

# Appendix D: Environmental Assessment



**US Army Corps  
of Engineers**  
Louisville District

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**Environmental Assessment for the  
Disposition of Green River Lock and Dam  
Nos. 3, 4, 5, 6 and Barren River Lock and Dam No. 1**



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## **1.0 INTRODUCTION**

The facilities at Green River Lock and Dam Nos. 3 through 6, and Barren River Lock and Dam No. 1 (figures 1 through 5) in west central Kentucky are no longer being operated for commercial navigation. Decline in commercial navigation and continued deterioration at the facilities led to the failure of Green River Dam No. 4 and loss of the navigation pool in 1965. All navigation upstream of Green River Lock and Dam No. 3 was discontinued with its closure in 1981.

The Louisville District, U.S. Army Corps of Engineers (USACE) completed a study in 1993 that analyzed the feasibility of facility improvements along the Green and Barren rivers. The study concluded that there were insufficient economic benefits from commercial navigation to support any improvements. The USACE is currently considering disposal of Federal interests in the facilities at Green River Lock and Dam Nos. 3 through 6, and Barren River Lock and Dam No. 1. As required by the National Environmental Policy Act (NEPA), the USACE is evaluating the impacts associated with several alternatives of disposal. This Environmental Assessment (EA) evaluates environmental impacts associated with all alternatives, including the No-Action Alternative.

### **1.1 Description of the Proposed Action**

The proposed action is Federal Government disposal of Federally owned properties at Green River Lock and Dam Nos. 3 through 6, and Barren River Lock and Dam No. 1. These locks and dams have are no longer operated for the purpose of commercial navigation. Specifically, the following properties are included in the Proposed Action:

#### Green River Lock and Dam No. 3

Located at Green River Mile 108.5 near Rochester in Ohio and Muhlenberg Counties, Kentucky, this lock was closed to navigation in September 1981. Land owned by the Federal Government at Green River Lock and Dam No. 3 includes 4.99 acres in Muhlenberg County, and 6.72 acres located in Ohio County. Improvements at the site include a gravel parking lot on the left descending bank, and remains of a brick dwelling and two metal sheds.

#### Green River Lock and Dam No. 4

Located at Green River Mile 149.0 at Woodbury, Butler County, Kentucky this lock and dam was closed to navigation when the dam failed on May 24, 1965, resulting in the loss of the majority of the pool; however, because some of the dam remains, some pooling still occurs here. Land owned by the Federal Government at this site includes 0.01 acres in Butler County, which supports a USGS gauging station.

#### Green River Lock and Dam No. 5

Located at Green River Mile 168.1 in Butler County, Kentucky, near the Hart County line, operation of this lock and dam ceased on August 31, 1951. Land owned by the Federal Government at Green River Lock and Dam No. 5 includes 27.064 acres along the right descending bank in Butler County, and 5.21 acres along the left descending bank in Warren County. Remains of old structures (sidewalks, remnant structures, stairs, etc.) are evident on-site. Remaining structures at this site include the old operations control house.

#### Green River Lock and Dam No. 6

Located at Green River Mile 181.7 near Brownsville, Edmonson County, Kentucky, operation of this lock and dam ceased on August 31, 1951. Land owned by the Federal government at Green River Lock and Dam No. 6 includes 18 acres along the right descending bank, and 4.19 acres along the left descending bank, both in Edmonson County. Remaining improvements to the site consist of a USGS gauging station located on the right descending bank.

#### Barren River Lock and Dam No. 1

Located at Barren River Mile 15.0 near Richardsville, Warren County, Kentucky, this lock was closed to navigation as a result of the loss of the lower pool associated with the failure of Green River Dam No. 4. Land owned by the Federal government at this site includes 16.63 acres along the right descending bank only. The only structure remaining aside from the lock and associated structures is the operations control house.

## **1.2 Purpose and Need**

The purpose of the project is to dispose of Federal interests at Green River Lock and Dam Nos. 3, 4, 5, and 6 and Barren River Lock and Dam No. 1. The need for disposition is due to the absence of any continued authorized project purpose. This study also supports the objectives of the 10 June 2010 Presidential Memorandum 'Disposing of Unneeded Federal Real Estate'. This EA evaluates the impacts associated with the action alternatives and the No-Action Alternative, within the existing legislative authorities as they may relate to the above referenced locks and dams.



**Figure 1a.** Green River Dam No. 3 (2011)



**Figure 1b.** Green River Lock No. 3 (2011)



**Figure 2a.** Breached Green River Dam No. 4 (2011)



**Figure 2b.** Green River Lock No. 4 (2011)



**Figure 3a.** Green River Lock No. 5 (2011)



**Figure 3b.** Green River Dam No. 5 (2013)



**Figure 4.** Green River Lock and Dam No. 6 (2011)



**Figure 5a.** Barren River Lock No. 1 (2011)



**Figure 5b.** Barren River Dam No. 1 (2011)

## **2.0 ALTERNATIVES**

Existing conditions vary at each of the lock and dam sites due to factors including, but not limited to: age and physical condition of the structures, plant growth and build-up of sediment, and the current and planned future use of the pool. Because of this site-to-site variation, each lock and dam was essentially evaluated as a standalone project and the preferred alternatives differ between sites.

### **2.1 Alternative 1 (No Action)**

With this alternative, the lock and dam would remain in Federal ownership with caretaker status. The Louisville District's Operations Division would remain responsible for these facilities. At present, the District spends approximately \$10,000 per year for all of the sites to inspect the properties and maintain "No Trespassing" signage. While trespassing is prohibited, there is ample evidence that the sites are frequently used, even those that are relatively remote. With a "no action" alternative, this would likely remain the case.

A “no action” alternative would mean that the Federal government would retain ownership and responsibility for the properties. No alterations would be done to the facilities. The District would continue in caretaker status, maintaining “No Trespassing” signage and periodically inspecting the properties.

## **2.2 Alternative 2 (Disposal of Federal Ownership after installation of barricades)**

With this alternative, the properties would be disposed of without any permanent alterations to the lock and dam structures. However, in order to deter access to the river side lock wall, the upstream and/or downstream miter gates would be gated off with barricades on the land side miter gates. Sites would be collectively and individually evaluated for fan gate installation. The Louisville District would remain responsible for the properties up to the point at which the ownership is transferred. Any action necessary to complete the real estate transfer would be included, but no construction is included in this alternative.

## **2.3 Alternative 3 (Disposal of Federal Ownership after Dam Removal and Lock Stabilization)**

With this alternative, the dams would be removed and the locks would be stabilized before disposal. At each site, locks would be filled with materials from the demolition of the dam. Sites would be evaluated for removal both collectively and individually. Some of the lock and dam sites are in remote and undeveloped areas, making the insertion of floating equipment from the bank difficult due to unimproved roads. Additionally, the dams do not provide sufficient depth of water for some modern equipment, which may lead to a need to use specialized equipment in order to work from floating platforms. Due to the difficulties perceived with using floating equipment as is typical in marine construction, it was assumed the work at any of the locks and dams would have to be done from a temporary construction embankment. The embankment would consist of dumped stone to build a raised access road and work platform in the river from which equipment could work. Demolition of the existing structures could then proceed. The demolition would most likely be accomplished by blasting, or by mechanical excavation equipment such as track hoes, clamshell excavation, etc, or a combination of blasting and excavation. Material could be loaded into trucks via the temporary access embankment and then taken and disposed of by placing it in the lock chamber or dumping it off site. After the dam removal is accomplished, the property would be disposed through normal GSA and Corps of Engineers procedures.

Pool level changes expected as a result of Alternative 3 (full dam removal would result in identical pool level changes) are listed in Table 1. Pool elevations are expressed in feet above mean sea level.

**Table 1. Changes in Pool Elevations with the Removal of Green River Dams Nos. 3 through 6, and Barren River Dam No. 1**

<b>Lock and Dam Pool</b>	<b>Existing Average Pool Elevation</b>	<b>New Average River Elevation</b>	<b>Net Change</b>
Barren River No. 1 (River Mile 18)	413	394	19 feet
Green River No. 3 (River Mile 120)	382	369	13 feet
Green River No. 4* (River Mile 160)	398	387	11 feet
Green River No. 5 (River Mile 174)	413	396	17 feet
Green River No. 6 (River Mile 186)	423	410	13 feet

\*Existing pool elevation is given for before the dam failed. The actual net change at this location will be significantly less than that expressed.

Sources: Engineering Appendix, *Green and Barren Rivers Locks and Dams – Reconnaissance Disposition Study*, U.S. Army Corps of Engineers.

After initial evaluations, it was determined that Green River Dam No.6 is the only dam considered for removal. The removal of Green River Dam Nos. 3 and 5 would adversely affect municipal water supply intakes, and were therefore dismissed from consideration for removal. Removal of Barren River Dam No. 1 would not impact current water supply facilities; however, there is high potential for the pool to be used by the City of Bowling Green, KY as a source of water supply. For this reason, Barren River Dam No. 1 will no longer be considered for removal. Therefore, from this point, only removal of Dam No. 6 will be evaluated in this EA.

#### **2.4 Alternative 4 (Disposal of Federal Ownership after Lock Modification)**

With this alternative, the locks would be modified before disposal but the dams would be left undisturbed. As with the other alternatives, sites would be evaluated for modification both collectively and individually to ensure the most practical project is implemented. Similar to Alternative 3, locks would be filled to stabilize gates and eliminate falling hazards; however, they would be filled with riprap brought from an offsite location since the dams would be kept in place.

Riprap would also be placed around the outside of the lock chamber in order to eliminate the vertical condition at that location. Additionally, at Green L&D 3, the upstream miter gates were not fully mitered and pool was being held by the downstream miter gates. However, to maintain pool for long term consideration, a concrete plug would be placed against the upstream face of the upstream miter gates.

### **3.0 ENVIRONMENT SETTING**

#### **3.1 General Characteristics**

The Green River Basin is located in west-central Kentucky and extends into north-central Tennessee. The largest of the twelve river basins in Kentucky, the Green River Basin encompasses approximately 9,230 square miles and drains all or portions of thirty-one counties in Kentucky and four counties in Tennessee. The Green River, originating in Lincoln and Casey counties, Kentucky, flows in a northwesterly direction for 330 miles to its confluence with the Ohio River near Evansville, Indiana. Elevations range from over 1,050 feet at the source to approximately 337 feet at the Ohio River pool. Averaged river gradient is 1.9 feet per mile and ranges from four feet per mile at the initial reach to 0.25 feet per mile where it enters the Ohio River. The portion of the Green River that traverses the Mammoth Cave National Park has been designated an Outstanding Resource Water and a Kentucky Wild River by the Kentucky Division of Water (Schuster, 1996).

The Barren River, which is the largest tributary of the Green River, begins in Monroe County, Kentucky, and flows northwesterly 158 miles to its confluence with the Green River at Green River Mile 149.5. The Barren River drains an area of approximately 2,141 square miles. Average river gradient in the Barren River is approximately 1.6 feet per mile. Other tributaries of the Green River include Rough River, Bear Creek, Nolin River, Pond River, and Mud River.

The study area encompasses the portion of Ohio, Muhlenberg, Butler, Warren, and Edmonson Counties that are directly affected by the pools of Green River Lock and Dam Nos. 3 through 6, and Barren River Lock and Dam No. 1 (including affected terrestrial habitat). The Western Coal Field and the Mississippi Plateau regions make up the majority of the physiographical regions of the study area. A majority of the study area lies within the Western Coal Field region that is characterized by gently rolling uplands and broad flood plains up to three miles wide. The remainder of the study area is characterized by undulating limestone uplands and moderately wide floodplains. Approximately 95 percent of the Green and Barren river basins are either used for agriculture or are forested. Agricultural crops include tobacco, corn, and wheat on the high quality soils in floodplain areas. Forests are mainly composed of secondary oak-hickory forest, with ash,

poplar, sugar maple, and elm as associated species. Although clearing has eliminated the majority of the virgin forests in the area, small tracts classified as near original vegetation may be found in the region, specifically in Mammoth Cave National Park. Forested, scrub-shrub, and emergent wetlands are found in the lower portion of the study area. Black willow, baldcypress, swamp and eastern cottonwood, oaks, river birch, and silver maple occur in the wetland areas in the western portion of the project area.

### **3.2 Land Use**

In general, land uses adjacent to the Green River and Barren River within the study area are rural, undeveloped woodland, agriculture, and small urban and industrial areas.

#### **3.2.1 Green River Lock and Dam No. 3**

Land owned by the Federal Government at Green River Lock and Dam No. 3 includes 4.99 acres in Muhlenberg County, and 6.72 acres located in Ohio County. Improvements at the site include a gravel parking lot on the left descending bank, and remains of a brick dwelling and two metal sheds. Adjacent land use is agriculture and residential. The northern portion of the property is undeveloped woodland. Recreational use of the Green River upstream of Lock and Dam No. 3 is evident, based on the presence of pleasure craft. Commercial fishing is also conducted in the pool above Green River Lock and Dam No. 3 (personal communication, John Spear, January 26, 2000).

#### **3.2.2 Green River Lock and Dam No. 4**

Land owned by the Federal Government at this site includes 0.01 acres in Butler County, which supports an U.S. Geological Survey (USGS) gauging station. The dam at Green River Lock and Dam No.4 was breached on May 24, 1965, and barge traffic in this area of the Green River was closed. Land use adjacent to this site includes the former lock and dam site, a residential community, and pastureland. The portion of the Green River adjacent to this site can accommodate light pleasure craft and is used for recreation.

#### **3.2.3 Green River Lock and Dam No. 5**

Land owned by the Federal Government at Green River Lock and Dam No. 5 includes 27.064 acres along the right descending bank in Butler County, and 5.21 acres along the left descending bank in Warren County. Remains of old structures (sidewalks, remnant structures, concrete stairs, etc.) are evident on-site. Remaining structures at this site include the old operations house. Lock and Dam No. 5 was de-activated on August 31, 1951. Adjacent land use on the right descending bank is residential, pastureland, undeveloped woodland; timber production, residential, and pastureland are

present on the left descending bank. Recreational use by fisherman upstream and downstream of Lock and Dam No. 5 is extensive.

#### 3.2.4 Green River Lock and Dam No. 6

Land owned by the Federal government at Green River Lock and Dam No. 6 includes 18 acres along the right descending bank and 0.83 acres along the left descending bank, both in Edmonson County. Remaining improvements to the site consist of a USGS gauging station located on the right descending bank. Adjacent land uses include pastureland, undeveloped timberland, and a single residential site along the right descending bank. Land use along the left descending bank is undeveloped timberland owned by the National Parks Service, pasture land, and light residential. Recreational use is extensive in this area. The pool of Lock and Dam No. 6 extends into the Mammoth Cave National Park. Several canoe liveries operate in this area, as well as a concessionaire tour boat operator.

#### 3.2.5 Barren River Lock and Dam No. 1

Land owned by the Federal government at this site includes 16.63 acres along the right descending bank only. Aside from the lock and associated structures, the only structure remaining is the operations house. Adjacent land use is light residential, pastureland, and agriculture on the right descending bank, and undeveloped woodland along the left descending bank.

### **3.3 Infrastructure**

All locks and dams are accessible by either improved or unimproved roads (see location maps in main report).

#### 3.3.1 Green River Lock and Dam No. 3

The 4.99-acre tract (left descending bank) in Muhlenberg County lies alongside Kentucky Highway 70. The site consists primarily of an improved gravel parking lot. The 6.72-acre tract (right descending bank) in Ohio County is accessed by taking an unnamed improved road directly north of the Green River west from Kentucky Highway 369. Neither tract is fenced or gated. Overhead electrical power lines traverse the 6.72-acre tract. No utilities were observed at the 4.99-acre tract.

#### 3.3.2 Green River Lock and Dam No. 4

The site is accessed by Kentucky Highway 403/263 and consists of a 0.01-acre USGS gauging station. Underground electrical utilities are present at the site. No other utilities were observed.

#### 3.3.3 Green River Lock and Dam No. 5

This site is located near Butler and Warren counties, 168.1 miles above the mouth of the Green River, and is accessed by Kentucky highways 185 and 67. Both tracts are fenced, but neither is

gated. Overhead electrical power lines cross the 27.064-acre tract (right descending bank). No utilities were observed at the 5.21-acre tract (left descending bank).

#### 3.3.4 Green River Lock and Dam No. 6

This site is located just upstream of Brownsville, Edmonson County, 181.7 miles above the mouth of the Green River, and is accessed by Kentucky Highway 259. The 18-acre tract on the right descending bank is fenced on the north and west, but not on the south. The 0.83-acre site (left descending bank) is not fenced. Utilities observed on the 18-acre tract include overhead electrical service for the gauging station. An underground telephone line also appears to transit the site. No utilities were observed on the left descending bank.

#### 3.3.5 Barren River Lock and Dam No. 1

The 16.63-acre site is accessed by taking Greencastle-Richardsville Road west from Kentucky Highway 263. Entrance to the site is by a gated dirt road that proceeds south and west from a boat ramp and parking lot adjacent to Taylor Creek. The site is not fenced but the access road is gated. Overhead electrical service transits the site along the access road. No other utilities were noted during the field investigation.

### **3.4 Socioeconomic**

The study area consists of five counties in western Kentucky; Butler, Edmonson, Muhlenberg, Ohio, and Warren. The locks reviewed in this assessment have not been operated for many years. Lock No. 3 was last operated in 1981, Dam No. 4 failed in 1965, and the other locks have not been operated since 1951.

