Wild Rivers Act. The state contains more than 2,700 surface water impoundments, both natural and artificial, although nearly all of the larger lakes are of human construction. Approximately one-third of the impoundments are greater than 10 acres in size. As elsewhere in the nation, much of Kentucky's

directly to those rivers. The basins of the Kentucky, Licking, Salt, Tradewater, Little Sandy and Tygarts are entirely contained within the state, as is all but a fraction of the Green River drainage.

The Green River, the longest river in the state (370 miles), has the largest drainage area (9,430 square miles) and the greatest number of miles navigable to commercial shipping (108.5). Originating in Lincoln County at the

eastern edge of the Mississippian Plateau, the river flows west, passing through Mammoth Cave National Park, and then turns northwest, flowing through the Western Coal Field to join the Ohio River across from Evansville. A series of locks and dams were built on the river, beginning in 1842, which once allowed river navigation as far as Bowling Green. The lowermost two locks and dams remain in service and facilitate a substantial amount of shipping, mainly coal and aluminum ore.

Although most of the Cumberland River flows through Tennessee, the beginning and end sections are located within the Commonwealth and are known as the Upper and Lower Cumberland River basins. The headwaters of the Cumberland River originate in the mountains of southeastern Kentucky. The Cumberland flows south and west for over 300 miles across the Eastern Coal Field region, crossing the Tennessee border in Monroe County, Kentucky, and returns to Kentucky in south-central Trigg County. The Upper Cumberland and its tributaries are exceptionally scenic: six of the state's eight wild rivers are found here, including 10.2 miles of the Big South Fork in Whitley County, one of the nation's finest stretches of whitewater. Cumberland Falls, sometimes called the "Niagara of the South," is located on the river at the border of McCreary and Whitley counties. The falls are 68 feet high and span about 125 feet.

The Licking River rises in southeastern Magoffin County in the Eastern Coal Field Region and follows a meandering course northwestward through the Bluegrass for 310 miles, joining the Ohio River in northern Kentucky opposite Cincinnati, where it separates the cities of Covington and Newport. The river was named for the many mineral springs near the river that attracted animals to salt licks. The river was an important transportation route for native Americans and during the settlement of Kentucky and a trade route during the 19th century.

The headwaters of the Kentucky River arise in the mountainous terrain of the Eastern Coal Field. The North Fork, Middle Fork and South Fork of the Kentucky flow northward from the vicinity of Pine Mountain, roughly parallel to each other, and join near Beattyville. From this confluence, the river flows northwestward for 255 miles through the Bluegrass Region to join the Ohio River at Carrollton in

northern Kentucky. The nearly 7,000-square-mile area of the Kentucky River basin is second largest in the state. Other major tributary streams include the Red River, Dix River, Eaglehorn Creek and Eagle Creek. The Palisades, a 100-mile stretch of scenic limestone gorge, lies between Clays Ferry in Madison County and Frankfort. The river once provided access to the mineral and timber resources of the Coal Field, aided by a series of 14 locks and dams constructed on the river beginning in the early 19th century, but is today navigable only as far as Frankfort, a distance of 65 river miles from the mouth. The Kentucky is an important regional resource for 63 municipal water systems that withdraw from the river, supplying over 700,000 residents with water.

The Salt River rises in Boyle County, west of Danville, flows northward and then west to the Ohio River at West Point. The river was named for the saline licks and springs along the lower reaches of the stream. Early settlers established a salt works at Bullitt's Lick near in 1779 and in several other locations.

The Big Sandy was named for the presence of many sand bars in the river channel. The main stem of the Big Sandy is a relatively short stretch of river, only 27 miles long, formed by the confluence of the Levisa Fork and Tug Fork at Louisa. The Big Sandy is navigable due to lock and dam construction, as are the lower parts of the Levisa and Tug Forks, and carries commercial shipping, primarily coal.

In northeastern Kentucky, Tygarts Creek and the Little Sandy River are the smallest of the Kentucky drainage systems of significance that flow to the Ohio River; both are less than 100 miles in length.

The Tennessee River is the largest tributary of the Ohio River, but only about 10 percent of its 620-mile length is within the Commonwealth, and most of that is impounded as Kentucky Lake.

