# APPENDIX

# G GEOTECHNICAL OVERVIEW

# GEOTECHNICAL OVERVIEW REPORT
# I-65 / I-264 INTERCHANGE
# ITEM NO. 5-559
# JEFFERSON COUNTY, KENTUCKY

Prepared for:

**WSP USA INC.**
**CINCINNATI, OHIO**

Prepared by:

**GEOTECHNOLOGY, INC.**
**ERLANGER, KENTUCKY**

Date:

**MARCH 5, 2020**

Geotechnology Project No.:

**J034432.01**

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

GEOTECHNOLOGY INC
FROM THE GROUND UP

March 5, 2020

Mr. Robert A. Hans, PE
WSP USA Inc.
312 Elm Street, Suite 2500
Cincinnati, Ohio 45202

Re: Geotechnical Overview Report
I-65 / I-264 Interchange
Item No. 5-559
Jefferson County, Kentucky
Geotechnology Project No. J034432.01

Dear Mr. Hans:

Presented in this report are the results of our geotechnical overview completed for the I-65 / I-264 Interchange Planning Study in Jefferson County, Kentucky. Our services were performed in general accordance with our Kentucky Transportation Cabinet (KYTC) approved cost estimate dated July 21, 2019 and our Professional Services Subcontract with WSP USA Inc. dated October 30, 2019.

We appreciate the opportunity to provide the geotechnical services for this project. If you have any questions regarding this report, or if we may be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,
**GEOTECHNOLOGY, INC.**

Michael Baird

Michael G. Baird, EI
Staff Engineer

William T. Basich

William T. Basich, PE
Senior Project Manager

MGB/WTB:mgb/tmk

Attachments: Project Location Map from KYTC RFP
Project Geologic Map

Copies emailed: WSP USA Inc.
KYTC Geotechnical Branch

**GEOTECHNICAL OVERVIEW REPORT**
**I-65 / I-264 INTERCHANGE**
**ITEM NO. 5-559**
**JEFFERSON COUNTY, KENTUCKY**
**March 5, 2020 | Geotechnology Project No. J034432.01**

## 1.0 SCOPE

The purposes of our services were to prepare a geotechnical overview report summarizing potential geotechnical issues that may affect transportation decisions within the project area in general conformance with Section GT-801 of the Kentucky Transportation Cabinet (KYTC) Geotechnical Guidance Manual and as described in the Request for Proposal (RFP) from KYTC Procurement Bulletin 2019-10. Our scope of services included a preliminary site reconnaissance, a review of published geologic mapping of the area, a review of previously completed KYTC geotechnical reports in the area, and preparation of this report.

## 2.0 PROJECT LOCATION AND DESCRIPTION

The I-65 / I-264 Interchange Planning Study encompasses the complex series of interstate roadways and ramps in the area surrounding the I-65 / I-264 Interchange. The limits of the Planning Study are shown on the Project Map included in the KYTC Procurement Bulletin 2019-10, which is attached to this report. The alignments included in the Planning Study are as follows:

- I-65 between mileposts 129.3 and 131.6, including the following interchanges:
    - I-65 / KY 60 (Preston Highway) & Grade Lane Interchange
    - I-65 / I-264 Interchange
- I-264 between mileposts 10.6 and 13.4, including the following interchanges:
    - I-264 / Crittenden Drive Interchange
    - I-264 / Freedom Way Interchange
    - I-65 / I-264 Interchange
    - I-264 / KY 864 (Poplar Level Road) Interchange

## 3.0 TOPOGRAPHY AND DRAINAGE

The project site is located south of downtown Louisville, immediately north and east of the Louisville Muhammed Ali International Airport, and within the Outer Bluegrass Physiographic

Region (McDowell, 1986). The Outer Bluegrass Physiographic Region is typically characterized by deeper valleys, with little flat land due to weathering of Ordovician aged limestones and shales. However, the project site is relatively flat with a gentle grade change from an approximate high of El. 500 near the north end of the project to an approximate low of El. 470 feet near the south end of the project. Surface water in the majority of the project area appears to flow to a series of ditches that drain to the southwest via Greasy Ditch, Northern Ditch, Southern Ditch, and Pond Creek. Pond Creek empties into the Salt River near the confluence of the Salt and Ohio Rivers southwest of downtown Louisville near West Point. The northeast portion of the site appears to drain to the north via tributaries of the South Fork Beargrass Creek, which flows to the north into Beargrass Creek and ultimately into the Ohio River just east of downtown Louisville.