The City of Bowling Green, in Warren County is the only city with the Metropolitan Statistical Area (MSA) status within the study area. Also within the study area is Mammoth Cave National Park, the most popular tourist attraction in Kentucky. Of the 342 National Park Service (NPS) sites that report visitation, Mammoth Cave National Park ranked 114<sup>th</sup> in the number of visits in 2012, the latest year that comparable visitation figures were available. That year, Mammoth Cave National Park reported over 508,000 visits- 0.18% of total National Park visits.

#### 3.4.1 Population

Historical population figures for each county, the largest city in each county, and the Commonwealth of Kentucky are shown in Table 2. The population in the study area grew 11.6 percent between 2000 and 2010. The population of the study area is forecasted to grow another 5 percent by 2015. The growth rate of the study area is lower than the Commonwealth of Kentucky in all periods.

The five counties in the study area have a land area of 2,354 square miles, or about six percent of the Kentucky land area. In 2010, the study area had a population density of 82.6 people per square mile, while Kentucky had a population density of 109.4 people per square mile. This population density reflects the rural character of the study area. The only urban area in the study area is the City of Bowling Green (2010 population of 57,203) which is on the Barren River.

The median age of the population is higher than the statewide average in every county except Warren County.

The towns on the Green River in the study area are Morgantown (2012 estimated population -- 2,463), Woodbury (2012 estimated population -- 91), and Rochester (2012 estimated population -- 154) in Butler County; Rockport (2012 estimated population -- 269) in Ohio County; and Brownsville (2012 estimated population -- 831) in Edmonson County.

### 3.4.2 Employment

The size of the labor force and unemployment figures for each county is shown in Table 3. The civilian labor force in the study area increased between 1990 and 2012 by 20.1 percent. The unemployment rate in Butler and Muhlenberg counties decreased during the same period. The decrease in Butler County was 0.1 percent, while unemployment in Muhlenberg County dropped 0.9 percent. The unemployment rate in Kentucky increased by 1.7 percent during the same period. Muhlenberg County is currently the only county in the study area with an unemployment rate lower than the statewide average.

Employment in the study area is diverse, and when measured by category it is similar to the employment distribution of Kentucky. Table 4 shows employment for each county in each category. Manufacturing, educational/ health care services, and government jobs dominant in the study area.

**Table 2. Population, Land Area, and Median Age Green River Study**

<b>Kentucky County (Largest City)</b>	<b>Land Area (Square Miles)</b>	<b>2000 Pop.</b>	<b>2005 Pop. Est.</b>	<b>2010 Pop.</b>	<b>% Pop. Change 2000-2010</b>	<b>2015 Pop. Forecast</b>	<b>% Pop. Change 2000-2015</b>	<b>1990 Median Age</b>	<b>2012 Median Age</b>
Butler	431	13,010	12,900	12,714	-2.3	12,658	-2.7	34.4	40.3
(Morgantown)		(2,000)	(2,284)	(2,515)					
Edmonson	302	11,644	11,987	12,171	4.3	12,429	4.3	34.8	41.7
(Brownsville)		(674)	(897)	(952)					
Muhlenberg	478	31,839	31,595	31,493	-1.1	31,548	-0.9	34.8	41.0
(Central City)		(5,214)	(5,074)	(4,878)					
Ohio	596	22,916	23,611	23,818	3.8	24,362	5.9	35.0	39.0
(Beaver Dam)		(3,185)	(2,904)	(2,882)					
Warren	547	92,522	102,121	114,172	19	125,085	26.0	31.2	32.7
(Bowling Green)		(40,450)	(41,688)	(57,203)					
Study Area Total	2,354	171,931	182,214	194,368	11.6	206,082	16.6		
State of Kentucky	39,669	4,068,132	4,182,742	4,339,367	6.3	4,522,468	10.1	33.0	38.0

Source: Census Bureau, U.S. Department of Commerce.

**Table 3. Labor Force and Unemployment Green River Study**

<b>County</b>	<b>1990 Civilian Labor Force</b>	<b>1990 Unemployment Rate</b>	<b>1996 Civilian Labor Force</b>	<b>1996 Unemployment Rate</b>	<b>2012 Civilian Labor Force</b>	<b>2012 Unemployment Rate</b>
Butler	5,471	10.6%	5,670	7.5%	5,487	10.5%
Edmonson	4,329	9.1%	4,783	10.2%	5,386	10.2%
Muhlenberg	12,861	8.7%	12,025	8.5%	12,760	7.8%
Ohio	8,761	8.3%	9,724	8.8%	9,906	9.5%
Warren	43,090	7.1%	47,948	6.2%	59,676	9.5%
Study Area Totals	74,512	7.9%	80,150	7.2%	93,215	9.6%
State of Kentucky			1,864,635	5.6%	2,054,159	9.5%

Source: Census Bureau, U.S. Department of Commerce and the Commonwealth of Kentucky Department of Employment Services.

**Table 4. Covered Employment By Industrial Division  
2010 U.S. Census Bureau**

<b>County</b>	<b>All</b>	<b>Mining/ Agriculture/ Logging</b>	<b>Construction</b>	<b>Manuf.</b>	<b>Transp./ Utilities</b>	<b>Retail Trade</b>	<b>Finance/ Insurance/ Real Estate</b>	<b>Educational / Health Care Services</b>	<b>Gov.</b>
Butler	4,913	178	646	1,405	319	143	165	877	643
Edmonson	4,840	99	471	856	235	539	306	1,137	849
Muhlenberg	11,764	626	800	1,424	951	1,718	260	3,268	2,638
Ohio	8,960	618	692	2,190	463	1,199	246	1,632	1,498
Warren	53,996	854	3,127	8,712	2,177	7,214	2,087	10,746	9,346
Study Area	72,709	2,375	5,736	14,587	4,145	10,813	3,064	17,660	14,974
Study Area		3.2%	7.9%	20.16%	5.7%	14.9%	4.2%	24.3%	20.6%
State of Kentucky	1,859,549	54,555	116,740	254,467	111,861	218,316	102,186	448,716	289,489
State of Kentucky		2.9%	6.3%	13.7%	6.0%	11.7%	5.5%	24.1%	15.6%

Source: U.S. Census Bureau

### 3.4.3 Income

Table 5 shows per capita personal income, persons below poverty level, and median household income for each county. In 2012 the counties in the study area have per capita personal income ranging from \$17,607 in Butler County to \$23,537 in Warren County. The highest percentage increase since 2000 was 36.3 percent in Muhlenberg County and the lowest was 20.2 percent in Ohio County. Meanwhile, average per capita personal income in Kentucky in 2012 was \$23,210 with growth of 31 percent since 2000.

The 2012 poverty levels in the study area ranged from 18.9 percent of persons in Edmonson and Warren Counties to 22.7 percent of persons in Butler County. The 2012 Kentucky poverty level was 18.6 percent of persons. Between 2000 and 2012, the poverty level in all counties in the study area, except Muhlenberg County, increased along with the poverty level in Kentucky which increased by 0.5 percent. The poverty level declined by 0.4 percent in Muhlenberg County.

The median household income increased in the study area between 2000 and 2012 ranged from 20.4 percent in Warren County to 50.5 percent in Edmonson County. The statewide median household income increase during the same period was 32.1 percent.

## **3.5 Water Quality**

### 3.5.1 Surface Water

During calendar year 2011, Kentucky Division of Water (DOW) focused monitoring activities on the Green River Basin Management Unit (BMU). These activities included probabilistic stream monitoring, reference reach monitoring, fish tissue collection, lake and large river monitoring, sampling for Chlorophyll-a in rivers and testing for ambient water quality. These data will be included in the DOW 2014 Integrated Report..

Two of these monitoring stations are located on Green River, one at Munfordville in Hart County, upstream of all the project sites on the Green River, and one at Livermore in McLean County, downstream of the project sites on that river. Another monitoring station is located on the Barren River, upstream of Lock and Dam No. 1 near Bowling Green in Warren County.

**Table 5. Per Capita Income, Poverty Level, and Median Family Income Green River Study**

County	Per Capita Personal Income				Percent of Persons Below Poverty Level			Median Household Income			
	1997 (Dollars)	2000 (Dollars)	2012 (Dollars)	2000-2012 Change	1995	2000	2012	1995	2000	2012	2000-2012 Change
Butler	14,843	14,617	17,607	20.4%	20.8%	16%	22.7%	23,501	29,405	36,237	23.2%
Edmonson	13,211	14,480	18,775	29.7%	21.2%	18.4%	18.9%	22,661	23,413	35,243	50.5%
Muhlenberg	15,893	14,798	20,173	36.3%	19.6%	19.7%	19.3%	24,158	28,566	38,835	35.9%
Ohio	15,927	15,317	18,409	20.2%	22.1%	17.3%	20.8%	24,047	29,557	38,286	29.5%
Warren	22,254	18,847	23,537	24.9%	15.7%	15.4%	18.9%	32,131	36,151	43,509	20.4%
State of Kentucky	20,570	17,721	23,210	31%	17.9%	18.1%	18.6%	28,929	32,256	42,610	32.1%

Source: Census Bureau, U.S. Department of Commerce and the State Data Center, University of Louisville.

Using data it gathers on chemical water quality, sediment quality, fish tissue residue, habitat condition, and biotic conditions, DOW evaluates streams and rivers for their support of four important uses of these waterways; aquatic life, swimming, drinking water, and fish consumption. In accordance with the Clean Water Act, Section 303(d), Kentucky has developed use support data for each stream monitored. These data are presented in the DOW report called the List of Waters. The purpose of this report is not only to list and prioritize impacted waters, but also to describe efforts that have been made and continue to be made to address problems in the water listed in previous 303(d) reports. The Green and Barren rivers are not included in the list of High-Priority Projects for severely impacted streams.

In May 2005, due to improvements in water quality, the DOW delisted the Barren River from RM 29.4 to RM 43.6 as “Impaired Use” stream for aquatic life and swimming for reasons of contamination by metals and pathogens. In 1998, the DOW rated water quality in the Green River in Hart, McLean, Edmonson, and Green counties as impaired for the use of swimming due to contamination by pathogens and impaired use for aquatic life and swimming in Muhlenberg County because of pH problems. Those sections in Hart and McLean counties were also delisted in May 2005 after improvements in water quality.

### 3.5.2 Groundwater

The location, availability, and quality of the groundwater within the project study area vary depending upon local geologic and hydrologic factors. According to a study completed for the USACE (1979), groundwater can be divided into two regions within the project study area. Those two regions coincide with two distinct geologic regions of south central Kentucky, the Western Coal Field and the Mississippian Plateau. The Western Coal Field, which includes the counties of Ohio, Butler, and Muhlenberg, is an area of rolling uplands and alluvial terraces of low relief. The Mississippian Plateau, which contains Edmonson and Warren counties, is a limestone area with considerable subsurface drainage.

Most groundwater found in the Western Coal Field in shallow aquifers is characterized by the presence of sodium or calcium bicarbonate, while that found in deeper aquifers is more highly mineralized with sodium chloride. Most groundwater in this region is soft to moderately hard, but may contain objectionable quantities of iron.

Groundwater of the Mississippian Plateau is generally of the calcium bicarbonate type and ranges from moderately to very hard depending upon its source. Sodium chloride and hydrogen sulfide present the major problems in waters of this region. Hydrogen sulfide can be toxic, but its strong odor usually allows for detection long before it reaches extreme levels. High levels of sodium

chloride could be a health concern for people on low sodium diets and can also interfere with taste, the watering of certain plants and may increase the corrosivity of the water and damage household plumbing.

### 3.5.3 Wells

The Kentucky Geological Society has 16 wells registered within a 3,000-foot radius of the five lock and dam installations that are subject to the proposed action. Available data on these wells is presented in Table 6.

**Table 6. Wells Within the Project Study Area**

<b>Lock and Dam</b>	<b>Number of Wells</b>	<b>Well Type</b>	<b>Total Depth</b>
Barren River No. 1 (River Mile 18)	3	2 domestic 1 abandoned	65', 25' N/A
Green River No. 3 (River Mile 120)	5	4 domestic 1 oil well	33', 75', N/A, N/A N/A
Green River No. 4 (River Mile 160)	3	3 domestic	100', 100'
Green River No. 5 (River Mile 174)	2	1 livestock 1 domestic	40' 100'
Green River No. 6 (River Mile 186)	3	3 domestic	N/A, N/A, N/A

Source: Kentucky Geological Survey.

### 3.5.4 Water Intakes

Water intakes on the Green River that are located within the project study area are shown in Table 7. The depth of the intake is given as the approximate depth below the water surface at normal summer levels.

**Table 7. Water Intakes Within the Project Study Area**

<b>Location/River Mile</b>	<b>Purpose</b>	<b>Number/Depth of Intake(s)</b>
Cromwell (Purdue Farms) River Mile 130.40	Process water	1 @ 8 feet
Cromwell (Ohio Co. Water District) River Mile 130.50	Potable water	1 @ 10 feet 1 @ 15 feet
Morgantown (Butler Co. Water District) River Mile 142.70	Potable water	1 @ 3 feet
Morgantown (City of Morgantown) River Mile 143.30	Potable water	1 @ +8 feet* 1 @ 6 feet
Brownsville (Edmonson Co. Water	Potable water	1 @ 5 feet

District)		1 @ 8 feet
River Mile 181.40		1 @ 12 feet

\*This is the high water intake. At normal low water it is approximately 8 feet above the water surface.

Source: G.E.C., 2000.

### 3.5.5 Contaminated Sources

The Nature Conservancy (TNC) study published in the *Green River Bioreserve Strategic Plan*, August 1998, pointed out contamination of both surface and groundwater in the project study area by hazardous materials is possibly from traffic accidents, businesses, homes and farms anywhere in the watershed. These materials can disperse relatively quickly through complex underground conduits underlying the watershed to contaminate underground streams and/or emerge from springs to contaminate surface streams far from the source. Because of traffic volume, and the variety and volume of materials transported, Interstate 65, other major highways, and railroads are likely sites of hazardous materials spills. In one study (Leitheuser 1988), five traffic or train accidents occurred in the vicinity of Mammoth Cave National Park between 1979 and 1985 that resulted in spills of cyanide salt, creosol, synthetic solvents, unidentified pesticides, and methyl alcohol. A 1979 accident caused mortality of aquatic cave organisms in part of the Mammoth Cave system.

Besides sudden-release sources of contamination, surface and ground waters may also be contaminated by point and non-point sources of contamination. Non-point sources within the project study area may include farming, logging, and mining operations, as well as urban runoff. Pesticides, herbicides, fertilizers, sediments/suspended solids, pathogens, petroleum products, brine, and heavy metals are among the contaminants that may result from non-point sources. Point sources may include wastewater treatment, industrial plants, mining, and storm water discharge points. Common contaminants may include chlorine, chloramines, pathogens, metals, petroleum products, organic matter, and ammonia.

### 3.6 **Air Quality**

Kentucky has operated an air quality monitoring network since July 1967. Currently, the network includes 137 monitoring stations in 35 counties. Monitoring station data is used to demonstrate compliance with and/or progress made toward meeting national ambient air quality standards (NAAQS), identify pollution trends, and to evaluate public health impacts and the possible need to initiate emergency control procedures. Of the five counties included in the study area for this

project, only Warren and Edmonson counties have established air quality monitoring stations; and, each of these two stations is monitored for only one parameter: acid rain (for which there is no NAAQS) in Edmonson County (which is one of only two monitoring stations in the state for this parameter) and particulate matter in Warren County.

Kentucky monitors for acid rain but because there are no national standards for this parameter the measurements from the Edmonson County station have no effect on state or regional air quality compliance with the NAAQS. Acid rain measurements in Edmonson County are taken at Mammoth Cave National Park where an automatic wet/dry precipitation collector is used to collect cumulative precipitation events occurring during a seven-day period. During the last year reported by KDEP, 1998, four measurements were taken from samples collected at this site. The pH measurements recorded for precipitation collected at Mammoth Cave National Park were: 3.70, 3.73, 3.79, and 3.92. Compared to the pH of normal rain, 5.6, these levels are more acidic.

Particulate matter is a broad classification of non-gaseous pollutants that consists of very fine solid particles and liquid droplets and aerosols. The average for PM<sub>2.5</sub> [particles less than or equal to 2.5 microns (µm) diameter] taken at the Warren County monitoring stations in 2013 were 39 and 76 micrograms per cubic meter (µg/m<sup>3</sup>) (Kentucky Division of Air Quality Fiscal Year 2013 Annual Report). These were well below the NAAQS maximum of 150 µg/m<sup>3</sup>.

### **3.7 Noise**

The Commonwealth of Kentucky does not have a statewide noise law. The Department for Natural Resources and Environmental Protection, Division of Air Quality, is responsible for noise control and abatement. Green River Lock and Dam Nos. 3 through 6 and Barren River Lock and Dam No. 1 are located outside of major metropolitan areas with high noise producing facilities. No significant noise producing operations remain in effect at these facilities. The only source of noise at the facilities is that of water flowing over the dams.

### **3.8 Hazardous/Toxic Materials**

In February 2000, an environmental baseline survey (EBS) was performed in to determine the possibility that the sites have been contaminated by hazardous, toxic, or radioactive wastes (HTRW); or, that the potential exists for contamination by such materials. The EBS was confined to those portions of the lock and dam properties that remain in Federal Government ownership. Site visits in December 2013 confirmed the findings of the EBS which are summarized in the following subsections.

### 3.8.1 Polychlorinated Biphenyls

One pole-mounted electrical transformer, located at Green River Lock and Dam No. 6, appears to be marked with a polychlorinated biphenyl (PCB) warning label. Based on a visual inspection of the transformer from the ground, it seems to be in good condition with no leakage of oil observed.

