

# APPENDIX G


## Geotechnical Overview

# MEMORANDUM

(P-005-2017) Consultant

**TO:** John Moore, PE  
Director, Division of Planning

**FROM:** Bart Asher, PE, PLS  
Director  
Division of Structural Design

**BY:** Erik Scott, PE   
Geotechnical Branch

**DATE:** September 26, 2017

**Subject:** Jefferson County  
Item No. 5-0000.00  
KY 1065  
Outer Loop Corridor Study:  
3<sup>rd</sup> Street (KY907) to National Turnpike (KY 1020)  
Preliminary Geotechnical Overview

The preliminary geotechnical overview report for the subject project has been completed by American Engineers, Inc. This report was prepared as part of the Outer Loop (KY 1065) Corridor Study by QK4, Inc. under Statewide Planning Contract. The report has been forwarded to the Design Consultant and will also be made available on ProjectWise.

If you have any questions or need additional information, please contact the Geotechnical Branch at 502-564-2374.

**cc:** TEBM for Project Development (District)  
Project Manager (District)  
Division of Highway Design  
Division of Planning  
American Engineers, Inc.  
QK4, Inc.

**Attachment**

# Outer Loop Corridor Study

From 3rd Street to National Turnpike



## GEOTECHNICAL OVERVIEW REPORT P-005-2017

Outer Loop (KY 1065) Corridor Study  
From 3<sup>rd</sup> Street (KY 907) to National Turnpike (KY 1020)

Jefferson County, KY

September 2017

DESIGNING YOUR FUTURE, TODAY.





September 18, 2017

Ms. Annette Coffey, P.E.  
Senior Transportation Engineer  
Qk4, Inc.  
Engineering Planning  
2225 Lawrenceburg Road  
Building B, 1<sup>st</sup> Floor  
Frankfort, KY 40601

Re: Geotechnical Overview Report  
Outer Loop (KY 1065)  
From 3<sup>rd</sup> Street (KY 907) to National Turnpike (KY 1020)  
Jefferson County, Kentucky  
AEI Project No. 217-195

Dear Ms. Coffey:

American Engineers, Inc. Field Services Center is pleased to submit this geotechnical overview that details the results of our site and mapping reconnaissance at the above referenced site.

The attached report describes the site conditions and near-surface geology and also details potential design recommendations for the proposed project. The Appendices to the report contains a water well location map for the study area as well as a geologic map of the study area. Site photographs have also been included following the report.

We appreciate the opportunity to be of service to you on this project and hope to provide further support on this and other projects in the future. Please contact us if you have any questions regarding this report.

Respectfully,  
**AMERICAN ENGINEERS, INC.**

A handwritten signature in blue ink that reads "Brad High".

