



KARST RECONNAISSANCE SURVEY

HURSTBOURNE APARTMENTS DEVELOPMENT
LOUISVILLE, KENTUCKY

SME Project No. 089555.00
June 16, 2022





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June 16, 2022

Mr. John Auble – Project Manager
Kennedy International, Inc.
c/o ARCO Senior Living Multi-Family
900 North Rock Hill Road
St. Louis, Missouri 63119

Via E-mail: jauble@arco1.com

RE: Karst Reconnaissance Survey
Hurstbourne Apartments Development
4900 S Hurstbourne Parkway and 5119 Bardstown Road
Louisville, Kentucky
SME Project No.: 089555.00

Dear John:

SME has completed a generalized karst reconnaissance survey for the referenced project.

These services were performed in accordance with Task 1 outlined in SME proposal P01091.22 dated April 7, 2022. Performance of this study was authorized by Mendy Reich with Kennedy International, Inc. on April 12, 2022.

Sincerely,

SME

A handwritten signature in blue ink, appearing to read "Wesley J. Hemp".

Wesley J. Hemp, PE, PG (LA), LEED AP
Project Manager

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APPENDIX A

PHOTOGRAPH LOG

HISTORICAL TOPOGRAPHIC MAPS (FIGURES 1 THROUGH 15)

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APPENDIX B

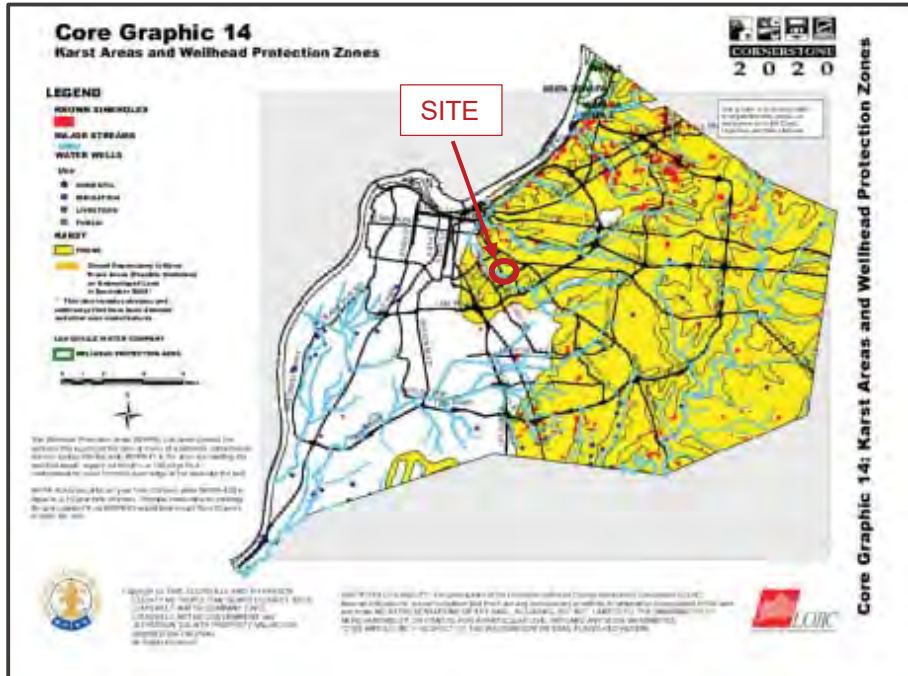
INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

GENERAL COMMENTS

1. INTRODUCTION

This report presents the karst survey performed by SME for the Hurstbourne Apartments project located at 4900 South Hurstbourne Parkway and 5119 Bardstown Road in Louisville, Kentucky. We understand that performance of a karst survey is required for the subject site per the document “Land Development Code for all of Louisville-Jefferson County” (LDC), Chapter 4 Part 9. The image below (extracted from Appendix 4I – “Development on Karst Terrain”) indicates portions of the Louisville Metro area where karst is prevalent, and performance of a karst survey is required (highlighted in yellow). Red shading indicates known sinkholes.