### 3.8.2 Petroleum Products/Petroleum Derivatives

In 2000, hydraulic oil stains were observed in the operations buildings and at several locations in the lock chambers at Green River Lock and Dam No. 5, and Barren River Lock and Dam No. 1. The stains appear to be the result of vandalism to the hydraulic piping system, e.g. bullet holes in exposed pipes. Some hydraulic oil has been released to the environment. On the December 2013 site visit, there was no longer any evidence of hydraulic oil leaks. It is likely all petroleum products have since leaked from the existing infrastructure since the locks were taken out of operation. No other petroleum products or petroleum derivatives were found at the other locks and dams during the survey.

### 3.8.3 Lead

Chipped, cracked, and flaked paint was observed at all locks and dams within the project area. The paint was on fittings associated with the locks and on various structures that remain on-site. No samples were taken to determine if a hazard to human health exists, however, based on the age of the structures, it seems likely that lead-based paint (LBP) is present at all locks and dams within the project area.

### 3.8.4 Asbestos

Possible asbestos containing material (ACM) in the form of ceiling tiles and other materials was observed in the structures remaining at Green River Lock and Dam No. 3. No samples were taken to confirm the presence of ACM. No other potential ACM was observed at the other locks and dams within the study area.

## **3.9 Biological Resources**

The Green and Barren River basins provide exceptional habitat for a variety of terrestrial and aquatic communities. The banks of the Green and Barren rivers support riparian vegetation, which when combined with the adjacent forested land, varies in width from approximately 30-feet to several thousand feet. This riparian zone provides nesting, roosting, and foraging habitat for large and small mammals, birds, reptiles and amphibians; helps to maintain stable water temperatures; provides a source of detritus; reduces shoreline erosion; and serves as a buffer zone between the rivers and adjacent upland forests.

### 3.9.1 Terrestrial Fauna

A variety of large and small mammals occurs within the study area. Typically, species composition is that which is associated with eastern hardwood forests, slope forests, and wet bottomland hardwoods. Mammalian fauna within the study area include, but are not limited to, white-tailed deer, red fox, gray fox, raccoon, opossum, woodchuck, beaver, eastern cottontail rabbit, spotted skunk, mice, chipmunks, gray squirrel, and fox squirrel. Over 200 bird species occur within the study area (USWFS, 2013). Game species include bobwhite quail, mourning dove, woodcock, eastern wild turkey, and waterfowl. Other birds within the study area include whippoorwills, owls, hawks, warblers, eastern blue bird, cardinal, blue jay, woodpeckers, Carolina wren, and various other songbirds.

Reptiles and amphibians found within the project area include the hellbender, spotted salamander, green frog, snapping turtle, eastern box turtle, red-ear slider, ringneck snake, eastern hognose snake, and northern water snake.

Karst features within the study area provide habitat for cave-dwelling species such as the Federally endangered gray bat (*Myotis grisescens*) and Indiana bat (*M. sodalis*).

### 3.9.2 Aquatic fauna

The fishes of the Green River are among the most diverse in Kentucky and are nationally important in terms of fish zoogeography, i.e., distribution, and need for conservation (Cicerello and Hannan, 1991). Kentucky waters support 226 native species or about one fourth of all North American freshwater fish fauna. Two-thirds (151 species) are known from the Green River and its tributaries.

Prior to the last ice age, the Green River was a smaller, more isolated, headwater tributary of the ancestral Ohio River. In part because of this isolation, the Green River supports the most unusual fish fauna in the lower Ohio-upper Mississippi basin, including five endemics (species that occur nowhere else), one species exclusively shared with the Kentucky River, three species of cavefishes, and an admixture of Coastal Plain and upland fauna. The Green River also served as an important refuge for northern species displaced by Pleistocene glaciers that did not extend south into Kentucky thus allowing these species to later invade streams created during the retreat of the glaciers.

Construction of the locks and dams changed aquatic habitats from those associated with cool free-flowing rivers to slower-flowing warm water communities. Riffle and shoal areas with sand and gravel substrates were eliminated and replaced with permanently inundated pools with finer sediments and silt bottoms. Subsequently, the species composition within the reaches of the Green and Barren rivers affected by the pools were altered as well. Construction of the locks and dams altered species composition within the pools to that of a slower warmer water system. Some native

species increased in numbers while many more declined, as they were not as well adapted to the change in habitat. This changed habitat also resulted in an increase in rough fish, some of which (freshwater drum, redhorse, and buffalo) represent commercially important species within the Green and Barren rivers.

Fourteen species of sport fishes are found in the project area including largemouth bass, smallmouth bass, white and black crappie, channel catfish, longear, redear, and green sunfish, walleye, rockbass, sauger, white bass, and striped bass. Another game species found naturally occurring in the Green and Barren rivers is the Ohio muskellunge.

The Green River and its tributaries are recognized as supporting one of the most diverse mussel faunas in North America (Stansbury 1965, Isom 1974). Seventy-one of the 104 species found in Kentucky are known from the Green River basin. More than one-third of the species inhabiting the Green and Barren rivers are considered rare, threatened or endangered at the state or Federal level, mostly due to changes in aquatic habitat caused by human alteration of land and water features (Cicerello and Hannan 1990). Fifty-seven of these 71 species of mussels are found within the Green River from Munfordville, Kentucky (Green River Mile 225), to the upper reaches of Pool No. 6 in Mammoth Cave National Park (personal communication, Ronald Cicerello, Kentucky State Nature Preserve Commission, from USFWS report, 1999). The most significant factor in the absence of the 14 missing species is the reduction in mussel habitat associated with construction of the locks and dams on the Green and Barren rivers.

### 3.9.3 Threatened and Endangered Species

Threatened and endangered species are found within the Green and Barren rivers, as well as in terrestrial habitat adjacent to the rivers. The Federally endangered Kentucky cave shrimp (*Palaemonias ganteri*) is endemic to the Mammoth Cave system. Populations of this endangered species have been impacted by the impoundment of Green River behind Dam 6. The pool has changed the base level for the cave system. The operation of Green River Lake has changed both the periodicity and magnitude of seasonal flood events from that which would be expected under natural conditions. These changes have affected sedimentation and food supply, among other parameters, within the subterranean environment. The USFWS has designated portions of the Roaring River passage of the Flint-Mammoth Cave system in the Edmonson County portion of Mammoth Cave National Park as critical habitat for the Kentucky cave shrimp.

Caves in the study area also provide habitat for the Federally endangered gray bat and Indiana bat, which use the caves primarily as hibernacula. One cave within the study area is known to support a gray bat maternity colony (USFWS, 1999), and future surveys in the study area may

reveal the presence of other maternity colony caves. Suitable habitat for Indiana bat maternity colonies exists within the study area, and studies in the future may reveal the presence of additional roost colonies.

Threatened and endangered freshwater mussels within the study area include the rough pigtoe (*Pleurobema plenum*), orange-footed pearly mussel (*Plethobasus cooperianus*), northern riffleshell (*Epioblasma torulosa rangiana*), pink mucket pearly mussel (*Lampsilis abrupta*), fanshell (*Cyprogenia stegaria*), rabbits foot pearly mussel (*Quadrula cylindrica*), and the spectacle case pearly mussel (*Cumberlandia monodonta*). Fresh-dead specimens of the ring pink (*Obovaria retusa*) and clubshell (*Pleurobema clava*) indicate that these species persist in the Green River (USFWS, 1999). Other listed mussel species that may still occur in the study area are the fat pocketbook (*Potamilus capax*), tubercled-blossom pearly mussel (*E. torulosa torulosa*), cracking pearly mussel (*Hemistena lata*), and purple catspaw pearly mussel (*E. sulcata sulcata*). The orange-footed pearly mussel, ring pink, and purple catspaw pearly mussel are still reproducing in the Green River, and it is thought that this is the only, or one of the few, rivers in which this occurs (pers. communication, Monte McGregor, KDFWR, 2013). None of the Federally listed threatened or endangered mussel species were found in the pool behind Dam 6 during a three year survey of mussels in Mammoth Cave National Park (Cicerello and Hannan, 1990). These species have been reported from the free flowing section of the river upstream of the influence of Dam 6 and in the free flowing sections of the Green and Barren rivers downstream of Dam 5 which were created by the failure of Dam 4.

The Federally endangered American peregrine falcon (*Falco peregrinus anatum*) occurs within the study area as a migrant or transient in the study area.

Federally threatened plants that may be found in the study area include Price's potato bean (*Apios priceana*).

Other uncommon species that are potential Federal candidates for listing as threatened or endangered may be found in or around the Green and Barren rivers. These include the southeastern bat (*M. austroriparius*), Rafinesque's big-eared bat (*Plecotus rafinesquii*), eastern small-footed bat (*M. leibii*), eastern woodrat (*Neotoma floridana*), Bachman's sparrow (*Aimophila aestivalis*), eastern sand darter (*Ammocrypta pellucida*), northern cave fish (*Amblyopsis spelaea*), southern cave fish (*Typhlichthys subterraneus*), longhead darter (*Percina macrocephala*), blue sucker (*Cycleptus elongatus*), hellbender (*Cryptobranchus alleganiensis*), Kirtland's water snake (*Clonophis kirtlandi*), copperbelly water snake (*Nerodia erythrogaster* var. *neglecta*), Kentucky creekshell mussel (*Villosa ortmanni*), purple liliput pearly mussel (*Toxolasma lividus*), pale false foxglove (*Agalinis skinneriana*), royal catchfly (*Silene regia*), and Gattinger's lobelia (*Lobelia appendiculata* var.

*gattingeri*). Any of these species could be listed in the future if their numbers decline and threats to their survival continue.

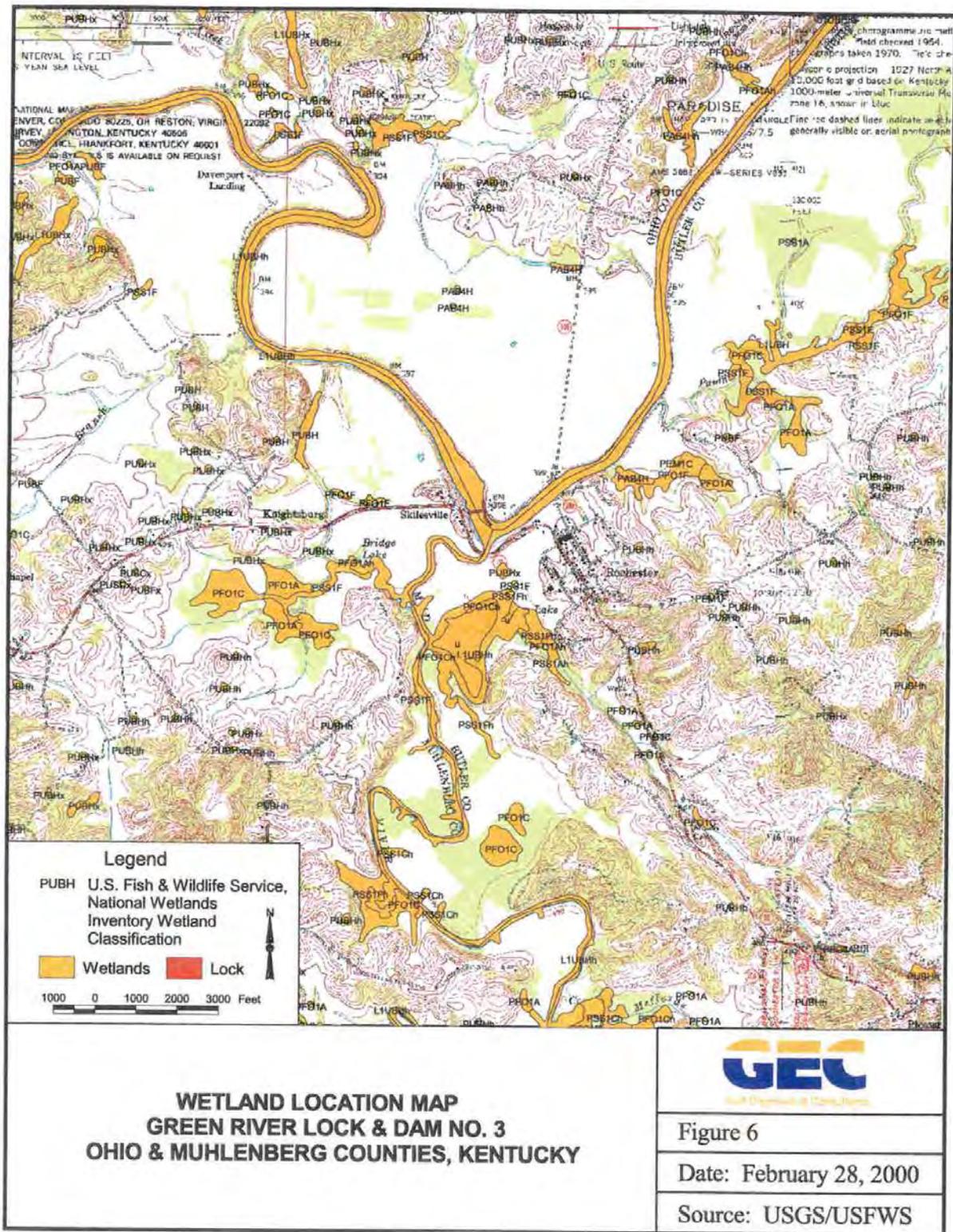
### **3.10 Wetlands and Floodplains**

U.S. Department of the Interior, National Wetlands Inventory (NWI) maps, dated 2013, were reviewed to determine the presence of wetlands within the project area including the Government owned properties at Green River Lock and Dam Nos. 3 through 6 and Barren River Lock and Dam No. 1. The NWI maps showed no wetlands landward of the government owned properties at Lock and Dam Nos. 3 through 6 along the Green and Barren rivers Lock and Dam No. 1 with the exception of a linear band of wetlands running the length of the rivers on both banks (see Figures 6 through 10). This area includes the riparian zone directly adjacent to the river and is affected hydrologically with the fluctuation in river levels. NWI classification is a palustrine system with a forested class. Species composition is broad-leaved deciduous species and the water regime is temporarily flooded with a special modifier being diked/impounded. U.S. Department of Agriculture, Natural Resources Conservation Service soil survey information was reviewed for each lock and dam. The majority of the soils mapped were Nolin series soils. Nolin series soils are generally well drained located in the flood plains and in upland depressions with slopes ranging from 0 to 4 percent. The Nolin series is listed as a hydric soil in the *Hydric Soils of the United States, U.S. Department of Agriculture, Revised October 1990*. Soil samples were not taken to confirm NRCS data, however, a field investigation of government owned property adjacent to Lock and Dam Nos. 3 through 6 on the Green River and Lock and Dam No.1 on the Barren River confirmed the NWI classifications for this area with the exception of Barren River Lock and Dam No. 1. A small (less than one acre) palustrine forested wetland dominated with red maple was observed upstream of the lock on the right descending bank. This area appeared to have a seasonally flooded water regime and holds backwater from the river during periods of high flow.

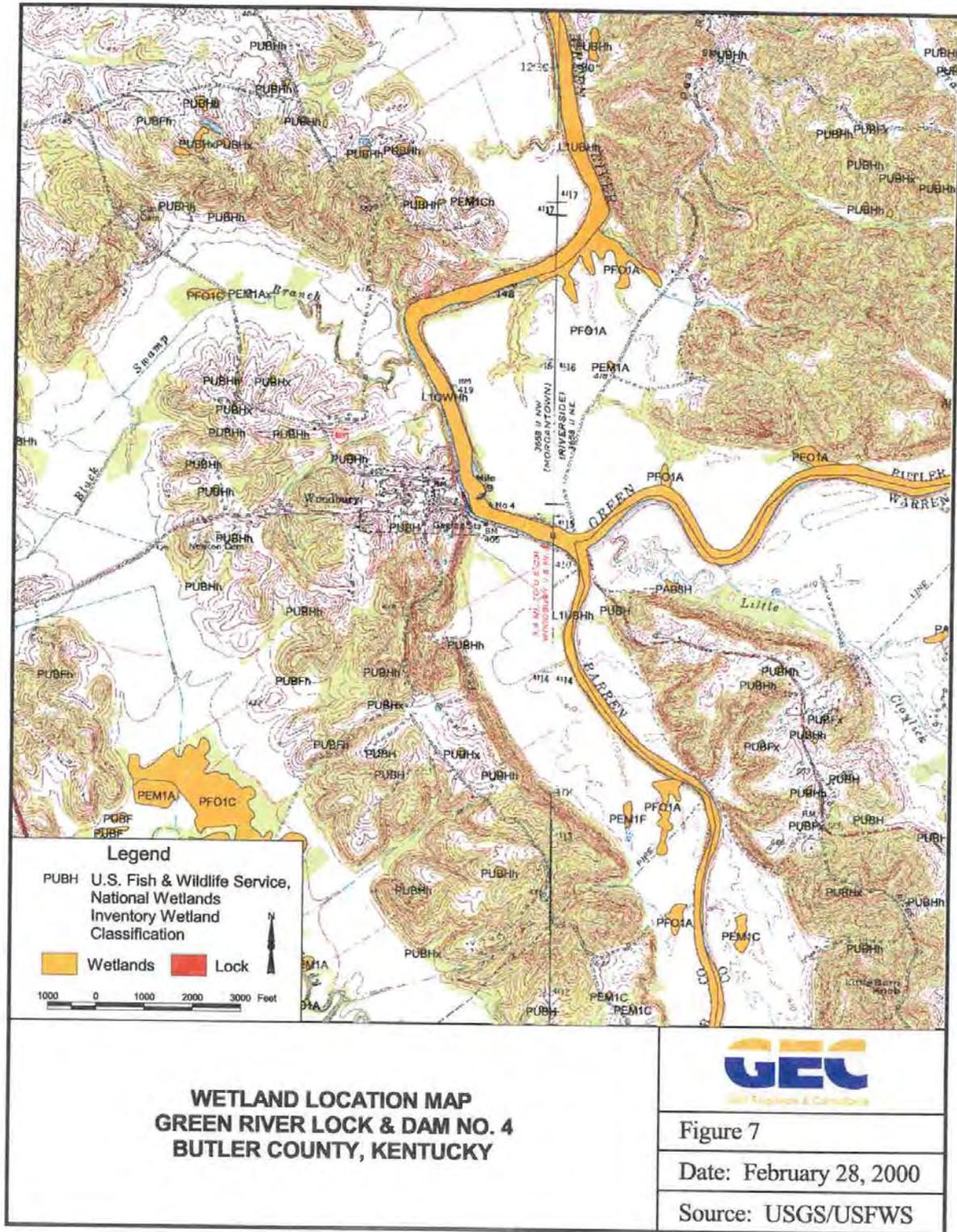
The reach of the Green and Barren rivers within the study area, where pooling occurs from the locks and dams, is classified as a lacustrine system, with a limnetic subsystem and an unconsolidated bottom. Water regimes in these areas are permanently flooded with a special modifier being diked/impounded. The portion of the rivers not impacted by the pools is classified as a riverine system with a lower perennial subsystem and an unconsolidated bottom, and a permanently flooded water regime. The difference in the classification is the presence of the locks and dams.