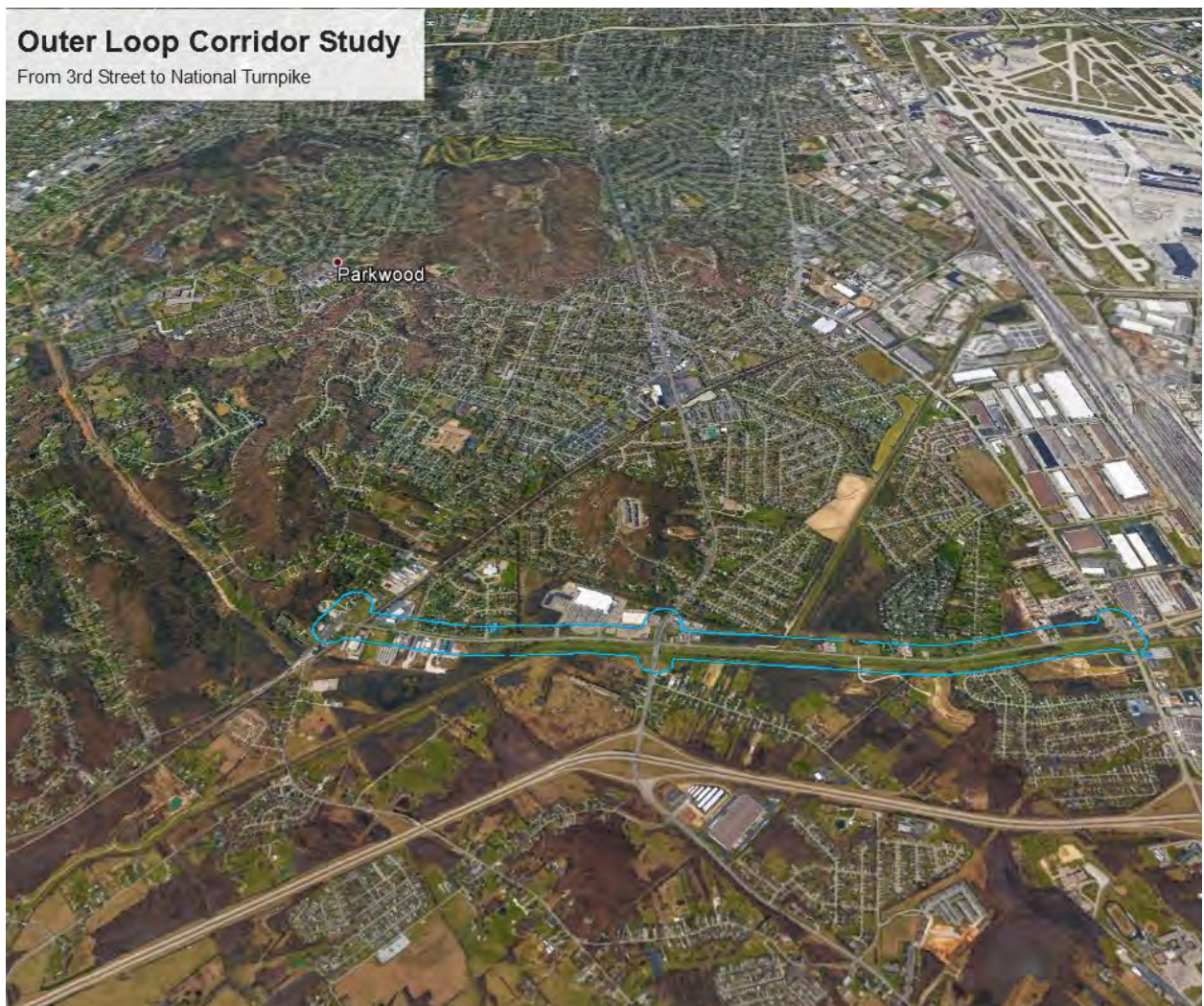
Brad High, PG  
Project Geologist

A handwritten signature in blue ink that reads "Dennis Mitchell".

Dennis Mitchell, PE  
Geotechnical Project Manager

**Geotechnical Overview Report**  
**Outer Loop Corridor Study**  
**From 3<sup>rd</sup> Street Road to National Turnpike**  
**Louisville, KY**

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**Geotechnical Overview Report  
Outer Loop Corridor Study  
From 3<sup>rd</sup> Street Road to National Turnpike  
Louisville, KY**

**1 PROJECT DESCRIPTION**

The study area includes a section of Outer Loop beginning at the intersection with 3<sup>rd</sup> Street Road and continuing east to the intersection with National Turnpike covering a length of about 2.5 miles. The extent of the study area encompasses the existing roadway and several approach roads about 300 feet north and south of the existing alignment. The area is a partially developed residential area and also has several light to heavy commercial and retail properties. In general, development along the existing roadway is primarily on the north side of the existing roadway. The section of Outer Loop in the study area is also intersected by numerous streets and includes a railway crossing near the intersection with 3<sup>rd</sup> Street Road. Southern Ditch runs parallel to and south of Outer Loop for the majority of the study area and Northern Ditch crosses Outer Loop near MP 1.4. With the exception of the area near 3<sup>rd</sup> Street Road, most of the current alignment lies within the 100-year floodplain based on FEMA floodplain mapping. The current roadway is paved with asphaltic pavement. A few areas along the existing roadway show signs of fatigue and exhibit cracking particularly along pavement joints. Sporadic signs of subgrade failure were also observed during field reconnaissance. Approximate coordinates for the western extent of the study area near 3<sup>rd</sup> Street are 38.1286806, -85.7957306; and 38.1273278, -85.7481611 for the eastern end of the study area near the intersection with National Turnpike.

The geotechnical overview was conducted in relative accordance with Section 801 of the Kentucky Transportation Cabinet Geotechnical Manual. The purpose of this overview is to identify potential geotechnical concerns and provide anticipated typical parameters for design throughout the defined study area as a precursor to a more thorough geotechnical field investigation.

