# PRELIMINARY ENGINEERING REPORT MCUPTON PUMP STATION REPLACEMENT AND WATERLINE UPGRADES

# BARKLEY LAKE WATER DISTRICT TRIGG COUNTY, KENTUCKY

JULY 2017



BELL ENGINEERING 2480 FORTUNE DRIVE, SUITE 350 LEXINGTON, KY 40509



# TABLE OF CONTENTS PRELIMINARY ENGINEERING REPORT MCUPTON BOOSTER PUMP STATION (MBPS) REPLACEMENT AND WATERLINE UPGRADES

I.	Introduction1
II.	Planning Area 2
III.	Existing Facilities
P A W P	VC PIPE
IV.	Need for the Project4
V.	Alternatives
А. В.	McUpton Booster Pump Station Replacement and Waterline Upgrades
VI.	Environmental Impacts
VII.	Land Requirements
VIII.	Construction Problems
IX.	Hydraulic Calculations7
X.	Opinions of Probable Project Costs
Α.	Opinion of Probable Construction Costs
T	able 17
В.	Opinion of Probable Project Costs
Т	able 2 McUpton Pump Station Replacement Opinion of Probable Costs Total Project 8
XI.	Annual Operating Budget8
XII.	Conclusion and Recommendations8

- Map #1 BLWD Service Area and Project Area
- Map #2 Proposed Booster Pump Station Location
- Map #3 Waterline Locations

Appendix D Annual Operating Budget

**Appendix E State Clearinghouse Letter** 



# PRELIMINARY ENGINEERING REPORT MCUPTON BOOSTER PUMP STATION (MBPS) REPLACEMENT AND WATER LINE UPGRADES

#### I. INTRODUCTION

The Barkley Lake Water District (BLWD) desires to increase flow and improve pressure in the northern portion of their service area. The existing McUpton Booster Pump Station (MBPS), and transmission lines which serve the northern portion of the service area were constructed in the late 1970's. Although the system was adequate at the time, higher water demand due to regional growth at higher elevations is making it increasingly difficult and costly for the BLWD to adequately operate and serve the northern portion of the service area in a reliable manner. The current system is undersized, aging, and in need of upgrades and replacements. The proposed project will establish the necessary upgrades to allow BLWD to continue to provide an adequate, safe and reliable water supply for its customers in the northern portion of the service area. In addition, this project will enhance the ability of the BLWD to provide water to the Lyon County Water District near the county line.

The MBPS will be replaced as part of this project in order to increase flow and pressure. The BLWD estimates that the existing pump station was built in the 1980's. Previous projects have added storage tanks and additional booster pump stations to the service area, with few upgrades to the MBPS itself. As a result, the station is operating at near capacity. Much of the yard piping is inadequate and has to be operated in an inefficient manner in order to maintain supply. For example, when system demand is met, the pump(s) constantly cycle with excess flow bypassed back to the suction side of the pumps. This situation creates an energy drain and accelerates degradation of the pumps themselves.

The MBPS is an integral part of the BLWD system and any issue with this station has the potential to negatively affect service to the northern geographic regions that could be negatively impacted by outages include but are not limited to Trigg County, southern portions of Caldwell county, western portions of Christian County, and southern portions of Lyon County.

The design of the new MBPS will incorporate an efficient, tri-plex pump design with variable frequency drives (VFDs) motors to save on energy costs and enhance the reliability of the pump station.

Increased pressure from the new MBPS will require that portions of the existing distribution system to be replaced specifically lines located at lower elevations, higher pressure class lines in order to help minimize potential rupture problems



#### Preliminary Engineering Report

*McUpton Booster Pump Station (MBPS) Replacement and Water Line Upgrades Barkley Lake Water District*  arising out of increased operating pressure. The majority of existing lines were constructed with Class 160 (160 P.S.I.) Polyvinyl chloride (PVC) lines. This project will replace the existing Class 160 PVC with Class 250 PVC at specific points identified by BLWD. As funds become available, the BLWD plans to replace the remainder of the Class 160 Pipe serviced by the MBPS.

These proposed improvements will benefit customers in the northern portion of the service area through increased supply, increased pressure, and reliability of the system. The proposed improvements will also reduce the number of service interruptions and reduce operational maintenance (O & M) cost to BLWD.