FIGURE 1 - KARST AREAS AND WELLHEAD PROTECTION ZONES ⁽¹⁾



Land Development Code for all of Louisville-Jefferson County Kentucky, Appendix 4I – *Karst Areas and Wellhead Protection Zones*. (March 2006, updated November 22, 2021.) Retrieved from <https://www.louisvilleky.gov/planning-design/document/louisville-metro-code-november-2021>

This evaluation was conducted in general accordance with the scope of services outlined in SME Proposal No. P01091.22 dated April 7, 2022. This proposal was authorized by Ms. Mendy Reich with Kennedy International, Inc. on April 12, 2022.

1.1 KARST DEVELOPMENT

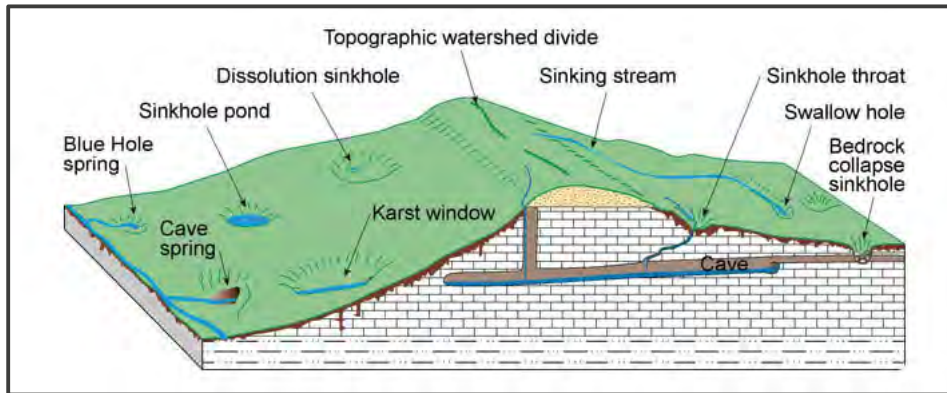
Karst topography is characterized by pinnacled, fissured, and/or cavernous bedrock topography caused by dissolution of the rock by chemical weathering. Sinkholes, sinking streams, springs, and caves (among other features) are associated with karst terrain.

In Kentucky, this phenomenon occurs in carbonate rocks (e.g., limestone, dolomite) that are considered relatively dense, and soluble. The overlying soils typically consist of residual clay deposits weathered from the underlying rock, but can be infilled with fine-grained soils via erosion or other transport mechanisms. Buried sinkhole features, which have been infilled (naturally or artificially), are difficult to characterize or identify visually from the surface, and can better be evaluated by excavation, drilling test borings, and/or geophysical ground imaging. Abundant rainfall within a geographic region over time is required for karst features to develop. The actual weathering within the underlying bedrock occurs over thousands or tens of thousands of years, while an actual sinkhole dropout can occur in a short period of

time due to washing/raveling of the overburden soils through the fissured bedrock. This raveling may occur due to fluctuations in surface and/or subsurface drainage patterns, or changes in groundwater elevation. Engineering works and site development can result in acceleration of incipient sinkhole development or encourage new sinkhole formation.

Swell and swale topography (e.g., undulating hills intermixed with shallow depression) are also characteristic of karst, with localized depressions typically being the result of subsidence related to sinkhole activity. The figure below is characteristic of features associated with karst terrain.

FIGURE 2 - KARST TERRAIN FEATURES ⁽¹⁾



(1) Kentucky Geological Survey. (2022). Retrieved from <https://www.kgs.uky.edu/KGS/karst/>

Karst development can also occur within rocks such as chalks and evaporites (e.g., gypsum and anhydrite), although the mechanism and rate of karst development differs when compared to formation in carbonate rock.

