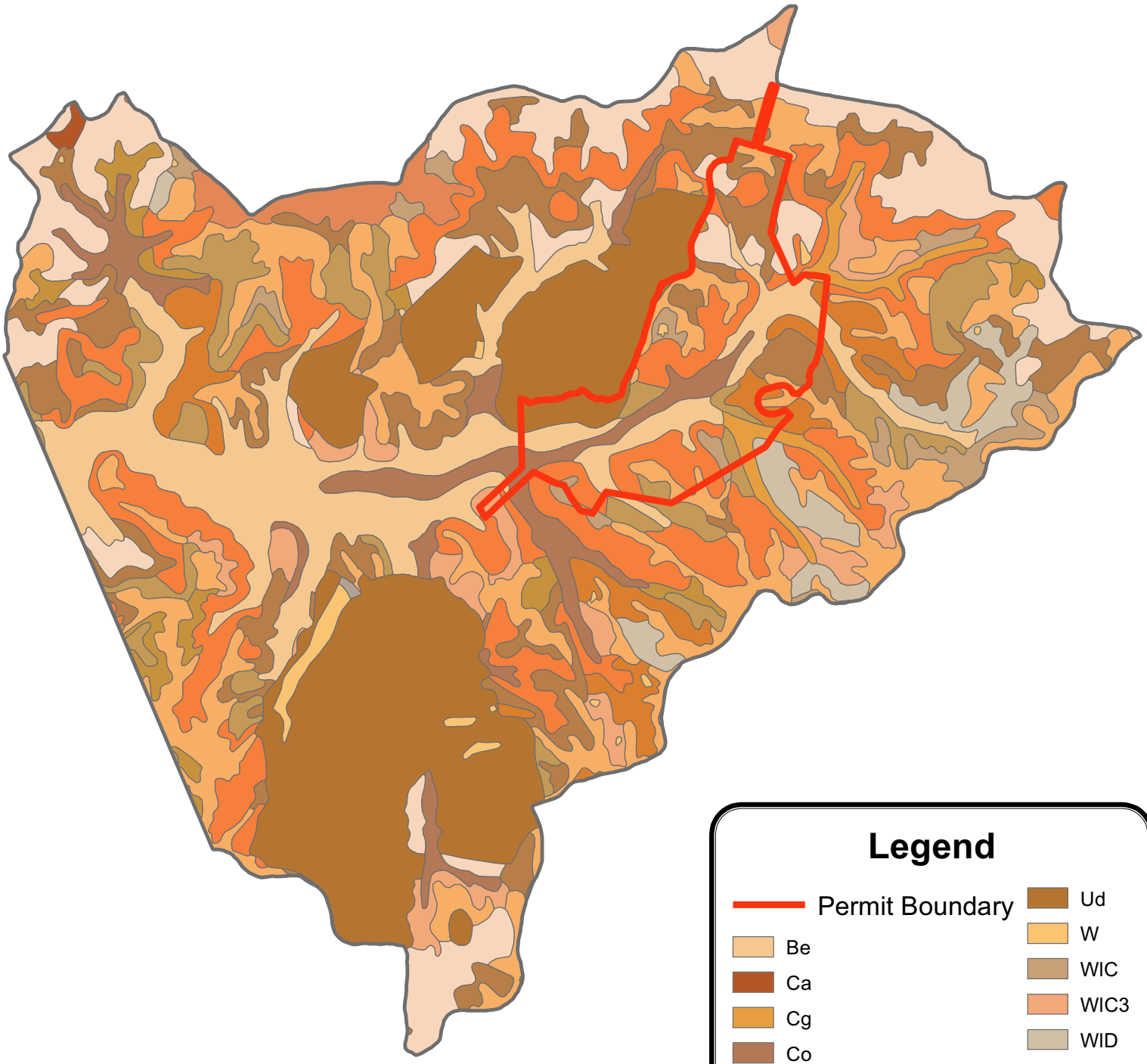
Soils



Legend

- Permit Boundary
- Be
- Ca
- Cg
- Co
- DAM
- FID
- FIE
- SaA
- SaB
- Ud
- W
- WIC
- WIC3
- WID
- WID3
- ZaB
- ZaC
- ZaC3

N
W E
S

0 1,500 3,000 6,000
Feet

Data Source: US Natural Resources Conservation Service

7. Land Use Assessment, Present & Reasonably Foreseeable Future

A. Current Land Use

An understanding of land use provides insight into environmental impacts and ecosystem health. In 1993 several federal agencies including the U.S. Geological Survey, Environmental Protection Agency, National Oceanic and Atmospheric Administration, and the U.S. Forest Service formed an association called the Multi-Resolution Land Characteristics (MRLC) Consortium. The Consortium produced the 1992 National Land Cover Data (NLCD) layer to exhibit land use across the conterminous United States at 30-meter resolution (Volgelmann et al. 2001). The Consortium processed and categorized Landsat Thematic Mapper satellite data from the early to mid 1990s into a 21-class schematic through a clustering algorithm model to develop the 1992 NLCD. 'Leaf-off' and 'leaf-on' image analysis allowed discrimination between different agricultural and forest types. They incorporated ancillary data layers such as the National Wetlands Inventory and the National Gap Analysis Program to glean wetland and stream information. Additional federal agencies including the National Aeronautics and Space Administration, National Parks Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and National Resources Conservation Service joined the MRLC Consortium in the late 1990s. The Consortium then used modified mapping methods and classification algorithms to improve thematic accuracy for the 2001 NLCD (Homer et al. 2004). The group reduced the Land Cover schematic from 21 to 16 classes.

The land cover within the project area was mapped from the National Land Cover Data (NLCD) 2006. A total of nine land cover classes were found within the project area, including open water, developed space, forest, scrub/shrub, grassland/herbaceous, pasture/hay, cultivated crops, woody wetlands and emergent herbaceous wetlands (Figure 7-3). Deciduous forest covered the largest amount of area with approximately 2,458 acres (54%). Cultivated cropland was the second highest land use at approximately 737 acres (16%), followed by Pasture / Hay at approximately 569 acres (12%).

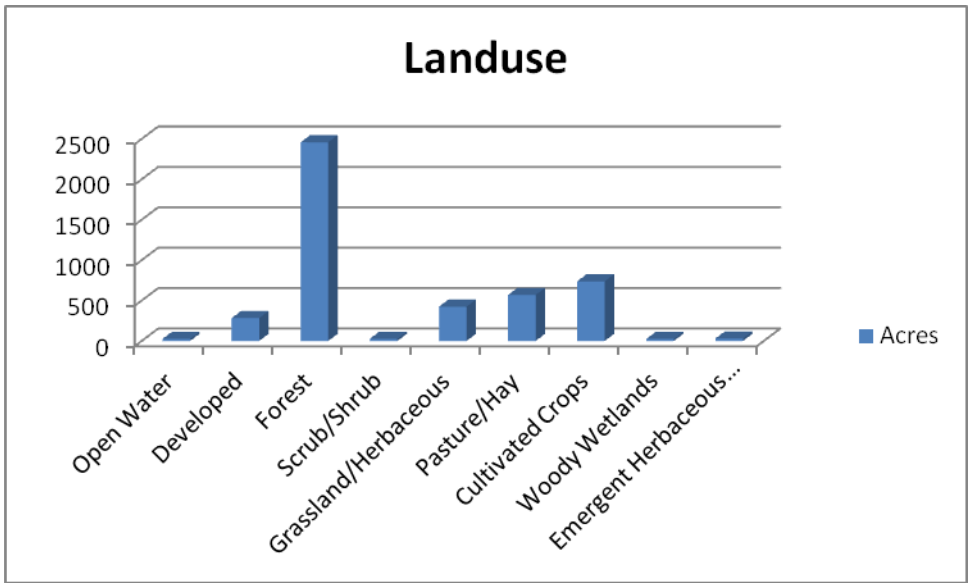


Figure 7-1. Current land use within the permit area.

Table 7-1. Land use within the permit area.

Land Cover Class	Area (Acres)	Percent Area
Open Water	25	1%
Developed	282	6%
Forest	2458	54%
Scrub/Shrub	27	1%
Grassland/Herbaceous	424	9%
Pasture/Hay	569	12%
Cultivated Crops	737	16%
Woody Wetlands	24	1%
Emergent Herbaceous Wetlands	30	1%
Total	4575	100%

B. Stream Network Analysis

Mapping current day stream locations in the field is not feasible due to the sheer number of streams in a HUC-12 watershed in Kentucky. Geographic Information System (GIS) methods are required to develop a stream network. To facilitate this, the United States Geological Survey (USGS) oversaw the

of the National Hydrology Dataset (NHD), a spatial layer exhibiting all surface water features in the United States including ponds, lakes, dams, canals, rivers and streams. Released in 1999, the NHD incorporates streams delineated from 1:100,000-scale topographic maps. These historic topographic maps were authored by many different cartographers and often vary in detail even in adjacent quads. Extrapolating meaningful stream network data from the USGS NHD layer is not feasible for small scale projects such as this. We used GIS techniques accompanied with the USGS National Elevation Dataset (NED) geospatial layers and field stream determinations to develop a stream network model for the project area. In the field we designated stream origins through methods outlined by the *North Carolina Division of Water Quality's Identification methods for the Origins of Intermittent and Perennial Streams* (2005). We plotted field-delineated points of origin for stream classes on a flow accumulation raster developed for the region from the NED layers. We then calculated threshold values for stream classes by averaging values from multiple field reference points. Following this step, we applied threshold values to the Flow Accumulation raster for the entire study area to develop a rough stream network depicting ephemeral, intermittent and perennial streams. A map was created depicting the modeled stream of the GIS developed network (Figures 7-4).

We found there are approximately 71 miles of streams within the project area, comprised mainly of intermittent channels (Table 7-2). There are approximately 21.6 miles (30%) of ephemeral streams, 37.5 miles (53%) of intermittent streams and approximately 11.8 miles (17%) of perennial streams within this stream network.

Table 7-2. Total lengths of streams in the project area by flow regime.

Flow Regime	Length (feet)	miles (ft)	Percent
Ephemeral	114,025	21.6	30%
Intermittent	198,007	37.5	53%
Perennial	62,121	11.8	17%
Total	**374,153**	**71**	**100%**

We performed Jurisdictional Determinations in the field to quantify the amount of stream that will be disturbed by the proposed permit. We found a total of 18,814 feet of ephemeral and intermittent

stream channel within the proposed permit area. The majority of these channels are intermittent (64.5%) while the remaining 35% are ephemeral.

C. Wetland Classification

We reviewed the National Wetland Inventory (NWI) map within Muhlenberg County to locate any known wetlands within the project area. According to the NWI, there are three wetland types within the proposed project area: freshwater emergent wetland, freshwater forested/shrub, and freshwater pond. Cowardin (1979) defines emergent wetland *as characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens.* The vegetation in this wetland class is present for most of the growing seasons in most years.

An estimated total of 36.2 acres of wetland are in the project area (Figure 7-6). The wetlands are all constructed freshwater ponds as large as 4.8 acres. The majority of the fifty ponds in the project area are less than half an acre in size.

We conducted Wetland Delineations within the proposed permit area and found a total of fourteen wetlands. The majority of these wetlands were classified as emergent and ranged in size from 0.02 acres to 1.79 acres, although all of the wetlands but two were less than half an acre in size. We found a total acreage of 4.34 acres of wetland in the project area.

D. Timber Harvest

Approximately 47%, or approximately 12 million acres, of Kentucky's land area is covered in forest. According to the University of Kentucky Cooperative Extension Service, the forest industry in Kentucky *has approximately 37,500 Kentuckians employed by the 1,125 wood industries in the state. Out of Kentucky's 120 counties, 112 have at least one wood-based company. The annual payroll for the wood industry is approximately $820 million. Wood industries in Kentucky employ one out of every nine manufacturing workers in the state.* (University of Kentucky Extension Service 2006).

Timbering within the permit area may have many effects on the local environment. Tree removal causes appreciable impacts to water quality in several ways. Initially, increased erosion clogs streams with excessive sediment, which increases flooding potential and impacts aquatic life through suffocation. Secondly, storm water runoff is increased as infiltration and evapotranspiration is reduced. This effect causes even more physical alteration to the stream as it increases in size to accommodate the

additional flow. This alteration leads to stream entrenchment which reduces the stream's access to its floodplain, increases sedimentation even further, and can lower adjacent water tables. Lastly, tree removal adjacent to streams reduces organic matter input (food source) and increases solar exposure.

According to literature provided by the United States Department of Agriculture (USDA), there were a total of 2,116 thousands of cubic feet (MCF) of boards produced in Muhlenberg County and a total of 136,338 MCF for the state of Kentucky in 2009. This production shows a decrease for both the study area and Kentucky production from 1995-2007. From 1995-2007, literature showed an average production of approximately 2,835 MCF for Muhlenberg county and approximately 181,655 MCF for the state of Kentucky.

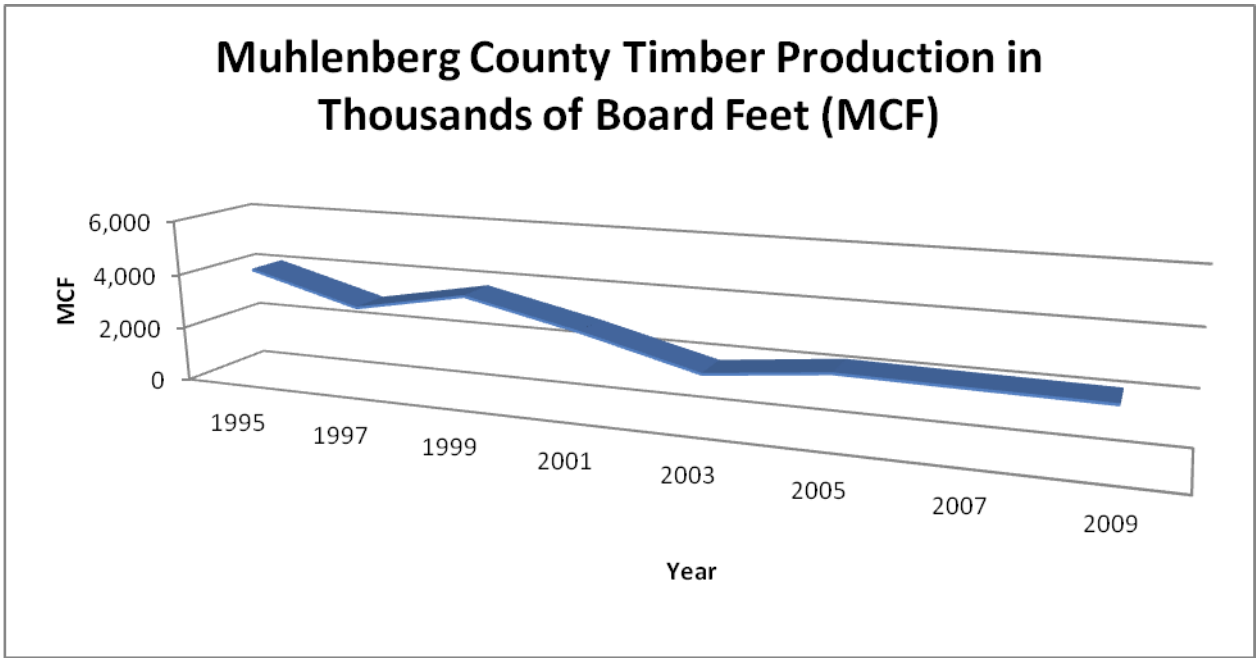


Figure 7-2. Muhlenberg county timber production in thousands of board feet (MCF).