Wetlands adjacent to the Green and Barren rivers within the study area include small forested, scrub-shrub, or emergent wetlands in the floodplains, and riverine systems associated with

the tributaries. Wetland systems include palustrine, lacustrine and riverine with water regimes ranging from temporarily flooded to permanently flooded. The larger more definable wetland systems are located in the eastern portion of the study area which contains the broader floodplains.



**Figure 6.** Wetland location map for Green River Lock and Dam No. 3.



**Figure 7.** Wetland location map for Green River Lock and Dam No. 4.

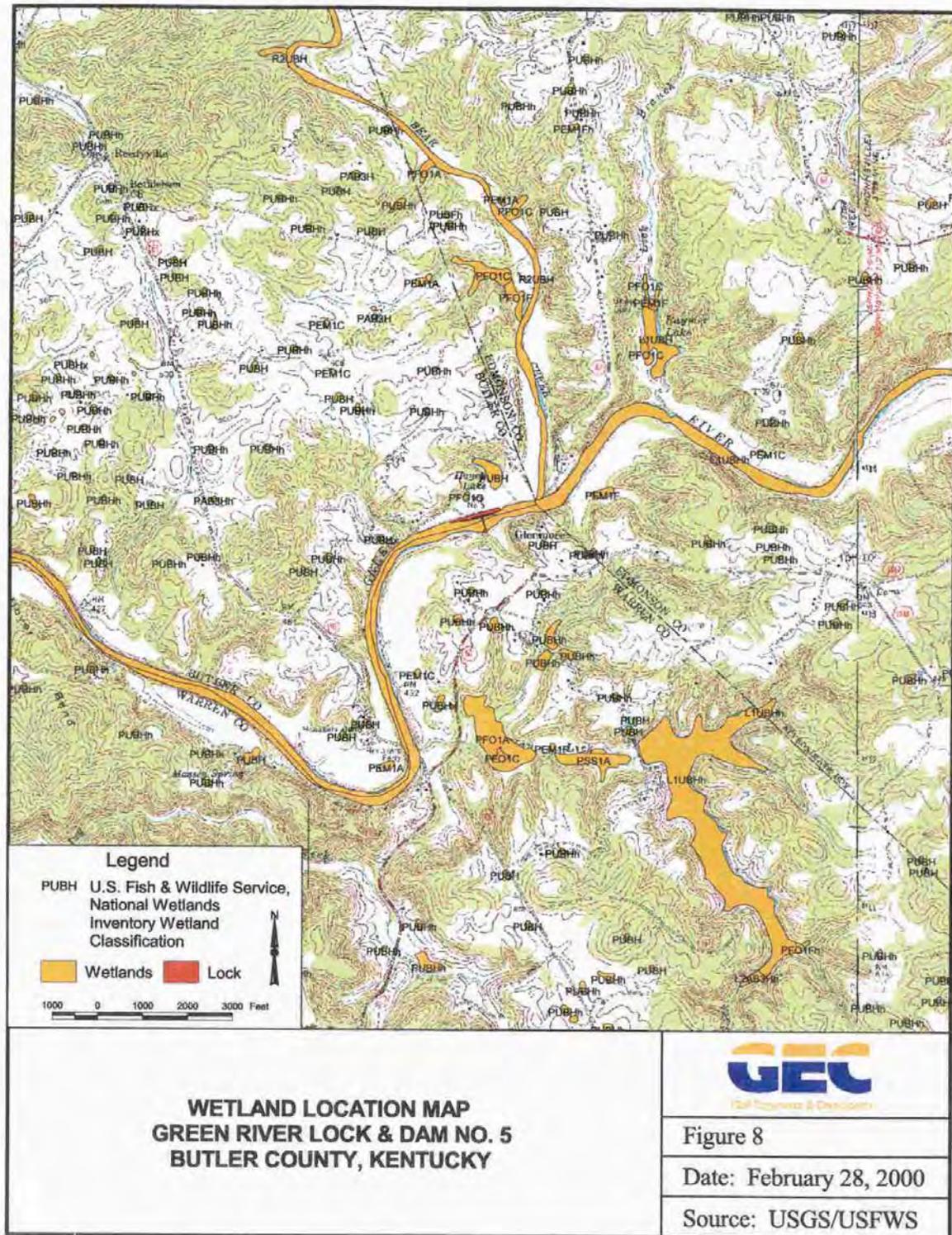


Figure 8. Wetland location map for Green River Lock and Dam No. 5.

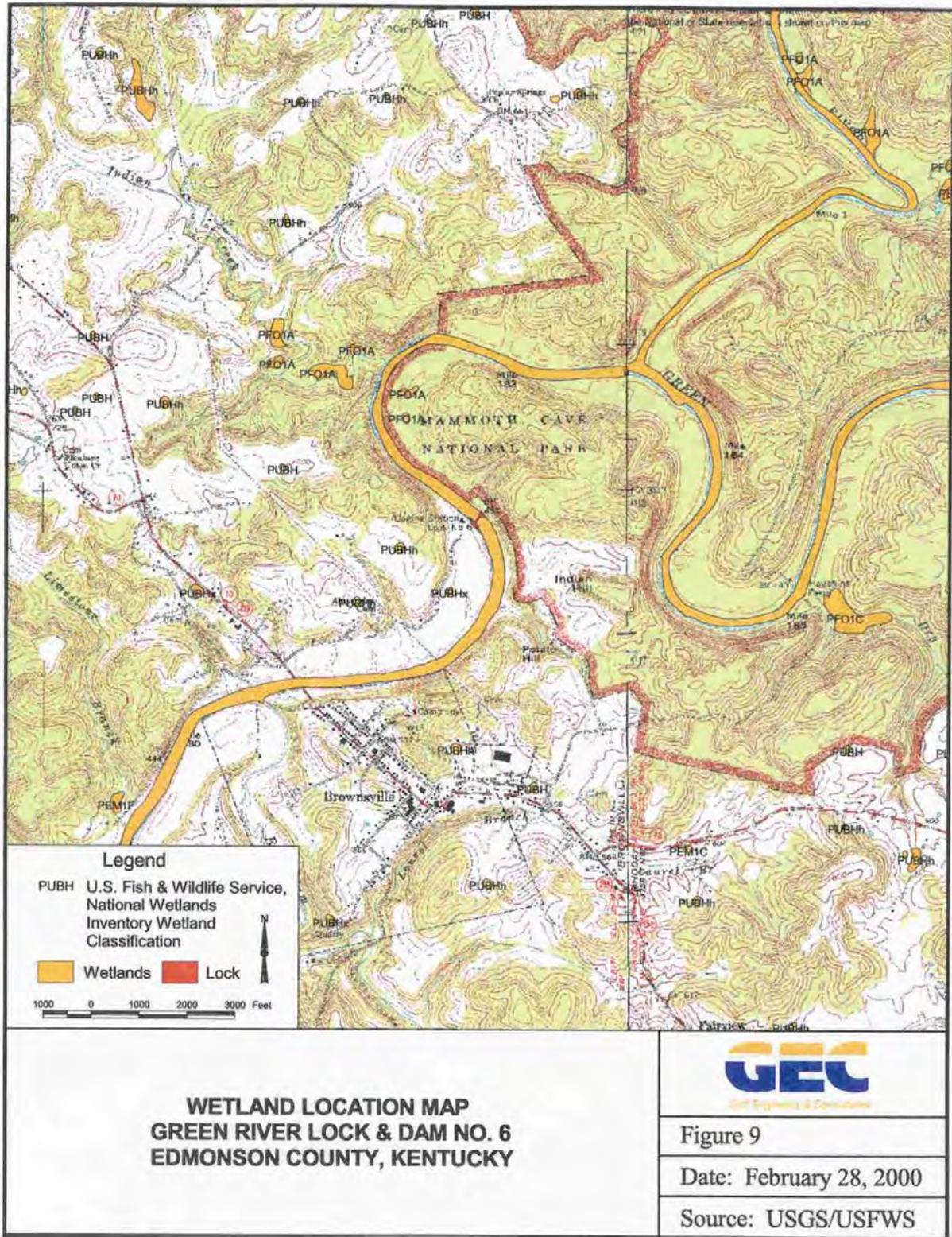


Figure 9. Wetland location map for Green River Lock and Dam No. 6.

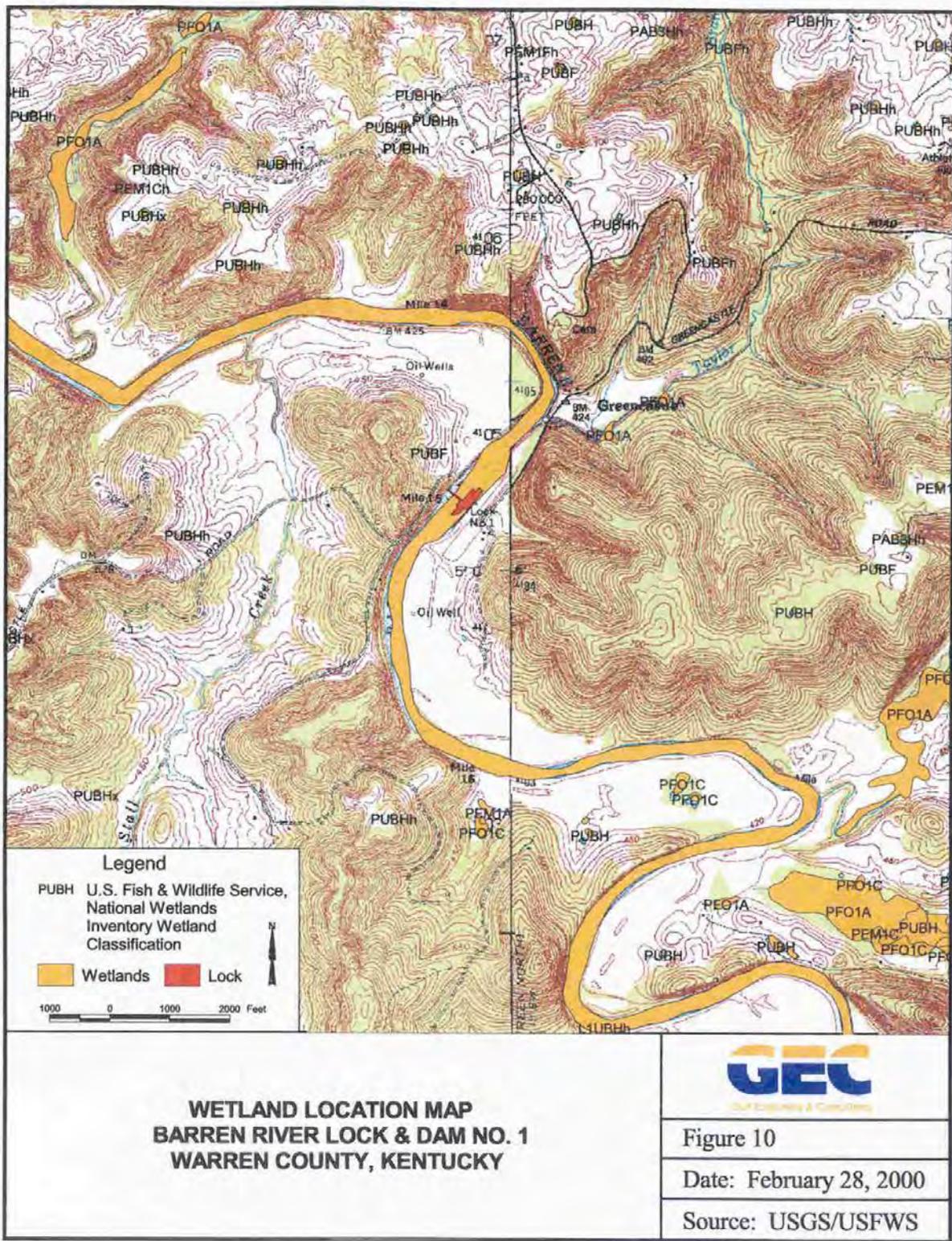


Figure 10. Wetland location map for Barren River Lock and Dam No. 1.

### 3.11 Cultural Resources

A review of records and files available in the Louisville District indicate a number of cultural resources in the general study area. For the purposes of this cultural resources overview, the general study area is defined as the area immediately adjacent to, or within 500 feet of, the extant banks of the Green and Barren rivers. This information was gathered from the National Register of Historic Places (NRHP), the Office of State Archaeology (OSA) and the Kentucky State Historic Preservation Office (KY-SHPO) primarily as a result of various preliminary environmental studies undertaken on the general area by the Corps of Engineers.

Based on this review the majority of the recorded sites within the general study area are prehistoric (N=57) in origin. The best known of the prehistoric resources would be the Green River Shell Middens of Kentucky, a multiple NRHP listing with sites in Butler, Henderson, McClean, Muhlenberg and Ohio counties. Historic era resources (N=44) such as farmsteads and riverboat, ferry, and wharf landings are also known within the general study area. Information on file with OSA indicates a likelihood of additional cultural resources in the general study area as the entirety of this area has not been systematically examined for cultural resources. A quantified summary of known cultural resources by pool reach is presented in Table 8.

**TABLE 8. QUANTIFIED SUMMARY OF KNOWN CULTURAL RESOURCES ADJACENT TO POOLS OF GREEN RIVER LOCKS AND DAMS 2 (UPPER POOL), 3, AND 4, AND. BARREN RIVER (MOUTH TO BOWLING GREEN)**

<u>Pool</u>	<u>Prehistoric Sites</u>	<u>Historic Sites</u>	<u>Pool Total</u>
Green River –Pool #2 (upper reaches only) (RM 102.5-108.5)	3	2	5
Green River - Pool #3 (RM 108.5-149.0)	30	24	54
Green River - Pool #4 (RM 149.0-168.1)	7	13	20
Lower Barren River (RM 0.0-15.0)	6	3	9
Barren River - Pool #1			

(RM 15.0-Bowling Green)	11	2	13
<b>TOTALS</b>	<b>57</b>	<b>44</b>	<b>101</b>

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A Phase I cultural resources reconnaissance of the specific project area did not locate any of these previously recorded sites within the project. This reconnaissance undertaken in 1998 on the Government property associated with Locks and Dams 3, 4, 5, and 6 along the Green River and Lock and Dam 1 on the Barren River also encountered no new evidence of either prehistoric or undisturbed historic archaeological remains. Based on documentation of the history and architecture of these facilities completed in 2000, the lock and dam components are considered by the Louisville District to be eligible for listing on the NRHP as part of a navigation system. The KY-SHPO has concurred with the findings of the reconnaissance, the history/architectural documentation and that the lock and dam components are considered eligible for the NRHP.

### 3.12 Soils

Soils in the Green River Basin can be categorized into six associations: Frondorf-Wellston, Frondorf-Caneyville-Dekalb, Newark- Nolin-Lawrence, Zanesville-Sadler-Wellston, Fredonia-Pembroke, and Pembroke-Crider-Cumberland. All of these associations are localized regionally in conjunction with other associations with the exception of the Zanesville-Sadler-Wellston association which occurs at scattered locations throughout the project area. Frondorf-Wellston (broad ridge tops and steep side slopes), and the Newark-Nolin- Lawrence (low areas along the Green and Barren rivers and their tributaries) associations comprise the majority of the soils in the study area, and are found together throughout the central and western regions. The Frondorf-Wellston has a high potential for erosion and is not considered prime farmland in most areas, and the Newark-Nolin-Lawrence association is prone to wetness and flooding. The remainder of the associations occurs in the southern and eastern portion of the study area and occur in steeply sloped to rolling karst uplands. Frondorf-Caneyville-Dekalb, Zanesville-Sadler-Wellston, Fredonia-Pembroke, and Pembroke-Crider-Cumberland Associations are considered to have limited suitability for most crops, and erosion is a problem in some areas. Table 9 shows the physical characteristics of the soils association within the study area. U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) soil survey information was reviewed for each lock and dam. The majority of the soils mapped were Nolin series soils. Nolin series soils are generally well drained soils located in the flood plains and in upland depressions with slopes ranging from 0 to 4 percent. The Nolin series is

listed as a hydric soil in the *Hydric Soils of the United States*, U.S. Department of Agriculture, Revised October 1990.