#### II. PLANNING AREA

The BLWD service area encompasses most of Trigg County, Kentucky with some water provided to the adjoining counties of Caldwell, Christian, and Lyon. In addition, the BLWD also provides water to Stewart County, Tennessee. As previously discussed, this project will affect the northern portions of the service area specifically two geographic regions north of Interstate 24. Maps of the service area and location of the MBSP have been attached.

#### III. EXISTING FACILITIES

The Barkley Lake Water District owns and operates water treatment facilities on the shores of Lake Barkley near the community of Canton. These facilities were recently upgraded resulting in the plant capacity being increased from 2 mgd to 3.75 mgd. Transmission piping upgrades near the plant will allow efficient distribution of the treated water to meet rising demands. The BLWD distribution system is comprised of approximately 531 total miles of water mains averaging in size and composition along with 6 water storage tanks. A breakdown of the components of the distribution system are as follows:

IVC	
MILES	SIZE
30.5	2″
102.5	3″
170	4″
68	6″
17	8″
12	12″
2	14″
2	16″
404	TOTAL

#### **PVC PIPE**

# bell

McUpton Booster Pump Station (MBPS) Replacement and Water Line Upgrades Barkley Lake Water District

Preliminary Engineering Report

#### **ASBESTOS-CEMENT PIPE**

MILES	SIZE
63	4‴
41	6"
17	8″
3	10″
3	12″
127	TOTAL

#### WATER STORAGE TANKS

NAME	ТҮРЕ	CAPACITY	<b>OVERFLOW</b>	GROUND EL.
		(GAL.)	EL.	
Plant Tank	Standpipe	500,000	620.00	493.00
Rogers Tank	Standpipe	450,000	704.00	594.00
Pete Light Tank	Elevated	1,000,000	735.50	625.50
South Road Tank	Elevated	300,000	815.00	727.00
Siloam Tank	Elevated	300,000	704.00	614.00
Cerulean (New)	Standpipe	300,000	712.50	670.50
Storage Capacity '	Fotal:	2,850,000	Gallons	

#### PUMPS (ALL ELECTRIC)

LOCATION	ТҮРЕ	GPM	HP	NO.
Plant (Intake)	Raw Water	1,400	50	2
Plant	Low Service	1,400	100	2
Plant	High Service	1,400	60	2
Pete Light	Booster	800	40	2
Rogers	Booster	300	25	2
McUpton	Booster	600	30	2
Cerulean (New)	Booster	250	30	2
South Road	Booster	300	25	2

Additional components include approximately eighty (80) large hydrants and five hundred and forty nine (549) flush hydrants. The BLWD also has three (3) disinfection units with a combined maximum chlorine feed rate of 240 pounds per day (lbs/d).



**Preliminary Engineering Report** McUpton Booster Pump Station (MBPS) Replacement and Water Line Upgrades Barkley Lake Water District

Page 3

According to the Kentucky Infrastructure Authority (KIA) "Drinking Water System Information" page, the BLWD operational statistics are as follows:

Total Annual Volume Produced (mg):		555,836
Total Annual Volume Purchased (mg):		0.0
Total Annual Volume Provided (mg):		555,836
Estimated Annual Water Loss:		27%
Wholesale Customers:	4	Usage (mg): 84.041
Residential Customers:	5,287	Usage (mg): 240.620
Commercial Customers:	66	Usage (mg): 39.230
Industrial Customers:	5	Usage (mg): 5.231
Total Customers:	5,367	

Flushing, Maintenance and Fire Protection Usage (mg):82.000Total Water Usage (mg):413,631

The BLWD system is generally in good repair; however, some components are aging, undersized, and are in need of upgrading or replacement.

The BLWD is currently in compliance with all federal and state regulations regarding the sanitary features of the distribution system. In addition, the BLWD is governed by the Public Service Commission, and they have no current violations of PSC regulations.

### IV. NEED FOR THE PROJECT

The MBPS located is near the old McUpton School in North Cadiz, just off Highway 139, and is an integral part of the BLWD distribution system. This station supplies all of the northern portion of Trigg County including another booster pump station (Cerulean), and two water storage tanks, Siloam and Cerulean.

Currently, when system demand is met in the pressure zone of the Siloam tank, the pumps must continue to operate to supply the Cerulean booster pump station and tank. Excess flow is bypassed into the supply (suction) side of the pumps creating a continual loop. This condition is inefficient, costly, and creates unnecessary wear on the pump station.