The Tennessee flows into the Ohio River at Paducah. The Kentucky Dam is located about 22 miles from the river mouth, creating the largest impoundment in the eastern U.S., 184-mile-long Kentucky Lake. This lake is linked by a navigation canal to Lake Barkley, an almost equally large and parallel impoundment of the Cumberland River. The area is known as "Land Between the Lakes" National Recreation Area.

The Mississippi River forms a short sec-

tion of Kentucky's far western boundary, flowing 49 miles from its confluence with the Ohio River at Wickliffe to the Tennessee state line. In addition, the Mississippi comprises another 15.5 miles of boundary for the Kentucky Bend enclave, a small area within a hairpin bend of the river not directly connected to another part of the state.



**Wolf Creek Dam
on the Cumberland River**

Source: Sid Webb

The Ohio River is one of the most important tributaries of the Mississippi, flowing 981 miles from the confluence of the Allegheny and Monongahela rivers in downtown Pittsburgh to join with the Mississippi near Wickliffe in far western Kentucky. The Ohio forms the boundary between West Virginia and Ohio and, for a distance of 665 miles, the northern boundary of Kentucky that separates it from Indiana and Illinois. Unlike most boundary rivers, the boundaries between states along the Ohio were established along the centerline of the river. This situation derives from the January 2, 1781, resolution of the General Assembly of Virginia that the Commonwealth of Virginia would cede to the U.S. all those lands granted to it under the Virginia Charter

"northwest of the river Ohio." This was interpreted to mean that Virginia owned the Ohio River to the far shore, a right of possession that was extended to Kentucky and West Virginia when those states were formed. In the years since the original boundary was established, many locks and dams have been built on the river to improve navigation.

During the settlement of Kentucky and the western territory, the Ohio River was a primary transportation route and remains today an important artery for commerce. The only significant navigation obstacle on the river is the Falls of the Ohio, a series of cascading rapids over limestone ledges that drops 26 feet in a 2-1/2 mile stretch of the river. The river barrier created a natural stopping point for travelers, and the city of Louisville was founded on the south side of the rapids. The first canal and locks around the Falls was completed in 1830 by a private stock company chartered by the Commonwealth. In 1874 the canal and locks were appropriated by the U.S. government. The U.S. Army Corps of Engineers has widened and improved the original canal and locks and constructed an additional route to bypass the falls. About 20 barge tows pass through the canals and locks every day.

LAKES

Since most of Kentucky lies south of the farthest glacial advance, there are few natural lakes of significant size within the state. Swan Lake in Ballard County is the largest natural lake wholly contained within Kentucky and is of about 300 acres extent. The lake is situated in the bottom land of the Ohio River, surrounded by cypress swamps and part of the 2,200 acre Swan Lake Wildlife Management Area. The far larger Reelfoot Lake, 15,500 acres at normal pool, is almost entirely within Tennessee, except for a tiny section that extends north into Fulton County, Kentucky. This is a very shallow lake, surrounded by cypress swamps and marshes and a habitat for bald eagles and is included within the Reelfoot National Wildlife Refuge.

Nearly all of Kentucky's larger lakes are artificial impoundments formed by the damming of a stream or river. With the exception of Kentucky Lake, managed by the Tennessee Valley Authority, these lakes are under the jurisdiction of the U.S. Army Corps of Engineers and the Kentucky Dept. of Fish and Wildlife Resources. Most of these lakes

were built during the 1960s and early 1970s for flood control, recreation and hydroelectric power generation. Lake Herrington, built in the 1920s, was the first major impoundment in the state, and supplied hydroelectric power for many years. The most recent large impoundment was Cedar Creek Lake, a reservoir of 762 acres that finished filling in 2002. Kentucky Lake is one of the largest artificial lakes in the eastern U.S., although only a little more than a third of its 160,000 acres are contained within the Commonwealth. The largest lake entirely within Kentucky is Lake Cumberland in the southeastern section of the state, which contains over 50,000 acres at normal pool and more than 1,000 miles of shoreline. Five lakes in the state produce hydroelectric power – Kentucky, Cumberland, Barkley, Dale Hollow and Laurel lakes – with a total capacity of nearly 2.9 billion annual kilowatt-hours.