## 4.0 GEOLOGY

### 4.1 United States Geologic Survey Mapping

The majority of the project area is located within the Geologic Map of the Louisville East Quadrangle (GQ-1203), Jefferson County, Kentucky, United States Geologic Survey (USGS), 1974. The west end of the project, between mileposts 10.6 and 11.0 on I-264, is located within the Geologic Map of Parts of the Louisville West and Lanesville Quadrangles (GQ-1202), Jefferson County, Kentucky, USGS, 1974. The attached Project Geologic Map shows the combined images from the USGS maps in the area of the project.

The USGS maps indicate that the project area is located near the Springdale Anticline, and is primarily underlain by Sellersburg and Jeffersonville Limestones of the Devonian Age atop Louisville Limestone of the Silurian Age. The westernmost and southernmost portions of the project are mapped as underlain by New Albany Shale of the Devonian Age over the Sellersburg and Jeffersonville Limestones. The mapping indicates that the New Albany Shale covered by various surficial soil deposits. Sellersburg Limestone is divided into two members: the Beechwood Limestone Member and the Silver Creek Limestone Member. Full descriptions of the bedrock formations and bedrock members can be found on the referenced USGS maps. A brief summary of the USGS map bedrock descriptions is included following this paragraph. The Springdale Anticline could cause the bedrock to have a relatively minor amount of local dip, although it is not anticipated to impact future cuts on this project.

- The New Albany Shale is described by USGS as being silty, carbonaceous, and olive- to grayish-black, weathers to thin brittle chips; contains abundant disseminated blebs of pyrite, which on weathering produce iron oxides and sulfates that stain outcrops brown and yellow.

- The Beechwood Limestone Member of the Sellersburg Limestone is described by USGS as very thin to thin bedded fossil fragmental with local chert beds up to six inches thick, and with thin layers of pyrite and quartzose sand occasionally noted at the top and bottom of beds. USGS notes that bedrock of the Beechwood Limestone Member is exposed at the Watterson Expressway (I-264) Interchange on Kentucky Turnpike (I-65). The Louisville East Quadrangle Map labels this as “the most susceptible to solution,” and therefore potential for sinkhole formation, of any bedrock in the quadrangle.

- The Silver Creek Limestone Member of the Sellersburg Limestone is described as dolomitic, weathering shaly in part, and containing a seam of phosphatic pebbles, quartz grains, pyrite, and glauconite at its base.

- The Jeffersonville Limestone is described as coarse-grained, fossil fragmental with a calcite or calcareous mudstone matrix, pyritic, and dolomitic in part.

- The Louisville Limestone is dolomitic, micrograined to fine grained, and very thin to thick bedded.

Various soil deposits; including loess and eolian sands, terrace deposits, and lacustrine deposits; are mapped by USGS in the westernmost and southernmost portions of the project area. The majority of these deposits overly the New Albany Shale. Loess and eolian sands are mapped between mileposts 10.6 and 11.2 along I-264. Lacustrine deposits are mapped between mileposts 129.3 and 129.6 along I-65. Terrace deposits are mapped between mileposts 129.6 and 130.0 along I-65.

The USGS maps indicate that the loess and eolian deposits consist primarily of silt and minor sand. The terrace deposits are noted to consist of silt, clay, sand, and gravel (in order of predominant to less predominant soil type). The lacustrine deposits consist of clay, silt, sand, and gravel (in order of predominant to less predominant soil type). Additional information and descriptions are included on the referenced USGS maps.

