



November 11, 2021

Mr. David Mindel
Mindel, Scott & Associates, Inc.
5151 Jefferson Blvd.,
Louisville, Kentucky 40219

Reference: **Preliminary Slope Evaluation – Oak Grove Road Subdivision**
10212 and 10302 Oak Grove Road
Louisville, Jefferson County, Kentucky 40291
ECS Project No. 61:2626

Dear Mr. Mindel:

ECS Southeast, LLP (ECS) conducted a preliminary slope evaluation for the referenced site in accordance with ECS Proposal No. 61:P2598, dated October 11, 2021. The slope survey included the following elements: a review of provided drawings; a review of soil survey information; a review of geologic maps; a review of topographic maps; conduct a visual reconnaissance of indicated steeper slope areas that would be disturbed by new construction; and evaluate the reviewed information and prepare a report of our findings and recommendation.

Project Information

The proposed development on-site includes 263 single-family residential lots and associated roadways. There is approximately 70 feet of fall across the entire site (excluding the western slope that leads to Cedar Creek). The land generally slopes downhill from east to west – toward Cedar Creek. The terrain slopes more severely near Cedar Creek with approximately 30% slopes extending from the 610-ft contour to the banks of the creek. The slopes are much more mild in the proposed development areas, with approximately 2 feet of fall across most single proposed residential development lots. The site included approximately 26 acres of relatively flat open field, and approximately 43 acres of wooded land. The wooded land was more prevalent on the western side of the site. Residential buildings (house, barn, and shed) were present at the northwest side of the 10212 Oak Grove property, and in the middle of 10302 Oak Grove property. Two ponds were observed within the 10302 property.

The "Detailed Development & Preliminary Plan" prepared by Mindel Scott, dated 3/29/2021 identified existing 20 to 30 percent slopes and >30% slopes on the property – primarily on the western side of the 10212 Oak Grove property, sloping toward Cedar Creek.

The current Metro Louisville Land Development Code (LDC) 4.7.5 includes requirements for land disturbing activities on slopes greater than 20%. Item B.3 of 4.7.5 states "Land disturbing activities on slopes greater than 20% and less than 30% shall be required to prepare a geotechnical survey report if the staff of the USDA Natural Resources Conservation Service (NRCS) determines such a study is warranted, given the site's soil and geologic characteristics. A geotechnical survey report shall be submitted for land disturbing activities on slopes greater than 30%."

We understand that at present the NRCS is not making the determination of the need for a geotechnical survey report. Accordingly, ECS Southeast, LLP (ECS) was retained to conduct an initial slope evaluation of the site and to determine if additional geotechnical exploration/analyses would be required. Our evaluation consisted of the following tasks:

- Review the Plan
- Review USGS Geologic Quadrangle Map information
- Review USDA NRCS Soil Survey information
- Conduct a visual reconnaissance of indicated steeper slope areas that would be disturbed by new construction
- Evaluate the reviewed information and prepare a report of our findings and recommendations

Geology

The following geologic information is based on the review of the Geologic Map of the Mount Washington Quadrangle, published by the United States Geological Survey (USGS); information (aerial photos, geologic maps, and topographic maps, etc.) obtained from the Kentucky Geological Survey (KGS) Geologic Information Service website; and Google Earth Satellite Imaging.

The Kentucky Geologic Map Information Service website indicated that majority of the proposed development area was underlain by Laurel Dolomite. A band of Waldron Shale traverses the northeast portion of the site, and the north portion of the 10302 Oak Grove property is underlain by Louisville Limestone. The steep slopes near Cedar Creek were underlain by Laurel Dolomite.

Above	~EL 673	Louisville Limestone
	~EL 669 – 673	Waldron Shale
Below	~EL 670	Laurel Dolomite