1.2 PROPOSED DEVELOPMENT

The project includes construction of the second phase of a new apartment complex to be located directly south of and adjacent to the 4700 South Hurstbourne Parkway development in Louisville, Kentucky. The entire project site for the current project is encompassed by four parcels identified as 4900 Hurstbourne Parkway, 5113 Bardstown Road, 5119 Bardstown Road, and 5201 Bardstown Road. The combined area for the referenced properties is 25.77 acres. However, the proposed development will only include the northern 3.93 acres of the 5119 Bardstown Road property and the northern 4.94 acres of the 4900 South Hurstbourne Parkway property (the Site). For the purposes of this evaluation (and for easy identification of site boundaries for this evaluation), the stream located parallel and adjacent to the southern boundary of 4900 South Hurstbourne Parkway (and which bisects 5119 Bardstown Road) was considered as the southern limit for this evaluation.

The proposed complex will include nine multi-family housing buildings and associated parking areas and drives. We assume the multi-family housing buildings will have up to three stories. At this time, we do not have information regarding if the lower level will be slab-on-grade or partially recessed.

A grading plan was not provided to SME at the time of this report.

1.3 GENERAL SITE CONDITIONS

The project site is densely wooded with a mixture of deciduous trees and brush. A dilapidated wooden fence was observed along the northern boundary of the site between the project site and 4700 South Hurstbourne Parkway. Based on the topographic information obtained from the figure titled "Concept Plan - 4900 S Hurstbourne Parkway" dated December 22, 2021, existing topography within the project area is described as rolling. In general, site grades gradually increase from about elevation 617 feet near the

northwest corner of the project area and slope down towards the south/southeast. The highpoint (approximately elevation 638 feet) of the site is near the east-central portion of the useable area. The low point within the useable portion of the project area (based upon limited topographic information) is approximately elevation 565 feet +/- near the stream adjacent to the southern border of useable area. However, development is not planned for the southern portion of the useable area where steep slopes exist.

FIGURE 3 – SITE LOCATION MAP



2. EVALUATION PROCEDURES

2.1 MAP AND LITERATURE REVIEW

Our preliminary research for the subject site included review of available geologic maps, geological literature, soils data, and historical and aerial topographic maps to develop a better understanding of native soil and rock conditions near the site, along with possible changes in ground surface topography related to development of sinkholes or other karst features. SME also contacted a local cave exploration group (“cavers”) regarding possible documentation of identified cave or cavern features within the project vicinity. Preliminary site research included review of the following items:

- Online Kentucky Geologic Map Service (including detailed geologic unit map, karst potential map, and water well and springs map);
- 7.5-minute series Geological Quadrangle Map (Jeffersontown, 1972) developed by the United States Geological Survey (USGS) in cooperation with the Kentucky Geological Survey (KGS);
- Submission inquiry to the Kentucky Speleological Survey regarding documented cave systems and/or cave openings;
- USDA National Resource Conservation Services (NRCS) web soil survey map;

- Historical aerial photographs obtained between the 1955 to 2022 time period; and
- Historical topographic maps obtained between the 1907 to 2019 time period.

2.2 VISUAL RECONNAISSANCE PROCEDURE

Our visual reconnaissance procedure consisted of a registered professional engineer specializing in geotechnical engineering traversing the project site. This visual evaluation was performed by Mr. Wesley J. Hemp on May 22, 2022. Mr. Hemp initiated the visual survey at the northern boundary of the site, entering through the adjacent property located at 4700 South Hurstbourne Parkway (which is considered the first phase of the proposed development). Mr. Hemp traversed the property from north to south until the existing stream was reached. This procedure was repeated multiple times, with each line staggered from the previous. A machete was utilized to develop a path where smaller vines and brush were observed. Please note, due to the overgrowth of trees, brush, and under growth, we were unable to effectively walk the entire parcel. However, we were able to visually observe features for some distance extending from each path where vegetation did not obscure surficial features, which allowed for observance of large and obvious karst features.

Approximate location and dimensions of remarkable visual features (along with GPS coordinates) were recorded on a printed satellite image of the project site.

2.3 DATA INQUIRY REQUEST

SME submitted an inquiry to the Kentucky Speleological Survey (KSS) on May 31, 2022 regarding potential for cave-related activity within the project area. The Kentucky Speleological Survey is a non-profit organization of cavers that function as gathers, archivists, and curators of cave and karst data for the State of Kentucky. We have not received a response at this time to our inquiry.

Please visit www.ksscaves.com for more information regarding KSS.