Table 7-3. Muhlenberg county timber production in thousands of board feet.

	Timber Products		(thousands of cubic board feet)					
	1995	1997	1999	2001	2003	2005	2007	2009
Muhlenberg	4,096	2,991	3,756	2,841	1,773	2,226	2,165	2,116
Kentucky	186,186	194,605	177,020	195,633	186,584	191,180	185,696	136,338

E. Roads

According to the National Research Council Committee on ecological impacts of road density in 2005, there are approximately 4 million miles of public roads in the United States and 8.3 million lane miles. The majority (76%) of paved public roads in the United States are two-lane rural highways, and the remaining are urban and rural multilane roads. The road network is expanding slowly, having only 55,000 lane miles built between 1987 and 1997 (less than 0.2% increase per year). About 80% of the expansion to the system is from road widening. This extensive road network can have many ecological impacts throughout the United States.

Historically in the United States, roads have been narrow, mainly composed of dirt and gravel, and have followed existing topography. These roads are what formed the basis for our current road system. Only 4% of roads were paved before 1900 making traveling conditions unreliable. Since then the road system has just under doubled in length since 1900, however, the carrying capacity has multiplied making it possible to meet increasing traffic demand (Forman et al. 2003). Some major developments in road history in the United States occurred in 1893 when the Office of Road Inquiry in the U.S. Department of Agriculture was created and in 1916 when congress created the Federal-Aid Highway Program, the latter of which is still the basic program supporting federal highways today.

Improvement of roads progressed from the original dirt and gravel surfaces to oiling and natural surfacing, which then culminated with asphalt pavement. Paving of roads was done only by small scale until after World War I. Today almost 96% of paved roads in the United States use asphalt.

Roads within the project area are primarily County, State, and private. There are no railways in the project area. The project area contains a total of approximately 14.67 miles of road. County roads make up most of the length in miles of road in the project area covering 8.07 miles.

Table 7-4. Miles of road within the permit area.

Road Type	Length (miles)
County	8.07
State	3.27
Private	2.58
US	0.75
total	14.67

Roads within the project area may affect the local environment in the watersheds. Road systems may alter ecosystems in many ways including: chemical input into water/air/soil, changes in hydrological processes, habitat modification, and wildlife mortality. Chemical inputs may lead to degradation of water and air quality, as well as bioaccumulation. Changes in hydrological processes can influence fluvial dynamics and sediment transport. High wildlife mortality may affect population dynamics.

Habitats may be modified in many ways from roads including changes in soil bulk density, temperature, soil moisture content, light, runoff, and sedimentation (Tromulak and Frissell 2000). Increased soil bulk density may take place from long term road use, but may also remain after use has ceased (Vora 1988). Soil moisture content may change due to decreased soil porosity. The hydrology of slopes and stream channels may be changed by roads and affect animal communities. Roads on floodplains may redirect water, sediment, and nutrients between streams and wetlands and their riparian ecosystem. Furthermore, road crossings may act as a barrier to many aquatic animals. Habitat alteration may also aid in the spread of exotic species by removing native species and allowing easier pathways of transport.

Roads have been implicated to have many negative effects on animal populations. Roads are a great source of mortality risk to many animals. Some species are attracted to roads or simply have low car avoidance. For example, some snakes may be attracted to roads for thermoregulation (Sullivan 1981), while other reptiles may not necessarily be attracted to the roads but do not behaviorally avoid them (Fahrig and Rytwinski 2009). Some species, such as large mammals, require large movement ranges and inevitably have to cross roads (Noss et al. 1996). High mortality rates may affect animal abundance and population dynamics. Population fragmentation may occur due to the movement-barrier effects roads create (Groom et al. 2006). Barrier effects can not just have short-term effects on populations, but may also effect genetic and community levels of organization (Groom et al. 2006). Along with high mortality rate and population fragmentation, animal behavior may be modified and the spread of non-native species may increase. Roads may modify animal behavior either positively or negatively through home range shifts, altered movement patterns, altered reproductive success, altered escape response, or altered physiological state (Tromulak and Frissell 2000).

F. Natural Resources

1819 marked the first recorded discovery of hydrocarbons in Kentucky when a well drilled for producing saltwater in the Cumberland River encountered oil at a depth of several hundred feet. In 1883, the first recorded oil production in Kentucky began, and after 1900 production increased rapidly. Oil production

peaked in 1959, with 27,271,997.61 oil barrels (bbl) produced. Oil production has dropped since then with 2,552,400 bbl being produced in 2009 (Figure 8-4). Within the project area, there are six active oil wells, six active gas wells, one oil and gas well and sixty-three dry and abandoned wells. There are five abandoned wells, one oil and one gas wells within the proposed permit boundary.

Table 7-5. Oil and gas wells within the permit area.

Type of Well	Permit Area Total
Oil	6
Gas	6
Oil and Gas	1
Dry and Abandoned	63
Total	**76**

Historically, poor production practices have led to oil and gas wells having great impact on the surrounding environment. Drilling practices may lead to environmental contamination from a number of sources. Drilling fluids and muds may be spilled during drilling, or the well may blow out if adequate mud pressure is not maintained. Drilling fluids and muds, which contain many constituents capable of polluting water, may possibly escape into subsurface freshwater aquifers, contaminating water supplies (Alexander and Fairbridge 1999). Any rupture or accidental break of any line used in drilling may also result in pollution. When crude oils escape on land or water they are subjected to evaporation, oxidation, solution, dispersion, and utilization by microorganisms (Collins 1971). Surface spills may contaminate soil or seep into groundwater aquifers. Contamination of soil can affect the soil's ability to absorb water, which may limit plant growth (Ezeonu 2010), and it can decrease the fertility of soil and affect agriculture by reducing crop yields (Osuji and Nwoye 2007).

Wells are treated with acids (hydrochloric, nitric, sulfuric, hydrofluoric, formic, or acetic acids) to increase the permeability of the reservoir rocks and pollution problems may develop when the salt-enriched solutions and any unspent acid are withdrawn from the well due to the hard disposal of this

waste (Collins 1971). Pollution may also occur when acid use leads to pipe failure allowing acidic solutions to escape at the point of failure and pollute the adjacent environment or possibly a subsurface freshwater aquifer (Collins 1971).

Surface disposal ponds are another source of pollution. In surface disposal ponds or holding ponds, petroleum and brine or mixtures of crude oils and sand that are difficult to break down are held in bulldozed holes in the ground within the vicinity of the well. The brine is expected to evaporate but in reality much of it infiltrates, polluting the land (Pettyjohn 1971). If these ponds overflow the surrounding land or surface streams would be polluted.

Gas wells may pollute any freshwater they contact if communication between the gas zone and upper freshwater zone occurs. Gas wells contain ample amounts of hydrogen sulfide which may lead to large quantities of sulfide contamination to freshwater supplies (Collins 1971).

Oil spills could potentially even harm wildlife if surface spills occur. The toxic effects of inhaling vapors or ingestion of oil can make animals sick and oil can coat fur or feathers leading to hypothermia (Mosbech 2002). However, these harmful effects in terrestrial spills are unlikely to affect large populations of animals since these spills generally only affect a relatively small area (Mosbech 2002).

Abandoned mines can also provide pathways for oil and gas to contaminate groundwater supplies. The casings of abandoned wells eventually develop leaks, and if not plugged, can allow pollutants to reach freshwater aquifers that supply drinking water. This has occurred before in Kentucky with the Fort Knox well near West Point (Lyverse and Unthank 1988). Discharge of oil-field brines into both flowing waters and palustrine habitats is also a persistent source of water pollution, especially in northern counties of the drainage (Burr and Warren 1986).

The potential pollutants originating from Oil or Gas wells are variable and abundant. These activities may be impacting the environment. When oil or gas related disasters occur they typically produce a large environmental disturbance. The project appears to currently be void of any such historic or present disturbance.

Figure 7-3. Land use map.

Land Use

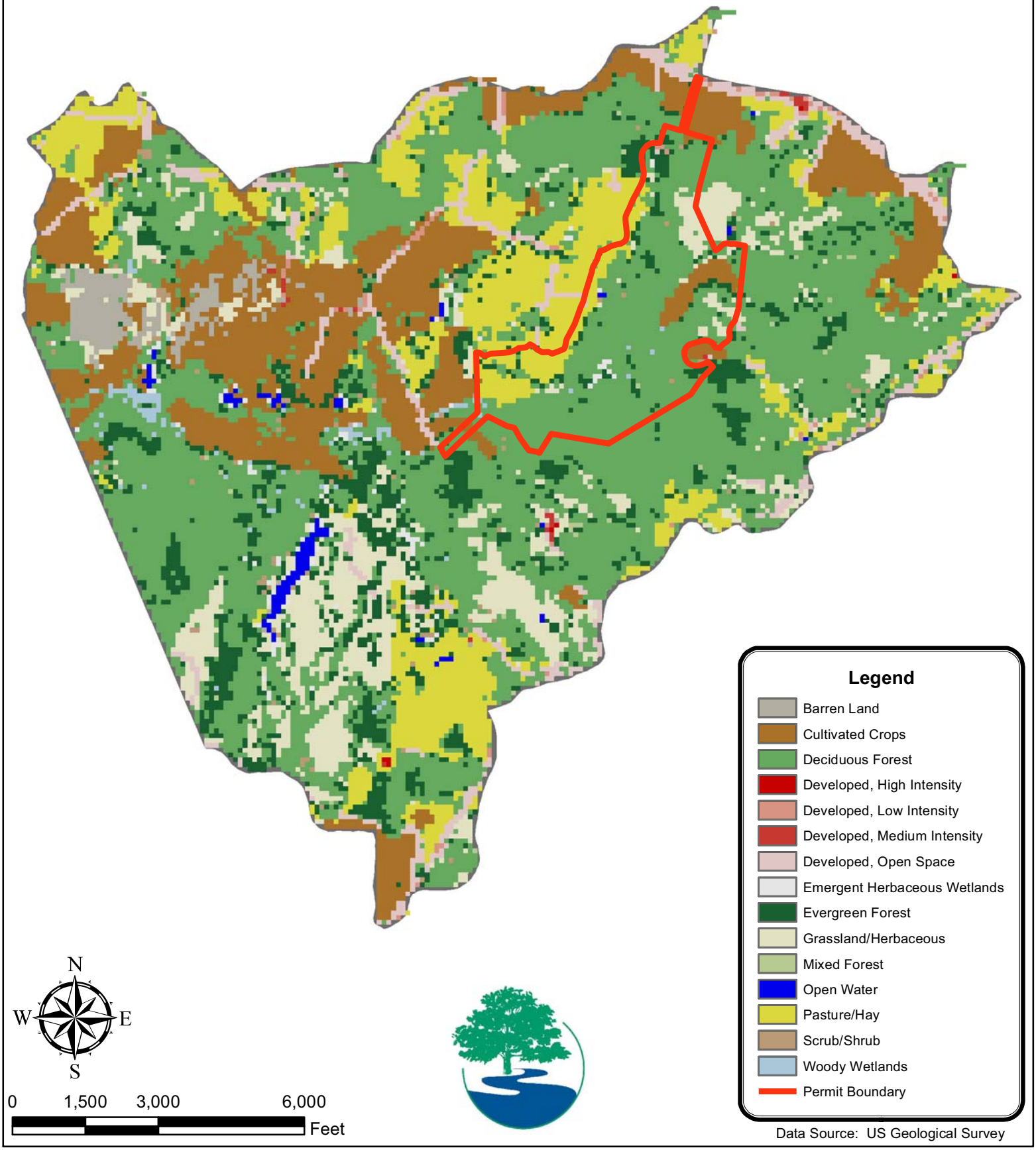
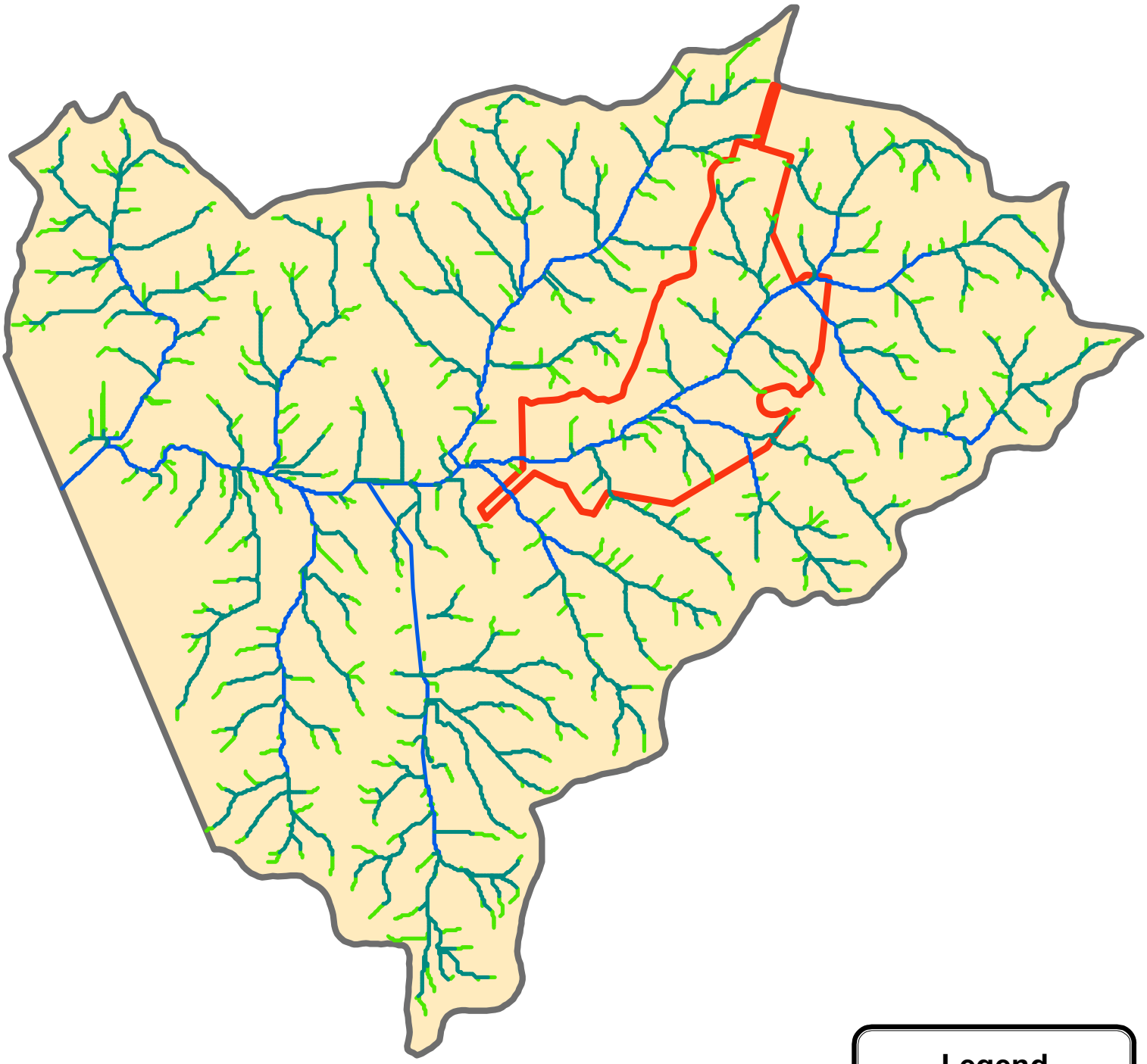