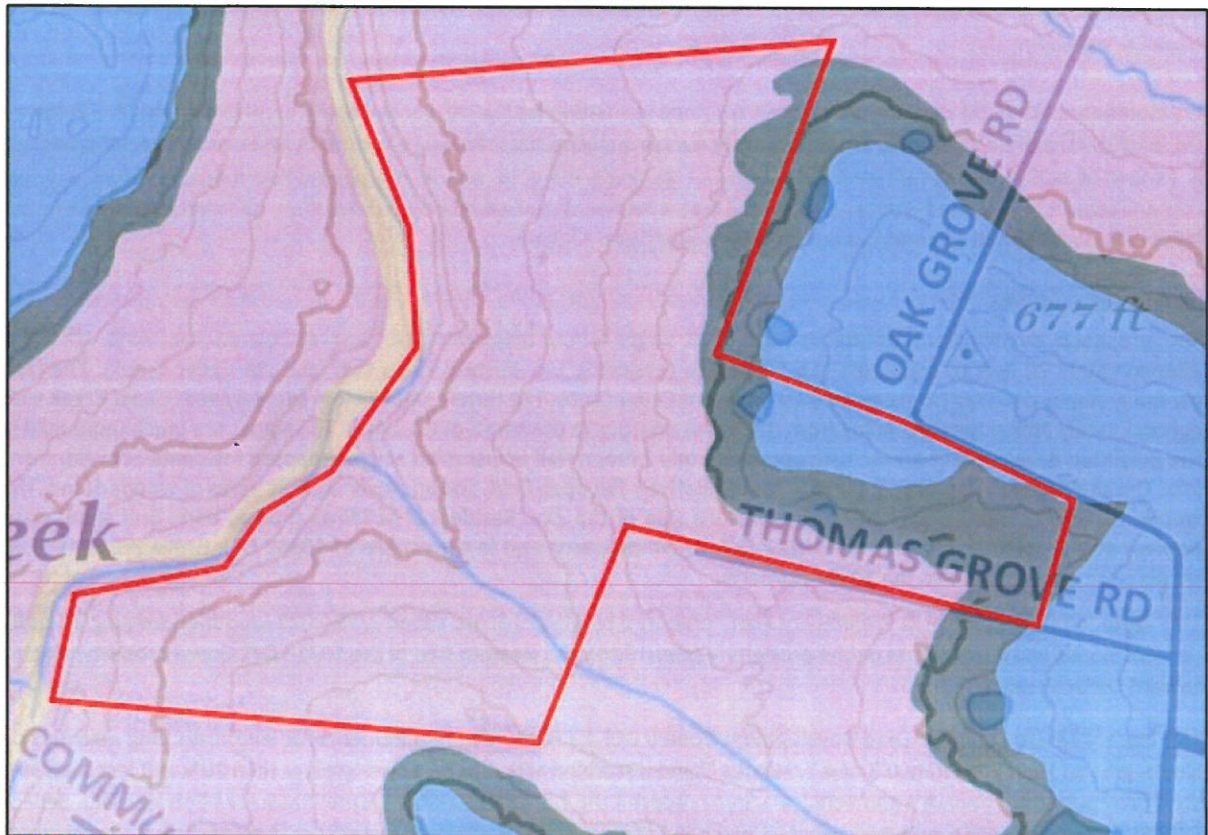


Figure 1: Reported Site Geology

Laurel Dolomite

Total Reported Thickness: 44 - 52 feet

Karst Potential: Prone to Intense

Primary Lithology: Dolomite and Minor Shale

Dolomite and minor shale in three distinct parts: Uppermost part is dolomite, light olive gray to olive gray with dark gray mottling, weathers yellowish gray to grayish orange; finely crystalline to medium crystalline (0.02 to 0.25 mm); distinguished by even "quarry stone" bedding ranging in thickness from 0.2 to 2.8 feet; locally contains interbedded and intermixed oolitic dolomite in upper 1.5 feet; some beds contain stylolites. Bedding planes commonly accentuated by thin shale partings; burrows common. Middle part is moderate brown and medium gray to medium light gray dolomite that weathers yellowish gray to pale yellowish orange; mottled, vuggy, without distinct partings; calcitic; contains dolomitized brachiopods, cephalopods, trilobites; planar bedded finely crystalline limestone (calcilutite) near base. Middle and basal parts of unit form massive ledges marked by honeycombed surface. Basal part, in descending order, is shale, dolomite,

and shaly dolomite. Shale is dark greenish gray, weathers grayish yellow; dolomitic, calcareous; in a single bed 1.5 to 2.5 feet thick; equivalent to upper shale of Osgood Formation as mapped by Butts (1915). Dolomite and shaly dolomite are greenish gray to light olive gray, weather same to grayish orange; finely crystalline to medium crystalline (0.02 to 0.25 mm); beds 0.3 to 2.0 feet thick. Basal contact gradational through as much as 3 feet with dolomitic shale and shaly dolomite of underlying formation; contact commonly coincides with break in slope. Springs at base contribute to slumping of lower dolomite down shaly slopes of underlying formation. Laurel Dolomite resists erosion and rims steep bluffs along Salt River and Floyds Fork in west half of quadrangle. Soils developed on formation commonly include Russellville, Dickson, and Crider Series (Zimmerman, 1966). Thickness of residuum generally ranges from 5 to 12 feet on uplands.

Waldron Shale

Total Reported Thickness: 9 - 15 feet

Karst Potential: Non-Karst

Primary Lithology: Shale.

Shale, medium gray, olive gray, and greenish gray to medium bluish gray, weathers yellowish gray; dolomitic, pyritic; near base of quarry exposure at north border of quadrangle unit contains dolomitized brachiopods, small crinoid stems, trilobite fragments, and dark to brownish gray organic discs less than 1 mm in diameter that resemble the palynomorph *Tasmanites* (termed *Sporangites* by Butts, 1915, p. 132). Unit thickest in southwestern part of quadrangle. Weathers in gentle slopes, locally forms bench; contact probably conformable. Soils on unit belong mainly to Beasley Series (Zimmerman, 1966).

Louisville Limestone

Total Reported Thickness: ± 60 feet

Karst Potential: Intense

Primary Lithology: Dolomite and Limestone.

Dolomitic limestone, light olive gray with medium dark gray mottled bands, weathers very pale orange to yellowish gray; finely crystalline to medium crystalline (0.02 to 0.25 mm); beds 0.1 to 3.5 feet thick; pyritic; in part grades to dolomitic shale; calcitic in bands along bedding planes and in irregular concentrations as much as 0.5 foot across. Dolomitized fossils common as casts, abundant in some layers, include brachiopods, horn corals, colonial corals (including halysitid corals), and algal mat remains. Shale near base is greenish gray to dark greenish gray, non-calcareous. Contact with underlying shale commonly distinct on steep hillsides; poorly exposed and partly inferred on broad rolling uplands near Mount Washington. Soils developed in this unit include Crider, Russellville, and Dickson Series (Zimmerman, 1966). Residuum generally 5 to 12 feet thick on uplands.

Karst Potential

According to the KGS Karst Potential Classification definitions, formations designated with an "Intense" karst potential "may exhibit mature karst, including caves, sinkholes, and springs where they crop out." Formations designated with a "Prone" karst potential have "moderate potential for karst development. Development of karst features in this category is variable and dependent on site-specific conditions. Occurrence of caves may be influenced by physiographic setting, unit thickness, and lithology." Formations designated with a "Non-Karst" karst potential are described as "Consolidated or unconsolidated siliclastic units. Karst features rare or absent."

Soil Conservation Service Soil Survey

The USDA Natural Resources Conservation Service "Web Soil Survey" website indicated 9 general soil types at the site as shown in Figure 2. Descriptions of these soil types are summarized below.