The study was conducted during July and August 2017 and included field reconnaissance and geologic research of available geologic and topographic quadrangle maps, Soil Survey of Jefferson County, Kentucky, as well as multiple resources available from the Kentucky Geological Survey and the United States Geological Survey. Past reports from geotechnical investigations for roadways and structures in and near the area of the Overview were also reviewed.

## **2 SITE GEOLOGY**

Available geologic mapping (*Geologic Map of the Louisville West and Lanesville Quadrangles, Jefferson County, Kentucky, USGS, 1974, Geologic Map of the Louisville East Quadrangle, Jefferson County, Kentucky, USGS, 1974, Geologic Map of the Valley Station Quadrangle and Part of the Kosmosdale Quadrangle, North-Central Kentucky, USGS 1972* and the Kentucky Geological Survey Geologic Map Information Service online) shows the immediate ground surface within the study area to be primarily underlain by Quaternary-aged lacustrine, terrace and loess deposits. Geologic mapping also indicates bedrock which underlies the study area is comprised of, in descending order of lithology, Mississippian-aged New Providence Shale Member of the Borden Formation and Devonian-aged New Albany Shale. In general, the uppermost bedrock beneath the study area is anticipated to lie within the New Albany Shale Formation. The lacustrine deposits are generally comprised of a heterogeneous, unconsolidated mixture of clay, silt, sand and gravel. The terrace deposits are similar in composition however tend to be more silty in composition. The loess deposits, where encountered in the area are primarily silt with minor sand.

The New Providence Shale Member of the Borden Formation is predominantly clay shale with occasional minor limestone which exhibits a silty texture and is typically olive-gray to grayish-green in color where freshly exposed. Shale of the New Providence Formation is typically non-durable and makes poor subgrade material and is often plastic when wet. Exposed New Providence Shale also tends to slump and slide where cut slopes are oversteepened.

The New Albany Shale is described by geologic mapping as silty, carbonaceous and olive to grayish-black where freshly exposed and contains abundant blebs of pyrite. In general, the New

Albany Shale is much more durable than the New Providence Shale however is problematic where exposed in roadway construction as pyrite within the bedrock lends to acidic runoff where the rock is exposed. Mapping indicates the New Albany Shale will likely be encountered only at the westernmost portions of the study area.

The study area lies east of the Springdale Anticline. Regional dip in the study area was reviewed based on subsurface topographic contours drawn on the top of the underlying New Albany Shale and indicates a dip of about 22 feet per mile, or about ½ percent to the southwest.

Mapping did not indicate any potential for karst development and no known coal zones or oil or gas fields exist in the project area. A few monitoring and other water wells were noted from the KY Geologic Map Information Service near the intersection of Outer Loop and New Cut Road as well as near the intersection of National Turnpike and Outer Loop. A geologic map inclusive of the study area as well as a water wells and springs map is attached.

### **3 TOPOGRAPHY AND DRAINAGE**

The study area lies within the Outer Bluegrass Physiographic Region in Jefferson County. Topography of the study area is characterized by broad, gently sloping ridgetops, moderately sloping to steep side slopes and moderately wide to narrow flood plains. Topographic relief throughout the study area ranges from a low of about 455 feet near National Turnpike to a high of about 480 feet at the intersection with 3<sup>rd</sup> Street Road.

Surface drainage within the study area trends toward several small localized creeks and ditches and ultimately drains to the Salt and Ohio Rivers. Much of the roadway is elevated above adjacent right of way and drains immediately into broad, deep ditches.

### **4 Geotechnical Considerations**

- Subgrade soils which lie within the study area are anticipated to have a design CBR value ranging from 2 to 5. It is anticipated that subgrade stabilization will likely be required for any new construction. Chemical treatment, such as lime or cement stabilization may be

desired to effectively stabilize road subgrades, however may not be practical due to traffic flow and existing structures, utilities, etc. Stabilization utilizing processed crushed stone and geogrid may prove to be a more viable alternative for this project.