**Table 9. Soil Association Within the Five-County Study Area**

Soil Association and Number	Characteristics			
	Slope	Drainage	Texture	Parent Material
7. Frondorf-Wellston	Mostly steep (up to 50%)	Good	Loamy	Formed in loam and loess over siltstone residuum.
8. Frondorf-Caneyville-DeKalb	Mostly steep (up to 50%)	Good	Loamy and clayey	Formed in siltstone, limestone, or sandstone residuums.
9. Newark-Nolin-Lawrence	Nearly level (0-2%)	Somewhat poor to good	Loamy	Formed in alluvium.
10. Zonesville-Sadler-Wellston	Nearly level to gently sloping (0-12%)	Moderately good	Loamy, most with fragipan	Formed in loess over siltstone and sandstone residuum.
11. Fredonia-Pembroke	Moderately steep to gently sloping (2-30%)	Good	Clayey, some are shallow	Formed in limestone residuum and loess.
12. Pembroke-Crider-Cumberland	Nearly level to sloping (2-12%)	Good	Loamy	Formed in thin loess over limestone residuum.

Source: U.S. Department of Agriculture.

#### **4.0 ENVIRONMENTAL IMPACTS**

##### **4.1 Land Use**

###### 4.1.1 Alternative 1/No-Action

This is the No-Action Alternative. Under the No-Action Alternative, the property would remain in Government ownership and caretaker status. No change in adjacent land use or conflicts with adjacent uses is expected under this alternative.

###### 4.1.2 Alternative 2

Alternative 2 includes disposition of Federal interests without any permanent alterations to the lock and dam structures. In order to deter access to the river side lock wall, the upstream and/or downstream miter gates would be gated with barricades on the land side miter gates. No change in adjacent land use or conflicts with adjacent uses is expected due to the addition of the barricades. Construction activities associated with installation of the barricades would cause temporary impacts in the form of increased noise levels in the immediate vicinity of the construction zone. These

impacts are described in more detail in Section 4.7, with mitigative measures outlined in Section 5.0. The increase in noise levels would be temporary and should not conflict with adjacent land uses.

Impacts to land use after disposition is mostly speculative, as it is not known who would take ownership of the sites. Currently, it is assumed that the Three County River Authority would purchase the Lock and Dam No. 3 site in order to protect water supply. Therefore, it would be expected that the structure would be maintained at its present condition.

At Lock and Dam No. 6, Mammoth Cave National Park would be expected to purchase 0.83 acres on the south side of the Green River after dam removal, as this land falls within the original authorized boundary for the Park. Butler County Museum, who currently maintains the land adjacent to the Lock and Dam No. 4 site, would likely continue to do so after disposition, resulting in no changes to land use. The counties surrounding Lock and Dam No. 5 have expressed interest in acquiring the site and using as park. Likewise, Warren County has expressed interest in acquiring the Barren River Lock and Dam No. 1 property to turn into park lands. For any of the alternatives discussed in this EA, there are no negative impacts to land use expected after the disposition of these sites.

#### 4.1.3 Alternative 3 (Green River Lock and Dam No. 6 only)

Alternative 3 includes disposition of Federal interests with dam removal and lock stabilization. Impacts described under Alternative 2 are expected to be the same as this alternative, except that opportunities for recreational development would be improved with the reductions in safety and liability concerns presented by the structures. Work would have to be done from a temporary construction embankment. The embankment would consist of dumped stone to build a raised access road and work platform in the river from which equipment could work. This embankment would also be removed after the dam; therefore no impacts to land use would be expected from this work. Impacts to land use from the disposition of federal interests itself are discussed under Alternative 2.

#### 4.1.4 Alternative 4

Under this alternative, all the locks would be filled with riprap to stabilize the gates and to eliminate the hazard associated with falling into the locks. Additionally, at Green River Lock and Dam No. 3, a concrete plug would be placed against the upstream face of the upstream miter gates to help maintain pool. No change in adjacent land use, or conflicts with adjacent uses are expected under this alternative. Impacts to land use from the disposition of federal interests itself are discussed under Alternative 2.

## **4.2 Infrastructure**

### **4.2.1 Alternative 1/No-Action**

Under the No-Action Alternative, no significant impact to existing utilities or other infrastructure at Green River Lock and Dam Nos. 3 through 6 and Barren River Lock and Dam No. 1 are expected.

### **4.2.2 Alternative 2**

Disposal of Federal interests after installation of barricades on the land side miter gates would not impact existing utilities or infrastructure at the sites. Refer to section 4.1.2 for the possible changes at each site after disposition. No negative impacts to infrastructure are expected after disposition for any of the alternatives.

### **4.2.3 Alternative 3 (Green River Lock and Dam No. 6 only)**

Removal of Green River Dam No. 6, and filling the lock would not significantly impact existing utility service or infrastructure within the Green or Barren rivers. An embankment would need to be constructed within the river to access the dam for removal. The embankment would consist of dumped stone to build a raised access road and work platform in the river from which equipment could work. This embankment would also be removed after the dam, therefore no impacts to infrastructure would be expected.

### **4.2.4 Alternative 4**

Disposal of Federal interests after lock stabilization and modification would not adversely impact existing utility service or infrastructure at the sites. The installation of the concrete plug at Green River Lock and Dam No. 3 would aid in maintaining the upstream pool. This would ensure continued access to the pool water for municipal water supply.

## **4.3 Socioeconomics**

### **4.3.1 Alternative 1/ No-Action**

Under the No-Action Alternative, the locks and dams would not be altered and the pools would be maintained at their current levels. Therefore, there should be no short-term or long-term changes in the socioeconomic conditions in the study area under No-Action.

### **4.3.2 Alternative 2**

Under Alternative 2, barricades would be implemented on each of the miter gates of all locks. There would be no long-term changes in the socioeconomic conditions in the study area due to the implementation of Alternative 2.

The construction expenditures associated with Alternative 2 would result in beneficial short-term economic impacts to the region during the actual period of construction. Because of the rural

nature of the study area, the impacts may be limited due to contract award, the availability of skilled and unskilled labor in the region, the availability of regional materials and equipment. It is assumed that, at a minimum, a portion of the direct labor and materials budgets would be expended in the region. This assumption is based on the belief that some of the labor would be hired locally and the materials, much of which is aggregate, would come from local sources.

Expending these resources within the regional economy could result in a temporary increase in employment, personal income and business activity. Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to socioeconomics are expected after disposition for any of the alternatives.

#### 4.3.3 Alternative 3 (Green River Lock and Dam No. 6 only)

Since Green River Lock and Dam No. 6 is located near Mammoth Cave National Park where most recreational facilities are located, it is reviewed separately in this assessment. The removal of Green River Lock and Dam No. 6 would impact two ferry operations that are operated by the NPS in Mammoth Cave National Park. The plan would also affect canoeing on the Green River by removing a barrier to longer canoe trips and restoring the natural channel for 17 miles.

Presently, the NPS has no plans to establish additional tours. No additional tourism revenue from increased cave access for the public would be realized under this alternative in the immediate future, but could occur long-term. It is likely that increased revenues would result from an increase in cave exploration and mapping activities by researchers and cartographers. It is also likely that some visitors and researchers would spend additional time in the Brownsville area to view the removal of the dam and to take hikes or canoe trips to examine the restored river channel as it returns to a natural condition.

Presently, the canoe liveries on the Green River serve canoeists wanting primarily half-day trips. Removal of the dam is expected to increase demand for multi-day canoe trips leading increased rentals and revenues for local businesses.

Two documents have addressed the potential popularity of canoeing in the study area. These are the January 1980 *Draft Environmental Assessment of Lock and Dam Six, Green River Navigation Project on Mammoth Cave National Park*, prepared by the Cave Research Foundation and the August 1990 *Lock and Dam No. 6 on the Green River Compilation Paper and Annotated Bibliography*, prepared by Jeff Luoma. The 1980 document estimated an economic impact of \$75,000 per year based upon an additional 500 to 1,000 canoe trips annually.

The NPS would continue operating its two ferries if Dam No. 6 was removed. The Green River Ferry would be operable after dam removal with modifications to the ferry landings. Dam No.

6 is 14 miles downriver from this ferry and, based upon past periods of low water, it is believed that modifications to the landings would allow the ferry to continue operations. Dam No. 6 is three miles downriver from Houchin Ferry and modifications would be more extensive.

Tables 10 and 11 show that Green River Ferry and Houchin Ferry are used for commuting, as well as park visitation. Green River Ferry is 29 river miles downriver from the bridge in Munfordville and 15 river miles upriver from the bridge in Brownsville. The Houchin Ferry is three miles upriver from the bridge in Brownsville. Closure of Green River Ferry would cause considerable inconvenience and economic cost to commuters, park visitors, and the National Park Service. The NPS has clearly indicated to Louisville District personnel that there are no plans to close either ferry as this would eliminate direct access to the northern half of the park from the Visitors Center and otherwise impede park operations.

**Table 10. Green River Ferry Traffic  
(Monthly Average)**

<b>Traffic</b>	<b>FY 1998</b>	<b>FY 1999</b>
Park Visitor	2,880	2,665
Horse Trailer	111	47
Local Traffic	6,070	5,858
Park Service Vehicle	467	467
<b>TOTAL</b>	<b>9,528</b>	<b>9,037</b>

Source: G.E.C., Inc., 2000.

**Table 11. Houchin Ferry Traffic  
(Monthly Average)**

<b>Traffic</b>	<b>FY 1998</b>	<b>FY 1999</b>
Park Visitor	244	168
Local Traffic	525	411
Park Service Vehicle	115	43
<b>TOTAL</b>	<b>884</b>	<b>622</b>

Source: G.E.C., Inc., 2000.

Ferry operators take traffic counts of all boats in the Green River in Mammoth Cave National Park. The total count was 9,853 in 1997 and 9,151 in 1998. The removal of Dam No. 6 would not markedly affect boating businesses in the study area because there are two nearby Corps of Engineers

lakes that are used for boating and fishing. Marinas and boating supply stores are located at Nolin River Lake and Barren River Lake. The slack water near Dam No. 6 is used for power boating almost exclusively by local residents.

Construction activities associated with the removal of the dam would create short-term impacts within the regional economy. The construction expenditures associated with Alternative 3 should result in beneficial short-term economic impacts to the region during the actual period of construction. Because of the rural nature of the study area, the impacts may be limited due to contract award, the availability of skilled and unskilled labor in the region, and the availability of materials and equipment. It is assumed that a portion of the direct labor and materials budgets would be expended in the region. This assumption is based on the belief that some of the labor would be hired from the local work force and the materials, much of which is aggregate, would come from local sources.

#### 4.3.4 Alternative 4

Under Alternative 4, the locks would be stabilized and the water pools would be maintained at their current levels. Therefore, there should be no long-term changes in the socioeconomic conditions in the study area due to the implementation of Alternative 4. However, similar to Alternative 3 (although to a lesser extent) construction activities associated with the stabilization of the locks would create short-term impacts positive within the regional economy. Because of the rural nature of the study area, the impacts may be limited due to contract award, the availability of skilled and unskilled labor in the region, and the availability of regional materials and equipment. It is assumed that a portion of the direct labor and materials budgets would be expended in the region. This assumption is based on the belief that some of the labor would be hired locally and the materials, much of which is aggregate, would come from local sources.

## **4.4 Water Quality**

### **4.4.1 Alternative 1/No-Action**

Because no additional work on the facility is anticipated under this alternative, dam failure which occurred at Green River No. 4 is a possibility, although unlikely in the near future. Such failure and breaching would result in a reduction in pool levels. This could result in water quality degradation in the vicinity of the breached dam. If dam failure were to occur impacts would be similar to those described under Alternative 3.

### **4.4.2 Alternative 2**

Under disposal with implemented barricades, it is anticipated that impacts to water quality would be the same as described under Alternative 1/No-Action. Because no additional work is anticipated to the facility under this alternative, dam failure at which occurred Green River No. 4 is a possibility, although unlikely in the near future. Such failure and breaching would result in a reduction in pool levels. This could result in water quality degradation in the vicinity of the breached dam. If dam failure were to occur impacts would be similar to those described under Alternative 3.

Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to water quality are expected after disposition for any of the alternatives.

### **4.4.3 Alternative 3 (Green River Lock and Dam No. 6 only)**

With filling of the lock chamber under this alternative, minor impacts to water quality can be expected. During the removal of the Green River Dam No.6 under this alternative, temporary increases in turbidity would likely create short-term degradation of water quality downstream from the work sites. Following the dam removal, increased water flow in the pool area would likely re-suspend sediment from that area and for some period of time result in increased turbidity and total suspended solids downstream. Over time, this process would result in a redistribution of the sediment, as fine sediment would be picked up by the increased current and carried the farthest before settling out. Increased water velocity in the pool areas would also likely result in increased aeration and higher dissolved oxygen levels. Most sediment capable of re-suspension would be picked up from the pool areas above the dams within the first one to two years after removal and redistributed downstream creating a more natural bed elevation throughout the channel. Upon reaching this state of equilibrium, stream water quality should stabilize at conditions somewhat better than the existing levels. According to the Clean Water Act (CWA), a 404(b)(1) evaluation must be completed for any project proposing fill be placed into Waters of the U.S. This analysis can be found in Appendix A of this document. Refer to Section 8.0 of this report for information on compliance other environmental laws.

Increased velocities of groundwater flow toward the river as well as changes in the hydrologic patterns of underground streams in the Mammoth Cave system may result. A decrease in groundwater elevation in the Mammoth Cave system is anticipated to be beneficial, as this would expose previously documented, and possibly some undocumented, passages for exploration and study. The lowering of Green River Pool No. 6 is expected to allow the River Styx to once again flow out of Mammoth Cave into the Green River. This effect would greatly reduce the period of flow into the cave from the river, consequently reducing flooding and sedimentation within cave passages.

#### 4.4.4 Alternative 4

Minor impacts to water quality under Alternative 4 are expected at all lock and dams. Because all locks are accessible to highway-transported construction equipment, it is expected that impact to water quality in the rivers would be minimal under Alternative 4. Some minor temporary increases in turbidity may result from the filling of the locks and modifications to the lock gates, should that be necessary. However, the increased turbidity is expected to be of a short-term nature and is not anticipated to significantly degrade water quality in the Green River. Stream water levels are not expected to be significantly affected under this alternative, therefore no impacts on groundwater are anticipated.

### **4.5 Air Impacts**

#### 4.5.1 Alternative 1/No-Action

Under this alternative, local and regional air quality would not be impacted. There would be no change to attainment status.

#### 4.5.2 Alternative 2

This alternative has no action included that would affect air quality within the project area. There would be no change to attainment status. Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to air quality are expected after disposition for any of the alternatives.

#### 4.5.3 Alternative 3 (Green River Lock and Dam No. 6 only)

This alternative is not expected to result in a significant impact to air quality. During stabilization operations, the filling of lock chamber, dam removal and other construction activities may cause a temporary increase in fugitive dust emissions and motorized construction equipment would contribute temporary additional exhaust emissions to the localized area. However, neither of these emission sources is expected to cause a significant degradation in air quality. There would be no

change to attainment status. Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to air quality are expected after disposition for any of the alternatives.

#### 4.5.4 Alternative 4

Under this alternative, local and regional air quality would not be impacted. There would be no change to attainment status. Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to air quality are expected after disposition for any of the alternatives.

### **4.6 Noise**

#### 4.6.1 Alternative 1/No-Action

Under the No-Action Alternative, properties would remain in Federal ownership. No new noise sources are anticipated under this alternative.

#### 4.6.2 Alternative 2

Alternative 2 includes the disposition of Federal interests with installation of barricades to reduce safety hazards. There is no potential for permanent noise sources with increases in noise levels under this alternative.

Construction activities associated with installing the barricades would cause temporary increases in noise levels in the immediate vicinity of the construction zone. Noise levels in the immediate area of construction equipment powered by internal combustion engines generally range from 70 dBA (pumps) to a high of approximately 95 dBA (tractors, trucks, bulldozers, etc). Increased noise would occur in close proximity to the equipment and would not affect residential areas or other sensitive receptors. Further, the increase in noise levels would be temporary and would not be considered significant. Abatement measures that can be implemented during construction are included in Section 5.0. Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to noise are expected after disposition for any of the alternatives.

#### 4.6.3 Alternative 3 (Green River Lock and Dam No. 6 only)

Alternative 3 includes the disposition of Federal interests with removal and lock stabilization of Green River Lock and Dam No.6. The potential for new intermittent sources of noise does exist. The most likely permanent noise sources would be those associated with a recreational use of the property, such as a campground, or possibly a boat rental/convenience store, and would not be considered significant or in conflict with existing conditions.

Construction activities associated with dam removal would cause temporary increases in the noise levels in the immediate vicinity of the construction zone. Noise levels from construction equipment powered by internal combustion engines generally range from 70 dBA (pumps) to a high

of approximately 95 dBA (tractors, trucks, bulldozers, etc). The increase in noise levels during construction would be temporary and would not be considered significant. Abatement measures that can be implemented during construction are included in Section 5.0.

#### 4.6.4 Alternative 4

Under this alternative, each lock would be filled with riprap and a concrete plug would be placed in front of the miter gates and Green River Lock and Dam No. 3. Impacts associated with this alternative are expected to be similar to those described in Alternative 3.