NRCS CUSTOM SOIL RESOURCE REPORT			
Map Unit Symbol	Map Unit Name	Acres in AOI (Approximate)	Percent of AOI (Approximate)
BeB	Beasley silt loam, 2 to 6 percent slopes	3.4	0.046
BrB	Bedford silt loam, 2 to 6 percent slopes	5.3	0.074
CaB2	Caneyville silt loam, 2 to 6 percent slopes, eroded, very rocky	22	0.303
CaC2	Caneyville silt loam, 6 to 12 percent slopes, eroded, very rocky	8	0.11
CcF2	Caneyville-Rock outcrop complex, 12 to 60 percent slopes, eroded	7.2	0.099
CrB	Crider silt loam, 2 to 6 percent slopes	17.4	0.24
No	Nolin silt loam, 0 to 2 percent slopes, occasionally flooded	4.3	0.06
ShC3	Shrouts silt loam, 6 to 12 percent slopes, severely eroded	0.2	0.003
ShD3	Shrouts silt loam, 12 to 25 percent slopes, severely eroded, very rocky	4.7	0.065

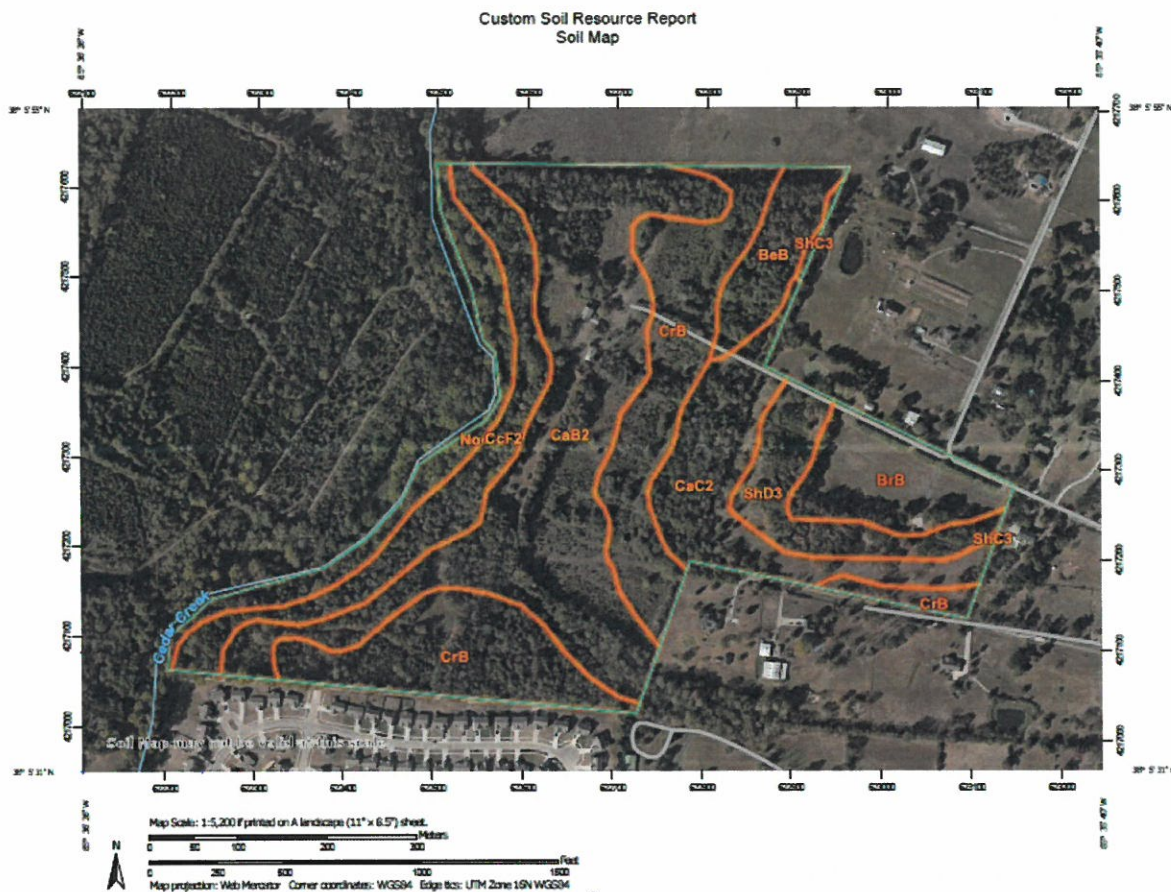


Figure 2: Reported Soil Data

Site Reconnaissance

Based on our review of the provided drawing, the west side of the site included either 20% to 30% slopes or >30% slopes that may be slightly disturbed during development. A site reconnaissance was conducted on November 9, 2021, by Kyle Stolte of ECS. Refer to the attached **Slope Reconnaissance Plan** for the approximate locations.

Steep slopes with numerous rock outcroppings were observed along the west portion of the site, near Cedar Creek. Surface drainage generally was directed to the west topography and small swales. A large tributary creek (ranging in width from approximately 10 to 30 feet) was observed in the middle west portion of the site that extended to Cedar Creek (Areas 4 and 5 of the Slope Reconnaissance Plan). Indications of erosion were observed along the western slope, indicated by small gullies.

Some visual indications of minor slope instability and evidence of creep were observed in the along the western slope portions including displaced cobbles and boulders and minor eroded soil. Slightly leaning trees were observed in Area 8. No indications of large, wide-scale or deep-seated slope movements were noted. For the remainder of the site (east of the slopes leading to Cedar Creek portion), the slopes appeared to be generally steady. In particular, none of the following were noted in the remaining areas: unusual tilting or fallen trees, tension cracks, scarps, displaced soil, or mounds of soil. The Large tributary creek observed in the middle of the site (Areas 4 and 5) includes steep slopes on either side, more prevalent in the portion that is within approximately 400 feet of Cedar Creek.