- Soils which underlie the study area are anticipated to largely consist of clayey silts with excessive moisture content.
- Wet areas could require stabilization for embankment construction. Likewise, subgrade soils under existing pavements could be very wet and might require stabilization if pavements are removed. It should be anticipated that New Albany Shale may have been utilized for pavement subgrade stabilization during prior roadway construction in the area.
- Any new culverts or culvert extensions will likely be designed for a yielding foundation. Any new bridges will likely be designed for a non-yielding foundation utilizing point-bearing piles.
- Adequate drainage will be of primary concern with any new design or new construction since the soils in the area are anticipated to be silty in nature. Positive drainage should be promoted at all times during construction. Mitigation of surface runoff should be performed by silt checks, silt traps, sediment basins and lined ditches where appropriate and directed toward permanent drainage structures as soon as possible.
- Any new roadway embankments or cut slopes for new construction will likely be minimal. Any embankments constructed at 2H:1V or flatter will likely provide an acceptable factor of safety for embankments. Soil cuts in the residual soils and plastic shales of the New Providence Shale can be problematic due to softening of the clays upon exposure in the cuts. Soil cut slopes should not be steeper than 2H:1V.

- Depending on whether widening of the roadway will occur to the south toward Southern Ditch, evaluation of the existing slopes leading to the ditch should be performed prior to development of final plans to confirm adequate stability.
- Pyritic shales are known to exist beneath the study area within the New Albany Shale Formation. Geologic mapping review would suggest that these shales would most likely be encountered in the western part of the study area. Any design for widening, realignment, etc. should avoid these shales to minimize the potential for acidic runoff from surface drainage which may encounter this formation in open cuts or if utilized as embankment material. If encountered during construction, special treatment may be required to minimize the potential for acidic runoff if this bedrock is exposed. Placement of the New Albany Shale within embankment would require encapsulation with clay or non-durable shale.
- No oil or gas wells were identified through review of online mapping or during field review of the study area. Any oil or gas wells identified prior to or during construction should be closed in accordance with Section 708 of the current edition of the Standard Specifications for Road and Bridge Construction.
- Several monitoring wells or other water wells were indicated to lie within the study area upon review of online mapping near New Cut Road as well as near the intersection with National Turnpike. Any water wells, cisterns, manholes or catch basins not incorporated into any new design and identified prior to or during construction should be closed in accordance with Section 708 of the current edition of the Standard Specifications for Road and Bridge Construction.
- Most of the existing roadway is paved with flexible pavement, however shows some signs of fatigue and distress. Other roadways in the area are paved with rigid pavement. Use of rigid pavement within any new construction may warrant consideration.

- Numerous underground and overhead utilities were apparent during the field reconnaissance. If abandoned utilities are left in place, the roadway designer should be prepared to mitigate any related geotechnical issues. Water can often become trapped or perched in and around abandoned utility lines and cause deterioration of subgrade materials. These issues may require, but are not limited to safeloading of pipes and removal and replacement of pipe, pipe bedding and pipe backfill. Areas of shallow cut and fill will be particularly susceptible to geotechnical issues from old utility lines. During the design and construction phases, consideration should also be given to active utilities scheduled to remain in place. Adequate cover should be provided for existing utilities to protect the utility as well as allow for proper performance of subgrade materials.
- A list of previously completed Geotechnical Investigations proximate to the study area is included below. These reports can be accessed through the KYTC Geotechnical Branch Database.

### **List of Projects & Reports**

<b>Project ID</b>	<b>Project Type</b>	<b>Project Description</b>
R-002-1979	Roadway	National Turnpike at Jefferson Freeway
R-018-1983	Roadway	Jefferson Freeway, Section 2B
R-017-1983	Roadway	Jefferson Freeway, Section 2A
R-006-1978	Roadway	Jefferson Freeway Mainline Station 180+00 to 478+00
R-010-1997	Roadway	National Turnpike Outer Loop- Southside Drive
R-017-2013	Roadway	Grade Lane Reconstruction
S-094-2000	Wall	New Cut Road Retaining Wall @ Sta. 100+41.76-103+75.01
S-056-1976	State Bridge	Jefferson Freeway over National Turnpike
S-007-1978	Bridges	Greyling Drive, Ramp 1, Ramp 7 & New Cut Rd over Pond
S-030-1977	Culvert Extension	Kentucky Turnpike over Slop Ditch

## 5 SUMMARY

Much of the entire study area is developed with residential and commercial properties, a railway crossing, bridge and intersections with high traffic counts. Numerous utilities, including both overhead and underground, were observed along the exiting roadway and much of the existing alignment is bound by Southern Ditch on the south side of the existing roadway. It is likely that any new construction will be constrained by these existing features. A means of soil stabilization will likely be required to provide a suitable platform for any additional fill placement and to support any new construction, whether by utilization of granular embankment or chemical stabilization. Manipulation and drying of subgrade soils will likely be required during construction to provide adequate compaction.