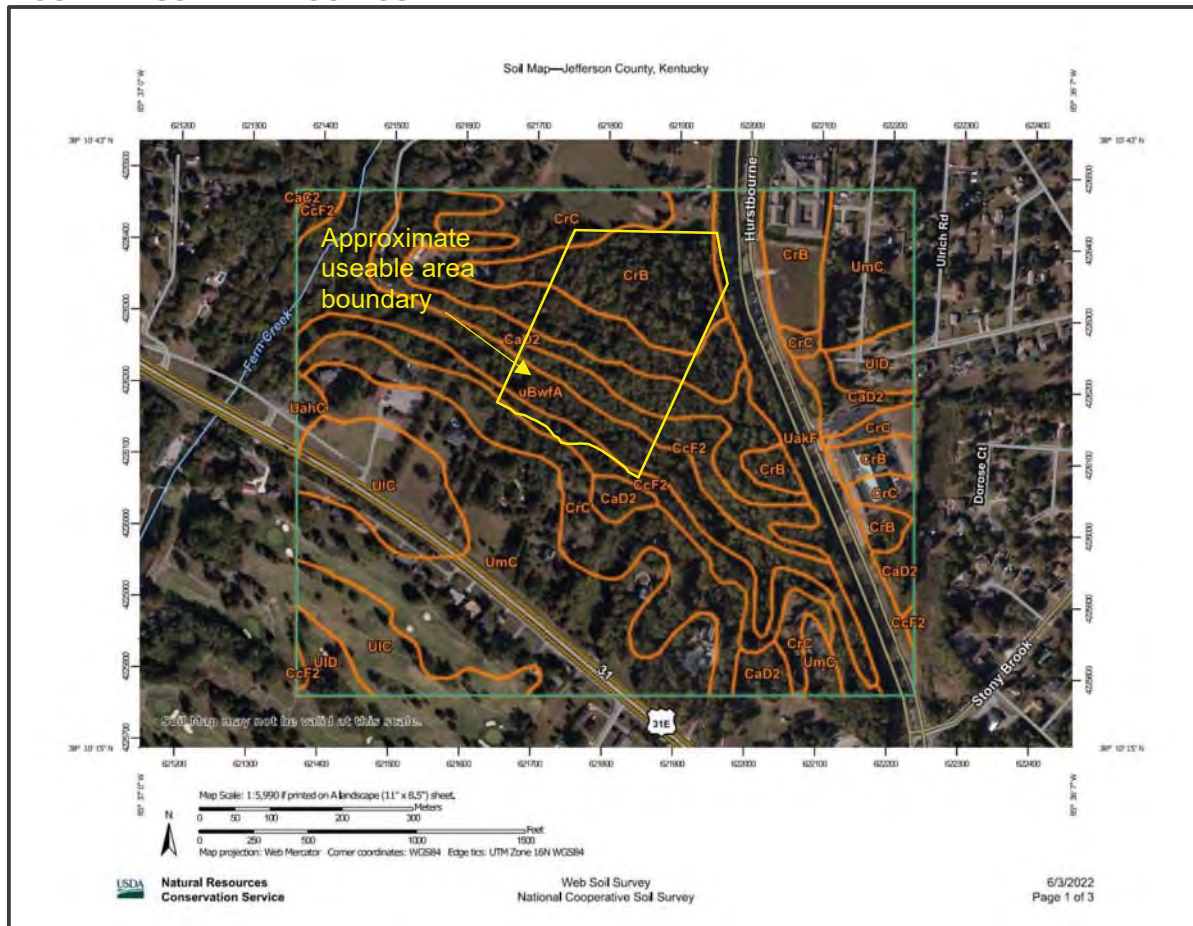
3. MAP AND LITERATURE REVIEW EVALUATION

3.1 SURFICIAL GEOLOGY

Information obtained from the United States Department of Agriculture (USDA) Web Soil Survey indicates the near-surface natural soils consist predominantly of Crider Silt Loam (CrB, slopes 2-6% and CrC, slopes 6-12%). Crider-series soils, which are residual soils derived from weathering of the underlying rock, are typically red in hue, contain varying quantities of manganese or iron oxide concretions, and are of medium to high plasticity. These soils generally dominate soil stratigraphy for the Site area planned for development.