Growth in this area of the county has increased by 10 percent since the year 2000 according to the Kentucky State Data Center. The majority of growth has occurred at high elevations near hilltops and ridgelines. Because of the existing supply conflicts, homes and businesses at these locations experience low water pressures frequently.



### V. ALTERNATIVES

A. McUpton Booster Pump Station Replacement and Waterline Upgrades

**Alternative 1**: Install a new water storage facility to meet current and future demands in this area.

Alternative 2: Install individual booster pumps on customer lines.

Alternative 3: Do nothing.

- B. Selected Alternative
  - 1. New Booster Pump Station

The existing MBPS will be replaced by a modern, efficient, tri-plex booster pump station sized to meet current and future demands. The proposed pump station will consist of three (3) energy efficient booster pumps capable of running concurrently during times of high demand and on an alternating basis under normal demand conditions. The tri-plex arrangement adds redundancy to the station should one of the pumps fail. Each booster pump shall operate on a variable frequency drive (VFD) which gives operators enhanced ability to control the output of the pump in an efficient manner. The VFDs also serve to reduce stress on piping and appurtenances due to their ability to increase to operating pressure gradually during start up, and decrease pressure gradually during shutdown, reducing pressure surges in the lines. The pumps will also be controlled/monitored by a modern "Supervisory Control and Data Acquisition" (SCADA) system. New telemetry equipment will be installed to allow the SCADA system to communicate with other components of the system as well as operators at the Water Treatment Plant.

The new pump station will be housed in a new, modern and climate controlled facility. The facility will allow maintenance of the equipment, be energy efficient, and provide protection and security for the pumps and appurtenances. The new structure will be constructed adjacent to the existing station.



#### 2. Waterline Upgrades

A section of the existing pressure class 160 PVC pipe located along Highway 139 South has been identified by BLWD for replacement. Pipe replacement will begin near the intersection of Complex Road and Highway 139 South to the intersection of Stone Road and Highway 139 South. Included in this section is a directional bore under the Muddy Fork of Little River.

### VI. ENVIRONMENTAL IMPACTS

Proposed line work construction will occur in its entirety on previously disturbed land in the state right-of-way. The work being accomplished will consist of excavation three to five feet deep and stream/creek crossings.

The construction will not have any biological impact along the route to endangered species such as the Gray Bat, Indiana Bat, and the Northern Longeared Bat due to the avoidance of clear cutting trees. Also, according to U.S. Fish & Wildlife Service Information for Planning and Consultation (IPaC) there are no critical habitats in the construction zones.

Furthermore, all stream/creek crossings will be directionally bored which will avoid affecting the endangered Slabside Pearly Mussel and all wetlands. Historical, cultural, and geological sites will not be impacted being the land has been previously disturbed.

Lastly, no specific part of the population will be disproportionally affected by the new construction of the waterline.

The project has been submitted to the Kentucky clearing house, which is designated as the single point of contact pursuant to Presidential Executive Order 12372. The clearinghouse letter SAI# KY20111121-1350 is included in Appendix D.

# VII. LAND REQUIREMENTS

The project will be constructed predominantly on property on which the BLWD already holds easements, and State and County Roadway Right-of Ways.

### VIII. CONSTRUCTION PROBLEMS

Construction problems are not anticipated for the pump station or waterline upgrades.



# IX. HYDRAULIC CALCULATIONS

A KYPIPE 2010 model was developed from system schematics and discussions with system operators. Demand data was developed from meter books and their associated routes. Tank overflow elevations and pump station data was provided by the BLWD. Hydraulic grades at master meters were established from a hydraulic model developed by Bell Engineering for the BLWD. The results of the hydraulic analysis are available on request.

## X. OPINIONS OF PROBABLE PROJECT COSTS

A. Opinion of Probable Construction Costs

Opinions of probable construction costs are provided in the Table 1 below.

A detailed opinion of probable construction costs is listed in Appendix A.

ITEM	DESCRIPTION	SIZE	QUANTITY	TOTAL COST
1	Booster Pump Station	750 gpm	1	\$325,000.
2	6" Waterline Upgrades and Directional Bore	6-inch	7,025 feet	\$268,908.
	Construction Subtotal			\$593,908.
	Construction Contingency		10%	\$59,391.
	Preliminary Opinion of Probable Construction Costs			\$653,299.