Legend
Barren Land
Cultivated Crops
Deciduous Forest
Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Emergent Herbaceous Wetlands
Evergreen Forest
Grassland/Herbaceous
Mixed Forest
Open Water
Pasture/Hay
Scrub/Shrub
Woody Wetlands
Permit Boundary
N
W
E
S
0
1,500
3,000
6,000
Feet
Data Source: US Geological Survey

Figure 7-4. Stream network by flow regime.

Stream Network



Legend

- Ephemeral
- Intermittent
- Perenial
- Permit Boundary

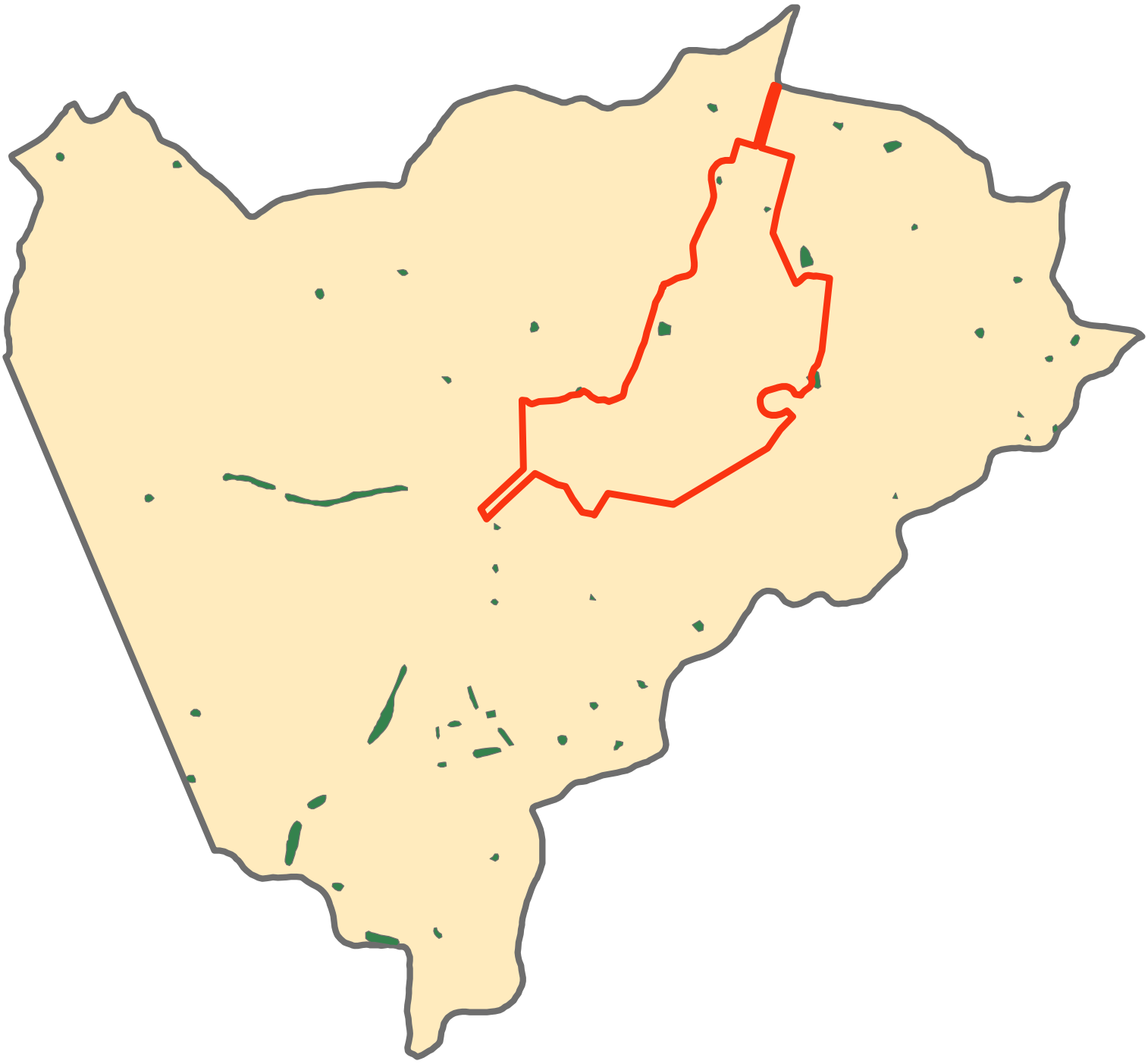
N
W E
S

0 1,500 3,000 6,000
Feet

Data Source: US Geological Survey

Figure 7-5. Wetlands.

NWI Wetlands



N
W E
S

0 1,500 3,000 6,000
Feet

Legend

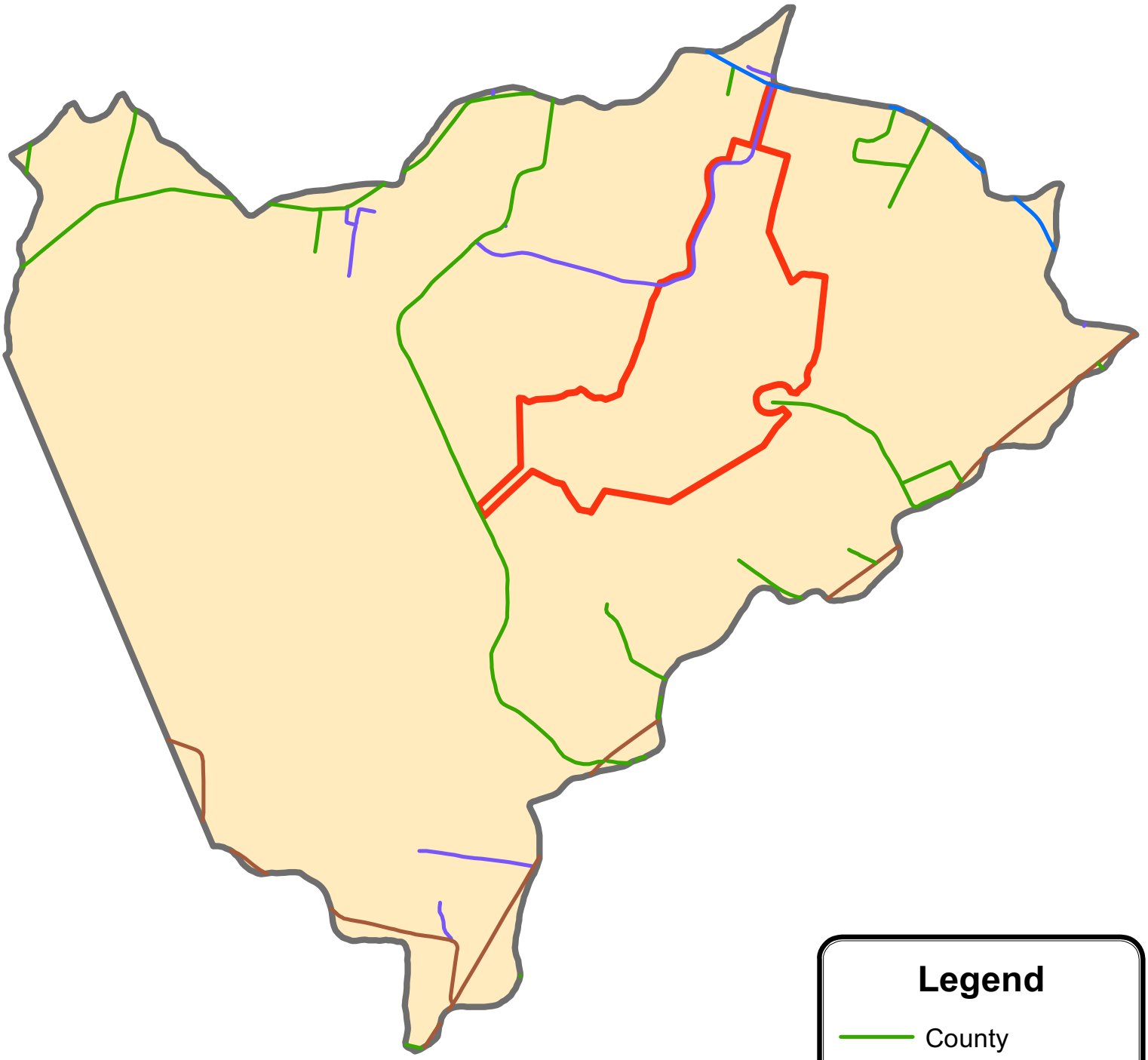
Freshwater Pond

Permit Boundary

Data Source: US Fish and Wildlife

Figure 7-6. Roads.

Roads



Legend

- County
- State
- Private
- US
- Permit Boundary

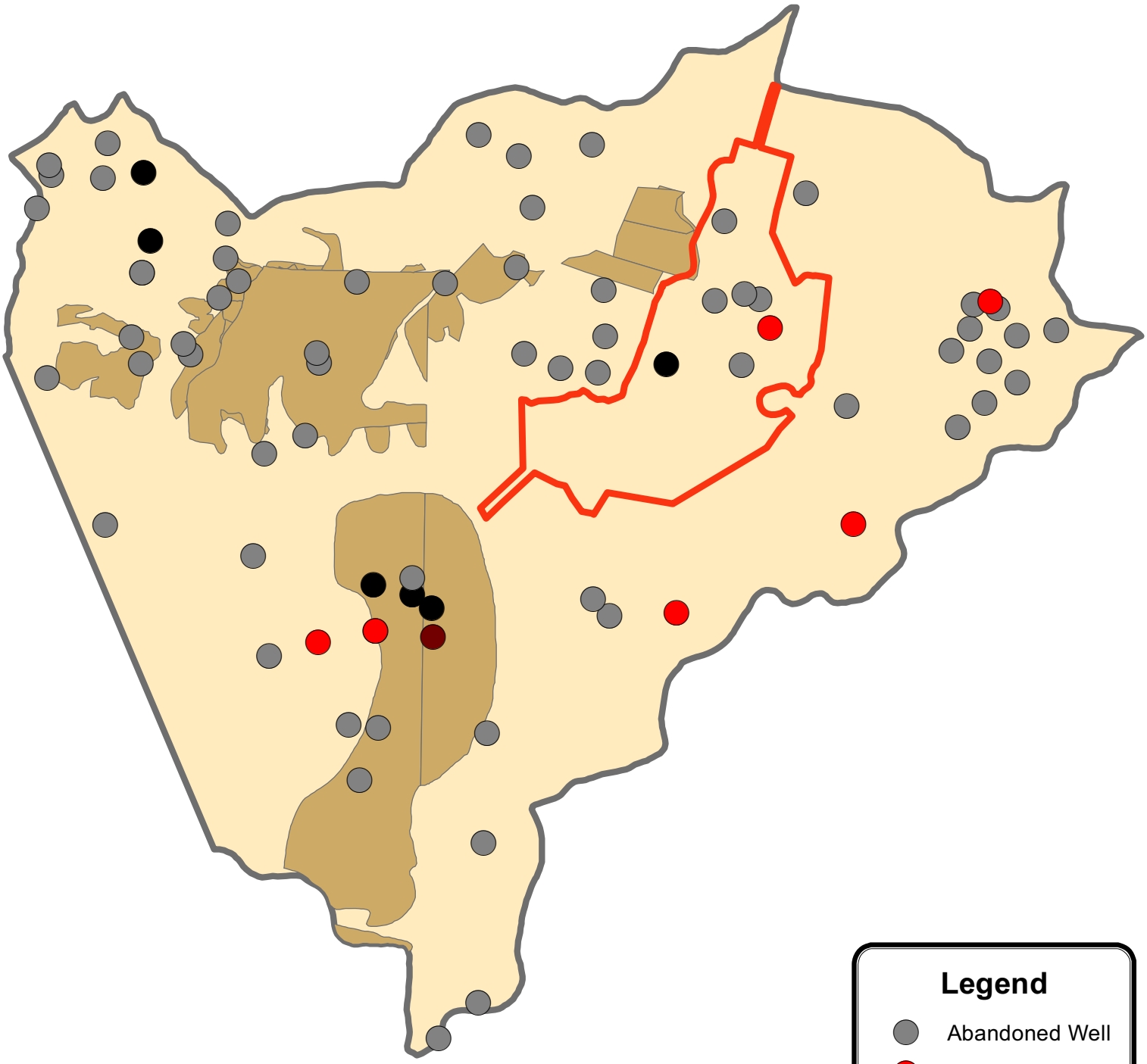
N
W E
S

0 1,500 3,000 6,000
Feet

Data Source: US Geological Survey

Figure 7-8. Resource Extraction.