WETLANDS

Kentucky's wetlands are an important natural resource that is often unappreciated by the general public. Wetlands are areas that may be flooded on a permanent, seasonal or occasional basis, or are saturated by groundwater seepage, and are characterized by specialized plants (hydrophytic) that are adapted to wet environments and soils (hydric) that are sufficiently wet during the growing season to develop anaerobic conditions in the upper part. Freshwater wetlands include marshes, swamps, bogs and fens. Wetlands were once perceived as undesirable wastelands, breeding grounds for mosquitoes and flies and sources of diseases and unpleasant odors. Because of this viewpoint, more than half of America's original wetlands have been destroyed, drained or filled for agriculture or development. More recently, we have come to understand that wetlands provide important benefits to people and the environment. Wetlands help to control water levels within watersheds, improve water quality, reduce flood damages, provide fish and wildlife habitat and support recreational activities.

About 2.5 percent of Kentucky is wetlands. At the time of settlement the state contained an estimated 1,566,000 acres of wetlands; today only about 637,000 acres remain – a 60 percent loss. Most of the wetland loss has occurred in the western part of the state as a result of conversion to cropland and pasture-

land. The Kentucky Division of Water estimates that about 3,600 acres of existing wetland are lost annually, being drained or filled. Most of the wetlands of the state are privately owned. The 2005 General Assembly authorized the Environmental and Public Protection Cabinet to investigate the possibility of administering the federal wetlands program at the state level, and the state has received a grant from the EPA to help fund development of a proposed program.

GROUNDWATER

Nearly one-fifth of the earth's fresh water is contained underground, more than three times as much as can be found in all the rivers, streams and lakes combined. Groundwater is an important water-supply resource for the planet, and in Kentucky, more than 1.6 million citizens depend upon groundwater from wells and springs for drinking water and other household needs. Groundwater sources also supply commercial, agricultural and industrial uses in the state. The normal flow and dry-weather flow of Kentucky's rivers and streams is maintained by groundwater seepage. The use of groundwater in the state is increasing, although contamination from urban, industrial and agricultural sources poses an increasing threat to quality.

Just over half of Kentucky's public water supplies (226 of 435) depend upon groundwater sources, supplying a combined population of over 1.2 million persons. This represents about 30 percent of the total population. An estimated 400,000 persons are self-supplied, of which about 90 percent rely on groundwater from private wells and springs. Over 35,000 private water wells for domestic use have been drilled in Kentucky since 1985.

The Kentucky Division of Water has monitored groundwater quality across the state since 1995. Overall water quality is considered good, though impacts from human activity, primarily related to agriculture, occur in the karst regions where shallow conduit aquifers are particularly vulnerable to contamination. Pesticides are routinely detected in groundwater samples only in the karst regions. Local groundwater contamination from causes such as landfills, leaking underground storage tanks, Superfund and hazardous waste sites is of concern in Kentucky as elsewhere, but does not represent a widespread disruption of groundwater use.