Area 1: Shallow Gully



Area 1: Rock Outcropping



Area 1: Cedar Creek



Area 2: Rock Outcropping and Shallow Gully



Area 3: Rock Outcropping and tributary creek



Area 4: Major Tributary Creek



Area 4: Tributary Creek with steep, bare-soil banks



Area 5: Shallow Portion of Major Tributary Creek



Area 5: Gentle Slopes of Major Tributary Creek



Area 5: Steeper Slopes, Exposed Soil Banks of Major Tributary Creek



Area 6: Rock Outcropping and Shallow Swale



Area 7: Rock Outcropping and exposed ledge



Area 7: Rock Outcropping and Shallow Swale



Area 8: Wide, Shallow Swale



Area 8: Rock Outcropping, Minor Instability



Area 8: Rock Outcropping



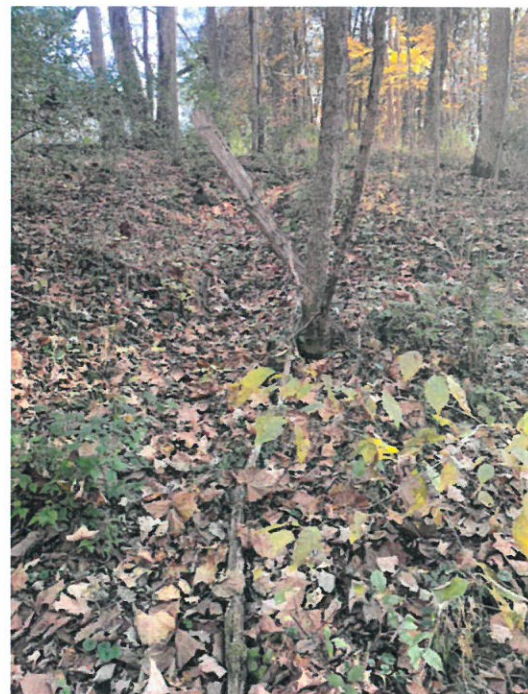
Area 8: Slightly Leaning Trees



Area 8: Rock Outcropping



Area 9: 12' Wide, 6' Deep Gully



Area 10: Shallow Swale



Area 10" Cedar Creek (Upstream)



Possible Sinkhole (Sinkhole 1)



Possible Sinkhole (Sinkhole 2)



Possible Sinkhole (Sinkhole 3) with Dumped Trash and Debris

Based on our review of the above reference observations and information, and on our past experience with site development for similar conditions in Jefferson County, it is our opinion that the on-site slopes (excluding small, localized erosion features along swales and streams) in the observed areas were generally steady at the time of our reconnaissance. Evidence of minor instability was observed in an isolated area in the northwest portions of the site (Area 8).

The current, on-site localized slope instability observed likely is related to the following factors:

- Relatively thin depths of soil in slope areas
- Cohesive (clayey) soil matrix
- Rocky soil texture
- Limestone bedrock
- Numerous trees and other vegetation

Based on the conditions observed, it is ECS' opinion that an additional geotechnical survey exploration/analyses including soil/rock test borings/coring, shear strength tests of soils, etc. are not required for most of the evaluated site slopes, provided that the planned subdivision is designed and constructed according to the current plan ("Detailed Development & Preliminary Plan" prepared by Mindel Scott, dated 3/29/2021), and utilizing the guidelines included in this report. The western portion of the site, as shown in the shaded ("contains slopes > 30%" area) where minor instability was observed should be further explored during the construction phase of the project once the location and planned elevation of the proposed structures and related improvements are known.

The following guidelines should be used to help maintain the stability of the existing and planned slopes during the design and construction of the new subdivision, and over the life of the new homes. These guidelines include:

- Plan grading to minimize changes to existing topography along slopes.
- Minimize disturbance to slopes and vegetation outside new construction areas.
- Avoid significant transverse cuts along face or at the toe of existing slopes.
- Avoid significant embankments on the face, or along or at the crest of existing slopes.
- Maintain the following limits for new embankments without additional geotechnical exploration and analysis:
 - 3:1 (horizontal: vertical) or flatter slopes.
 - Properly strip the vegetation, topsoil, etc. where fill will be placed.
 - Construct embankments with controlled fill compacted to at least 98 percent of the Standard Proctor maximum dry density and within 2 percent of the optimum moisture content.
 - Maximum fill embankment height – 5 feet.
 - Horizontally bench new fill into existing slopes in maximum one-foot vertical steps.
- Maintain the following limits for new cuts in soil without additional geotechnical exploration and analysis:
 - 3:1 (horizontal: vertical) or flatter slopes.
 - Maximum cut height – 5 feet.
- Provide adequate erosion and surface water drainage control during construction and over the life of the subdivision.
- Establish permanent vegetative cover as soon as practical.

Closing

We appreciate the opportunity to serve as your geotechnical consultants for this project. We look forward to future association with you on this and other projects.