### **4.7 Hazardous/Toxic Materials**

#### 4.7.1 Alternative 1/No-Action

Under the No-Action Alternative, the properties would remain in caretaker status with no additional work performed. Therefore, this alternative is not expected to result in the release of hazardous or toxic materials to the environment.

Small amounts of chipped and cracked paint were observed at each site on fittings associated with the locks and on various other structures. There appear to be no asbestos concerns at any of the properties except Green River Lock and Dam No. 3, where possible asbestos containing material, in the form of ceiling tiles, was observed in the former residence. The negligible amount of paint and possible asbestos containing material (ACM) does not pose significant risk, and therefore would not be removed if the properties remained in caretaker status. If desired, removal of these materials would be conducted in accordance with state and local regulations.

#### 4.7.2 Alternative 2

Some indications of the presence, or potential presence, of hazardous or toxic materials were noted at almost all of the properties surveyed during the EBS. However, based on the information reviewed and physical observations, there is no evidence that significant amounts of hazardous materials were ever stored, handled, transported, disposed, or otherwise released at any of the locks and dams within the study area. Therefore, the proposed action under this alternative is not expected to result in the release of hazardous or toxic materials to the environment.

Impacts described under Alternative 1 would be the same under this alternative, with the following exceptions. Construction activities associated with installing barricades would have a slight potential for release of hazardous or toxic materials into the environment in the form of spills or leaks of fuels or lubricants utilized by construction machinery. This potential is lesser than that of Alternatives 3 and 4 and would be minimized by following best management practices to reduce any exposure of pollutants. More on these practices can be found in Section 5.2.

#### 4.7.3 Alternative 3 (Green River Lock and Dam No. 6 only)

Anticipated impacts under this alternative would likely be the same as those described under Alternatives 1 and 2. Bottom sediments in the dam pools would be re-suspended by the increased current; however, no release of hazardous or toxic materials to the environment is expected from this re-suspension. Sediment accumulations at Lock and Dam No. 3 were obtained and analyzed in 2010 (Stantec Consulting Services Inc. 2010). Other than arsenic (to be discussed below), all constituents tested at non-detectible levels, or at levels that were 1 to 4 orders of magnitude (i.e., 10 to 10,000 times) below the residential soil Preliminary Remediation Goals (PRGs).

The nine arsenic tests produced two non-detect (less than approximately 0.53 mg/kg) results and detected levels of 1.06 to 3.97 mg/kg. The residential soil PRG for arsenic is 0.39 mg/kg. Such results are not unusual for Kentucky soils, which have ambient background levels of arsenic higher than those typically found in USEPA Region 9 (California, Nevada, Arizona, Hawaii) where the PRGs were developed and subsequently adopted by Region 4 (Kentucky, Tennessee, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina). The State of Kentucky developed a procedure to compare site specific findings in Kentucky against “generic statewide ambient background” levels of various constituents. Various statistical tests can be applied to compare site data to the generic background data. For arsenic levels to be considered background, the mean of the site data must be less than 9.4 mg/kg, 50% of the site data must be less than 8.3 mg/kg, and all site data must be less than 21.2 mg/kg (Natural Resources and Environmental Protection Cabinet 2004). The arsenic results for Green River Lock and Dam No. 3 meet all three of the above criteria, and thus the results are considered within normal background levels for Kentucky soils.

It is not anticipated that soils above Dam No. 6 will require testing since the samples from further downstream at Lock and Dam no. 3 were not problematic. It is assumed that soils upstream of Lock and Dam No.3 would be less likely to accumulate harmful constituents due to the decreasing size of watershed area.

#### 4.7.4 Alternative 4

Anticipated impacts under this alternative would likely be the same as those described under Alternative 3, except that because no dams would be removed, any unforeseen impacts from the disturbance of bottom sediments associated with Alternative 3 are not at issue for Alternative 4.

### **4.8 Biological Resources**

#### 4.8.1 Alternative 1/No-Action

Under the No-Action Alternative, no changes are expected to the terrestrial fauna or flora. Short-term benefits in the form of sediment trapping and gradual sediment release during low flows are expected. However, because no additional work is anticipated under this alternative, dam failure as has occurred at Green River Dam No. 4 is a possibility, although unlikely in the near future. Such failure and breaching would result in a reduction in pool levels. In turn, the aquatic biota would shift from that dominated by pool species to that dominated by free-flowing species.

#### 4.8.2 Alternative 2

Alternative 2 involves the disposal of Federal properties at Green River Lock and Dam Nos. 3 through 6, and Barren River Lock and Dam No. 1 with the installation of barricades on the each of the miter gates. No additional construction or maintenance would occur. Under this Alternative, no changes are expected to the terrestrial fauna or flora. However, as no additional work on any facility is anticipated under this alternative, dam failure as has occurred at Green River No. 4 is a possibility, although unlikely in the near future. Such failure and breaching would result in a reduction in pool levels. In turn, the aquatic biota would shift from that dominated by pool species to that dominated by free-flowing species.

Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to biological resources are expected after disposition for any of the alternatives.

#### 4.8.3 Alternative 3 (Green River Lock and Dam No. 6 only)

Alternative 3 would involve the removal of Lock and Dam No. 6 on the Green River and the stabilization of the associated lock. Lock stabilization activities may temporarily disrupt wildlife patterns in the immediate vicinity of the locks, but no significant effects on terrestrial wildlife are expected under this alternative. Short term aquatic impacts are expected in the form of increased turbidity downstream of the stabilization. This is not expected to alter the aquatic community, or habitat. Implementation of this alternative is not likely to adversely affect federally threatened or endangered species or existing habitat.

Dam removal would likely involve construction of a temporary embankment or access road that would be used for demolition and hauling debris from the site. Construction activities may temporarily disrupt wildlife patterns in the immediate vicinity of locks and dams, but no significant effects on terrestrial wildlife are expected. The aquatic community would be the most affected by this alternative. Removal of the dams would change river characteristics from lentic (still waters such as lakes, and ponds) to lotic (actively moving water). It is expected that the dams would be removed in a manner to encourage a slow drawdown rather than a rapid drawdown.

Short-term impacts associated with dam removal would be an increase in turbidity and sediment load during construction. Some stream bank erosion may occur with the lowering of the water levels. However, once vegetation becomes established along the exposed portions of the bank, erosion would be minimized. Short-term water quality impacts are expected to be of shorter duration with the notching process, as compared to full dam removal.

Long-term impacts would be beneficial to the aquatic community. Removal of the dam would restore approximately 17 miles of natural river habitat. Lock and Dam No. 4 on the Green River once maintained a pool 22 miles long. However, since this dam was breached, free-flowing conditions and riffles have become reestablished.

Species composition would change to the more natural community present above Pool 6 on the Green River. Smallmouth bass numbers would likely increase as largemouth bass numbers would likely decrease. Kentucky bass populations would not likely be significantly affected. As recolonization by pre-project fish species occurs, those fish species that serve as hosts for glochidia of freshwater mussels would increase the potential for recolonization of restored riverine habitats by mussels (USFWS, 1999). Implementation of Alternative 3 would likely have long-term beneficial impacts to threatened and endangered mussels and their habitat. The endangered aquatic species present in the project area evolved in free flowing water not impounded streams. Removal of the dams and flushing of accumulated sediments would re-expose gravel bars within the channel, which could then be recolonized by mussels and other aquatic species.

The Kentucky cave shrimp and its habitat would also benefit from the removal of Dam No. 6 on the Green River which would restore free flow out of Mammoth Cave. Restoring this area to near pre-project conditions would reduce the potential for sediment accumulation in the subterranean passages of Mammoth Cave and enhance habitat for the endangered Kentucky cave shrimp, the northern and southern cavefish, and crayfish. The endangered Indiana bat and gray bat would also gain potential hibernacula and maternity sites, as water elevations drop and open additional cave passages or entrances openings within Mammoth Cave National Park. The return to more naturally occurring water levels would also benefit microclimatic conditions within the cave system thereby benefiting many cave dwelling organisms.

The USACE is preparing and Biological Assessment and has been in consultation with the USFWS regarding potential impacts to threatened and endangered mussels in the action area, and would apply measures to minimize impacts to these species.

#### 4.8.4 Alternative 4

This alternative would involve the stabilization locks Nos. 6 on the Green River. Additionally, a concrete plug would be constructed on the upstream face of the upper miter gates of Lock No. 3 to help preserve the pool over the long term. Very limited removal of vegetation would be required around the upstream miter gate. This vegetation currently does not offer viable habitat for threatened or endangered species. Temporary disruption of wildlife patterns may occur during construction activities associated with filling the lock chambers, however, no significant terrestrial affects are expected from this activity. Short term aquatic impacts are expected in the form of increased turbidity downstream of the stabilization. This is not expected to alter the aquatic community, or habitat. However, as with Alternative 3, consultation with the USFWS is being conducted regarding the potential impacts to threatened and endangered mussels within the project area.

#### **4.9 Wetlands and Floodplains**

##### **4.9.1 Alternative 1/No-Action**

Under the No-Action Alternative, no work in waters of the U.S. including wetlands is proposed. The No-Action Alternative would not adversely affect wetlands.

##### **4.9.2 Alternative 2**

Alternative 2 involve disposition of Federal interests with barricade installation on each miter gate. No work in waters of the U.S. including wetlands is proposed. Alternative 2 would not adversely affect wetlands.

Refer to section 4.1.2 for possible changes at each site after disposition. No negative impacts to wetlands and floodplains are expected after disposition for any of the alternatives.

##### **4.9.3 Alternative 3 (Green River Lock and Dam No. 6 only)**

Alternative 3 involves disposition of Federal interests with removal of Green River Dam No.6 and stabilization the associated lock. The NWI maps showed no wetlands landward of the government owned properties at Lock and Dam Nos. 3 through 6 along the Green and Barren River Lock and Dam No. 1 with the exception of a small linear band of wetlands running the length of the rivers on both banks. The only additional areas potentially classified as wetlands on Government at Barren River Lock and Dam No. 1. A small (less than one acre) palustrine forested wetland dominated with red maple was observed upstream of the lock on the right descending bank. Positive impacts to the streamside wetlands would be expected under this alternative. Latent seed banks would be exposed as the water level drops after dam removal. Native plants, including sycamore, cottonwood, water maple, box elder, and willow trees, would soon begin to grow on the newly exposed riverbank, likely increasing wetland habitat.

Dam removal would likely involve construction of a temporary embankment, or access road, which would be used for demolition and hauling debris from the site. Construction of the embankment/access road would require clearing in the linear band of wetlands adjacent to the Green Rivers, as well as the deposition of fill material in waters of the U.S. including wetlands. Impacts would be localized and temporary, as the areas would be restored upon completion of dam removal. Although these impacts are considered temporary, an evaluation under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act was completed as required prior to any discharge of fill material in jurisdictional waters. No long-term significantly adverse impacts are expected on wetlands or floodplains under this alternative.

Upon completion of dam removal and removal of the temporary construction embankment/access road, water levels in the Green River affected by Dam No. 6 would drop to near pre-dam levels. This would result in the exposure of additional lands within and directly adjacent to the channel. Additional emergent wetlands would form along the Green and Barren rivers. Further, wetland classification would likely change to a riverine system with a lower perennial subsystem with an unconsolidated bottom and a permanently flooded water regime.

#### 4.9.4 Alternative 4

Alternative 4 involves disposition of Federal interests with lock stabilization and the installation of concrete plug at Green River Lock and Dam No. 3. Construction vehicles would utilize existing roads for hauling materials to and from sites. This alternative would require the deposition of fill material in waters of the U.S. Impacts would be localized and temporary as the areas would be restored upon completion of dam removal. Although these impacts are considered temporary, an evaluation under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act was completed as required prior to any discharge of fill material in jurisdictional waters. No long-term significantly adverse impacts are expected on wetlands or floodplains under this alternative.

## **4.10 Cultural Resources**

### 4.10.1 Alternative 1/No-Action

Under the No-Action Alternative the federal government would retain ownership of and responsibility for Green River Lock and Dam Nos. 3 through 6, and Barren River Lock and Dam No. 1. No deterioration affecting the National Register of Historic Places (NRHP) eligibility of these facilities has been noted since 2004. No project related alterations would be done to the facilities under the No-Action Alternative. Therefore there would be no impacts to cultural resources from the project.

#### 4.10.2 Alternative 2

Under Alternative 2 barricades would be installed on the land side miter gates of Green River Locks and Dams Nos. 3 through 6 and Barren River No. 1 locks and then disposal of Federal interests in the facilities would occur. No prehistoric or historic archaeological sites would be affected by these actions. However, this alternative would have an effect to the locks and dams. The Kentucky State Historic Preservation Officer (KY-SHPO) has commented that the proposed disposition of Green River Locks and Dams 3, 4, 5 and 6 and Barren River Lock and Dam 1 would have an adverse effect on these NRHP eligible properties. Transfer from Federal ownership is considered an adverse effect. Further consultation with the KY-SHPO and other interested parties would be undertaken. The focus of consultation would be to determine appropriate mitigation measures for inclusion in a Memorandum of Agreement to address project effects. Development of a Memorandum of Agreement would be completed prior to implementation of this alternative.

#### 4.10.3 Alternative 3 (Green River Lock and Dam No. 6 only)

Under Alternative 3, dam removal would occur at Lock and Dam No. 6, measures would be taken as needed to ensure the structural integrity and safety of the remaining facility elements and then disposal of Federal interests in the facilities would occur. Temporary placement of an access road would occur for dam removal. No prehistoric or historic archaeological sites would be affected by these actions. However, this alternative would have an effect to the lock and dam. The KY-SHPO has commented that the proposed disposition of Green River Locks and Dams 3, 4, 5 and 6 and Barren River Lock and Dam 1 would have an adverse effect on these NRHP eligible properties. In accordance with 36 CFR 800.5(a)(2)(vii), transfer from Federal ownership is considered an adverse effect. Further consultation with the KY-SHPO and other interested parties would be undertaken. The focus of consultation would be to determine appropriate mitigation measures for inclusion in a Memorandum of Agreement to address project effects. Development of a Memorandum of Agreement would be completed prior to implementation of this alternative.

#### 4.10.4 Alternative 4

Under Alternative 4, measures would be taken as needed to ensure the structural integrity and safety of Green River Locks and Dams Nos.3 and 6 and then disposal of Federal interests in the facilities would occur. No prehistoric or historic archaeological sites would be affected by these actions. However, this alternative would have an effect to the locks and dams. The KY-SHPO has commented that the proposed disposition of Green River Locks and Dams 3, 4, 5 and 6 and Barren River Lock and Dam 1 would have an adverse effect on these NRHP eligible properties. In accordance with 36 CFR 800.5(a)(2)(vii), transfer from Federal ownership is considered an adverse

effect. Further consultation with the KY-SHPO and other interested parties would be undertaken. The focus of consultation would be to determine appropriate mitigation measures for inclusion in a Memorandum of Agreement to address project effects. Development of a Memorandum of Agreement would be completed prior to implementation of this alternative.

#### **4.11 Soils**

##### **4.11.1 Alternative 1/No-Action**

Under the No-Action Alternative, no additional work would be conducted which may impact soils in the area. Dam failure, as has occurred at Green River No. 4, is a possibility, although unlikely in the near future. Such failure and breaching would increase the potential for bank sloughing and erosion associated with rapid changes in water levels, especially if the surrounding soil is already saturated. These impacts would be localized and insignificant.

##### **4.11.2 Alternative 2**

Impacts to soils caused by the implementation of this alternative are the same as those described for Alternative 1/No Impact. Refer to section 4.1.2 for possible changes to land use at each site following disposition. No negative impacts to soils are expected after disposition for any of the alternatives.

##### **4.11.3 Alternative 3 (Green River Lock and Dam No. 6 only)**

Construction activities associated with dam removal and lock stabilization would involve the redistribution of soils during construction and installation of the temporary embankment/access road. Work directly adjacent to the riverbanks could result in some erosion or bank sloughing, but these impacts should be temporary and would be alleviated once the embankment/access road is removed. The proposed method of dam removal would involve a gradual drawdown of the pool. This would reduce the potential for bank sloughing and erosion associated with rapid changes in water levels. Best management practices during construction should reduce the potential for erosion or bank sloughing. No significant impacts to soils are expected under this alternative.

##### **4.11.4 Alternative 4**

Construction activities associated with stabilizing the locks and constructing a concrete plug would involve the redistribution of soils during construction. Work directly adjacent to the riverbank at Green River Lock No. 3 could result in some erosion or bank sloughing, but these impacts should be temporary and would be alleviated once construction is completed. Best management practices during construction should reduce the potential for erosion. Implementation of Alternative 4 would not cause changes in water levels. No significant impacts to soils are expected under this alternative.

**4.12 Environmental Justice**

On February 11, 1994, the President issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. The purpose of this order is to avoid the disproportionate placement of any adverse environmental or economic impacts from Federal policies and actions on minority or low-income populations. The executive order required that any significant adverse impacts of the project or alternatives on minority or low-income populations be addressed.

Table 12 presents 2010 U.S. Census Data for communities in the vicinity of the locks and dams.