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### 4.2 Kentucky Geologic Society Mapping

The Kentucky Geologic Society (KGS) online mapping was reviewed with respect to karst potential, landsliding, oil and gas well locations, and water well locations. The majority of the project area is mapped as having a high karst potential and corresponds with the areas underlain by bedrock of the Sellersburg and Jeffersonville Limestone Formations. The remainder of the site is mapped as non-karst. KGS defines karst potential as a range from non-karst to very high karst potential as noted in Table 1. Sinkholes are not shown in the immediate project area on the KGS online mapping; however, two sinkholes are mapped to be within approximately 0.5 miles of the project. KGS maps a number of water wells in the project area that could impact improvements, depending on location, while no oil and gas wells are mapped.

**Table 1. KGS Karst Potential Definitions**

| Karst Potential | Definition |
|---|---|
| Very High | Thick-bedded, typically fine-grained and pure limestone units with little or no insoluble content. Will exhibit mature karst including caves, sinkholes, and springs where they crop out. |
| High | Limestone units with low insoluble content, but varied grain size and bedding characteristics. Likely to contain karst features. Occurrence of caves may be influenced by physiographic setting, unit thickness, and lithology. |
| Medium | Limestone units and coarse-grained, or siliciclastic units with limestone interbeds. Limestone units may contain a high percentage of insoluble minerals. Siliciclastic units will only be karst-prone where limestone beds occur in the near surface. Development of karst features in this category is variable and dependent on site-specific conditions. |
| Low | Siliciclastic units with minor limestone beds or units primarily composed of dolomite. Karst features are poorly developed or absent. |
| Non-Karst | Consolidated or unconsolidated siliciclastic units. Karst features rare or absent. |

*  *  *  *  *

## 5.0 RESEARCH OF KYTC GEOTECHNICAL DATABASE

### 5.1 Roadway Projects

A review of the KYTC Geotechnical Database indicates that a large number of geotechnical engineering projects have been completed in the project area. Table 2 presents a list of the previously completed KYTC geotechnical roadway reports. The roadway reports typically did not include stability analyses for the roadway grading. The reports recommended CBR values ranging from 2 to 6 be used for design. Subgrade stabilization was typically recommended for use only as-needed in poor soil areas, with cement stabilization being recommended most often. Mechanical stabilization with aggregate was also recommended in poor soil areas in some cases as an alternative to cement stabilization.

**Table 2. Previously Completed Roadway Projects from KYTC Geotechnical Database**

| Item Number | Route | Report Number | Project Description | Recommended CBR Value from Report |
|---|---|---|---|---|
| 05-0000.00 | I-65 | R-022-1978 | Kentucky Turnpike (I-65) Fern Valley Interchange and Grade Lane Interchange | - |
| 05-0022.00 | I-65 & I-264 | R-009-1981 | Watterson Expressway (I-264) & I-65 Interchange, Section A | 6 |
| 05-0022.00 | I-65 & I-264 | R-003-1981 | Watterson Expressway (I-264) & I-65 Interchange, Section B | 6 |
| 05-0708.20 | I-65 | R-025-1984 | I-65, Section 1-2 | - |
| 05-0708.40 | I-65 | R-024-1984 | I-65, Section 1-4 | - |
| 05-0024.02 | I-264 | R-020-1986 | Watterson Expressway (I-264) & Southern Parkway Interchange | 5 |
| 05-0026.00 | Gardiner Lane | R-017-1986 | Gardiner Lane | 5 |
| 05-0024.30 | I-264 | R-014-1986 | Waterson Expressway (I-264) & Poplar Level Road Interchange | 5 |
| 05-0482.00 | Grade Lane | R-017-2013 | Grade Lane Reconstruction | 2 |

* * * * *

### 5.2 Structure Reports

A number of pertinent geotechnical structure reports are available from the KYTC Geotechnical Database and are summarized in Table 3. The geotechnical structure reports typically included recommendations for foundations bearing on bedrock, with bridges typically utilizing spread footings and/or point bearing piles.