Respectfully submitted,
ECS Southeast, LLP

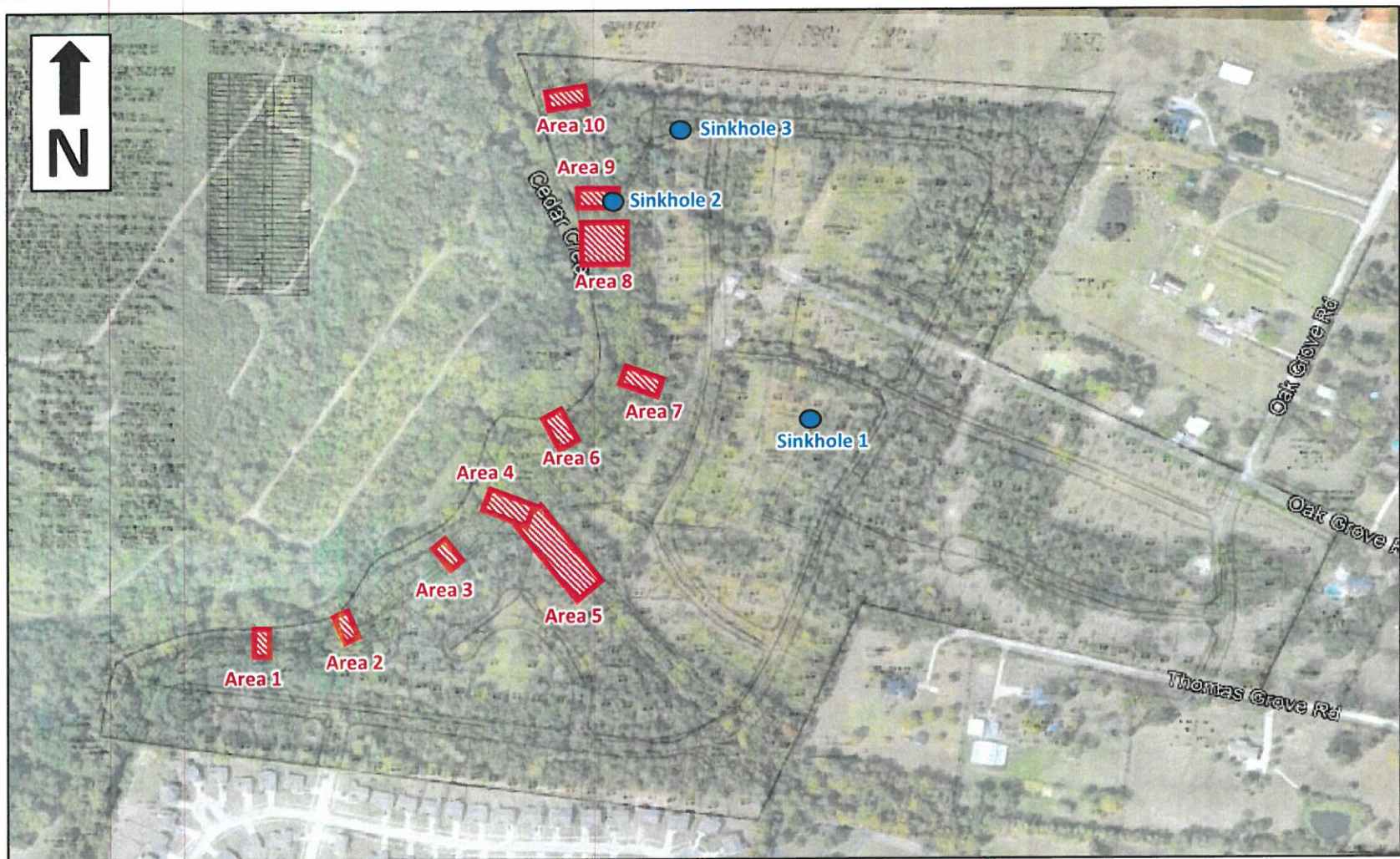


Kyle Stolte
Project Manager
KStolte@ecslimited.com



John D. Godfrey Jr., P.E.
Principal Engineer
JGodfrey@ecslimited.com

Attachments: Slope Reconnaissance Plan
Karst Map
"Detailed Development & Preliminary Plan" - Prepared by Mindel Scott, dated 3/29/21



Based on "Detailed Development & Preliminary Plan" - Provided by Mindell Scott, dated 3/29/21

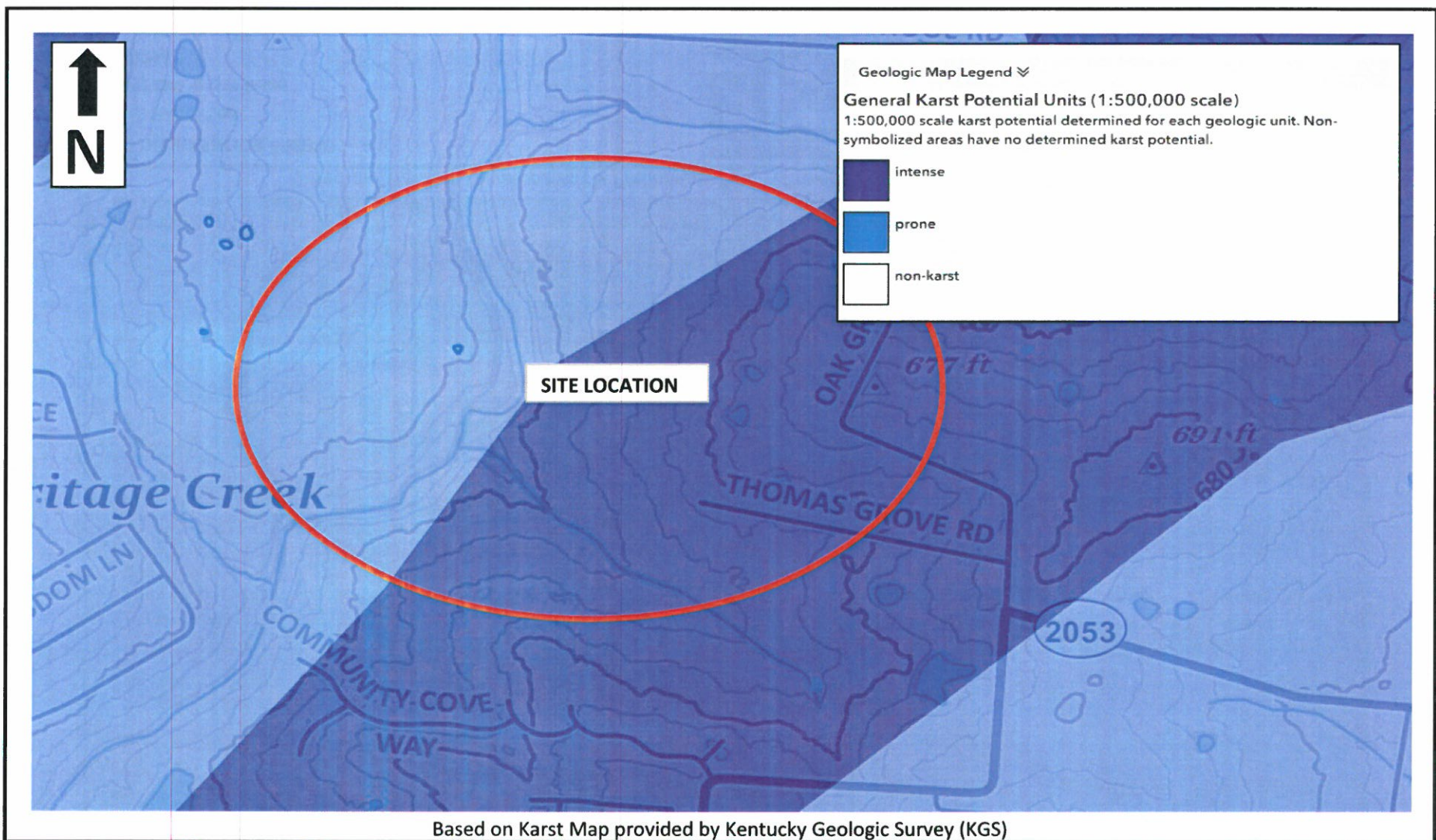
Slope Reconnaissance Plane

Oak Grove Slope Evaluation
10212 and 10302 Oak Grove Road
Louisville, KY 40291
ECS Project No. 61:2626