Resource Extraction



Legend

- Abandoned Well
- Gas Well
- Oil and Gas
- Oil Well
- Mined Areas
- Permit Boundary

N
W E
S

0 1,500 3,000 6,000
Feet

Data Source: KY Geological Society

8. Socioeconomic Assessment

A. Demographics

Statewide for Kentucky, there are currently 4,339,367 people within 1,674,738 households (Figure 8-1). The population density averages 109.2 persons per square mile. There are presently 1,934,973 housing units in the state. The racial makeup of this state is 87.8% White, 7.8% Black or African American, 0.2% Native American or Alaska Native, 1.1% Asian, 0.1% Native Hawaiian or Pacific Islander, and 1.7% from two or more races, while 3.1% of the population is Hispanic or Latino of any race (Figure 8-2).

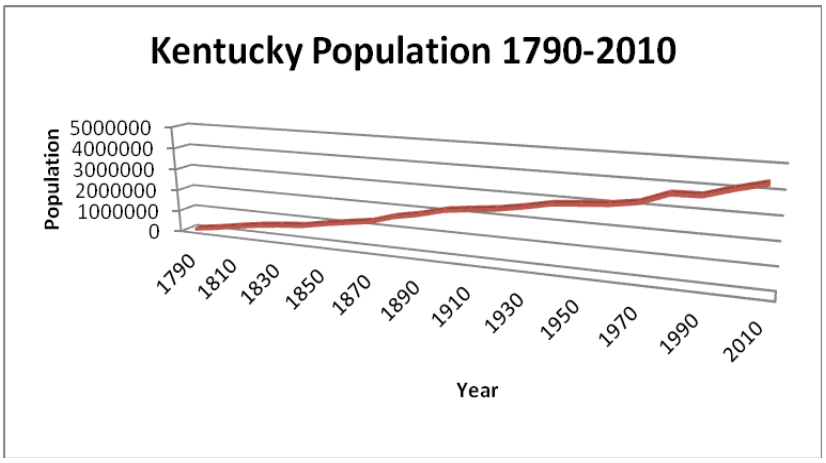


Figure 8-1: Population of the state of Kentucky (University of Kentucky Census 2011 & United States Census 2010).

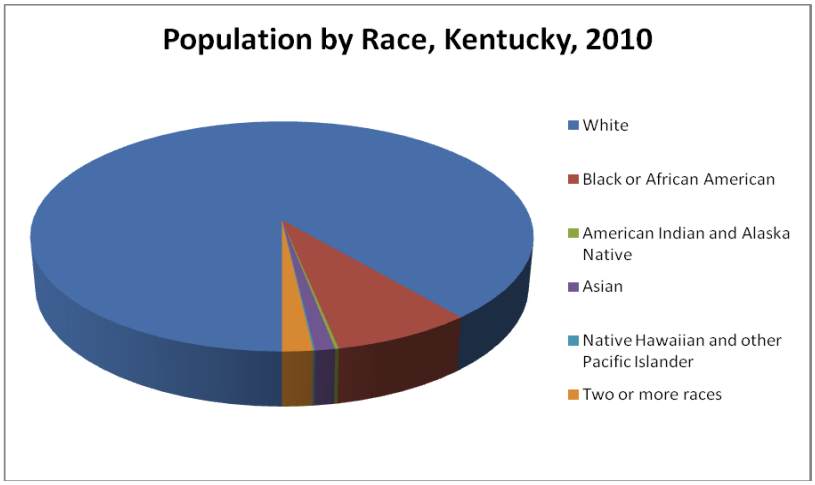


Figure 8-2: Racial composition of Kentucky.

The proposed project is expected to affect Muhlenberg County, located in western Kentucky. According to the U.S. Census of 2010 (U.S. Census Bureau (A) 2011), there were 31,499 people and 13,699

households residing in Muhlenberg County. The population density in this same area averaged to be 67.4 persons per square mile. This county's population racial makeup was 93.7% White, 4.5% Black or African American, 0.1% Native American or Alaska native, 0.10% Asian, 0% native Hawaiian or other Pacific Islander, and 1.10% from two or more races. A total of 3.10% of the population was Hispanic or Latino of any race. Population percentage breakdown can be seen in figure 8-3 below. The general composition of Muhlenberg County's population by race follows similar percentages to those displayed in Kentucky's statewide composition.

Table 8-1: Population of Muhlenberg County and Kentucky 1999-2009 according to the U.S. Census.

Census Date	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Muhlenberg County	31,968	31,839	31,755	31,598	31,505	31,523	31,458	31,429	31,450	31,279	31,274

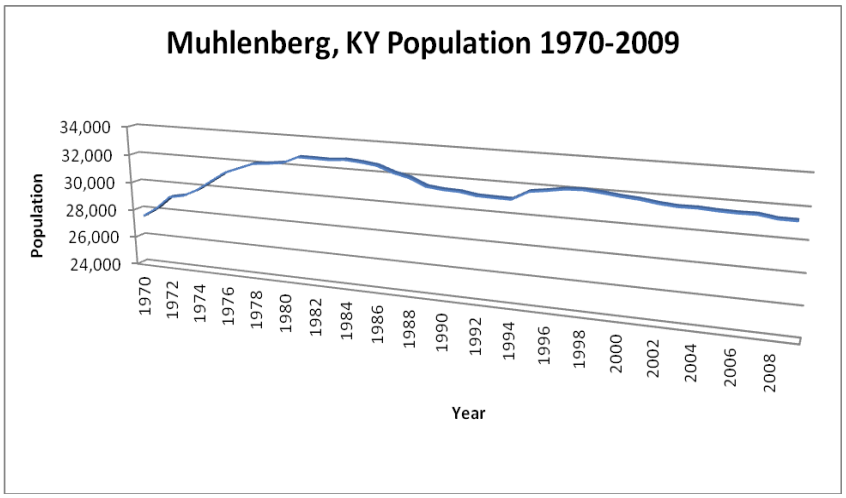


Figure 8-3: Population of Muhlenberg County, Kentucky (Kentucky Census).

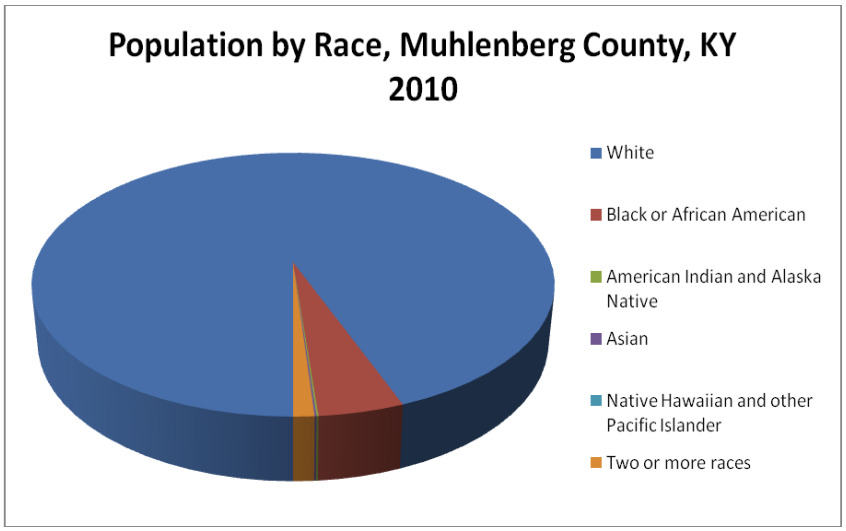


Figure 8-4: Racial composition of Muhlenberg County, Kentucky.

B. Income & Poverty Level

Median household income in Muhlenberg County, KY has increased from $29,787 in 2000 to $31,141 in 2004 (4% increase) as compared to the entire state, which has increased from $35,150 in 2000 to $37,046 in 2004 (5% increase) for the same time period (Table 8-2 and Figure 8-5). The United States as a whole increased from $41,990 to $44,334 (6%) (Workforce Kentucky (C) 2011).

Table 8-2: Annual median household income for the state of Kentucky 2000-2004.

Year	Period	Area	Source	Income Type	Income ($)	Population
2000	Annual	KENTUCKY	Census	Median household income	$35,150	4,041,769
2001	Annual	KENTUCKY	Census	Median household income	$35,977	4,067,643
2002	Annual	KENTUCKY	Census	Median household income	$35,875	4,088,977
2003	Annual	KENTUCKY	Census	Median household income	$36,663	4,114,489
2004	Annual	KENTUCKY	Census	Median household income	$37,046	4,140,427

Table 8-3: Annual median household income for Muhlenberg County, Kentucky 2000-2004.

Year	Period	Area	Source	Income Type	Income ($)	Population
2000	Annual	MUHLENBERG COUNTY	Census	Median household income	$29,787	31,839
2001	Annual	MUHLENBERG COUNTY	Census	Median household income	$29,241	31,790
2002	Annual	MUHLENBERG COUNTY	Census	Median household income	$29,568	31,702
2003	Annual	MUHLENBERG COUNTY	Census	Median household income	$30,458	31,688
2004	Annual	MUHLENBERG COUNTY	Census	Median household income	$31,141	31,635

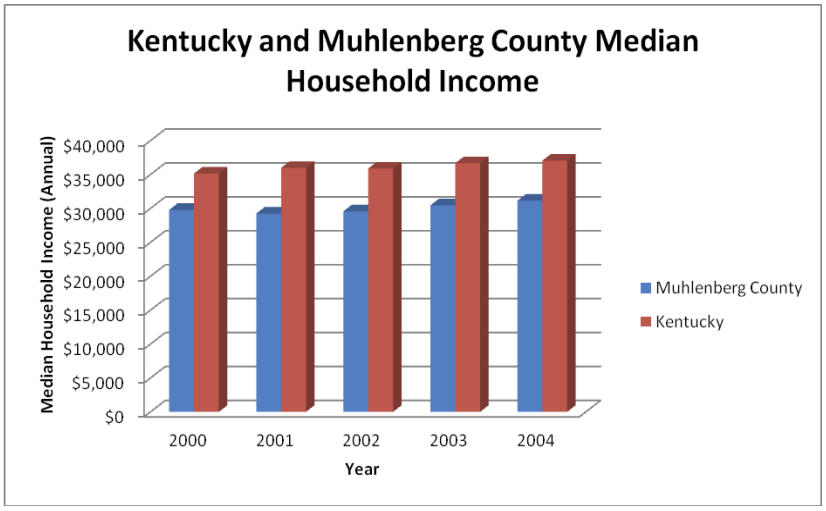


Figure 8-5: Kentucky and Muhlenberg County, KY Median Household Income.

Per Capita income in Muhlenberg County, KY has increased from $11,943 in 1989 to $25,110 in 2008 (52% increase) as compared to the entire state, which has increased from $14,530 in 1989 to $31,936 in 2008 (54% increase) for the same time period (Figure 8-6). (Workforce Kentucky (C) 2011).

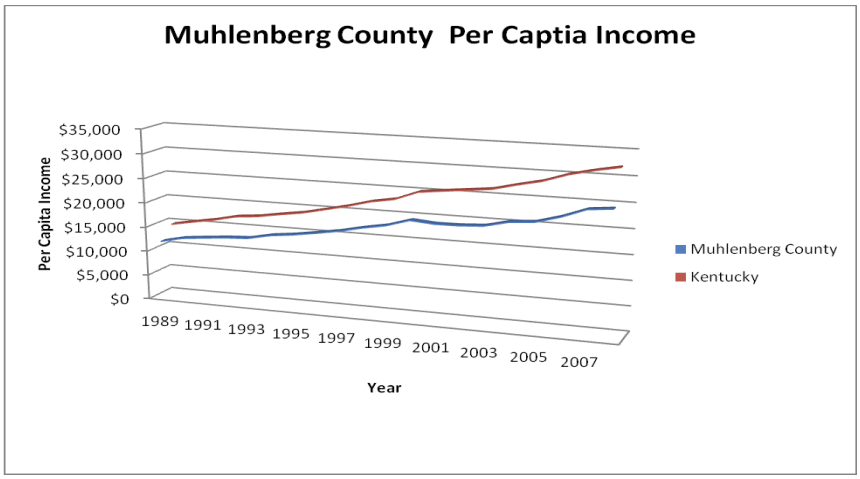


Figure 8-6: Kentucky and Muhlenberg County, KY Per Capita Income.

According to the 2010 U.S. Census for Muhlenberg County, 21.0% of the population (all ages) was below the poverty line. This percentage was higher than the rate found for the state of Kentucky, which was 18.9% (U.S. Census Bureau (C) 2011). Overall in the United States 14.3% of people of all ages are under the poverty line.

Table 8-4: Number and percent of people below poverty line for Muhlenberg County and Kentucky 1997-2010.

Muhlenberg County			Kentucky		
Year	Number	Percent	Year	Number	Percent
1997	5,572	17.3	1997	624,219	16.0
1998	5,323	16.5	1998	603,038	15.3
1999	4,948	16.1	1999	566,549	14.3
2000	4,663	15.3	2000	550,332	13.9
2001	5,026	16.5	2001	585,302	14.7
2002	5,096	16.7	2002	596,255	14.8
2003	5,303	17.3	2003	606,513	15.0
2004	5,781	19.0	2004	668,241	16.3
2005	5,908	19.8	2005	684,138	16.9
2006	6,050	20.0	2006	694,866	17.0
2007	5,980	20.0	2007	706,947	17.2
2008	6,388	21.4	2008	716,951	17.3
2009	5,752	19.2	2009	771,876	18.4
2010	6,262	21.0	2010	796,208	18.9

C. Unemployment

Unemployment in Muhlenberg County, KY has increased from 5.9% in 2000 to 11.0% in 2010 as compared to the entire state, which has varied from 4.2% to 10.5% for the same time period. The United States as a whole has varied from 4% to 9.3% for this period.