**Table 3. Previously Completed Structure Projects from KYTC Geotechnical Database**

| Item Number | Route | Report Number | Project Description | Recommended Foundation Type(s) |
|---|---|---|---|---|
| 05-0000.00 | I-65 | S-085-1977 | Fern Valley Road over I-65<br>I-65 over Grade Lane | Spread Footings, Piles |
| 05-0000.00 | - | S-063-1979 | District Office Building near I-264 & I-65 Interchange | Caissons, Spread Footings |
| 05-0708.40 | I-65 | S-060-1981 | I-65 over Standiford Lane<br>Ramp D over Grade Lane<br>I-65 over Grade Lane | Spread Footings, Piles |
| 05-0022.00 | I-264 | S-030-1982 | Watterson Expressway (I-264) Structures, Section C | Spread Footings, Piles, Stub Abutments on Reinforced Earth, |
| 05-0024.00 | I-264 | S-022-1982 | Watterson Expressway (I-264) Structures, Section C | Spread Footings, Piles, Stub Abutments on Reinforced Earth, |
| 05-0024.30 | I-264 | S-026-1984 | I-264 Eastbound over Southern RR & Curtis Avenue,<br>Durrett Lane over Southern RR & Curtis Avenue | Spread Footings, Piles |
| 05-0024.20 | I-264 | S-046-1985 | I-264 Viaduct Westbound over L&N RR, Park Avenue, & Louisville Avenue | Piles |
| 05-0024.30 | I-264 | S-101-1985 | Poplar Level Road over I-264 Retaining Walls | Spread Footings |
| 05-0024.03 | Poplar Level Road | S-057-1985 | Poplar Level Road over I-264 | Spread Footings |
| 05-0435.00 | I-65 | S-058-1999 | Grade Lane and I-65 Retaining Walls | Spread Footings |

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## 6.0 SITE RECONNAISSANCE

On January 14, 2020 our Mr. William T. Basich, PE and Mr. Michael G. Baird, EI visited the site to perform a preliminary engineering reconnaissance to review the existing site conditions within the project vicinity. Reports from previous projects in the area were reviewed prior to the site visit, as well as the USGS and KGS Mapping referenced in Section 4.0.

The overall site topography was observed to be primarily flat to gently sloping. The majority of the roadway alignments along I-65 and I-264 appeared to be built near original grade with minor grading. More substantial grading was evident at interchange and bridge locations. The majority of the interchanges and bridges were constructed by raising the new roadways with fill over roadways and railroads that were previously constructed. The exception being the I-65 / I-264 Interchange, which was constructed predominately with cuts to lower I-264 below I-65. Bedrock in the area of this interchange appeared to consist primarily of limestone with a relatively shallow cap of overburden soil. The bedrock appeared to mostly be cut near-vertical with only minor degradation/weathering of the cut faces and with minor accumulation of fallen rock material at the cut bottoms. Figures 1 through 4, taken from Google Earth street view photographs, show typical cuts in the area of the I-65 / I-264 Interchange. Fills were also apparent along I-65, north of the I-65 / I-264 Interchange. The fill slopes in the project area were judged to be graded at 2 horizontal to 1 vertical (2H:1V).