## 6 Site Photographs



*Figure 1 Outer Loop railroad crossing approach from 3<sup>rd</sup> Street intersection*



*Figure 2 Residential area between Afterglow Drive and Candleworth Drive*



*Figure 3 Underground utilities north side of Outer Loop at Candleworth Drive*



*Figure 4 Overhead utilities north side of Outer Loop at Candleworth Drive*



*Figure 5 Commercial development near New Cut Road.*



*Figure 6 Bridge near Wilshire Boulevard*



*Figure 7 Wetland Mitigation Area near Wilshire Boulevard*



*Figure 8 Pavement distress near Wilshire Boulevard*



*Figure 9 Underground Pipeline markers south side of Outer Loop*



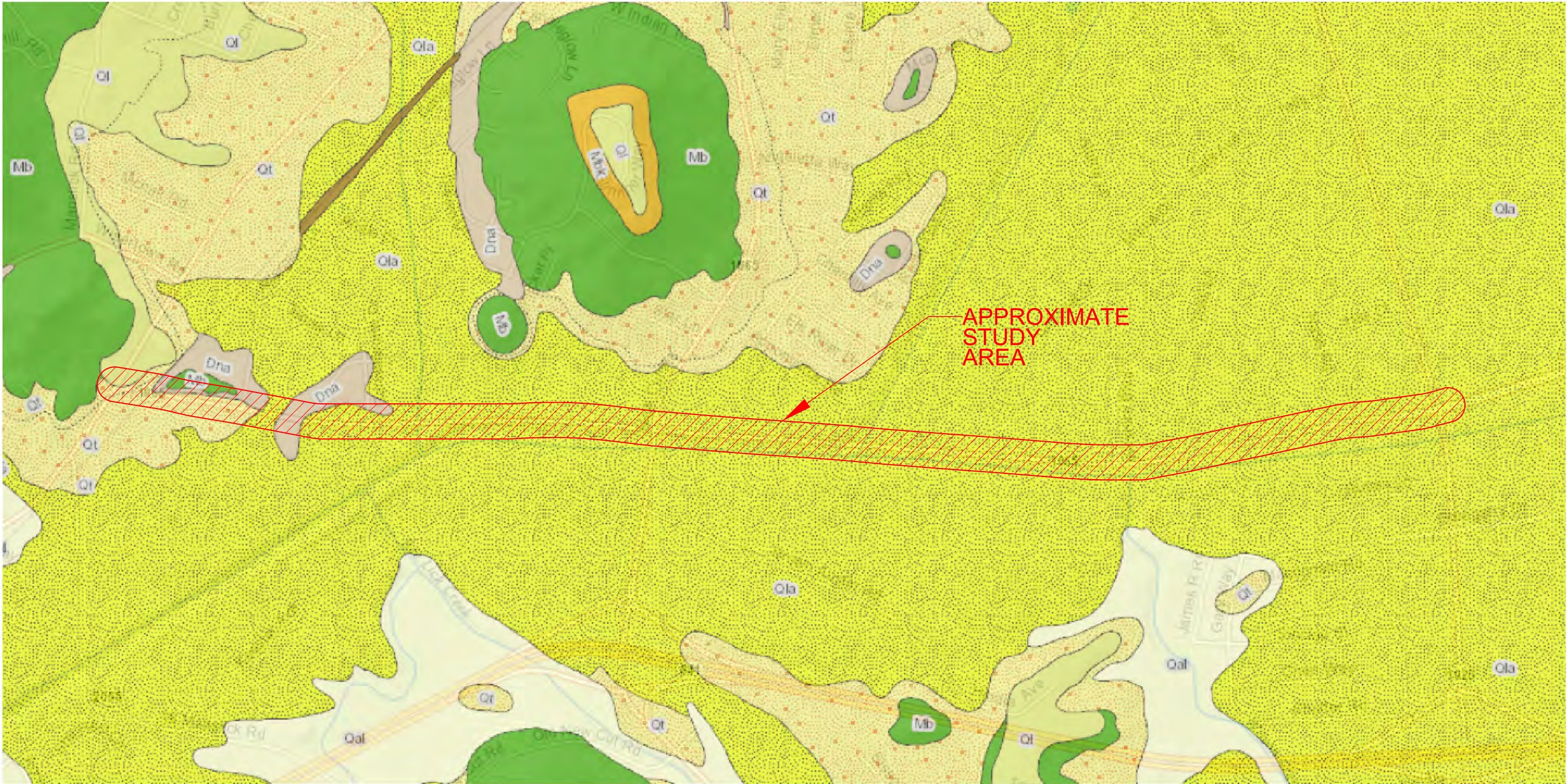
*Figure 10 Alligator Cracking in flexible pavement near Metro Public Works facility*