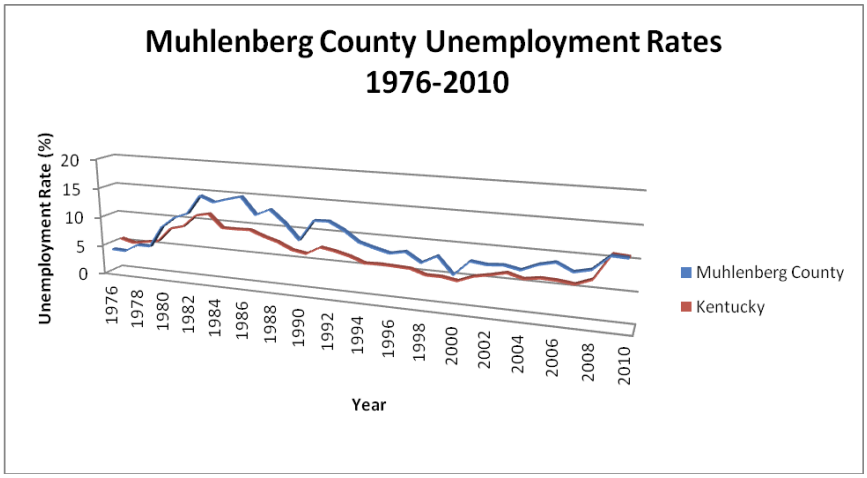


Figure 8-7: Kentucky and Muhlenberg County Unemployment Rates 1976-2010.

D. Industry

Muhlenberg County has had a stable coal mining industry over the years. However, according to the United States Bureau of Labor Statistics (BLS), from 1980 to 2000 total industry employment in mining in Muhlenberg County, Kentucky decreased from 2,984 to 420. From 1970 to 2000 the growing industries in Muhlenberg have been manufacturing, retail trade, and services.

Table 8-5. Industry data for Muhlenberg, County Kentucky.

Employment by Industry	Number Employed
Farm employment	1,190
Nonfarm employment	12,174
Private employment	9,719
Mining	420
Construction	997
Manufacturing	1,523
Transportation and public utilities	564
Wholesale trade	461
Retail trade	2,206
Services	2,919
Government and government enterprises	2,455
Federal, civilian	624
Military	106
State and local	1,725
State government	405
Local government	1,320

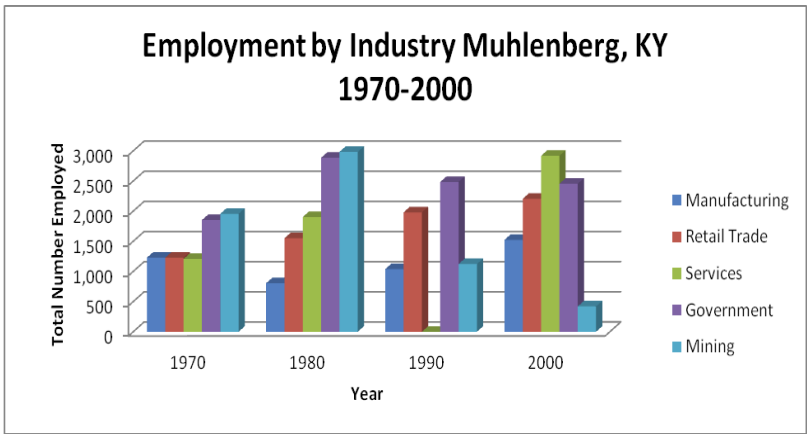


Figure 8-8. Employment by industry for the five largest industries of Muhlenberg County (1970-2000).

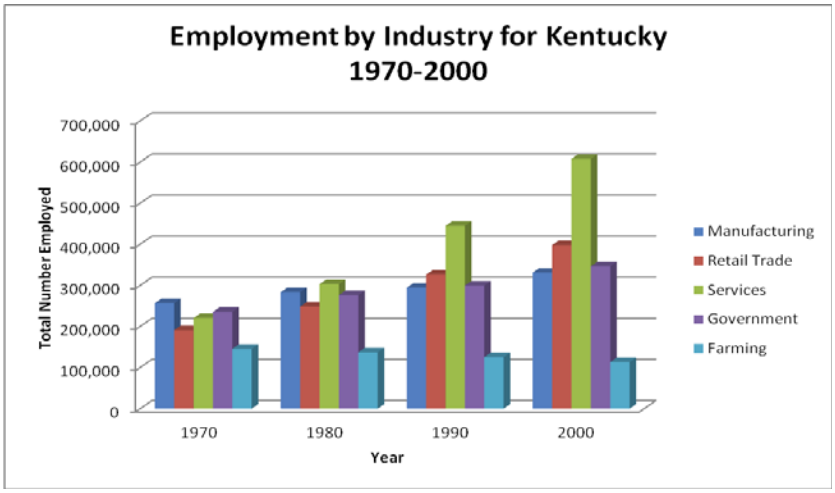


Figure 8-9. Employment by industry for the five largest industries of Kentucky (1970-2000).

9. Conclusions

We have determined through this cumulative analyses that environmental impacts have historically occurred in the project area, most notably in the form of logging, agriculture and resource extraction. We observed through GIS analysis that multiple factors are contributing to the environmental status of the area. Gas and oil wells, as well as coal mines are common in the project area. Although nearly all of the area has historically been logged, forest continuous to dominate the land use. Timber harvest for the county has declined over the past decade. Residential and industrial environmental disturbances are low, although some roads weave through the watershed. Agriculture in the form of cultivated crops and pasture lands are common. Over 70 miles of stream flow through the project area, although only 17% of these streams are classified as perennial. Our Jurisdictional Determinations in the field to revealed a total of 18,814 feet of ephemeral and intermittent stream channel within the proposed permit area. The majority of these channels are intermittent (64.5%) while the remaining 35% are ephemeral. Thirty-five acres of wetlands occur in the project area, most of which are dugout farm ponds. Our wetland delineations within the proposed permit area revealed a total of fourteen wetlands. The majority of these wetlands were classified as emergent and ranged in size from 0.02 acres to 1.79 acres, although all of the wetlands but two were less than half an acre in size. We found a total acreage of 4.34 acres of wetland in the project area.

References

Alexander DE, RW Fairbridge. 1999. Encyclopedia of Environmental Science. Springer.

Bently JW, L Lowe. 2007. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 2005. US Dept of Agriculture.

Bently JW, L Lowe. 2006. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 2003. US Dept of Agriculture.

Bently JW, L Lowe. 2004. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 2001. US Dept of Agriculture.

Collins AG. 1971. Oil and Gas Wells: Potential Polluters of the Environment? Water Pollution Control Federation 43:2383-2393.

Committee on Ecological Impacts of Road Density, National Research Council. 2005. Assessing and Managing the Ecological Impacts of Paved Roads.

Compton MC, GJ Pond and JF Brumley. 2003. Development and Application of the Kentucky Index of Biotic Integrity (KIBI). Kentucky Department for Environmental Protection.

Cooper JA, TG Johnson and CG Nevins. 2011. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 2009. US Department of Agriculture.

Cowardin LM, V Carter, FC Golet, and ET LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Department of the Interior. Fish and Wildlife Service. Washington, DC.

Forest Inventory and Analysis National Program. United states Department of Agriculture. Accessed 2011: http://www.fia.fs.fed.us/

Fahrig, L, T Rytwinski. 2009. Effects of Roads on Animal Abundance: an Empirical Review and Synthesis. Ecology and Society 14:21.

Forman RT, D Sperling, JA Bissonette, AP Clevenger, CC Cutshal, VH Dale, L Fahrig, R France, CR Coldman, K Heanue, JA Jones, WJ Swanson, T Turrentine, TC Winter. 2003. Road Ecology: Science and Solutions. Island Press. Washington.

Groom MJ, GK Meffe, CR Carroll. 2006. Principles of Conservation Biology. Sinauer Associates, Inc.

Homer C, C Huang, L Yang, B. Wylie, M Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing 70: 829-840.

Johnson TG, A Jenkins, L Lowe. 1997. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 1995. US Department of Agriculture.

Jones R. 2005. Plant Life of Kentucky. The University Press of Kentucky. Lexington.

Johnson TG, L Lowe. 2002. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 1999. US Department of Agriculture.

Kentucky Division of Water (KDOW). 2010. Methods for Conducting Resource Extraction General Permit Intensive Surveys in Non-OSRW Streams of Eastern and Central Kentucky. Department for Environmental Protection Frankfort, Kentucky.

Kentucky Division of Water (KDOW). 2002. Methods for Assessing Biological Integrity of Surface Waters. Department for Environmental Protection, Frankfort, KY. Pages 72-79.

Kentucky State Nature Preserves Commission. Energy and Environment Cabinet. Accessed December 2011: http://naturepreserves.ky.gov/Pages/default.aspx

Kingsley, NP and DS Powell. 1978. The Forest Resources of Kentucky. US Department of Agriculture.

Krebbs CJ. 1999. Ecological Methodology. Addison Wesley Longman Inc., Menlo Park, CA.

Libby GW, JD Kiser, HD Bryan. 1998. Endangered species screening study and field survey for the Cumberland Bean Pearly Mussel (Villosa trabalis). Mangi Environmental Group, Falls Church, Virginia.

Lyverse MA, MD Unthank. 1988. Assessment of ground-water contamination in the alluvial aquifer near West Point, Kentucky. Water-Resources Investigation Report. 88:4166. US Geological Survey.

Mathison RM, CG Nevins. 2009. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 2007. US Department of Agriculture.

McCune B, JB Grace. 2002. Analysis of Ecological Communities. MJM Sofware Design. Gleneden Beach, Oregon.

National Hydrography Dataset. United States Geological Survey. Accessed 2011: http://nhd.usgs.gov/applications.html

National Wetlands Inventory. U.S. Fish & Wildlife Services. Accessed 2011: http://www.fws.gov/wetlands/

NC Division of Water Quality. 2005. Identification Methods for the Origins of Intermittent and Perennial Streams, Version 3.1. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, NC.

Noss RF, HB Quigley, MG Hornocker, T Merrill, PC Paquet. 1996. Conservation Biology and Carnivore Conservation in the Rocky Mountains. Conservation Biology 10:949-963.

Pond GJ, SM Call, JF Brumley and MC Compton. 2003. The Kentucky macroinvertebrate bioassessment index: derivation of regional narrative ratings for wadeable and headwater streams. Kentucky Division of Water, Frankfort, KY.

Rosgen DL. 2007. Rosgen Geomorphic Channel Design. Chapter 11 in Bernard J, JF Fripp & KR Robinson. Stream Resoration Design National Engineering Handbook. U.S. Department of Agriculture. Washington.

Strahler, AN. 1952. Hypsometric (area-altitude) analysis of erosional topography. *Geological Society American Bulletin*, 63, 1117-1142.

Stratton D, L Lowe. 1999. Kentucky's Timber Industry – An Assessment of Timber Product Output and Use, 1997. US Department of Agriculture.

Sullivan BK. 1981. Observed differences in body temperature and associated behavior of four snake species. Journal of Herpetology 15:245-246.

Trombulak SC, CA Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14:18-30.

University of Kentucky Extension Service. 2006. Kentucky Forest Fact Sheet.

United States Bureau of Labor Statistics. Accessed December 2011: http://www.bls.gov/

U.S. Census Bureau. Small Area Estimates Branch. Accessed December 2011: http://ksdc.louisville.edu/1income.htm

U.S. Census Bureau. State and County QuickFacts. Accessed December 2011: http://quickfacts.census.gov/qfd/

U.S. Fish & Wildlife Service. Endangered Species Program. Accessed December 2011: http://www.fws.gov/endangered/

Vogelmann JE, SM Howard, L Yang, CR Larson, BK Wylie, JN Van Driel. 2001. Completion of the 1990's National Land Cover Data Set for the conterminous United States. Photogrammetric Engineering and Remote Sensing 67:650-662.

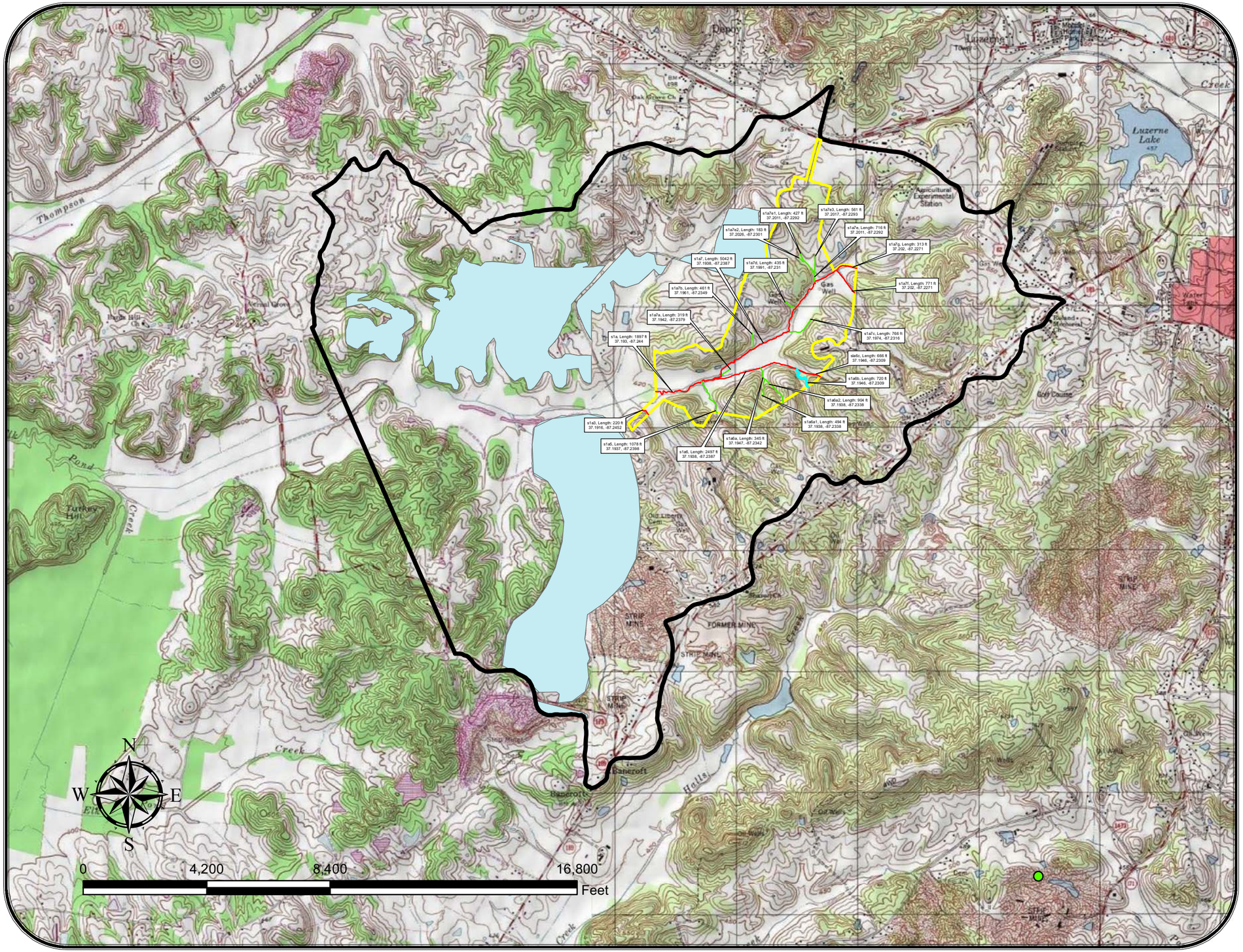
Vora RS. 1988. Potential soil compaction forty years after logging in northeastern California. Great Basin Naturalist 48:117-120.