MAJOR RIVERS

RIVER BASIN	TOTAL DRAINAGE AREA (mi)	DRAINAGE AREA IN KENTUCKY (sq. mi.)	TRIBUTARY STREAMS	LENGTH IN KENTUCKY (mi)*	DRAINAGE AREA IN KENTUCKY (sq. mi.)
Mississippi River	> 1.2 million	40,424 total 39,124 by Ohio River and tributaries; 1,300 by main stem and minor tributaries	Main stem and minor tributaries Mayfield Creek Obion Creek	49 (main stem) 63 60	329 436 320
Ohio River	204,000	39,124	Bayou du Chien Major tributaries Main stem and minor tributaries Barren River Rough River Pond River Nolin River Fannin Creek Rivers Fork Russell Creek North Fork South Fork Middle Fork Eagle Creek Little Creek Red River Dix River	86 (below main stem) 366 (main stem) 147 133 71 92 50 66 249 (main stem) 134 78 90 100 18 76 99	34,974 4,750 3,319 1,653 1,077 798 775 373 289 2,390 1,335 690 519 492 487 442
Green River	9,233	8,810	Main stem and minor tributaries Rockcastle River Big South Fork Burlingame River Laurel River Poor Fork Martins Fork Clover Fork Main stem and minor tributaries	289 (main stem) 57 71 63 41 52 37 73 58	3,056 294 294 289 149 118 139 1,801
Kentucky River	6,972	6,975	Main stem and minor tributaries Main stem and minor tributaries North Fork South Fork Middle Fork Eagle Creek Little Creek Red River Dix River	62 (main stem) 267 (main stem) 68 58 62 68 62 58	2,348 2,344 308 308 308 308 308 308
Cumberland River	17,913	5,180 Upper Cumberland	Main stem and minor tributaries Rockcastle River Big South Fork Burlingame River Laurel River Poor Fork Martins Fork Clover Fork Main stem and minor tributaries	159 (main stem) 159 62 37 26 (main stem) 127 94 94	1,450 1,450 284 262 262 72 778 265
Licking River	3,712	2,040 Lower Cumberland	Main stem and minor tributaries Main stem and minor tributaries North Fork Slate Creek	63 (main stem) 65 (main stem) 86 (main stem) 36	572 154 572 340
Salt River	2,920	2,920	Main stem and minor tributaries Levisa Fork Floodgates Floodgates Floodgates	63 (main stem) 67 65 65	678 678 678 678
Big Sandy River	4,288	2,290	Main stem and minor tributaries Main stem and minor tributaries Clarks River Clarks River Main stem and minor tributaries East Fork	88 (main stem)	340
Tennessee River	40,879	1,040	Main stem and minor tributaries		
Tradewater River	943	943	Main stem and minor tributaries		
Little Sandy River	726	726	Main stem and minor tributaries		
Tygart Creek	340	340	Main stem and minor tributaries		

* "Length" is length of stream section bearing that name. For example, the given length of Elkhorn Creek is for that section downstream from the junction of North Elkhorn Creek and South Elkhorn Creek, which merge to form Elkhorn Creek.

Primary sources: Carvey, Daniel I. Catalog of hydrologic units in Kentucky. Kentucky Geological Survey 2003. Online at: <http://kgsweb.uky.edu/download/drivers/CATHTUCS.pdf>;

U.S. Geological Survey, Hydrology of Kentucky. Online at: <http://kygonnet.ky.gov/kyhydro/viewer.htm>

U.S. Geological Survey, High Resolution National Hydrography Dataset (by Basin) Coverage Area. Kentucky. Online at: <http://www.uky.edu/KGS/gis/kyhucspic.htm>