Mapped soils for the southern portion of the useable site area (and north of the stream) where development is not planned include the Caneyville silt loam 12-25% slopes (CaD2), Caneyville-Rock cover complex 12-60% slopes (CcF2), and the Bonewood silt loam 0-4% slopes (uBwfA). Most of the soils consist of residual soil weathered from limestone, while the Bonewood silt loam (which is located in the lower portion of the site in the general vicinity of the stream) consists of alluvium weathered from limestone. Please refer to the USDA Soil Survey Map below for more information.

FIGURE 4 - USDA WEB SOIL SURVEY MAP (1)



(1) USDA Web Soil Survey. (2022). United States Department of Agriculture – Natural Resource Conservation Service. Retrieved from <https://www.websoilsurvey.sc.egov.usda.gov>.

3.2 BEDROCK GEOLOGY

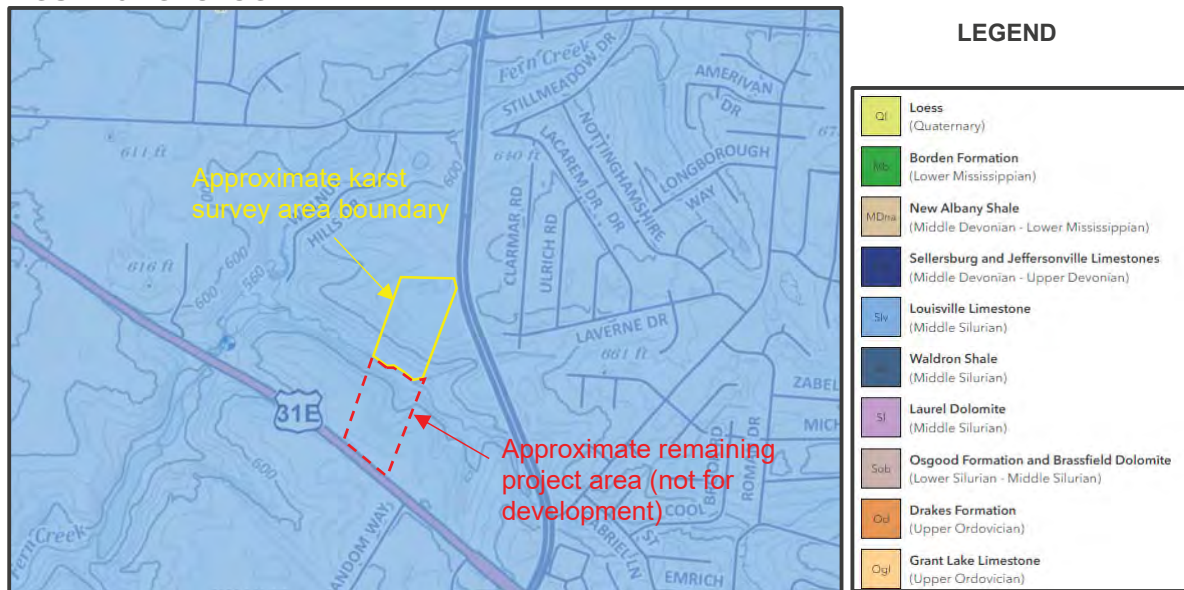
3.2.1 GENERAL BEDROCK GEOLOGY

Our review of the referenced geological literature indicates the project site is in the Blue Grass Physiographic Region, in the Outer Bluegrass Area.

The referenced geologic mapping indicates the underlying rock is composed of Silurian-age dolomitic limestone belonging to the Louisville Limestone Formation. This is formation is described as light-gray to yellowish gray, light brownish-gray in color and weathers to light brown or medium gray; fine-grained; thin to very-thick bedded; and contains chert nodules near the top of the formation. Calcite patches measuring less than 2 inches in diameter are scattered throughout. Sinkholes are commonly observed within the Louisville Limestone. Soil cover consists of residuum and generally is less than 10 feet in thickness in this area.