Table 1



Page 7

B. Opinion of Probable Project Costs

Opinions of probable project costs are provided in the Table 2 below.

Administration	\$10,000
Legal	\$15,000
Land, Appraisals, Easements	\$10,000
PlanningPER	\$10,000
Engineering Fees-Design and Construction	\$73,000
Engineering Fees-Inspection	\$42,000
Interest During Construction	\$5,000
Construction	\$625,000
Contingencies	\$62,500
Total	\$852,500

Table 2	
<b>McUpton Pump Station Replacemen</b>	t
<b>Opinion of Probable Costs</b>	
Total Project	

### XI. ANNUAL OPERATING BUDGET

The annual operating budget from FYE 2016 Audit has been attached.

### XII. CONCLUSION AND RECOMMENDATIONS

The distribution system upgrades outlined in this report will increase the pressure, reliability and capacity of the BLWD distribution system. The increased pumping capacity of the proposed system upgrades should provide ample amounts of water at a serviceable pressure for all of the existing customers and also allow increased sales to the Lyon County Water District, benefitting customers in the southeastern portion of their service area. The upgrades should be adequate to service increased demand due to growth in the area, and relieve low pressure issues for years to come.



# Map #1 BLWD Service Area and Project Area



# Map #2 Proposed Booster Pump Station Location



# Map #3 Waterline Locations



# Appendix D Annual Operating Budget

### BARKLEY LAKE WATER DISTRICT STATEMENT OF REVENUES, EXPENSES AND CHANGES IN FUND NET POSITION - PROPRIETARY FUND FOR THE YEAR ENDED DECEMBER 31, 2016

#### **Operating Revenues** Charges for Services \$ 2,469,449 Miscellaneous Revenue 19,850 2,489,299 Total Operating Revenues **Operating Expenses** Salaries, Wages and Benefits 1,172,427 Purchased Power 176,262 100,908 Chemicals Materials and Supplies 333,339 **Contract Services** 39,404 Transportation Expense 59,673 35,746 Insurance 17,500 Miscellaneous 56,767 Taxes Depreciation and Amortization 660,383 2,652,409 **Total Operating Expenses** Operating Income (Loss) (163, 110)Non-operating Revenues (Expenses) Interest Revenue 11,146 Federal Interest Subsidy 17,023 Gain on Disposal of Asset 1,878 Interest Expense (390, 480)Total Non-operating Revenues (Expenses) (360, 433)**Capital Contributions** Contributed Capital 180,967 Total Capital Contributions 180,967 Change in Net Position (342,576) Net Position, Beginning of Year 7,937,865 Net Position, End of Year \$ 7,595,289

# Appendix E State Clearinghouse Letter



MATTHEW G. BEVIN GOVERNOR DEPARTMENT FOR LOCAL GOVERNMENT OFFICE OF THE GOVERNOR 1024 CAPITAL CENTER DRIVE, SUITE 340 FRANKFORT, KENTUCKY 40601-8204 PHONE (502) 573-2382 FAX (502) 573-2939 TOLL FREE (800) 346-5606/ TDD:711 WWW.kydlgweb.ky.gov

SANDRA K. DUNAHOO COMMISSIONER

August 30, 2017

Mr. John Herring Barkley Lake Water District PO Box 308 Cadiz, KY 42211

> RE: McUpton Pump Station Replacement WX21221016 SAI# KY201708010950 CFDA# 10.760, 90.200

#### Dear Mr. Herring:

The Kentucky State e-Clearinghouse is the official designated Single Point of Contact (SPOC) for the Commonwealth pursuant to Presidential Executive Order 12372, and supported by Kentucky Statutes KRS 45.03. The primary function of the SPOC is to streamline the review aforementioned process for the applicant and the funding agency. This process helps in vocalizing the statutory and regulatory requirements. Information in the form of comments, if any, will be attached to this correspondence.

This proposal has been reviewed by the appropriate state agencies in the e-Clearinghouse for conflicts with state or local plans, goals and objectives. After receiving this letter, you should make it available to the funding agency and continue with the funding agencies application process. This e-clearinghouse SPOC letter signifies only that the project has followed the state reviewing requirements, and is neither a commitment of funds from this agency or any other state or federal agency. Please remember if any federal reviews are required the applicant must follow through with those federal agencies.