Woods, A.J., Omernik, J.M., Martin, W.H., Pond, G.J., Andrews, W.M., Call, S.M, Comstock, J.A., and Taylor, D.D., 2002, Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs): Reston, VA., U.S. Geological Survey (map scale 1:1,000,000).

Workforce Kentucky. Accessed December 2011: http://www.workforcekentucky.ky.gov/

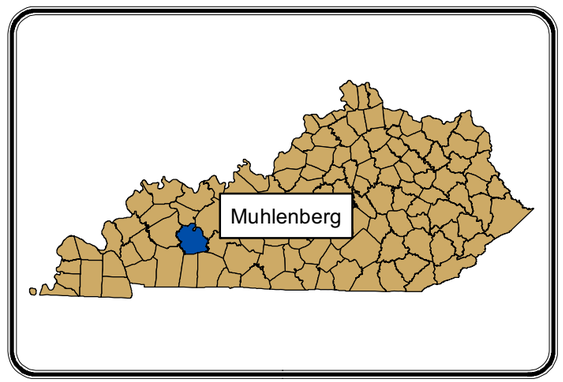
Appendix R Previously Mined Area Map

Topo Location Map



Legend

- Ephemeral
- Intermittent
- Permit Boundary
- Boundary Area
- Previously Mined



Oxford Mining Company

889-0130

Oxford Resource Partners

Reliability Matters

P.O. Box 427, 544 Chestnut Street, Coshoctin, OH 43812

Date: 2/7/2012 Drawn By: CJR

ARM Project #: 080-502

Aquatic Resources Management

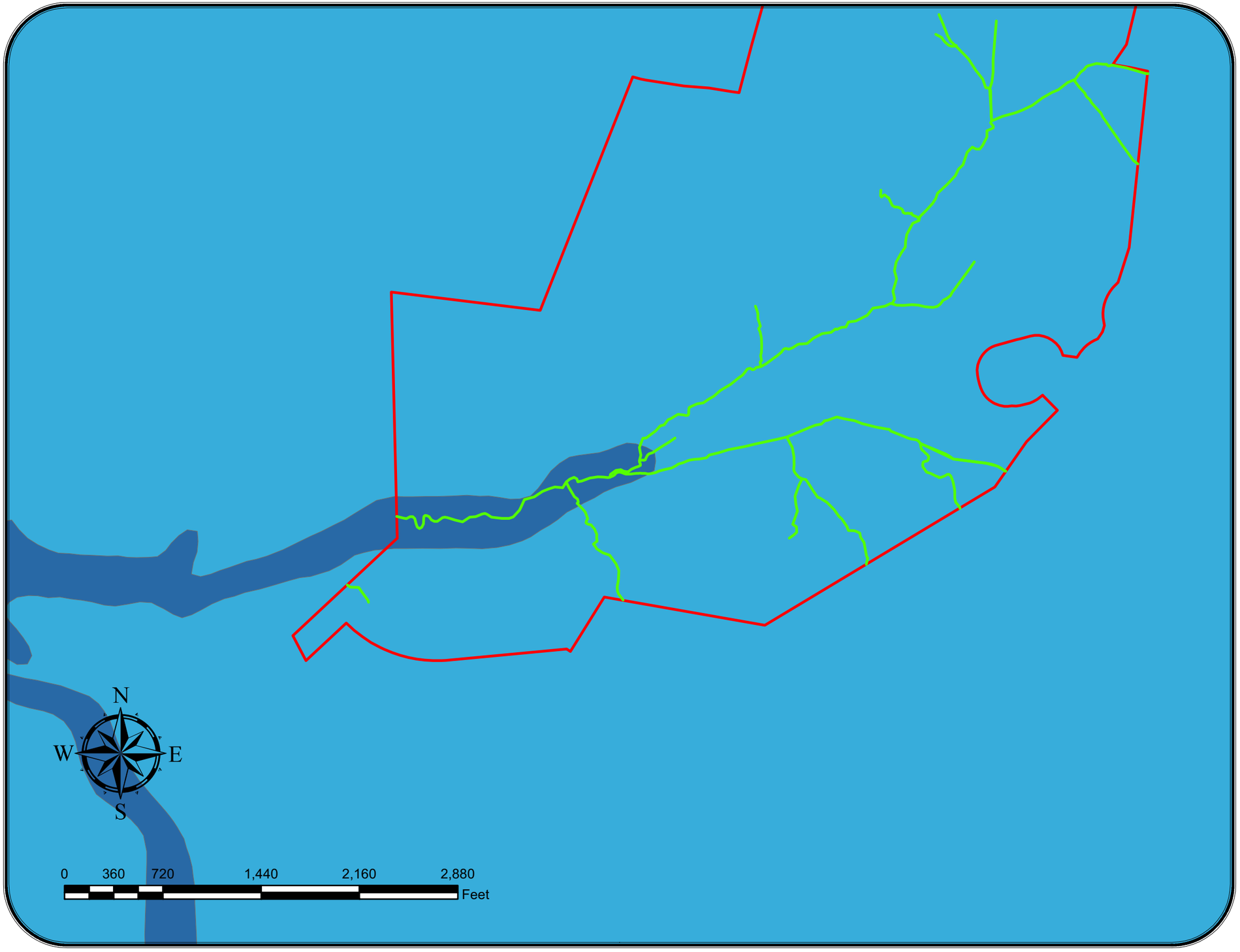
2265 Harrodsburg Rd., Suite 210

Lexington, KY 40504

(859) 388-9595

Appendix S FEMA 100 Year Flood Plain Location Map

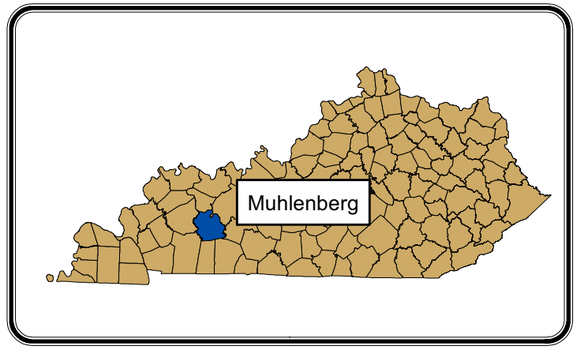
FEMA Flood Plain Location Map



Legend

Special Flood Hazard Areas Inundated By 100-Year Flood

- Zone A (No Base flood elevations determined)
- Zone AE (Base flood elevations determined)
- Zone X (Areas determined to be outside 500-Year flood plane)
- JD Streams
- Permit Boundary



Oxford Mining Company

889-0130

Oxford Resource Partners
Reliability Matters

P.O. Box 427, 544 Chestnut Street, Coshoctin, OH 43812

Date: 2/28/2012 Drawn By: NKB

ARM Project #: 080-502

Aquatic Resources Management
2265 Harrodsburg Rd., Suite 210
Lexington, KY 40504
(859) 388-9595

Appendix T Data from the American Coalition for Clean Coal Electricity (ACCCE) 2012 that **Figure 2** is created from

APPENDIX TABLE 1 - 2001, 2005 AND PROJECTED 2012 HOUSEHOLD INCOME AND ENERGY EXPENSES

2001 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS

						SUBTOTALS		
	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	$10K-<$50K	<$50K	>/=$50K
Households (Mil.)	9.8	28.9	23.6	47.0	109.3	52.5	62.3	47.0
Pct of total households	9.0%	26.4%	21.6%	43.0%	100.0%	48.0%	57.0%	43.0%
Avg pre-tax income	$5,733	$19,707	$39,201	$107,649	$60,488	$28,470	$24,893	$107,649
Effec. fed tax rate %	2.0%	8.5%	13.4%	23.1%	17.3%	10.7%	9.3%	23.1%
Est. state tax rate%	1.5%	2.6%	4.0%	6.3%	4.4%	3.2%	3.0%	6.3%
Est. after-tax income	$5,532	$17,520	$32,380	$76,054	$47,396	$24,504	$21,834	$76,054
Residential energy $	$1,039	$1,260	$1,456	$1,836	$1,493	$1,348	$1,299	$1,836
Residential electric $	$628	$772	$922	$1,172	$938	$839	$806	$1,172
Other resid. energy $	$411	$488	$534	$664	$555	$509	$493	$664
Transport energy $	$934	$1,160	$1,638	$2,195	$1,680	$1,375	$1,306	$2,195
Total energy $	$1,973	$2,420	$3,094	$4,031	$3,218	$2,723	$2,605	$4,031
Energy % of after-tax inc.	35.7%	13.8%	9.6%	5.3%	6.8%	11.1%	11.9%	5.3%
Resid. % of after-tax inc.	18.8%	7.2%	4.5%	2.4%	3.2%	5.5%	6.0%	2.4%
Trans. % of after-tax inc.	16.9%	6.6%	5.1%	2.9%	3.5%	5.6%	6.0%	2.9%

2005 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS

	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	$10K-<$50K	<$50K	>/=$50K
Households (Mil.)	9.4	28.1	23.4	53.5	114.4	51.5	60.9	53.5
Pct of total households	8.2%	24.6%	20.5%	46.8%	100.0%	45.0%	53.2%	46.8%
Avg pre-tax income	$5,400	$19,695	$39,388	$106,947	$63,344	$28,643	$25,055	$106,947
Effec. fed tax rate %	1.8%	5.0%	10.4%	17.9%	16.7%	7.5%	6.6%	17.9%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.5%	3.2%	2.9%	6.3%
Est. after-tax income	$5,249	$18,198	$33,716	$81,066	$49,924	$25,581	$22,682	$81,066
Residential energy $	$1,351	$1,498	$1,733	$2,173	$1,850	$1,604	$1,565	$2,173
Residential electric $	$785	$914	$1,098	$1,361	$1,150	$998	$965	$1,361
Other resid. energy $	$566	$583	$635	$812	$699	$607	$600	$812
Transport energy $	$1,513	$1,878	$2,652	$3,554	$2,790	$2,230	$2,119	$3,554
Total energy $	$2,863	$3,375	$4,385	$5,728	$4,640	$3,834	$3,684	$5,728
Energy % of after-tax inc.	54.5%	18.5%	13.0%	7.1%	9.3%	15.0%	16.2%	7.1%
Resid. % of after-tax inc.	25.7%	8.2%	5.1%	2.7%	3.7%	6.3%	6.9%	2.7%
Trans. % of after-tax inc.	28.8%	10.3%	7.9%	4.4%	5.6%	8.7%	9.3%	4.4%

PROJECTED 2012 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS

	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	$10K-<$50K	<$50K	>/=$50K
Households (Mil.)	9.2	28.0	22.6	58.9	118.7	50.6	59.8	58.9
Pct of total households	7.8%	23.6%	19.0%	49.6%	100.0%	42.6%	50.4%	49.6%
Avg pre-tax income	$4,906	$19,638	$39,183	$111,018	$67,530	$28,370	$24,751	$111,018
Effec. fed tax rate %	1.9%	5.2%	10.4%	17.8%	16.6%	7.5%	6.7%	17.8%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.6%	3.2%	2.9%	6.3%
Est. after-tax income	$4,764	$18,106	$33,541	$84,263	$53,229	$25,320	$22,390	$84,263
Residential energy $	$1,596	$1,773	$2,044	$2,554	$2,131	$1,894	$1,848	$2,554
Residential electric $	$930	$1,083	$1,302	$1,613	$1,330	$1,181	$1,142	$1,613
Other resid. energy $	$666	$690	$743	$941	$800	$713	$706	$941
Transport energy $	$2,106	$2,621	$3,705	$4,953	$3,957	$3,105	$2,951	$4,953
Total energy $	$3,702	$4,394	$5,749	$7,507	$6,088	$4,999	$4,799	$7,507
Energy % of after-tax inc.	77.7%	24.3%	17.1%	8.9%	11.4%	19.7%	21.4%	8.9%
Resid. % of after-tax inc.	33.5%	9.8%	6.1%	3.0%	4.0%	7.5%	8.3%	3.0%
Trans. % of after-tax inc.	44.2%	14.5%	11.0%	5.9%	7.4%	12.3%	13.2%	5.9%

Sources: Population and income data from U.S. Bureau of the Census, Current Population Survey Supp. (2001, 2005, 2011 eds.) Residential energy costs are based on U.S. DOE Residential Energy Consumption Survey (2001, 2005 eds.) 2012 projections based on changes in 2005-2012 residential energy prices from U.S. DOE/EIA Annual Energy Review 2005 and Short-Term Energy Outlook (January 2012). Transportation energy expenditures are estimated from U.S. DOE/EIA, Household Vehicle Energy Use: Latest and Trends (Nov 2005) and DOE/EIA Short-Term Energy Outlook (January 2012). Gasoline use per household in 2012 is reduced by 6.3% from 2001 levels based on data in US DOT 2009 National Highway Transportation Survey. Average effective federal tax rates are estimated from Congressional Budget Office, Effective Federal Tax Rates Under Current Law, 2001-2014 (August 2004), and Effective Federal Tax Rates, 1979-2006 (April 2009). State tax rates estimated from www.taxadmin.org/fta/rate/ind_inc.html.