Please refer to the site geology map obtained from the Kentucky Geological Survey – Kentucky Geologic Map Service below for more information:

FIGURE 5 - GEOLOGIC MAP (1)



(1) Kentucky Geological Survey. (2022). Kentucky Geologic Map Information Service. Retrieved from <https://www.kgs.uky.edu>.

3.2.2 KARST CONDITIONS

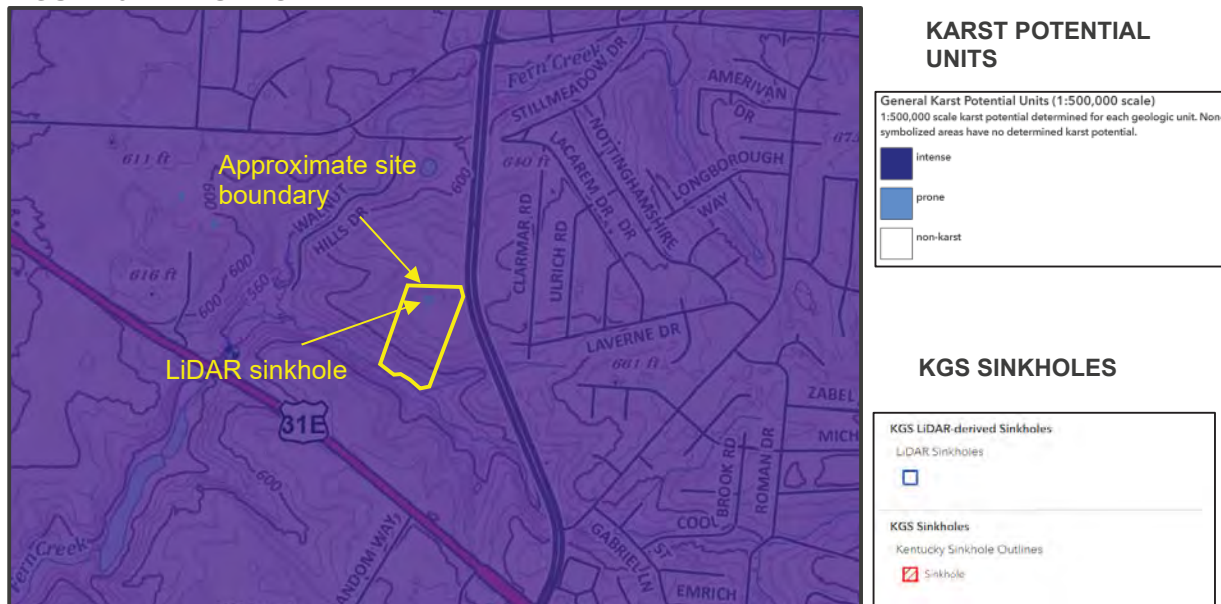
3.2.2.1 KARST POTENTIAL INDEX

The Kentucky Geological Survey has developed a generalized mapping tool to rate the general karst potential for the state of Kentucky. This tool, which is a feature of the online Kentucky Geologic Map Service, provides a color-coding scheme for relative karst potential. Dark blue/purple indicates areas of “intense” karst potential, while light blue indicates an area “prone” to karst development. White represents areas considered non-karst. This tool can be utilized to rate the general karst potential for a project site for preliminary risk assessment or for use in development of subsurface evaluation programs. Further discussion and application of this tool is discussed below in Section 3.2.2.2.

3.2.2.2 SINKHOLE CONSIDERATIONS

Our review of the referenced geological literature (including the KGS Karst Potential Map – see below) indicates the presence of a singular sinkhole as identified by LiDAR (represented by blue outline) in the north-central portion of the site. KGS estimates the accuracy of LiDAR detected sinkholes is greater than 85% based upon limited field verification. Statewide sinkholes are defined by a red-hashed zone. **However, the KGS map is a generalized tool for identifying sinkhole features and should not be considered as a suitable replacement for “boots on the ground” site evaluation, even when considering the estimated accuracy.**

FIGURE 6 - KARST POTENTIAL MAP (1)



(1) Kentucky Geological Survey. (2022). Kentucky Geologic Map Information Service. Retrieved from <https://www.kgs.uky.edu>.