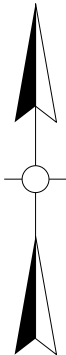
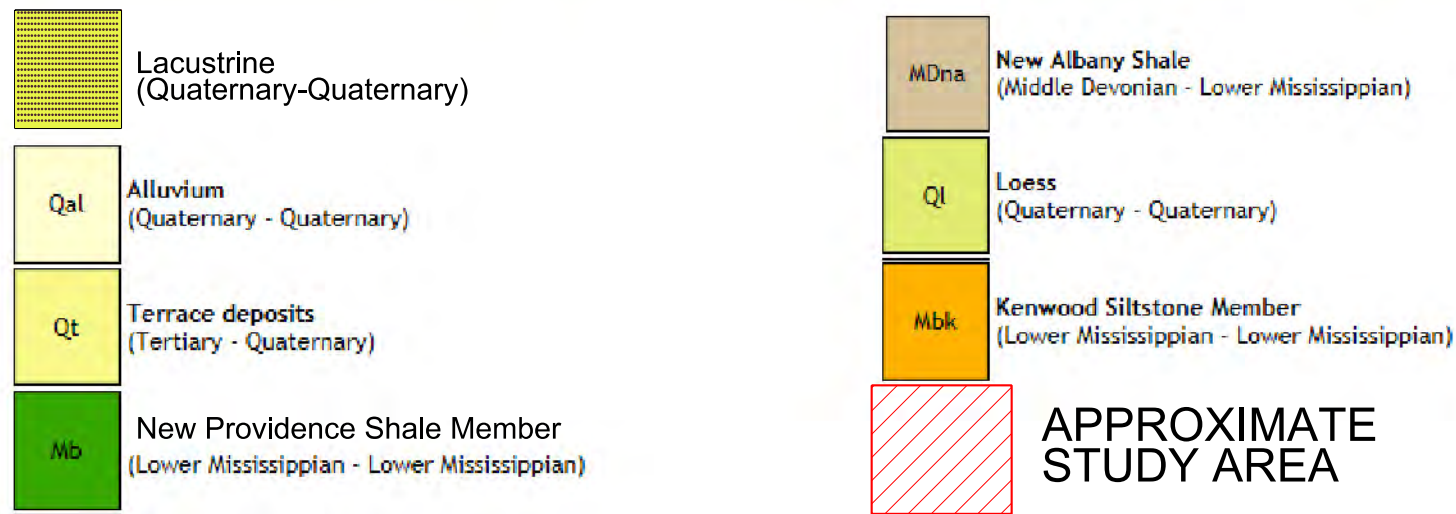
*Figure 11 Louisville Metro Public Works Facility north side of Outer Loop*