Appendix U Impacted Resources Vs. Mitigation Summary

Mitigation Table

	Impacted Feet	Mitigation Ratio	Mitigated Feet	Excess Mitigation
Intermittent Stream	12,125.6	1:1	13,225.0	1,099.4
Ephemeral Stream	6,689.0	1:1	6,174.0	-515.0
	18,814.6		19,399.0	584.4
	Impacted Acres	Mitigation Ratio	Mitigated Acres	
PSS	0.68	2:1*	1.36	0.68
PEM	2.62	1:1*	2.62	0
OW	1.04	1:1**	1.04	0
	4.34		5.02	0.68

* Functional lift to PFO

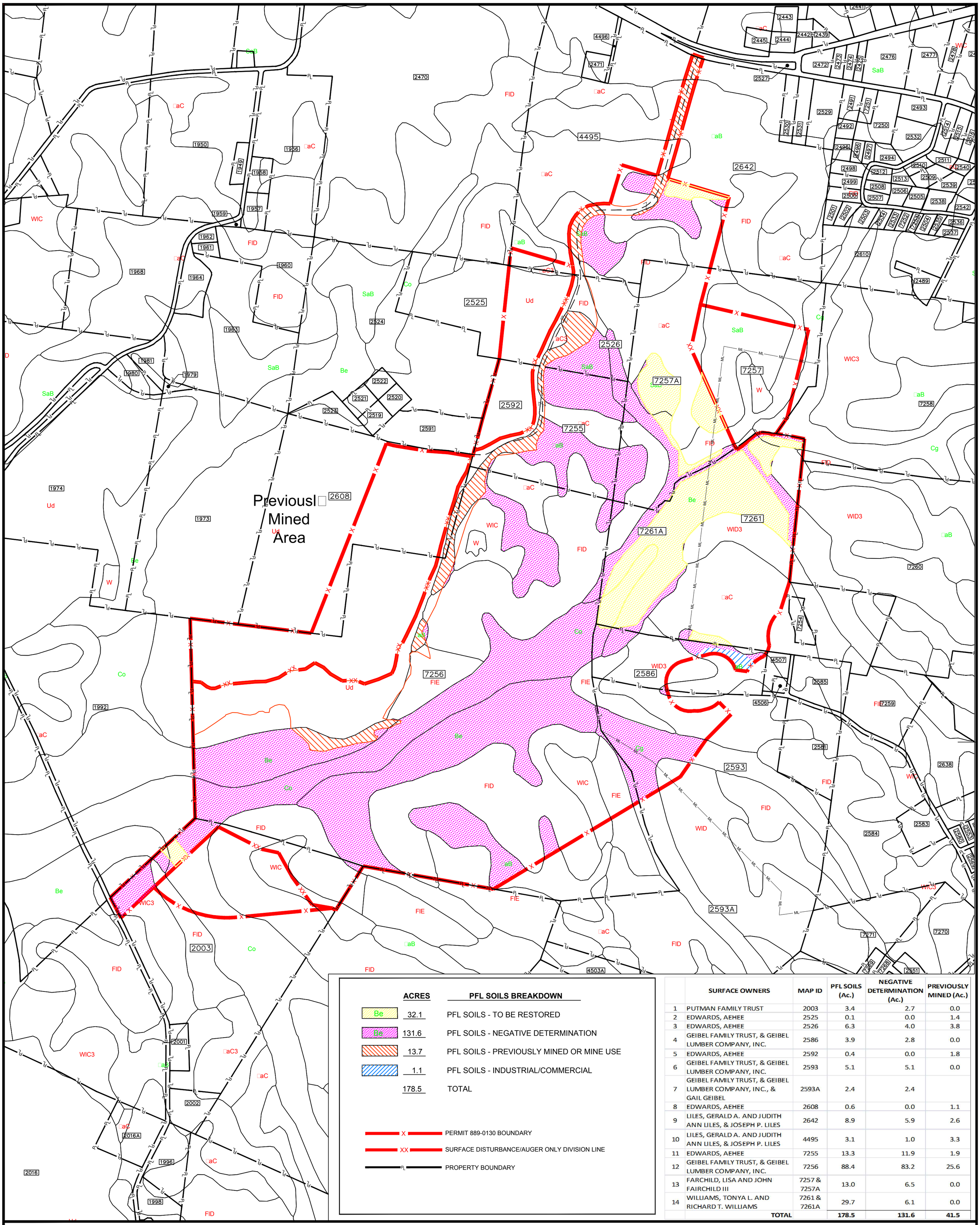
**Will be mitigated by OW

***The excess 3% stream establishment and 16% wetland establishment is proposed as compensation for the delay in construction of streams and wetlands since mining operations must be completed prior to any aquatic establishment.

Impacted Resources Vs. Mitigation Summary								
Geibel Stream Mitigation Information								
Stream	Type	Initial RBP Score	Initial Quality	Final Type	Final RBP Score	Final Quality	Mitigation Type	Linear Ft
s1a	Intermittent	87	Marginal	Intermittent	115	Suboptimal	Establishment with 50 ft Buffer	1914
s1a5	Ephemeral	92	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	1078
s1a7	Intermittent	87	Marginal	Intermittent	115	Suboptimal	Establishment with 50 ft Buffer	5516
s1a7b	Ephemeral	90	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	298
s1a6a	Ephemeral	88	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	519
s1a6a1	Ephemeral	94	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	263
s1a6a2	Ephemeral	82	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	778
s1a6	Intermittent	97	Marginal	Intermittent	115	Suboptimal	Establishment with 50 ft Buffer	3322
s1a6b	Intermittent	95	Marginal	Intermittent	115	Suboptimal	Establishment with 50 ft Buffer	718
s1a6c	Intermittent	94	Marginal	Intermittent	115	Suboptimal	Establishment with 50 ft Buffer	700
s1a7c	Ephemeral	69	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	446
s1a7d	Ephemeral	83	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	365
s1a7e	Ephemeral	103	Subobtimal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	2043
s1a7f	Intermittent	98	Marginal	Intermittent	115	Suboptimal	Establishment with 50 ft Buffer	1055
s1a7e3	Ephemeral	61	Marginal	Ephemeral	115	Suboptimal	Establishment with 50 ft Buffer	384
Total Stream Mitigation								**19399**
Total Stream Impacts								**18814.6**
Excess Mitigation								**584.4**

Impacted Resources Vs. Mitigation Summary				
Geibel Wetland Mitigation Information				
Wetland	Type	Final Type	Mitigation Type	Acreage
11	Shrub	Forested	Establishment with 50 ft Buffer	0.12
31	Shrub	Forested	Establishment with 50 ft Buffer	0.22
30	Emergent	Forested	Establishment with 50 ft Buffer	0.16
29	Emergent	Forested	Establishment with 50 ft Buffer	0.08
28	Emergent	Forested	Establishment with 50 ft Buffer	1.79
15	Emergent	Forested	Establishment with 50 ft Buffer	0.05
14	Emergent	Forested	Establishment with 50 ft Buffer	0.14
12	Emergent	Forested	Establishment with 50 ft Buffer	0.05
10	Emergent	Forested	Establishment with 50 ft Buffer	0.19
9	Shrub	Forested	Establishment with 50 ft Buffer	0.8
8	Shrub	Forested	Establishment with 50 ft Buffer	0.18
7	Open Water	Open Water	Establishment with 50 ft Buffer	0.88
4	Open Water	Open Water	Establishment with 50 ft Buffer	0.16
32	Emergent	Forested	Establishment with 50 ft Buffer	0.16
13	Shrub	Forested	Establishment with 50 ft Buffer	0.04
Total Wetland Mitigation				**5.02**
Total Wetland Impacts				**4.34**
Excess Mitigation				**0.68**

Appendix V Current Prime Farm Soils Location Map



	ACRES	PFL SOILS BREAKDOWN
Be	32.1	PFL SOILS - TO BE RESTORED
Co	131.6	PFL SOILS - NEGATIVE DETERMINATION
	13.7	PFL SOILS - PREVIOUSLY MINED OR MINE USE
	1.1	PFL SOILS - INDUSTRIAL/COMMERCIAL
	178.5	TOTAL

X — PERMIT 889-0130 BOUNDARY

XX — SURFACE DISTURBANCE/AUGER ONLY DIVISION LINE

PL — PROPERTY BOUNDARY

	SURFACE OWNERS	MAP ID	PFL SOILS (Ac.)	NEGATIVE DETERMINATION (Ac.)	PREVIOUSLY MINED (Ac.)
1	PUTMAN FAMILY TRUST	2003	3.4	2.7	0.0
2	EDWARDS, AEHEE	2525	0.1	0.0	1.4
3	EDWARDS, AEHEE	2526	6.3	4.0	3.8
4	GEIBEL FAMILY TRUST, & GEIBEL LUMBER COMPANY, INC.	2586	3.9	2.8	0.0
5	EDWARDS, AEHEE	2592	0.4	0.0	1.8
6	GEIBEL FAMILY TRUST, & GEIBEL LUMBER COMPANY, INC.	2593	5.1	5.1	0.0
7	GEIBEL FAMILY TRUST, & GEIBEL LUMBER COMPANY, INC., & GAIL GEIBEL	2593A	2.4	2.4	
8	EDWARDS, AEHEE	2608	0.6	0.0	1.1
9	LILES, GERALD A. AND JUDITH ANN LILES, & JOSEPH P. LILES	2642	8.9	5.9	2.6
10	LILES, GERALD A. AND JUDITH ANN LILES, & JOSEPH P. LILES	4495	3.1	1.0	3.3
11	EDWARDS, AEHEE	7255	13.3	11.9	1.9
12	GEIBEL FAMILY TRUST, & GEIBEL LUMBER COMPANY, INC.	7256	88.4	83.2	25.6
13	FARCHILD, LISA AND JOHN FAIRCHILD III	7257 & 7257A	13.0	6.5	0.0
14	WILLIAMS, TONYA L. AND RICHARD T. WILLIAMS	7261 & 7261A	29.7	6.1	0.0
	TOTAL		178.5	131.6	41.5

Environmental Resources Management Consulting Com□an□, LLC

LEXINGTON LOCATION
2265 Harrodsburg Rd., Suite 200
Le□ington, KY 40504
(859) 381-1000

MADISONVILLE LOCATION
229 Madison Square Drive
Madisonville, KY 42431
(270) 452-2740

Website: www.ermc2.us Email: engineering@ermc2.us

0′ 500′ 1000′ 1500′

Drawn b□: RBE | Date: 7/3/2011

Job □: 080-002 | Scale: 1"= 400'

File Location: M:\080 O□ord Mining\889-0130 Geibel 502\404 Ma□s\MRP\PMLU\AT□20□3B□ Prime Soils

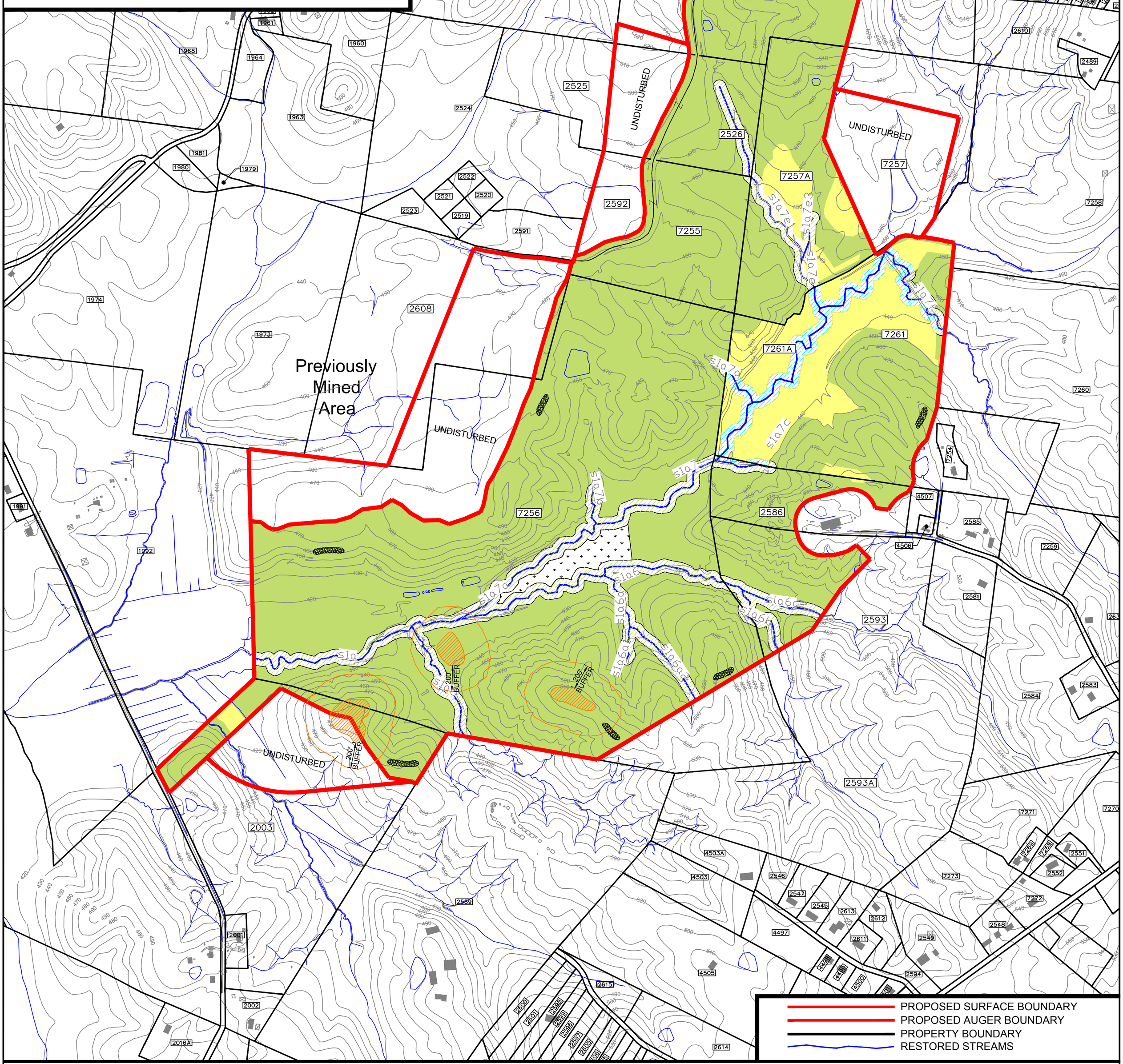
O□□ord Mining Com□an□ - Kentuc□□, LLC
889-0130
Prime Farmland Determination Ma□
AT□20□3B