**Figure 1. Bedrock exposure in cut for ramp from I-65 South to I-264 East, looking east.**


**Figure 2. Bedrock exposure in cut for ramp from I264 West to I-65 South, looking west.**


**Figure 3. Bedrock exposure in cut for ramp from I-65 North to I-264 West, looking west.**

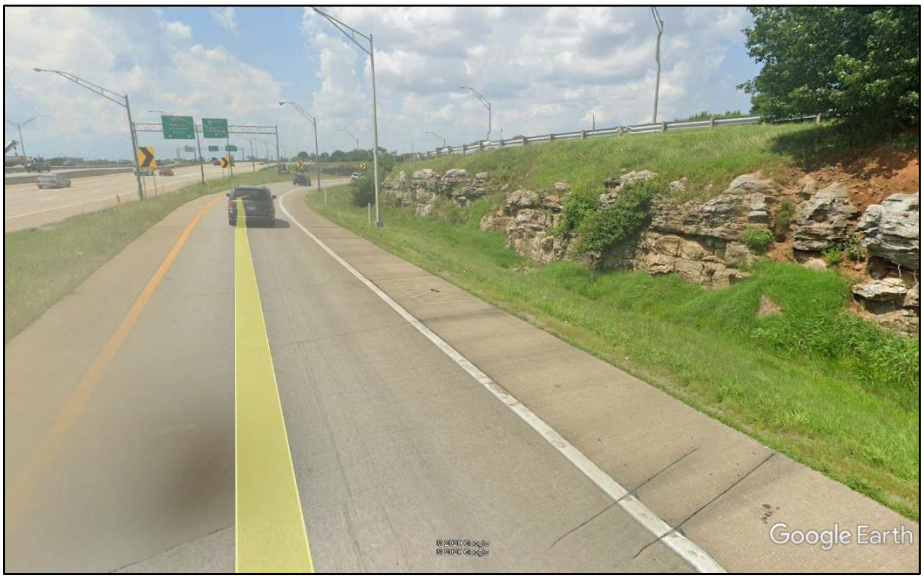



**Figure 4. Bedrock exposure in cut for ramp from I-264 North to I-65 East, looking north.**

## 7.0 LIMITATIONS

The preliminary conclusions and discussions provided in this report are based on our understanding of the project at the time this report was prepared, our review of the USGS quadrangle maps, our review of the KGS online mapping, our research of the KYTC Geotechnical Database, the findings of our site reconnaissance, and our experience as geotechnical consulting engineers in the Commonwealth of Kentucky.

This preliminary report has been prepared on behalf of and for the exclusive use of the client for specific application to the named project as described herein. If this report is provided to other parties, the report should be provided in its entirety with all supplementary information. In addition, the client should make it clear that the information is provided for factual data only and not as a warranty of subsurface conditions included in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions.

Unless specifically stated in our proposal or this report, our scope of service for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site.

