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MEMORANDUM

TO: John Moore, P.E.
Division of Planning

BY: Bart Asher, P.E., P.L.S.
Geotechnical Branch Manager

DATE: May 30, 2014

SUBJECT: **Caldwell County**
Princeton Small Urban Area Study
12FO C35 D625 02 FH02 0410 C017 E143
Mars # 8807407P
Preliminary Geotechnical Assessment

The Division of Planning is conducting a Small Urban Areas Study for the subject project. This project is located in Caldwell County, KY in an area surrounding Princeton as depicted on the site map. The study area is located in the Mississippian Plateau or Pennyrile Physiographic Region. This abbreviated review will discuss some general geotechnical concerns with the area.

The approximate coordinates for the center of this site is site are: 37.107778 degrees North and -87.8825 degrees West. The site is located in the Crider, Olney, Princeton West and Princeton East Geologic Quadrangles as depicted on the attached map.

The study area is well known for its rolling terrain, red clay soils (residual material remaining after the soluble elements of the bedrock have dissolved) and the Karst behavior of the underlying bedrock (Karst features may include sinkholes, caves and solution features in the bedrock.) Karst features are prevalent in this area.



Typical Landscape in the area with sinkholes



Sinkhole fix in ditch on KY 139 – numerous other sinkholes noted

The Kentucky Geological Survey states that the physiographic region encompassing the area:

consists of a limestone plain characterized by tens of thousands of sink holes, sinking streams, streamless valleys, springs, and caverns. The term "karst" is used to define this type of terrain. The Karst terrain of the Mississippian Plateau occurs because the bedrock in the eastern and southern parts of the region is dominated by thick deposits of Mississippian-age limestones. These limestones are soluble (i.e. will dissolve) under the right conditions, which means they can easily be eroded by waters moving through the ground. These groundwaters can form miles of passages beneath the surface, from tiny paths only inches wide, to large caverns and rooms more than 100 feet wide

Limestone has been and is currently being mined commercially in the region

The available mapping indicates some notable faults in the study area. The northern faults mark the beginning of the western Kentucky fluor spar-barite-zinc-lead district. Some commercial mining has taken place near the northeast portion of the study area.

Foundations for bridges in the study area are generally rock bearing (end bearing piles, drilled shafts or spread foundations). Smaller structures such as retaining walls and box culverts are commonly founded on soil or bedrock.

Soils in the area are generally suitable for embankment construction. Generally embankments built from the native soils can be constructed to a height of 60 feet with 2H:1V sideslopes if the foundation is suitable and proper compaction methods are used. Soil cuts in the native soils have been historically problematic. Soil cuts over approximately 10 feet often require analyses to design proper sideslopes. In no case should soil cuts be steeper than 2H:1V.

California Bearing Ratio (CBR) values used in pavement design are generally low for soils subgrades in the area. Chemical modification of subgrade or the use of rock roadbed is common in the area.

Rock cuts in the area can be problematic due to the Karst nature of the bedrock. Solution

features can cause the bedrock surface to be erratic. Where faulting is encountered dipping or folded bedrock can be an issue.

A list of previously completed Geotechnical Investigations within the study area is located in the appendix. The reports can be accessed through the KYTC Geotechnical Branch Database which can be accessed through the KYTC Division of Structural Designs home page (Click on Geotech and Search KYTC Completed Projects).

Site specific Geotechnical investigations are critical in this region for design due to the karst potential of the area and the potential for problematic soils.