The results of this review are valid for one year from the date of this letter. If the project is not submitted to the funding agency or not approved within one year after the completion of this review, the applicant can request an extension by email to Lee.Nalley@ky.gov. If the project changes in any way after the review, the applicant must reapply through the eclearinghouse for a new review. There are no exceptions.

If you have any questions regarding this letter or the review process please contact the e-Clearinghouse office at 502-573-2382, ext. 274.

Sincerely. Jalley

Lee Nalley, SPOC Kentucky State Clearinghouse

Attachment

#### **KY Department for Environmental Protection** Ronald Price

This review is based upon the information that was provided by the applicant through the Clearinghouse for this project. An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications, or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments.

The proposed project is subject to Division of Water (DOW) jurisdiction because the following are or appear to be involved: water lines and appurtenances and water treatment plant upgrades. Prior approval must be obtained from the DOW before construction can begin. The applicant must cite the State Application Identifier (SAI #KY201708010950) when submitting plans and specifications.

This project is consistent with the Trigg County Water Management Plan. It is approved for water management planning. It is approved for water withdrawal by the Water Quantity Management Section of DOW. From the application data, DOW ascertains that a 'stream construction permit' is not required for this project. Julia Harrod, Watershed Management Branch, (502) 782-6967, Julia.Harrod@ky.gov.

This project will replace the aging pump station located at the old McUpton School. The original pump station is a duplex the new station will be updated to a triplex pump system. The District will also include the installation of new supervisory control and data acquisition (SCADA), variable frequency drives (VFD), and piping to bring the new station online. This project will also include the replacement of aging lines that will not be able to handle the increased pressure of the new station.

The Engineering Section of the Water Infrastructure Branch has no objections to the proposed project. Plans and specifications along with hydraulic analysis of the proposed project (including pump curves and its design information etc.) must be submitted to the DOW's Water Infrastructure Branch by a registered professional engineer in Kentucky. A written approval must be received from the DOW prior to beginning construction. Abbas Pourghasemi, Water Infrastructure Branch, (502) 782-7041, Abbas.Pourghasemi@ky.gov.

During the last Sanitary Survey (2015) the system was found to be lacking technical capacity and had a few nonsignificant deficiencies. In their response letter all of the deficiencies were addressed or soon would be. Also during the last survey the plant was using 55.5% gallons per minutes and 34.8% gallons per day of its capacity. Water loss, according to the Water Resource Information System (WRIS), is 21% and 27% according to the Safe Drinking Water Information System (SDWIS). Jason Lambert, Water Infrastructure Branch, (502) 782-7001, Jason.Lambert@ky.gov.

Best management practices should be utilized to reduce runoff from project construction activities into nearby waters. Andrea Fredenburg, Water Quality Branch, (502) 782-6950, Andrea Fredenburg@ky.gov.

We endorses this project. Sarah Gaddis, Compliance and Technical Assistance Branch, (502) 782-6953, Sarah.Gaddis@ky.gov.

The Division of Enforcement does not object to the project proposed by the applicant. Tim Harrod, Division of Enforcement, (502) 782-6858, Timothy.Harrod@ky.gov.

The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, the proposed work is located in an area with a high potential for karst development where groundwater is susceptible to direct contamination from surface activities. It is our recommendation that proposed work be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area both during construction and in operation. Wei Ji, Watershed Management Branch, (502) 782-6934, Wei.Ji@ky.gov.

If the construction area disturbed is equal to or greater than 1 acre, the applicant will need to apply for a Kentucky Pollutant Discharge Elimination System (KPDES) storm water discharge permit.

Utility line projects that cross a stream will require a Section 404 permit from the US Army Corps of Engineers and a 401 Water Quality Certification from DOW.

The Kentucky Division of Water supports the goals of EPA's Sustainable Infrastructure Initiative. This Initiative seeks to promote sustainable practices that will help to reduce the potential gap between funding needs and spending at the local and national level. The Sustainable Infrastructure Initiative will guide our efforts in changing how Kentucky views, values, manages, and invests in its water infrastructure. This website, www.epa.gov/waterinfrastructure/, contains information that will help you ensure your facility and operations are consistent with and can benefit from the aims of the Sustainable Infrastructure Initiative.