ECS Southeast, LLP

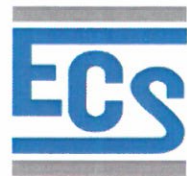
1762 Watterson Trail
Louisville, Kentucky 40299
Tel (502) 493-7100 Fax (502) 493-8190



Based on Karst Map provided by Kentucky Geologic Survey (KGS)

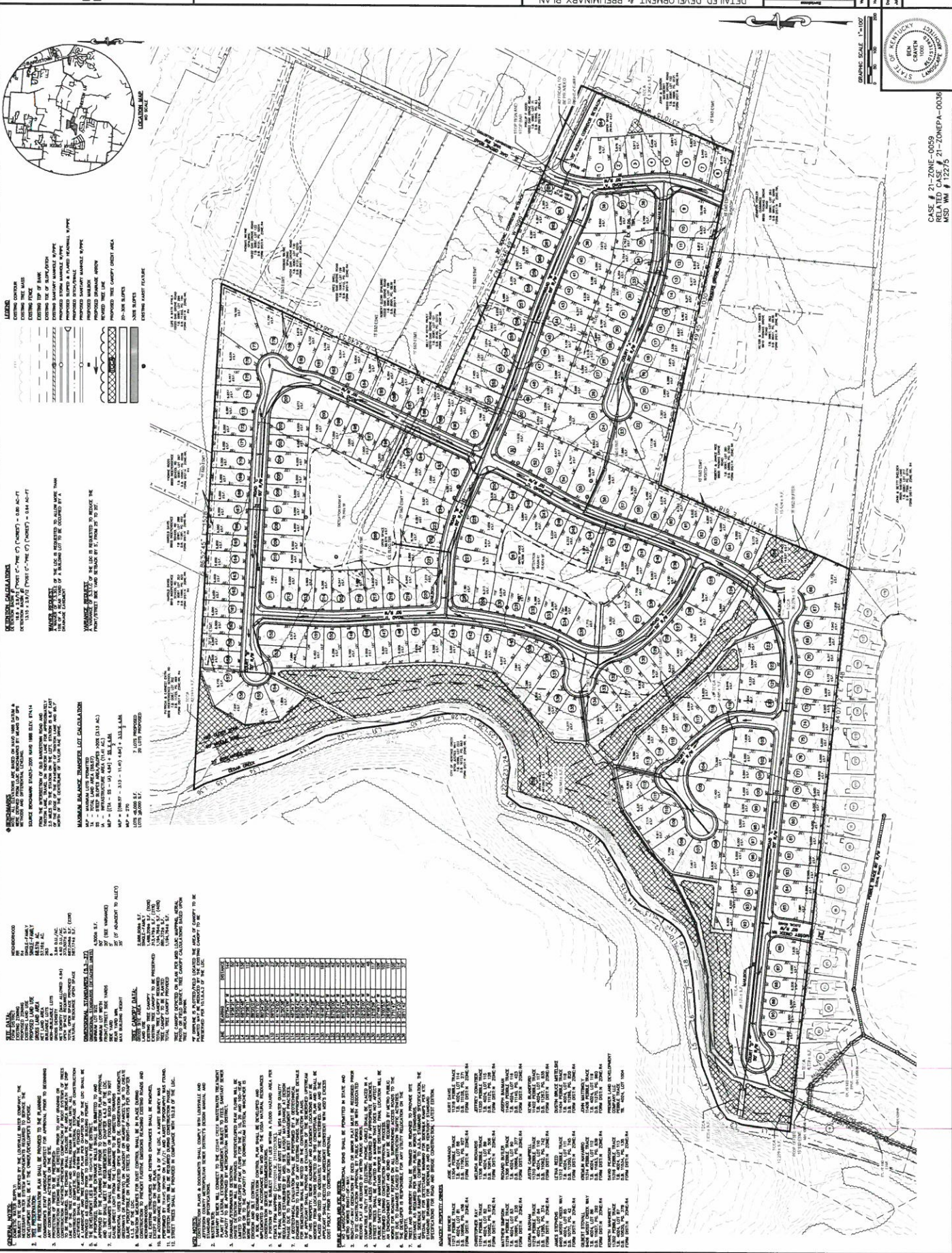
Slope Reconnaissance Plane

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10212 and 10302 Oak Grove Road
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ECS Southeast, LLP

1762 Watterson Trail
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Tel (502) 493-7100 Fax (502) 493-8190



General Waiver Justification:

In order to justify approval of any waiver, the Planning Commission or Board of Zoning Adjustment considers four criteria. Please answer all of the following questions. Use additional sheets if needed. A response of yes, no, or N/A is not acceptable.

Waiver of Section 5.9.2.A.1.a.ii of the Land Development Code to not provide a stub connection to the adjoining property to the west and to the undeveloped property to the north

Explanation of Waiver:

1. The waiver will not adversely affect adjacent property owners because the only property that the connection to the west would potentially serve is the vacant 49.5 acre tract of the subject site owned by the Regional Airport Authority, who presumably wouldn't want a connection anyway. Further, requiring a connection to the west would only provide access to this adjoining property and not all the way to Cedar Creek Road. The properties to the north along Independence School Road had been a part of a prior development application that also included the subject property, but that owner decided to instead subdivide the property into residential lots large enough to not require sewer and sell. As a result, these lots, while vacant, are already somewhat developed. Nevertheless, the likelihood of these being again consolidated to where a road would make feasible sense is remote.

2. The waiver will not violate the Comprehensive Plan for all the reasons set forth in the Detailed Statement of Compliance with all applicable Guidelines and Policies of the Comp Plan 2040 filed with the rezoning application and because there are no new potential impacts to be mitigated by this request to not provide a connection.