Appendix W Post-Mining Land Use Map

LAND USE:	ACRES
CROPLAND: (Includes 10.19 acres of Enhancement Area)	42.29
PASTURE/HAYLAND: (Includes 30.81 acres of Enhancement Area)	357.21
TOTAL AREA	399.50

FISH AND WILDLIFE ENHANCEMENT AREA:

- RIPARIAN RESTORATION (41.0 Ac.) (Area extends into Cropland and Pasture/Hayland areas)
- WETLAND RESTORATION (4.0 Ac.) (Area totally encompassed within Pasture/Hayland area)
- WINDROW BRUSH PILES (Approximate size and location)
- ARCHAEOLOGICAL SITES



Environmental Resources Management Consulting Company, LLC

LEXINGTON LOCATION
2265 Harrodsburg Rd., Suite 200
Lexington, KY 40504
(859) 381-1000

MADISONVILLE LOCATION
229 Madison Square Drive
Madisonville, KY 42431
(270) 452-2740

Website: www.ermc2.us Email: engineering@ermc2.us

0′ 500′ 1000′ 1500′

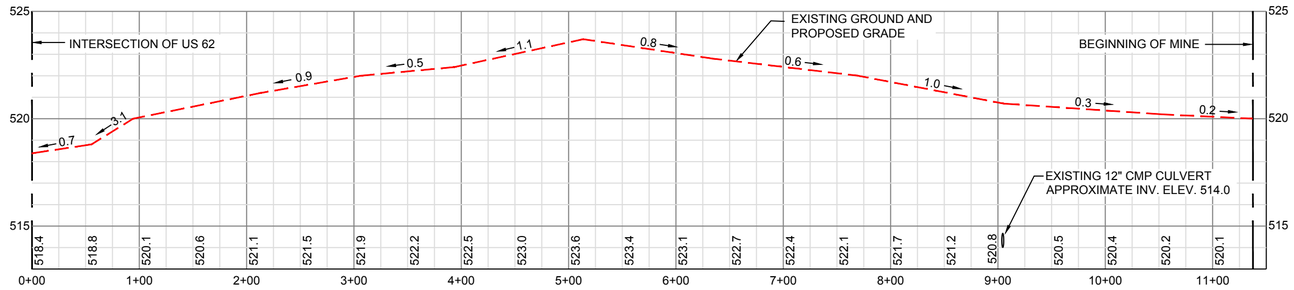
Drawn by: RBE | Date: 9/14/2011

Job #: 080-002 | Scale: 1"= 500'

File Location: M:\080 Oxford Mining\889-0130 Geibel 502\404\Maps\MRP\PMLU\AT_21_12D_PMLU

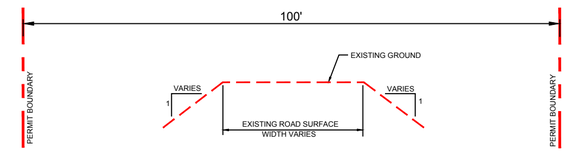
Oxford Mining Company, LLC
889-0130
Post-Mining Land Use Map
AT_21_12D

Appendix X Access Road Profiles and Sections

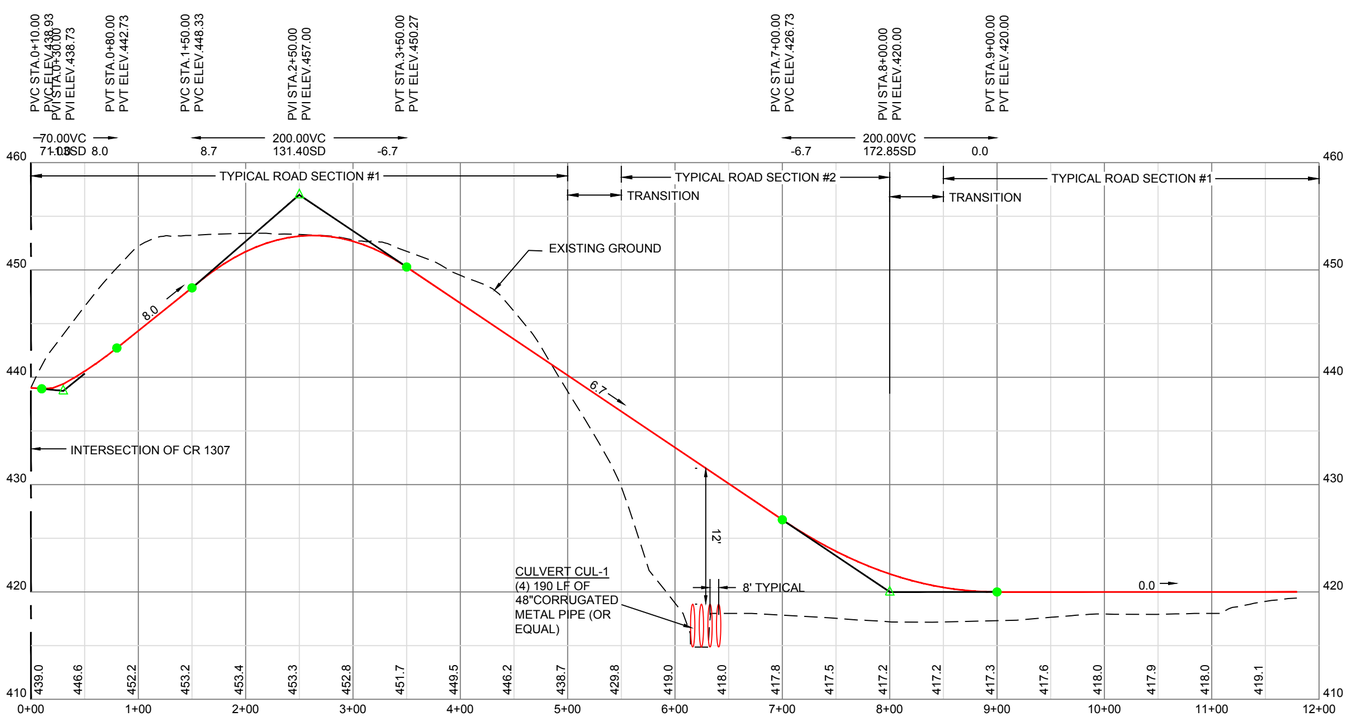


EXISTING ACCESS/HAUL ROAD "A" PROFILE
HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 5'

NOTE: SEE AT_A FOR ROAD LOCATION

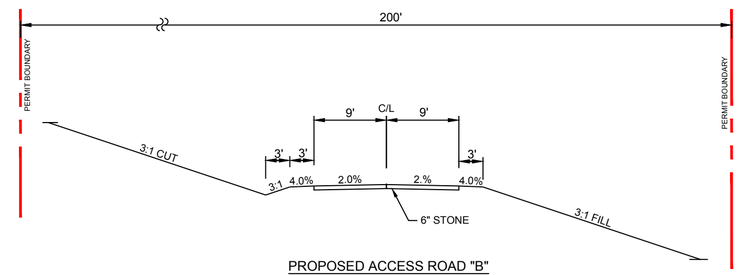


EXISTING ACCESS/HAUL ROAD "A"
TYPICAL ROAD SECTION
NOT TO SCALE

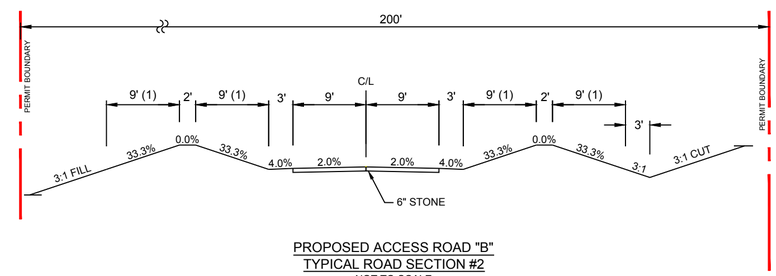


PROPOSED ACCESS ROAD "B" PROFILE
HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 10'

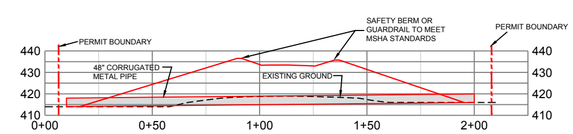
NOTE: SEE AT_A FOR ROAD LOCATION



PROPOSED ACCESS ROAD "B"
TYPICAL ROAD SECTION #1
(NOT TO SCALE)



PROPOSED ACCESS ROAD "B"
TYPICAL ROAD SECTION #2
NOT TO SCALE
(1) SAFETY BERM TO MEET MSHA STANDARDS



CULVERT CUL-1 CROSS SECTION
HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 100'

NOTE:
PROFILES AND ELEVATIONS SHOWN
OBTAINED FROM FLIGHT DATA
COMPILED BY OAS Inc., DATED 12/28/2010.

Environmental Resources Management Consulting Company, LLC

LEXINGTON LOCATION
2265 Harrodsburg Rd., Suite 200
Lexington, KY 40504
(859) 381-1000

MADISONVILLE LOCATION
229 Madison Square Drive
Madisonville, KY 42431
(270) 452-2740

Website: www.ermc2.us Email: engineering@ermc2.us

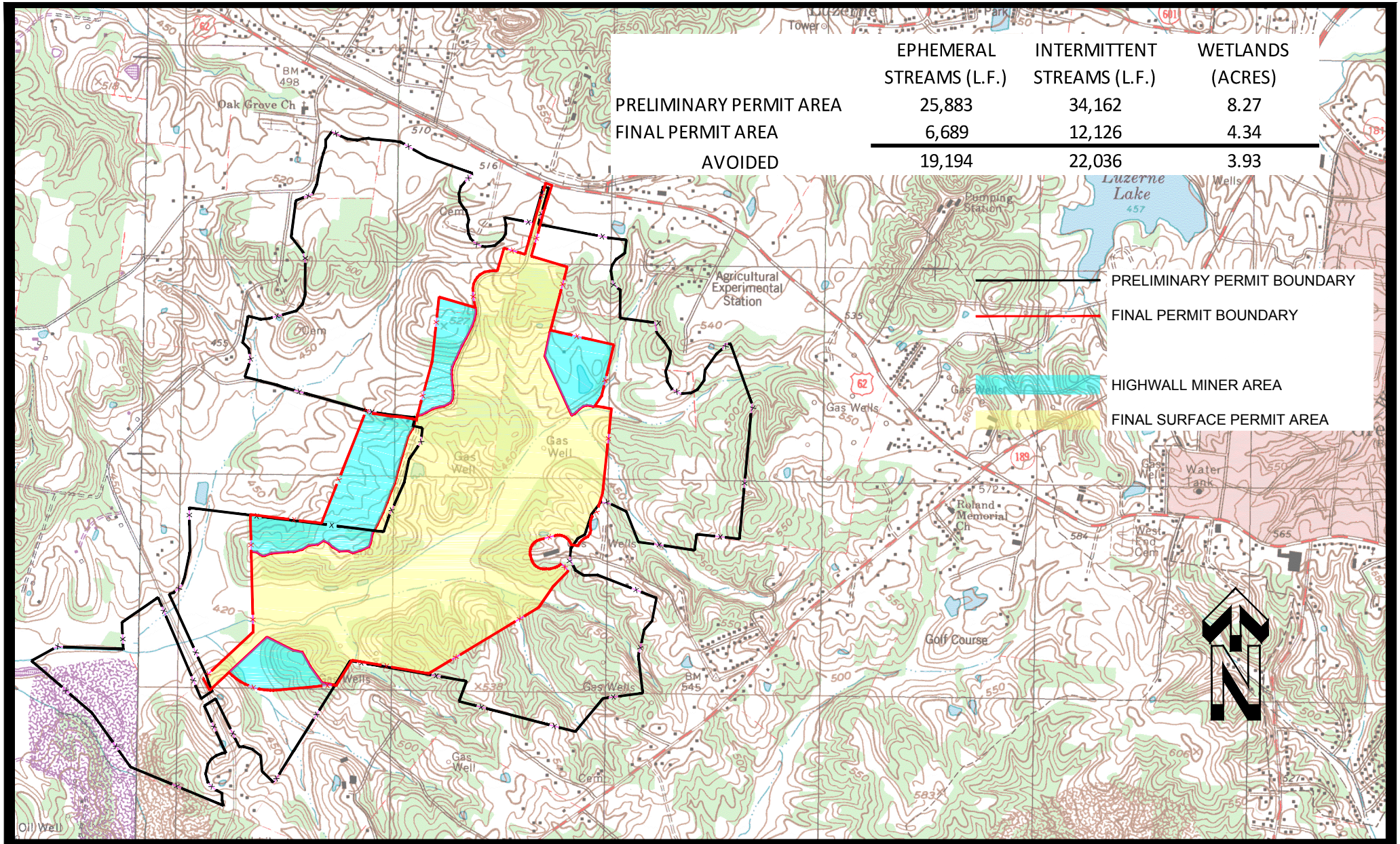
I, **R. Dale Davis** (Signature) **9675** (Registration) **2/2/2012** (Date)

Hereby Certify, In Accordance With 405 KAR 7:040, Section 10 That This Document Is Correct As determined By Accepted Engineering Practices And Includes All The Information Required Of It By KRS Charpter 350 And KAR Title 405

Drawn by: RBE	Date: 11/8/2011
Job #: 080-002	Scale: As Shown
File Location: M:\080 Oxford\002 Geibel Property 889-0130\CAD\AT_33_1A	

Oxford Mining Company - Kentucky, LLC
889-0130
Access Road Profiles and Sections
AT_33_1A

	EPHEMERAL STREAMS (L.F.)	INTERMITTENT STREAMS (L.F.)	WETLANDS (ACRES)
PRELIMINARY PERMIT AREA	25,883	34,162	8.27
FINAL PERMIT AREA	6,689	12,126	4.34
AVOIDED	19,194	22,036	3.93



Drawn: RDD	Date: 8/15/12
Job: 080-002	Scale: 1"= 2000
Drawing: AVOIDANCE	

0' 2000'

OXFORD MINING COMPANY - KENTUCKY, LLC

889-0130 NW

STREAM AND WETLAND

AVOIDANCE AND MINIMI□ATION

ErMC²

229 Madison Square Drive
Madisonville, KY 42431
(270) 452-2740
engineering@ermc2.us