#### Water

Jason Lambert

During the last Sanitary Survey (2015) the system was found to be lacking technical capacity and had a few nonsignificant deficiencies. In their response letter all of the deficiencies were addressed or soon would be. Also during the last survey the plant was using 55.5% GPM and 34.8% GPD of its capacity. Water loss, according to WRIS, is 21% and 27% (SDWIS).

There does not appear to be any issues with this project from a capacity standpoint.

Division of Enforcement Tim Harrod

The Division of Enforcement does not object to the project proposed by the applicant.

Tim Harrod, Enforcement Specialist Division of Enforcement Timothy.Harrod@ky.gov

#### **Division of Water**

Andrea Fredenburg

Best management practices should be utilized to reduce runoff from project construction activities into nearby waters.

#### Division of Water Julia Harrod

A 'stream construction permit' is not required for this project. Okay water withdrawal permitting. Okay water management planning.

Division of Water Abba Pourghasemi

The Engineering Section of the Water Infrastructure Branch has no objections to the proposed project. Plans and specifications along with hydraulic analysis of the proposed project (including pump curves and its design information etc.) must be submitted to the Division of Water's Water Infrastructure Branch by a registered professional engineer in Kentucky. A written approval must be received from the Division of Water prior to beginning construction.

DOW Sarah Gaddis DOW CTAB endorses this project.

**DOW** Wei Ji

The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, the proposed work is located in an area with a high potential for karst development where groundwater is susceptible to direct contamination from surface activities. It is our recommendation that proposed work be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area both during construction and in operation. Questions should be directed to Wei Ji (502-782-6934) or Section Supervisor David Jackson (502-782-6986).

Fish and Wildlife Dan Stoelb

To minimize impacts to the aquatic environment the Kentucky Dept. of Fish & Wildlife Resources recommends that erosion control measures be developed and implemented prior to construction to reduce siltation into waterways located within the project area. Such erosion control measures may include, but are not limited to silt fences, staked straw bales, brush barriers, sediment basins, and diversion ditches. Erosion control measures will need to be installed prior to construction and should be inspected and repaired regularly as needed. Please contact Dan Stoelb @ 502-564-7109 ex. 4453 or Daniel.Stoelb@ky.gov if you have further questions or require additional information.

Housing Building and Construction Phil Craig

The Department of Housing Buildings and Construction, Division of Building Code Enforcement has no comments concerning the proposed project.

Kentucky Transportation Cabinet (CO) Carolyn Weber Jessica Herring (D-1) - Endorse with Comments

The Kentucky Transportation Cabinet is responsible for controlling both public and private usage of right-of-way of the State road system. Any firm, individual, or government agency desiring access to a State road or desiring to perform any type of work (including signage, boring, etc.) on or adjacent to State right-of-way must obtain a permit from the Department

Any proposed access or encroachment of a State maintained road right-of- way should be coordinated at the earliest stage with:

Tom Hines, P.E. Permits Engineer Kentucky Department of Highways, District 1 5501 Kentucky Dam Road Paducah, Kentucky 42003 Telephone: (270) 898-2431 or 1 (800) 338-4283 Fax: (270) 898-7457 Endorsed by: Jessica Herring, EIT Planning Section Supervisor Kentucky Department of Highways, District 1 5501 Kentucky Dam Road Paducah, Kentucky 42003 Telephone: (270) 898-2431 or 1 (800) 338-4283 Fax: (270) 898-7457

KIA Jocelyn Gross

This project was reviewed in the WRIS Portal by KIA Staff. The ADD has been contacted to assist with the following WRIS Project Profile updates:

Please updated the Estimated Project Schedule and Project Funding Sources in the WRIS Portal.

**KY Heritage Council** Yvonne Sherrick

To receive a review from the KY Heritage Council/State Historical Preservation Office (SHPO) you must follow the instructions located on their website at http://www.heritage.ky.gov/siteprotect/. There you will find the required documents for the Section 106 Review and Compliance for 36 CFR Part 800. This Section 106 submission process to SHPO will assist applicants and agencies in providing the appropriate level of information to receive comments from SHPO.

If you have any questions please contact Yvonne Sherrick, Administrative Specialist III, (502) 564-7005, Ext. 113, yvonne.sherrick@ky.gov

#### Pennyrile ADD

Melody Goodwin Kyle Cunningham - Endorse with Comments

Endorsed



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