**Table 12. 2010 U.S. Census Data for Communities in the Vicinity of Locks and Dams**

<b>Lock and Dam</b>	<b>Census Unit</b>	<b>Racial Composition</b>	<b>Poverty Status</b>
Green River No. 3	Rochester (City)	98.9% White	13.7% Below Poverty Level
Green River No. 4	Woodbury (City)	100% White	64.4% Below Poverty Level
Green River No. 5	Warren Co. - North	99.3% White	16.0% Below Poverty Level
Green River No. 6	Brownsville (City)	97.1% White	27.7% Below Poverty Level
Barren River No. 1	Warren Co. – Greencastle	98.8% White	16.6% Below Poverty Level

Source: 2010 U.S. Census Bureau

As described in the previous sections of the EA, there are no significant environmental impacts associated with any of the various alternatives to which either minority or low-income families might be subjected. Because relatively few minority persons live in the vicinity of the locks and dams, unforeseen impacts associated with the alternatives would not present any disproportionate adverse effect. The census data indicate that even though there is a relatively large proportion of the population below the poverty level, the distribution of these persons appears not to be clustered, but generally dispersed. Therefore, any possible unforeseen impacts of the alternatives would not affect this portion of the local populace disproportionately.

**5.0 ABATEMENT MEASURES**

## 5.1 Noise

The construction contractor would adhere to the following abatement measures to minimize potential noise impacts associated with alternatives 2, 3, and 4:

- Maintain and operate equipment to minimize noise.
- Equip engines with properly functioning mufflers
- Limit activity near noise sensitive areas so as not to disrupt normal activities.

Should complaints arise due to construction noise, the following additional abatement measures may be considered:

- Install portable acoustic barrier around stationary construction noise sources.
- Shut off idling equipment.
- Notify nearby residents whenever extremely noisy work would be occurring.
- Schedule noisy construction operations near the middle of the day.
- Locate stationary construction equipment as far from nearby noise sensitive receptors as possible.

## 5.2 Hazardous/Toxic Materials

### 5.2.1 Alternative 2

Implementation of best management practices for spill prevention and containment during construction of barricades would reduce the potential for hazardous or toxic materials to be released to the environment.

### 5.2.2 Alternative 3

Implementation of best management practices for spill prevention and containment during construction would reduce the potential for hazardous or toxic materials to be released to the environment. These practices describe methods of minimizing exposure of pollutants to the river by enclosing any drips, overflows, leaks, and other liquid material releases or by isolating pollutant spills from the river or stormwater runoff. There are numerous spill containment methods, ranging from large structural barriers to simple, small drip pans. The benefits vary based on cost, maintenance requirements, and the size of spill control. Three possible options are discussed below:

**Containment Diking:** Temporary or permanent polyurethane or plastic berms, concrete berms, or retaining walls designed to hold spills. Diking is one of the best protective measures against stormwater pollution because it surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater outside of the diked area. Diking is one of the most common types of spill containment.

**Curbing:** Like containment diking, curbing is a barrier that surrounds an area of concern. It prevents spills or leaks from being released to the environment by routing runoff to treatment or control areas. The terms "curbing" and "diking" are sometimes used interchangeably, but curbing is usually small scale and cannot contain large spills like diking can. As with diking, common materials for curbing include earth, concrete, synthetic materials, metal, or other impenetrable materials. Asphalt is also a common material used in curbing.

**Drip Pans:** Pans used to contain very small volumes of leaks, drips, and spills. Drip pans can be depressions in concrete, asphalt, or other impenetrable materials, or they can be made of metals, plastic, or any material that does not react with the dripped chemicals. Empty or discarded containers may be used as drip pans. Catch drips so that the materials or chemicals can be cleaned up easily or recycled before they can contact storm water. Drip pans can be a temporary or permanent measure.

Prior to any disturbance of bottom sediments upstream of the dams, sediment samples would be obtained and analyzed in accordance with state and Federal requirements. Any further testing or remedial action would also be performed in accordance with those same requirements.

#### 5.2.3 Alternative 4

Implementation of best management practices for spill prevention and containment during construction covered in Section 5.2.2 would reduce the potential for hazardous or toxic materials to be released to the environment.

### **5.3 Biological Resources**

The following measures should minimize the temporary impacts associated with construction activities under alternatives 2, 3, and 4:

- Prior to construction of any temporary embankment/access road within the Green and Barren rivers, a mussel investigation in the proposed area of construction should be performed with the results forwarded to the USFWS for review.
- Remove dams in a manner that facilitates a gradual drawdown of the pools.

### **5.4 Water Quality**

The removal of the dams under Alternative 3 would likely result in short-term increases in turbidity and suspended solids due to the increased flow velocity and erosion of accumulated sediments. The lowering of pool water levels may also change the hydrology of nearby underground streams and other groundwater flow. As a means of reducing impacts to water quality and the potential problems

caused by decreases in pool levels, a phased approach to the dam removal and dam notching and subsequent lowering of pool levels is under consideration.

## **5.5 Soil Erosion**

Best management practices, such as placement of silt fences, sediment traps, hay bales, etc. would be utilized to reduce runoff from construction activities associated with Alternatives 3 and 4. Additional erosion control measures may need to be taken after completion. This may include measures such as seeding, sodding, or riprap placement on steep slopes.

## **5.6 Safety**

During the course of the recent site visits to each lock and dam, the Project Delivery Team explored measures other than filling the lock chambers to address safety at the lock and dam sites. While this measure does reduce some risk associated with the vertical condition of the sites, injuries associated with unauthorized entry upon the properties could be possible. Other actions can be implemented at the lock chambers, such as providing egress from the chambers or installing barricades on the land side miter gates that are expected to mitigate safety hazards at a reduced cost. The proposed plan would add barricades at each site to prevent foot traffic on the miter gates. Additionally, the possibility of egress from the chambers would be ensured at each site.

## **6.0 DETERMINATION**

### **6.1 Preferred Alternative**

Existing conditions vary at each of the lock and dam sites due to factors including, but not limited to: age and physical condition of the structures, plant growth and build-up of sediment, and the current and planned future use of the pool. Because of this site-to-site variation, each lock and dam was essentially evaluated as a standalone project and the preferred alternatives differ between sites. The following section details which alternative is preferred at each site.

#### **6.1.1. Green River Lock and Dam No.3**

Structurally, the lock and dam system looks sound and, except for the downstream guide wall, does not appear to be in any danger of imminent failure. The site investigation did not reveal any conditions at this structure which would result in the loss of pool in the foreseeable future. Therefore, no repair actions are considered necessary prior to disposition.

However, to maintain pool over the long term for municipal water supply, a concrete plug would be placed against the upstream face of the upstream miter gates. This would require some

sediment and vegetation removal and sheet piles driven upstream of the miter gates. These would serve as the upstream formwork for the concrete plug. The miter gates themselves could be used as the downstream forms. The height of the concrete plug would be equal to that of the dam. In addition, to mitigate safety hazards on the dam side lock wall, the upstream and downstream miter gates would be gated off with barricades on the land side miter gates (Alternative 2). The accumulated silt and vegetation within the chamber is substantial enough to act as a means of egress. It is expected for the sediment to continue to collect in the lock chamber provided the upstream and downstream miter gates remain closed/mitered.

#### 6.1.2. Green River Lock and Dam No.4

Structurally, the lock and downstream guide wall do not appear to be in any danger of failure. No conditions were observed at the site which would further impair the stability of this structure. To mitigate safety hazards on the river side lock wall, the upstream and downstream miter gates would be gated off with barricades on the land side miter gates (Alternative 2). Accumulated silt and vegetation in the chamber is substantial enough to acts as a means of egress along with the deterioration of the lower downstream miter gates. Sediment is expected to continue to collect in the lock chamber provided the upstream and downstream miter gates stay in place.

#### 6.1.3. Green River Lock and Dam No.5

No conditions were observed at this site which would result in the loss of pool in the foreseeable future. The condition of the miter gates appears to be satisfactory. The pool formed by Dam No. 5 is used as a municipal water supply source, so maintaining the pool is of great importance for surrounding communities. If the upper set of miter gates were to fail, the lower set would provide the redundancy needed to maintain the pool until a fix (rock plug, sheet pile cut off, etc.) could be effected on the upstream end of the lock and. To mitigate safety hazards on dam side lock wall, the upstream and downstream miter gates would be gated off with barricades on the land side miter gates (Alternative 2) and ensure the land side valve pits and bulkhead slots grates are bolted securely. Accumulated silt and vegetation in the chamber is substantial enough to acts as a means of egress. Sediment is expected to continue to collect in the lock chamber provided the upstream and downstream miter gates remain closed.

#### 6.1.4. Green River Lock and Dam No.6

No work would be done to the miter gates, as they would not be needed to help maintain pool. The dam would be demolished and removed from the river (Alternative 3). This would be accomplished by constructing a road just upstream of the dam to enable equipment to gain access to the dam from the lock side. The dam would be slowly breached on the side furthest from the lock. The material

would be removed from the dam gradually. Debris from the demolition would be placed in the lock chamber and along the lower approach wall and the associated steps to help minimize disposal costs and environmental impacts and mitigate safety hazards. As the dam is breached, the access road would be removed, as well. The stone used to construct the access road would also be placed in and around the lock chamber and lower approach. Egress for this structure is not an issue since the downstream gates have been removed.

In addition to work at the site of the lock and dam, modifications would also be made at the sites of the two ferry operations in the area of the former L&D 6 pool. At Houchin Ferry, the concrete approach ramps would be extended to ensure continued operation during low water events. At the Green River ferry site, material would be dredged from the river at the site of the ferry crossing and the concrete approach ramps would be extended. The identification of a disposal site or the possible reuse of dredge material for other purposes, as well as, all matters of environmental compliance will be completed and coordinated with the NPS prior to dredging.

#### 6.1.5. Barren River Lock and Dam No.1

No conditions were observed at this site that would result in the loss of pool in the foreseeable future. The condition of the miter gates appears to be satisfactory. If the upper set of miter gates were to fail, the lower set would provide the redundancy needed to maintain the pool until a fix (rock plug, sheet pile cut off, etc.) could be effected on the upstream end of the lock. To mitigate safety hazards on dam side lock wall, the upstream and downstream miter gates would be gated off with barricades on the land side miter gates (Alternative 2). Additionally, the land side valve pits and bulkhead slots grates would be inspected to ensure that they are bolted securely. Egress from the lock chamber is available by the following means: ladders located on the lock walls; vegetation and concrete berm just downstream of upstream miter gates; and accumulated sediment located near the miter gates.

### **7.0 Cumulative Impacts**

Cumulative impacts are defined under section 1508.7 of CEQ as: "...the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time." The following paragraphs summarize the cumulative impacts expected from the proposed project.

Construction of the Green and Barren Rivers lock and dam system has caused significant negative environmental impacts to the area over time. The dams have interrupted the natural hydrologic regime of the river, creating habitat that is not necessarily preferred by native species.

This has resulted in a decline in these species' populations even to the point of extinction in some cases.

The most important stretch of the river ecologically is the stretch in the Mammoth Cave National Park. By removing Green River Dam No. 6, natural flow would be restored to the most sensitive reach in the river. The most environmental benefits could be gained in that location, considering impacts to threatened and endangered species, the restoration of natural river conditions in the cave, the ability for bats to fly in and out of the cave in locations they had not been able to use for over 100 years. The Green River, which meanders through the park, supports an unusual diversity of fish, including five species that have not been found anywhere else in the world, and three species of cavefish. Another group of aquatic animals, freshwater mussels, survive in the sand and gravel of the Green River. Over 50 species of mussels, including at least three on the endangered species list, live in the park. About 94% of the Green River Lock and Dam No. 6 pool is in the National Park. Restoration of the river to its preimpoundment state would not only benefit the species in the river, but would restore natural hydrologic conditions to Mammoth Cave. Since the development of cave passages is dependent on the movement of water, cave development has been arrested to a degree by the transformation of the free-flowing river to a static pool.

By leaving Dams 3, 5 and 1, social impacts would be minimized, there would be no negative environmental impacts, and the properties would be much easier to dispose of. As a whole, the plan minimizes adverse social impacts, provides positive environmental impacts at the location where they would be the greatest, causes no negative environmental impacts, and facilitates the disposal of the properties in the most efficient manner.

The overall lack of negative impacts associated with the proposed project, as documented in this EA, demonstrates both the benign nature and limited impacts of this project. The only identified negative impacts that would be seen during the implementation of this project are temporary construction-related impacts. The use of best management practices would take place in order to keep the potential impacts in the area to a minimum. Any negative impacts associated with the construction of the proposed project, when added to other past, present and reasonable foreseeable future actions are collectively insignificant.

## **8.0 COMPLIANCE WITH OTHER ENVIRONMENTAL LAWS**

### **8.1 Clean Water Act**

As currently designed, implementation of Alternatives 3 and 4 as described in this EA, would require compliance of CFR 40 Part 230 Section 404(b)(1) Guidelines for Specification of Disposal Sites for

Dredged or Fill Material. The completed 404(b)(1) evaluation can be found in Appendix A of this document.

System (NPDES) permit for construction activities if over one acre of land will be disturbed. At this time, the total potential disturbed area for the construction of each alternative is undetermined. If the implementation of one of the proposed alternatives will require the disturbance of more than one acre of land, an NPDES permit will be required prior to construction.

Additionally, a State 401 water quality certification would also be obtained for excavation and fill within jurisdictional waters of the U.S.

## **8.2 Clean Air Act**

Ohio, Muhlenberg, Butler, Warren, and Edmonson Counties are considered attainment areas as defined in the Clean Air Act. Construction of any of the alternatives will only have a minor and temporary effect on air quality, and no additional work is required with regard to the Clean Air Act.

## **8.3 Endangered Species Act**

In compliance with the Endangered Species Act, coordination will be undertaken with the USFWS and the Kentucky Department of Fish and Wildlife Resources (KDFWR) regarding endangered species and other sensitive species and natural areas with the project area. A Biological Assessment will be prepared for the proposed project and coordinated with the USFWS before the signing of the FONSI.

## **8.4 Farmland Protection Policy Act**

The FPPA directs Federal agencies to identify and take into account the adverse effects of their programs on the preservation of farmlands. The implementation of any of the alternatives addressed in the EA will have no effect on farmlands associated with the project area.

## **8.5 Fish and Wildlife Coordination Act**

In compliance with the Fish and Wildlife Coordination Act, coordination is being undertaken with the USFWS and the KDFWR regarding endangered species and other sensitive species and natural areas with the project area. Their comments, if any, will be noted and become part of the permanent record for this project. A Fish and Wildlife Coordination Act Report for the Green and Barren Disposition Study was produced in 1999. However, due to its age, discussions with the USFWS have been reinitiated to ensure possible changes over the last 15 years are captured within this EA. The

USACE is currently preparing a Biological Assessment to address potential impacts to threatened and endangered species within the action area.

## **9.0 Public Involvement and Coordination**

Executive Order 12372, Intergovernmental Review of Federal Programs, states that Federal agencies shall provide opportunities for consultation by elected officials of those State and local governments that would provide the non-federal funds for or that would be directly affected by, proposed Federal financial assistance or direct Federal development. As required by NEPA (CEQ 1500.1), the proposed project has been coordinated with Federal, State, and local government agencies having jurisdictional responsibilities, or otherwise having an interest in the project.

The proposed project and environmental assessment is currently being coordinated with the U.S. Fish and Wildlife Service. Their comments and recommendations will be considered in the final project plan and will be provided in the correspondences section of the final report.

This draft EA is being circulated for public review and comment. It has been sent to Federal, state and local agencies, public officials, and interested individuals for their comment. Comments that are received will be considered in the decision to sign a Finding of No Significant Impact or to prepare an Environmental Impact Statement.

## 10.0 REFERENCES

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## **Appendix A**



**US Army Corps  
of Engineers**  
Louisville District

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**Clean Water Act Section 404(b)(1) Evaluation  
for the Disposition of Green River Lock and Dam  
Nos. 3, 4, 5, 6 and Barren River Lock and Dam No. 1**

Prepared by:  
U.S. Army Corps of Engineers, Louisville District  
January 2014

## **I. Project Description**

### **a. Location**

The Green River Basin has a drainage area of 9230 square miles and stretches from west-central Kentucky into north-central Tennessee. Basin topography varies from gently rolling in the east to the moderately rugged Western Kentucky coalfields regions and then into a broad floodplain as the river enters the Ohio River just upstream of Henderson, Kentucky. Major tributaries include the Barren, Rough and Nolin rivers.

### **b. General Description**

This Section 404(b)(1) evaluation addresses the discharge of dredged or fill material into the waters of the U.S. The U.S. Army Corps of Engineers (USACE) prepared a draft feasibility report and Environmental Assessment for the disposition of existing navigation facilities located on the Green and Barren Rivers between Brownsville, Kentucky and Rochester, Kentucky on the Green River, and at Greencastle, Kentucky on the Barren River. These facilities include Locks and Dams 3, 4, 5, and 6 on the Green River and Lock and Dam 1 on the Barren River. These facilities are the focus of this study because they are no longer used for navigation. This evaluation was used to make recommendations regarding the possible deauthorization and/or disposal of the facilities. Upon a favorable finding regarding deauthorization the facilities, the sites could then be disposed of using the provisions regarding surplus government property administered by the General Services Administration (GSA).

The recommended plan is to deauthorize all the projects and dispose of the properties after recommended construction is complete at each site. The recommended construction in Waters of the U.S. consists of demolishing the dam and filling the lock chamber at Green River Lock and Dam 6 and addressing stability at Green River Lock and Dam 3 by placing a concrete plug on the upstream side of the upstream miter gates.

### **c. Authority and Purpose**

This study was authorized by Section 216 of the Flood Control Act of 1970 (P.L. 91-611), which is a general authority for the Secretary of the Army to review completed projects due to changed physical, economic or environmental conditions. This study was initially funded as part of a congressional add to the FY 1995 Energy and Water Resource Appropriation Bill

and the resulting study found that there would be insufficient benefits from commercial navigation operations to support restoration of navigation. Currently, the Corps of Engineers maintains the properties in a caretaker status.