3. The extent of waiver of the regulation is the minimum necessary to afford relief to the applicant because a stub connection to the property to the west would not be feasible due to the enormous ravine and the Cedar Creek crossing. A connection to this property is virtually impossible due to the large ravine that holds Cedar Creek, which is 40 feet lower than the top of both adjoining properties, requiring a very large bridge spanning over 400 feet. This would seem to be a perfect candidate for a situation with a determination of infeasibility due to physical or environmental constraints. As to the property to the north, the waiver is requested as it is arguable whether a connection is even required with the property having just been subdivided and sold for individual home construction.

4. Strict application of the provisions of the regulation would deprive the applicant of a reasonable use of the land or would create an unnecessary hardship on the applicant because in order to provide a stub to the adjoining property to the west, a significant bridge would have to be constructed to cross the ravine and Cedar Creek, making the entire project infeasible. Further, the applicant would only have the ability to construct half of the western bridge with no cost sharing agreement with the Regional Airport Authority. As to the property to the north, if any of the 5 acre lots were developed, a roadway through the property would take up the entire width of these narrow lots.

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TRANSMITTAL FORM

TO: To Whom It May Concern

DATE	September 1, 2021	REF.#	3694
RE:	Oak Grove Subdivision		
	Karst Survey Report		

THE FOLLOWING ITEMS ARE: ☒ ATTACHED ☐ SHIPPED UNDER SEPARATE COVER VIA

- | | | | |
|---|--|--|---|
| ☐ PRINTS | ☐ ORIGINALS | ☐ SAMPLES | ☐ BASE MAPS |
| ☐ MYLARS | ☐ COPIES | ☐ CHANGE ORDERS | ☐ CONTACT PRINTS |
| ☒ DOCUMENTS | ☐ COMPACT DISCS | ☐ FIELD DATA | ☐ PHOTO ENLARGEMENTS |
| ☐ SPECIFICATIONS | ☐ SHOP DRAWINGS | | |

ITEM	QUANT.	DATE	SUBMITTAL NUMBER	DESCRIPTION	DISP.
1	1	09/01/21	1	Karst Survey Report (below)	2,4
2	1	09/01/21	1	KGS Karst Potential Map	2,4
3	1	09/01/21	1	Aerial Site Map	2,4
4	1	09/01/21	1	LOJIC Map	2,4

** THE DISPOSITION OF EACH ITEM IS AS FOLLOWS:

- | | | |
|--------------------------|-------------------------|-----------------------------|
| 1-FOR APPROVAL | 7-APPROVED AS SUBMITTED | 13- BORROWED ITEMS RETURNED |
| 2-FOR YOUR USE / INFO | 8-APPROVED AS NOTED | 14- RETURN BY |
| 3-FOR REVIEW & COMMENT | 9-REVISE & RESUBMIT | 15- |
| 4-FOR APPROPRIATE ACTION | 10-REJECTED | 16- |
| 5-FOR SIGNATURE & RETURN | 11-NO EXCEPTIONS TAKEN | 17- |
| 6-AS REQUESTED | 12-NOTE MARKINGS | 18- |

REMARKS: Mindel Scott professional engineer, Travis Brown, conducted online research to assess karst potential at the project site. The Kentucky Geologic Map

service online characterizes the site as being karst prone to intense karst potential, with no mapped sinkholes on the site but many in the project vicinity.

The engineer visited the site on September 1, 2021 to perform a visual inspection and site walk. Upon walking the site the engineer encountered

numerous sinkholes and other potentially karstic features on the site. Their approximate locations are noted on the attached location map. It

should be noted that much of the ground was invisible or inaccessible at the time of inspection due to dense vegetation. It is likely to encounter these

sinkholes other features during earthwork for the proposed construction. It is recommended to retain geotechnical services during construction to

call if sinkholes are encountered. Care should be taken during earthwork to investigate and properly remediate potential sinkholes, per the geotechnical

engineer's recommendations. It will be important to proofroll thoroughly before placing fill and after cutting.

COPIES TO:

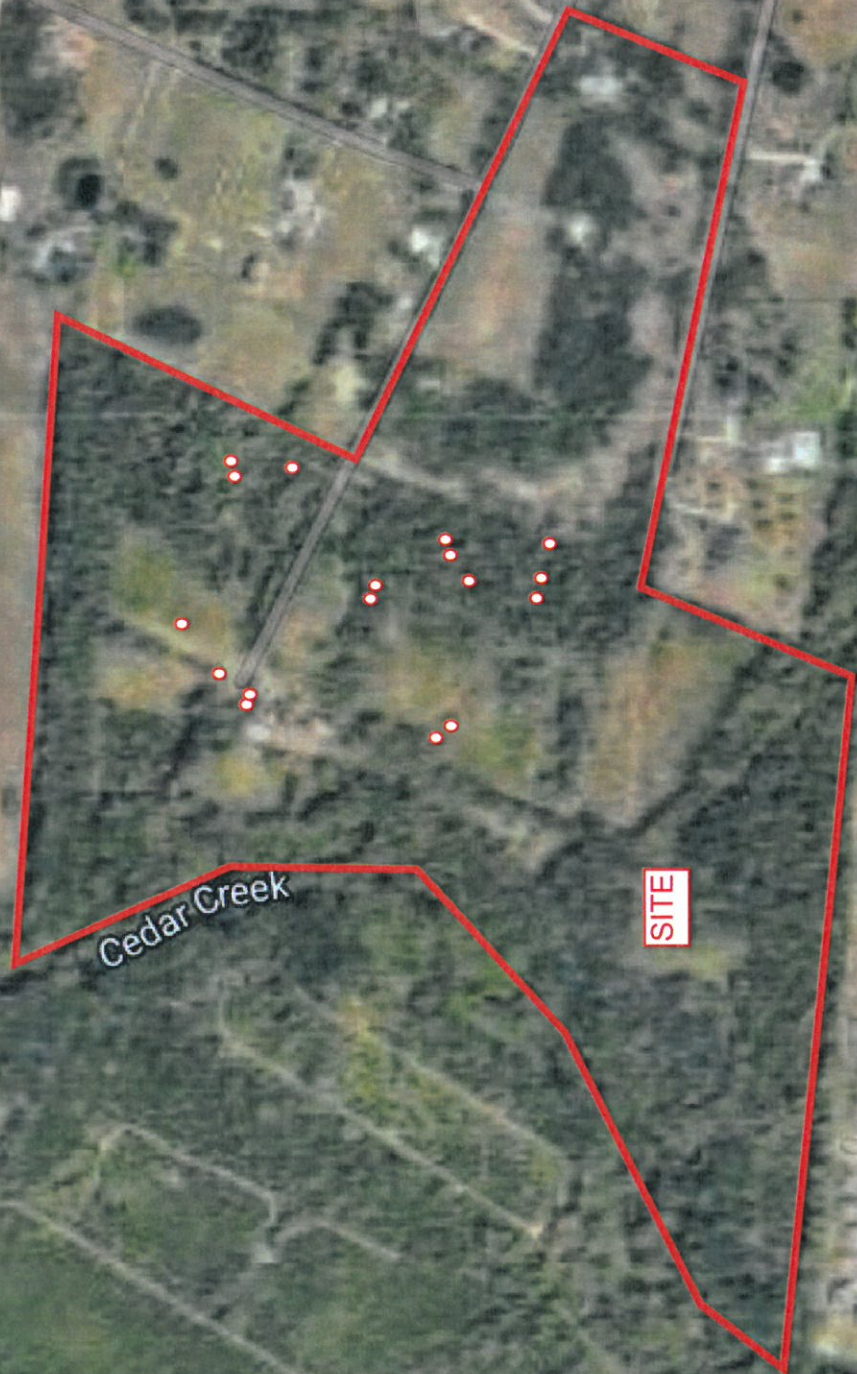
SENT BY:

Thank you,

Travis A. Brown, PE

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Oak Grove Church



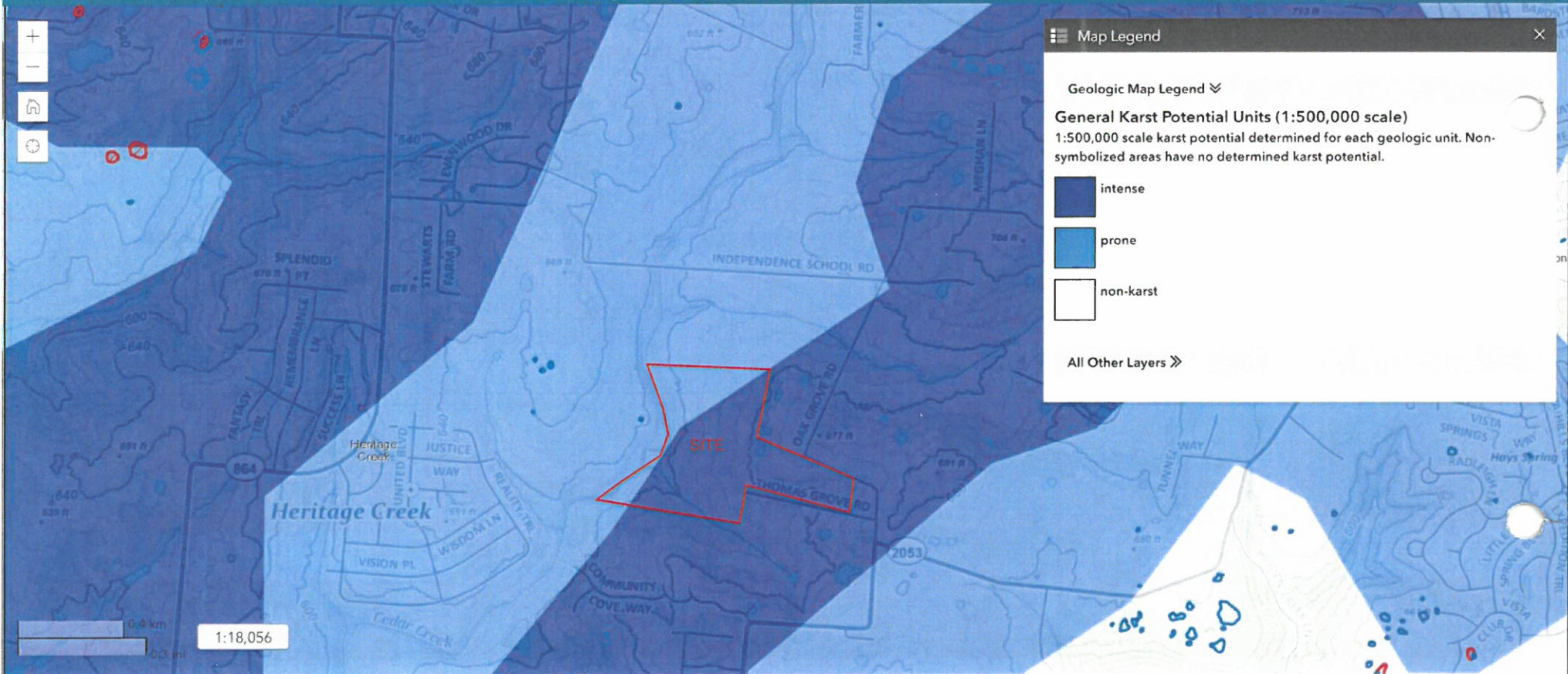
○ = SINKHOLE

MENU ▾

Kentucky Geologic Map Service

 Kentucky Geological Survey

 feedback

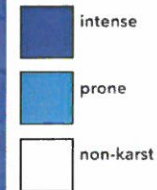


Map Legend

Geologic Map Legend

General Karst Potential Units (1:500,000 scale)

1:500,000 scale karst potential determined for each geologic unit. Non-symbolized areas have no determined karst potential.



All Other Layers >>



Maps

Data

Services

News

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Growing Needs of Louisville, KY