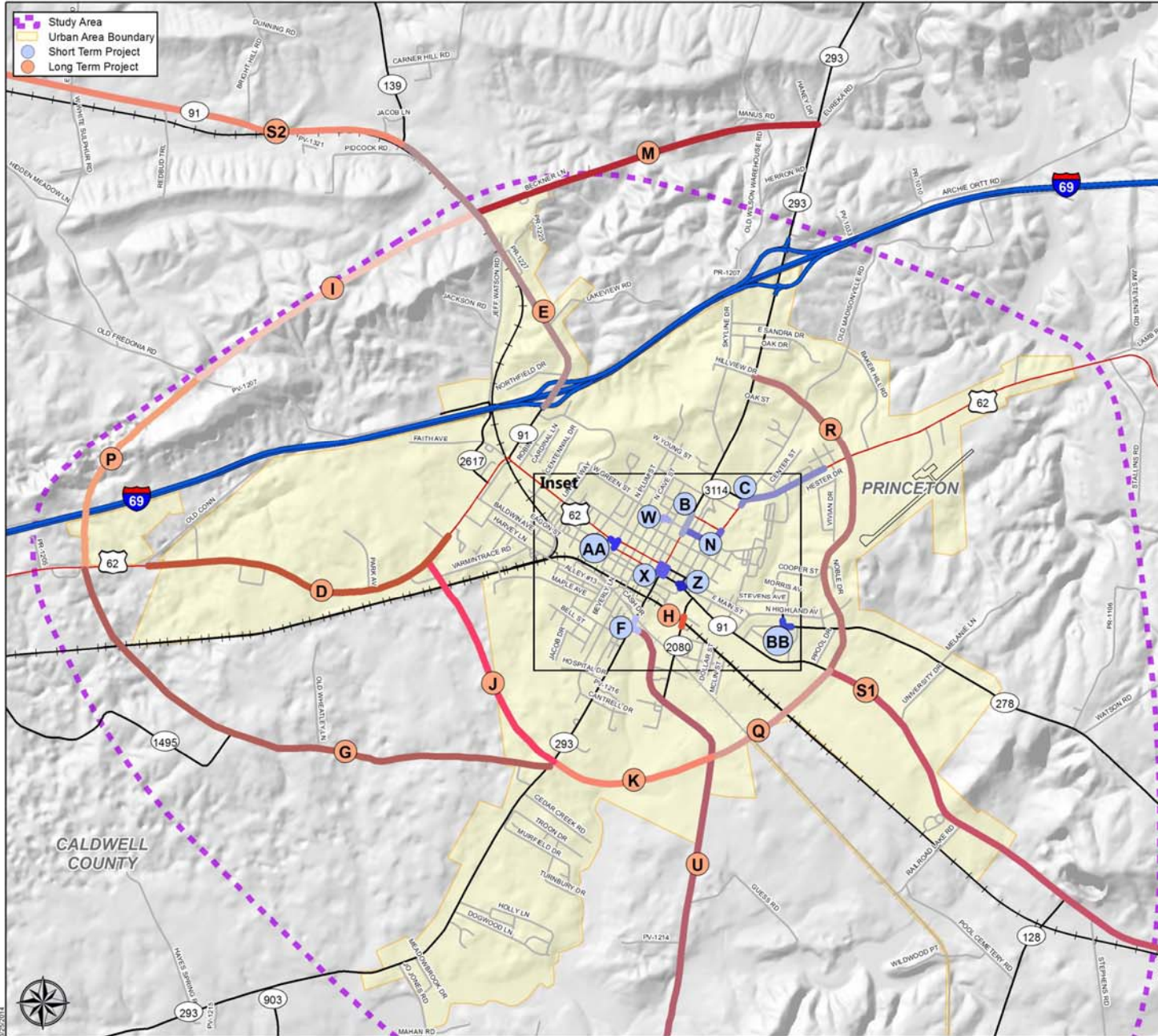
Attachments:

Project Site Map

Geologic Quadrangle Project Site Map

List of Previously Completed Geotechnical Investigations in Study Area

Princeton Small Urban Area Study Draft Study Recommendations



Long Term Project Recommendations:

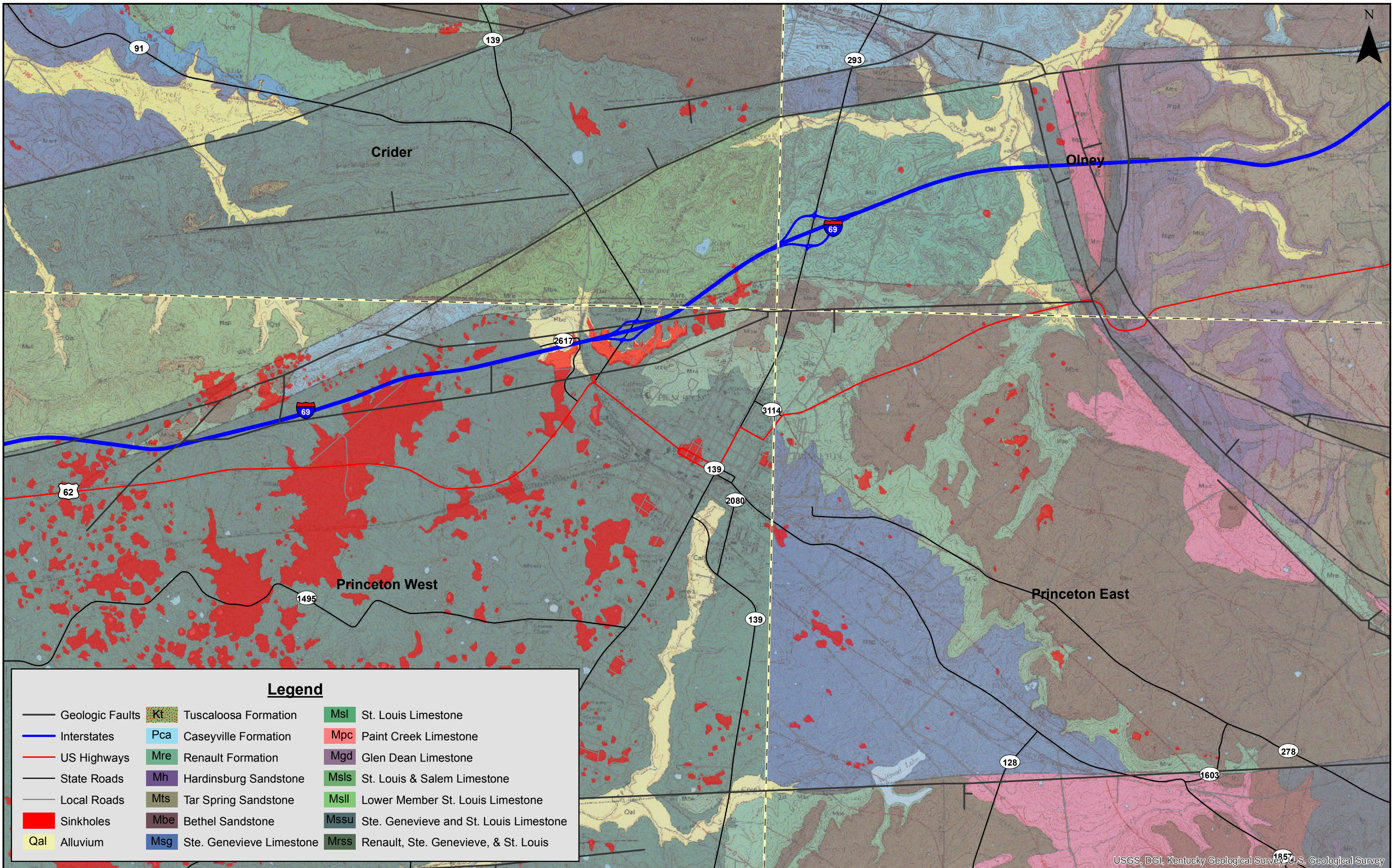
- New Southeast Connector (Projects R, Q, K)
- New Southern KY 293 to US 62 Connection (Projects J, G)
- New Northside Connector with Interchange (Projects M, I, P)
- Widen KY 91 (Projects S, E)
- Widen KY 139 (Project U)
- Add sidewalks along US 62 (Project D)
- Reconstruct KY 2080 Overpass (Project H)

Short Term Project Recommendations

- Five-Leg Intersection Improvements (Project Z)
- Truck Route Improvements (Projects F, W, B, N, C)
- Operational Improvements at Courthouse (Project X)
- US 62/Plum Street Intersection Improvements (Project AA)
- KY 278 Curve Realignment (Project BB)

Note: Recommended Projects shown represent planning-level concepts and not actual alignments





Legend

- | | | |
|------------------------|-------------------------------------|--|
| — Geologic Faults | Kt Tuscaloosa Formation | Msl St. Louis Limestone |
| — Interstates | Pca Caseyville Formation | Mpc Paint Creek Limestone |
| — US Highways | Mre Renault Formation | Mgd Glen Dean Limestone |
| — State Roads | Mh Hardinsburg Sandstone | Msls St. Louis & Salem Limestone |
| — Local Roads | Mts Tar Spring Sandstone | Mslil Lower Member St. Louis Limestone |
| Red Sinkholes | Mbe Bethel Sandstone | Mssu Ste. Genevieve and St. Louis Limestone |
| Yellow Alluvium | Msg Ste. Genevieve Limestone | Mrss Renault, Ste. Genevieve, & St. Louis |

0 3,000 6,000 12,000 Feet

<u>Report No.</u>	<u>Route</u>	<u>Structure Over</u>		<u>Description</u>
C-003-2013	I-69		Construction	Sinkhole Correction
SA-005-2012	WK-9001	KY 2617 and P&L RR	Structure Addendum	Widen bridge over KY-2617 and P&L RR
S-053-1988	KY-91	Skniframe Creek	Structure	Culvert at Sta. 50+00
S-032-1982	US-62	Wiley Creek	Structure	Bridge is just west of junction of US-62 and CR-1112
R-016-1989	KY-293		Roadway	
S-009-1981	KY-128	Goose Creek	Structure	Single Span @ Station 20+00
S-060-1994	KY-91	Skinframe Creek	Structure	18x9 RCBC @ Sta. 19+90
S-034-1983	KY-139	Goose Creek	Structure	Three Span
S-019-1982	KY-278	ICG Railroad	Structure	Bridge just east of junction of KY-278 and CR-1122
S-054-1999	US-62	Sinkhole	Structure	Land Bridge over Sinkhole US-62
L-009-1996	WK-9001		Landslide	Western KY Parkway at mp 13.2
S-050-2011	WK-9001	KY 2617 and P&L RR	Structure	Widen Bridge over KY-2617 and P&L RR
S-078-1994	CR-1203	P & L Railroad	Structure	Station 20+01.18