#### **d. General Description of Dredged or Fill Material**

##### **(1) General Characteristics of Material**

The plug proposed for Lock No. 3 would be constructed of concrete and rebar. The fill material used in the filling of Lock No. 6 would be material from the demolished dam adjacent to the lock. This would consist of concrete, timber from the original timber cribs, and a limited amount of sediment from the dam structure.

A temporary road would be constructed within the channel of the Green River above Dam No. 6 so that heavy equipment can access the dam for demolition. This road would be constructed of commercial limestone riprap and aggregate.

##### **(2) Quantity of Material**

Construction of the concrete plug at Lock No.3 would require the removal of approximately 2,400 cubic yards of channel sediment in order to effectively prepare the work site. The plug would consist of 50 cubic yards of concrete.

The chamber of Lock No.6 would be filled with approximately 4,950 cubic yards of material from the demolished dam. The remaining 5,800 cubic yards of material would be placed along the lower approach wall bringing the total fill to 10,750 cubic yards. These quantities include a swell and void factor of approximately 50 percent.

The temporary access road from landside (lock) to the mid-point of the dam would consist of 4,050 cubic yards of riprap. The access road from the mid-point to the far side of the dam would consist of an additional 3,700 cubic yards of riprap, for a total of 7,750 cubic yards to build the access road.

##### **(3) Source of Material**

The source of material in the channel of the river is sediments from the adjacent uplands. Sediments are primarily carried by runoff and smaller tributaries into the channel. Most of the adjacent lands upstream fall within the boundaries of Mammoth Cave National Park and are primarily in their natural state.

Material placed in and adjacent to Lock No. 6 would be directly from the concrete-capped timber crib dam and the commercial limestone riprap used in the temporary access road.

## **e. Description of the Proposed Discharge Sites**

### **(1) Location**

The concrete plug would be placed on the upstream side of the upstream miter gates of Lock No. 3.

Material from the demolished dam No. 6 would be placed in the adjacent lock and along the lower approach wall, not to extend past the lower end of the approach wall. Riprap hauled in to build the temporary access road to the dam to be removed and hauled off site.

### **(2) Size**

The concrete plug would be comprised of 50 cubic yards of concrete and would be approximately 17 feet long (the width of the existing lock) x 2 feet wide x 36 feet high.

The temporary access road at Lock and Dam No.6 would be 20 feet in width at the surface and 66 feet at the river bed assuming a 23 feet height and 1:1 side slopes. From the land to the dam breaching area would be 110 feet and another 146 feet to reach to the far side of the dam.

### **(3) Type(s) of Sites and Habitats**

The small footprint of the concrete plug proposed for placement at Lock No. 3 would have no significant adverse impact on aquatic habitat. In this area, the upstream miter gates slow water velocities and sediment falls around the base of the gates. The affected substrate is mostly unconsolidated sediments that offer no high quality habitat.

Placement areas at Lock and Dam No. 6 are similar to that of No. 3. The interior of the lock chamber is mostly unconsolidated sediments with sparse shrub vegetation that offers no valuable aquatic or terrestrial habitat. The placement area along the lower approach wall exhibits a mostly featureless substrate with no valuable or utilized habitat.

### **(4) Time and Duration of Discharge**

The total construction time of the recommended plan would be 2.3 years. Placement of the concrete plug at Lock and Dam No. 3 would take two months. Removal of Dam No. 6, filling of the chamber, and removal of the temporary access road would take 2.3 years. All construction activities at the two locks and dams would occur concurrently.

## **f. Description of Disposal Method**

The construction activities of the proposed plans would utilize the following vehicles:

- (3) Hydraulic Excavators 4.5 CY Bucket
- (2) 1000 FT-lbs Hydraulic Hammers
- (1) 200 HP Dozer
- (1) 100 Ton Track Crane
- (1) Front End Loader 4 CY Bucket
- (2) 25 Ton Off-Road Articulating Trucks

## **II. Factual Determinations**

### **a. Physical Substrate Determinations**

#### **(1) Substrate**

The substrate of the proposed construction sites are mostly comprised of a thick layer of unconsolidated sediments that fall from the water column as water velocities are slowed by the dam.

#### **(2) Sediment Type**

Sediments at the project sites are mostly fine sediments and sands that have accumulated within the pools since the dams were constructed.

#### **(3) Dredged/Fill Material Movement**

Movement of fill material is not expected since most would be larger chunks of rock concrete and debris from Dam No. 6. The finer sediments are expected to be quickly redistributed into the river by natural water level fluctuations.

#### **(4) Physical Effects on Benthos**

Temporary and localized impacts to benthic organisms and their habitats would occur in the immediate areas of construction; however, benthic organisms are expected to quickly rebound from the short-term impacts of material placement.

#### **(5) Other Effects**

No other effects are known.

## **(6) Actions Taken to Minimize Impacts**

Permanent impacts to the physical substrate from placement of fill material would be minimized by confining them to the Lock and chamber and the associated lower approach wall. The walls of the approach and the lock chamber would aid in piling the fill vertically, thus minimizing the footprint and impact to substrate.

The temporary access road would be promptly removed from the channel after demolition of the dam is complete.

## **b. Water Circulation, Fluctuation, and Salinity Determinations**

### **(1) Water**

Increases in turbidity would occur at the construction areas and downstream of the areas during construction. Temporary changes in turbidity have not been modeled however they are not expected to significantly impact water quality.

No significant negative impacts would be expected to water quality or sensitive organisms where material would be placed.

#### **(a) Salinity**

There are no impacts expected to salinity.

#### **(b) Water Chemistry**

There are no impacts expected to water chemistry.

#### **(c) Clarity**

There may be a local and temporary increase in turbidity during construction activities. Water clarity is expected to return to normal background levels shortly after operations are completed

#### **(d) Color**

Water immediately surrounding the construction area may become discolored temporarily due to disturbance of the sediment.

#### **(e) Odor**

Negligible amounts of hydrogen sulfide may be expected when disturbing possible anoxic sediments at the construction sites. Otherwise, there are no long-term impacts to odor.

#### **(f) Taste**

There are no impacts expected to taste.

**(g) Dissolved Gas Levels**

A slight temporary decrease in dissolved oxygen levels in the immediate area of the construction may occur if anoxic sediments are disturbed. This would be temporary, and no other impacts to dissolved gas levels would be expected.

**(h) Nutrients**

There are no impacts expected to nutrients.

**(i) Eutrophication**

Construction activities would not lead to eutrophication of surrounding waters.

**(j) Others as Appropriate**

None known

**(2) Current Patterns and Circulation**

**(a) Current Patterns and Flow**

Construction activities would not have an effect on inflows to the system or water surface elevations.

**(b) Velocity**

Placement of material within the channel would not significantly impact velocities. Material at both sites would be placed within pool areas, where velocities are already very slow. The embankment constructed within the channel to remove Dam No. 6 would be removed immediately after demolition of the dam. Velocities in the stretch of river that is now Pool 6 would increase to naturally occurring velocities after removal is complete.

**(c) Stratification**

No change in this condition is expected.

**(d) Hydrologic Regime**

Hydrologic regimes would not be altered with placement of material.

**(3) Normal Water Level Fluctuations**

The average water surface elevation throughout the study area would be unaffected by construction activities.

**(4) Salinity Gradients**

There would be no change in salinity gradients.

**(5) Actions That Would Be Taken to Minimize Impacts**

The footprint of the placed material would be minimized to the greatest extent possible, such that impacts to water circulation, fluctuation, and salinity would be negligible.

**c. Suspended Particulate/Turbidity Determination**

**(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site**

A temporary and localized increase in suspended particulates and turbidity levels is expected during placement material at sites.

**(2) Effects on Chemical and Physical Properties of the Water Column**

**(a) Light Penetration**

Turbidity levels would be temporarily increased during placement operations material.

**(b) Dissolved Oxygen**

No adverse impacts to dissolved oxygen (DO) are expected; a reduction in DO may occur at localized and temporary events during placement.

**(c) Toxic metals and organics**

Suspended particles resulting from placement would not result in detrimental effects to chemical and physical properties of the water column.

**(d) Pathogens**

None expected or found.

**(e) Aesthetics**

No impacts to aesthetics are expected.

**(f) Others as Appropriate**

None known

**(3) Effects on Biota**

No impacts are expected on photosynthesis, suspension/filter feeders, and sight feeders, except for temporary and localized impacts from placement operations (e.g., burial of benthos or temporary increase of local turbidity levels).

**(4) Actions Taken to Minimize Impacts**

The footprint of the placed material would be minimized to the greatest extent possible, such that impacts to suspended particulates and turbidity levels would be negligible.

**d. Contaminant Determinations**

Fill material used in Lock No. 6 would be taken from the river directly adjacent to the lock. Previous investigations reveal no reason to believe that the considered fill material is a carrier of contaminants.

**e. Aquatic Ecosystem and Organism Determinations**

**(1) Effects on Plankton**

Construction and placement operations are expected to have only minor temporary, local impacts on plankton from increased turbidity levels.

**(2) Effects on Benthos**

Temporary and localized impacts to benthic organisms and their habitats would occur; however, benthic organisms are expected to quickly rebound from the short-term impacts.

**(3) Effects on Nekton**

No significant impacts to the nekton of the area from the proposed construction and placement operations are expected.

**(4) Effects on Aquatic Food Web**

Reductions in primary productivity from turbidity would be temporary and localized around the immediate area of the construction and would be limited to the duration of the plume at a given site.

**(5) Effects on Special Aquatic Sites**

Construction activities do not have detrimental effects on special aquatic sites in the study area (i.e., sanctuaries and refuges, wetlands, mudflats).

**(6) Threatened and Endangered Species**

USACE is preparing a Biological Assessment (BA) and has been in consultation with the USFWS regarding potential impacts to threatened and endangered mussels in the action area.

**(7) Other Wildlife**

No significant impacts to other wildlife species are anticipated.

**(8) Actions to Minimize Impacts**

USACE is preparing a BA and has been in consultation with the USFWS regarding potential impacts to threatened and endangered mussels in the action area. Measures to minimize impacts to these species will be included, as appropriate, in the BA.

**f. Proposed Disposal Site Determinations**

**(1) Mixing Zone Determination**

N/A

**(2) Potential Effects on Human Use Characteristics**

**(a) Municipal and Private Water Supply**

Construction activities would not impact any municipal or private water supplies.

**(b) Recreational and Commercial Fisheries**

No impacts to recreational and commercial fishing are anticipated as there are no expected impacts to the aquatic food web.

**(c) Water-related Recreation**

No impacts to water-related recreation would occur as a result of the proposed construction activities.

**(d) Aesthetics**

No impacts to aesthetics are expected.

**(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves**

No special sites would be negatively impacted by the project.

**g. Determination of Cumulative Effects on the Aquatic Ecosystem**

The construction activities of the proposed project are expected to have negligible negative impacts to the environment. The removal of Green River Dam No. 6 would ultimately result in positive impacts to the aquatic ecosystem by restoring 17 miles of the Green River to a more natural flow regime and enhancing riverine habitat.

#### **h. Determination of Secondary Effects on the Aquatic Ecosystem**

No adverse significant secondary effects on the aquatic ecosystem should occur as a result of the proposed project.

### **III. Findings of Compliance with Restrictions on Discharge**

#### **a. Determination of Compliance with Applicable Water Quality Standards**

The discharges associated with the proposed project alternative are not anticipated to cause or contribute to violation of any water quality standards. A Clean Water Act Section 401 Water Quality Certification will be obtained from the State of Kentucky before commencing any work in waters of the U.S. Analyses of recent sediment samples within the Green River indicate no unacceptable negative impacts can be expected to water quality or sensitive organisms during material placement.

#### **b. Determination of Compliance with Other Restrictions on Discharge.**

- (1) There is no practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem.
- (2) The proposed discharge will not cause or contribute to significant degradation of waters of the United States.
- (3) All appropriate and practicable steps have been taken to minimize any potential adverse effects on the aquatic ecosystem.
- (4) Based on consultations with USFWS, the proposed discharge will not jeopardize the continued existence of any species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or to result in destruction or adverse modification of any habitat determined by the Secretary of the Interior under that Act to be critical habitat.

U.S. ARMY CORPS OF ENGINEERS  
LOUISVILLE DISTRICT

FINDING OF NO SIGNIFICANT IMPACT  
AND  
SECTION 404(b)(1) FINDING OF COMPLIANCE

DISPOSITION OF GREEN RIVER LOCK AND DAMS NOS. 3, 4, 5, 6 AND  
BARREN RIVER LOCK AND DAM NO. 1  
DRAFT

1. The U.S. Army Corps of Engineers has proposed a project for the disposition of Green River Lock and Dams Nos. 3, 4, 5, 6 and Barren River Lock and Dam No. 1. This study was authorized by Section 216 of the Flood Control Act of 1970 (P.L. 91-611), which is a general authority for the Secretary of the Army to review completed projects due to changed physical, economic or environmental conditions.
2. Alternatives considered in the environmental assessment (EA) for the proposed Disposition are: No Action, disposal after installation of barricades to impede access to river side lock wall, disposal after dam removal and stabilization of locks, and disposal after modifying locks. Because of this site-to-site variation due to factors including, but not limited to: age and physical condition of the structures, plant growth and build-up of sediment, and the current and planned future use of the pool, each lock and dam was essentially evaluated as a standalone project and the preferred alternatives differ between sites. Alternative 2 (barricades) would be implemented at each site. Additionally, Alternative 3 (dam removal and lock stabilization) would be implemented at Green River Lock and Dam No. 6, and Alternative 4 (lock modification) would be implemented at Green River Lock and Dam No. 3 by installing a concrete plug to maintain pool.
3. In accordance with ER 200-2-2, *Policy and Procedures for Implementing the National Environmental Policy Act (NEPA)*, an EA has been prepared and circulated to other agencies and groups for review. Coordination with the Kentucky State Historic Preservation Officer (SHPO) and federally recognized tribes were conducted. The proposed work would not significantly impact socioeconomic conditions with the project area. Benefits are realized with improved aquatic habitat and reduced risk of falling hazards at the locks. Additional benefits include employment opportunities to local construction contractors and/or workers spending money in the community.
4. Construction activities at Green River Lock and Dam Nos. 3 and 6 would temporarily increase turbidity levels and temporarily disrupt movement of some organisms. The EA revealed that the proposed project would cause temporary adverse impacts during construction to water quality, aquatic resources, terrestrial resources, and noise. There would be no significant impacts for the proposed project on wetlands. No significant issues were noted regarding hazardous, toxic, or radioactive materials. Results from construction of this project would be beneficial after construction is complete. The preferred alternative is in compliance with the Clean Air Act and Executive Order 12898 for Environmental Justice. None of the alternatives described in this

environmental assessment would disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations.

5. The placement of fill material into waters of the U.S. for the purpose of shoreline erosion prevention is subject to Sections 401 and 404 of the Clean Water Act (CWA). A 404 (b)(1) Evaluation has been conducted and is included in Appendix A of the EA. A CWA Section 401 water quality certification will be obtained from the state of Kentucky before work can proceed.

6. A Scoping Notice describing the proposed disposal project and input on environmental issues to be addressed through the NEPA process was issued on XXXX, 2014. Written responses to the scoping letter were received from XX federal agencies, XX state agencies, XX archaeological consultant, and XX tribes. An effort was made to address all environmentally related comments, as appropriate, in the EA. The EA along with the unsigned Finding of No Significant Impact was circulated for a 30 day public and agency review.

7. Coordination with U.S. Fish and Wildlife Service (USFWS) and Kentucky Department of Fish and Wildlife Resources (KDFWR), per the Fish and Wildlife Coordination Act (FWCA 48 Stat, 401, as amended; 16 U.S.C. 661 et seq.) and Endangered Species Act, was initiated by scoping letter. A Biological Assessment was performed to document the US Army Corps of Engineers' conclusions and the rationale to support those conclusions regarding the effects of the proposed actions on threatened and endangered species within the action area. Efforts would be made to minimize impacts during construction and would include visual turbidity monitoring, limiting spud placement, avoiding incidental fallback, and avoiding barge contact with the river substrate.

8. Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations at 36 CFR 800 require consideration of cultural resources prior to a federal undertaking and requires consultation with the KY-SHPO, federally recognized tribes with a connection to the project location, and other consulting parties defined at Section 800.3. The NHPA only affords protection to sites, buildings structures, objects, or landscapes listed in or determined eligible for listing in the National Register of Historic Places (NRHP). An archaeological survey report and a summary of the history and architecture have been completed for the Green River Locks 3-6 and Barren River Lock 1. Section 106 coordination is currently ongoing.

9. . I have evaluated this project in accordance with the CWA Section 404(b)(1) Guidelines promulgated by the Administrator of the Environmental Protection Act pursuant to Section 404(b)(1) of the CWA. Based on that evaluation, I have determined that the proposed disposition project will comply with the restrictions on discharge in 40 CFR 230.10 upon receipt of the Section 401 water quality certification. I have also determined that the proposed disposition project is specified as complying with the Guidelines with the inclusion of appropriate and practicable conditions to minimize pollution or adverse effects to the aquatic ecosystem.

10. I have reviewed the disposition proposal, the public and agency comments, and the EA in light of the general public interest. I have determined that issuing the respective approvals and

allowing the disposition project to be constructed would not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the NEPA of 1969, as amended. Accordingly, I have concluded that preparation of an Environmental Impact Statement would not be required.

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Luke T. Leonard  
Colonel, Corps of Engineers  
Commanding

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Date