Dr. Steven Parkansky, Morehead State University; and

Erik Siegel, Kentucky Environmental Quality Commission

MAJOR LAKES & DAMS

LAKE	COUNTY LOCATION	STREAM IMPOUNDED	AREA (Acres)*	SHORELINE (Miles)*	DAM	DAM HEIGHT & WIDTH (Feet)	WHEN CONSTRUCTED	GENERATING CAP (kwh/year)
Kentucky Lake	Calloway, Lyon, Marshall, Trigg	Tennessee River	160,300 total 51,000 Kentucky	2,064 total	Kentucky Dam	206 by 8,422	1938 - 1944	1.3 billion
Lake Cumberland	Clinton, Laurel, Pulaski, Russell, Wayne	Cumberland River	50,250	1,085	Wolf Creek Dam	258 by 5,736	1941 - 1943; 1946 - 1950	800 million
Lake Barkley	Caldwell, Livingston, Trigg	Cumberland River	57,920 45,600 Kentucky 10,000	1,004 total	Barkley Dam	157 by 10,180	1959 - 1964	582 million
Barren River Lake	Allen, Barren, Monroe	Barren River	10,000	300	Barren River Lake Dam	148 by 1,272	1961 - 1964	
Cave Run Lake	Bath, Menifee, Morgan, Rowan	Licking River	8,270	168	Cave Run Lake Dam	148 by 2,700	1969 - 1974	
Green River Lake	Adair, Casey, Taylor	Green River	8,210	250	Green River Dam	141 by 2,350	1964 - 1969	
Nolin River Lake	Edmonson, Grayson, Hart	Nolin River	5,795	172	Nolin Dam	166 by 980	1959 - 1963	
Laurel Lake	Laurel, Whitley	Laurel River	5,600	192	Laurel Dam	282 by 1,420	1964 - 1974	67 million
Rough River Lake	Breckinridge, Grayson, Hardin	Rough River	5,100	220	Rough River Dam	132 by 1,590	1955 - 1958	
Dale Hollow	Clinton, Cumberland	Obey River	27,700 total 4,933 Kentucky	620 total 112 Kentucky	Dale Hollow Dam	200 by 1,717	1942 - 1943	127 million
Taylorville Lake	Anderson, Nelson, Spencer	Salt River	3,050	75	Taylorville Lake Dam	163 by 1,280	1982 - 1983	
Lake Harrington	Boyle, Mercer, Garrard	Dix River	2,335	325	Dix Dam	287 by 1,080	1923 - 1925	
Yatesville Lake	Lawrence	Blaine Creek	2,242	93	Yatesville Dam	109 by 760	1984 - 1991	
Grayson Lake	Cartter, Elliot	Little Sandy River	1,512	74	Grayson Dam	120 by 1,460	1965 - 1968	
Buckhorn Lake	Leslie, Perry	Middle Fork, Kentucky River	1,230	65	Buckhorn Lake Dam	162 by 1,020	1956 - 1961	
Fishtrap Lake	Pike	Russell Fork	1,131	43	Fishtrap Lake Dam	195 by 1,000	1962 - 1968	
Dewey Lake	Floyd	John's Creek	1,100	52	Dewey Dam	118 by 920	1946 - 1949	
Paintsville Lake	Johnson, Morgan	Paint Creek	1,139	57	Paintsville Dam	160 by 1,660	1976 - 1980	
Lake Malone	Logan, Muhlenberg, Todd	Rocky Creek	826	30	Mud River MPS No. 51	56 by 610	1959 - 1961	
Cedar Creek Lake	Lincolin	Cedar Creek	762	23	Cedar Creek Dam	86 by 2110	2000 - 2002	
Lake Beshar	Caldwell, Christian	trib. Tradewater R.	710	24	Beshar Lake Dam	38 by 550	Completed 1962	
Carr Creek Lake	Knott	Carr Creek	760	24	Carr Creek Dam	130 by 720	1966 - 1978	
Wood-Creek Lake	Laurel	Wood-Creek	672	33.8	Wood-Creek Dam	163 by 900	Completed 1968	
Martin's Fork Lake	Harlan	Martin's Fork	340	10	Martina Fork Dam	87 by 504	1973 - 1978	
Gust Creek Lake	Shelby	Gust Creek	325	27	Gust Crk Lake Dam	60 by 1010	Completed 1961	
Williamstown Lake	Grant	Grassy Creek	300	13.5	Williamstown Lake Dam	55 by 680	Completed 1956	
Lake Linnville	Rockcastle	Renfro Creek	273	8.2	Renfro Lake Dam	72 by 1100	Completed 1978	
Cannon Creek Lake	Bell	Cannon Creek	243	7.7	Cannon Crk Lake Dam	125 by 900	Completed 1972	
Cranks Creek Lake (Herb Smith Lake)	Harlan	Cranks Creek	219	9	Granite Crk Lake Dam	120 by 635	Completed 1983	
Kincaid Lake	Pendleton	Kincaid Creek	183	12.5	Kincaid Lake Dam	51 by 480	Completed 1981	
Greenbo Lake	Greenup	Claylick Creek	181	7.6	Greenbo Lake Dam	70 by 570	1954 - 1955	

*Acres and shoreline vary according to pool elevation of lakes. Figures represent summer pool.

Compiled by Gary A. O'Dell

Primary sources: U.S. Army Corps of Engineers, Kentucky Division of Water, Kentucky Department of Fish and Wildlife Resources, Kentucky Department of Parks

This image shows the Teays River drainage that existed before the Ohio River.

Source: Emporia State University, Kansas, Earth Science Dept.