## REFERENCES

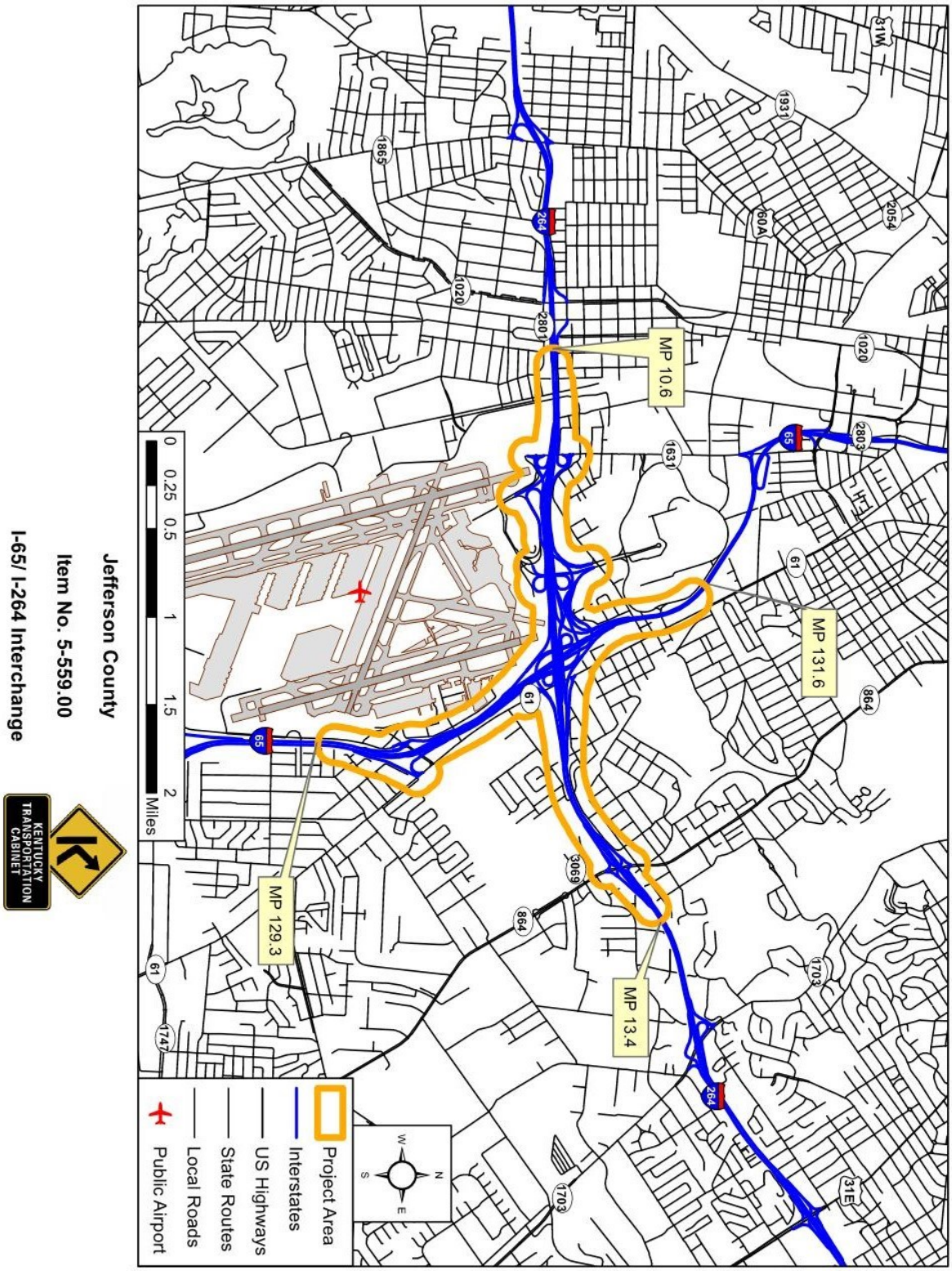
Kepferle, R.C. (1974). “Geologic Map of the Louisville East Quadrangle, Jefferson County, Kentucky,” United States Geological Survey.

Kepferle, R.C. (1974). “Geologic Map of Parts of the Louisville West and Lanesville Quadrangles, Jefferson County, Kentucky,” United States Geological Survey.

Kentucky Transportation Cabinet (2005), “Geotechnical Guidance Manual,” Department of Highways, Division of Materials, Geotechnical Branch.

McDowell, R.C. (ed.) (1986), “The geology of Kentucky; a text to accompany the Geologic Map of Kentucky,” Professional Paper 1151-H, United States Geological Survey.

## XXI. PROJECT MAP



Loess & Eolian Sand

MP 131.6

MP 13.4

MP 10.6

Sellersburg and Jeffersonville Limestones

Lacustrine Deposits

Terrace Deposits

MP 129.3

NOTE: BASE MAP FROM THE GEOLOGIC MAP OF THE LOUISVILLE EAST QUADRANGLE AND THE GEOLOGIC MAP OF PARTS OF THE LOUISVILLE WEST AND LANESVILLE QUADRANGLES, JEFFERSON COUNTY, KENTUCKY, KEPFERLE (1974), UNITED STATES GEOLOGICAL SURVEY (USGS).

0 1000 2000 4000
SCALE: 1" = 2000'

GEOTECHNOLOGY INC
FROM THE GROUND UP

Project: I-65 / I-264 Interchange
Location: Jefferson County, Kentucky

Title: Project Geologic Map
Client: WSP USA INC.

Date: 2/18/2020
Project No.: J034432.01
Sheet No.: 1

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