*Figure 12 National Turnpike intersection approach from west*



**LEGEND**



REVISIONS		DESCRIPTION
NO.	DATE	

Geologic Map
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CLIENT:	Qk4, Inc.
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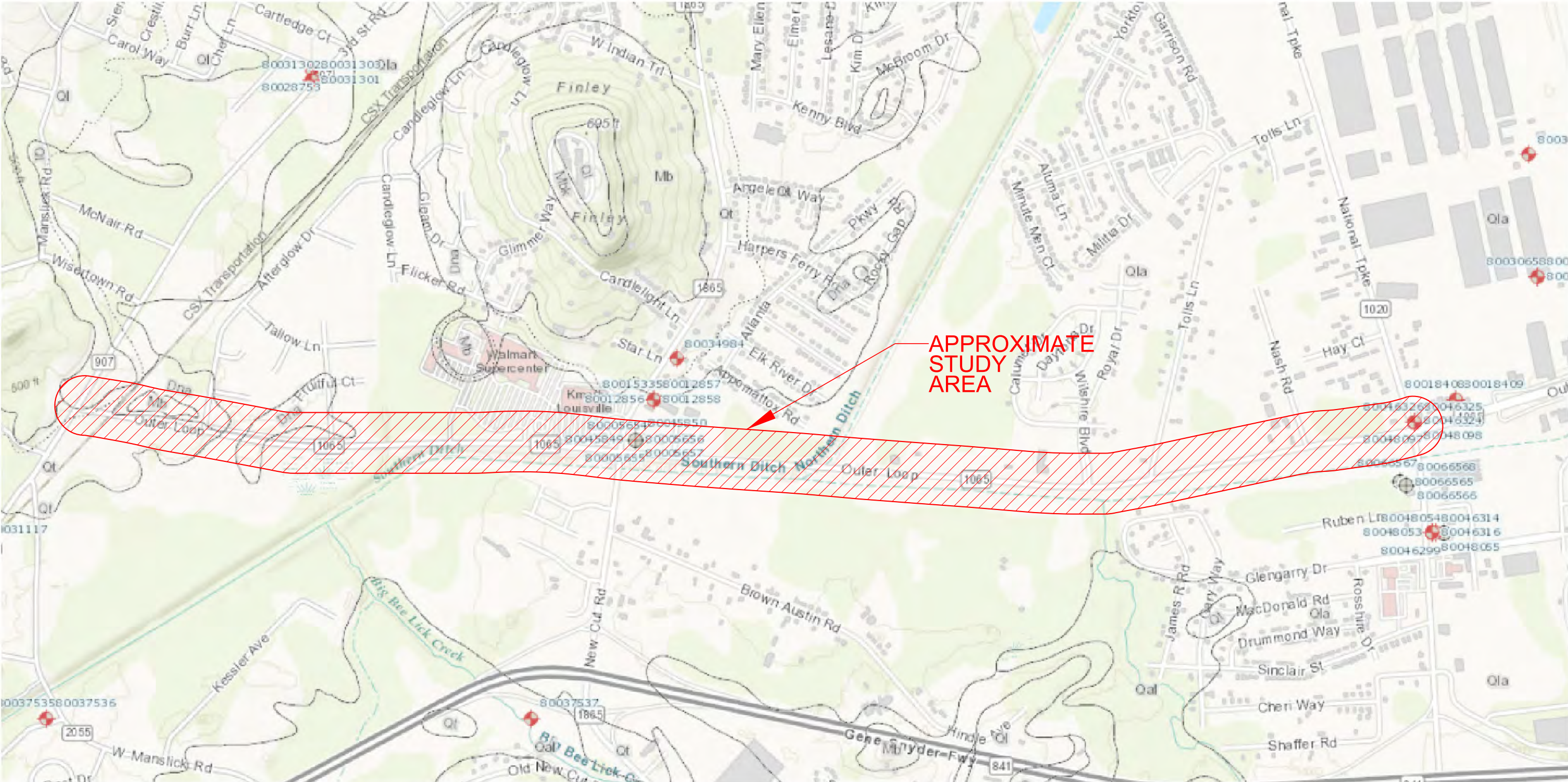
PROJECT:	Outer Loop Corridor Study Louisville, KY
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PLANS PREPARED AND SUBMITTED BY: <b>AEI</b> AMERICAN ENGINEERS, INC. PROFESSIONAL ENGINEERING 12701 Oldham Road Burlington, KY 40302 O 502.331.1100 F 502.331.1101 WWW.AEI.CC	DATE: 6-27-17
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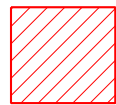
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FILE: T:\GIS\GISSupport\KYTC\Outer Loop Jefferson County\Outer Loop Study Area Geo Map.dgn
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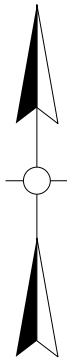


LEGEND



APPROXIMATE STUDY AREA

- Other
- Domestic
- Industrial
- Agriculture
- Monitoring
- Public
- Mining
- Geothermal
- Spring



REVISIONS

NO.	DATE	DESCRIPTION

Water Wells and Springs Map

Qk4, Inc.

CLIENT:

PROJECT:

Outer Loop Corridor Study  
Louisville, KY

PLANS PREPARED AND SUBMITTED BY:

AEI

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NTS

DATE:

6-27-17

DRAWN BY:

J. CHILDRESS

CHECKED BY:

D. MITCHELL

FILE:

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SHEET:

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