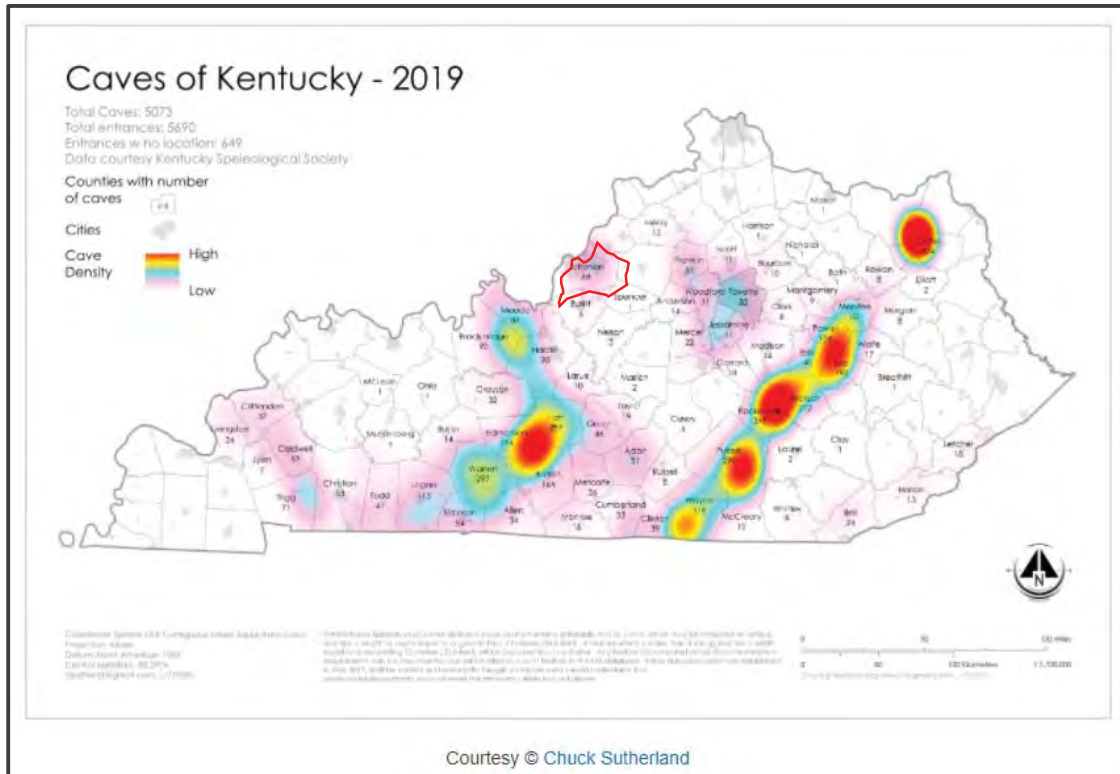
The above-referenced map reflects the generalized existing site topography and documented sinkholes. Changes in site topography, including development of new sinkholes or absence of old sinkholes, may be observed when comparing newer geologic maps to older maps.

3.2.2.3 CAVE CONSIDERATIONS

Caves are defined as a natural void in the ground (e.g., in limestone rock) that is large enough for a person to enter. A cavern is a series of connected caves. In Kentucky, caves and caverns exist within the underlying rock mass in areas of karst terrain. However, cave entrances are not always obvious, or may not be present at all. Many caves openings are formed by engineering works (e.g., excavation or mining), or in some cases, the result of sinkhole roof collapse.

We have not received a response from KSS regarding potential cave activity within the project boundaries at the time of this report. However, generalized mapping tools were able from KSS depicting cave density (i.e., number of caves within a certain defined area) and caves per county in Kentucky. Review of the available mapping indicates 68 cave openings have been documented within Jefferson County as of 2019. Please refer to the generalized image below obtained from the KSS website. This figure has been modified from the original version, as the boundary for Jefferson County is highlighted in red.

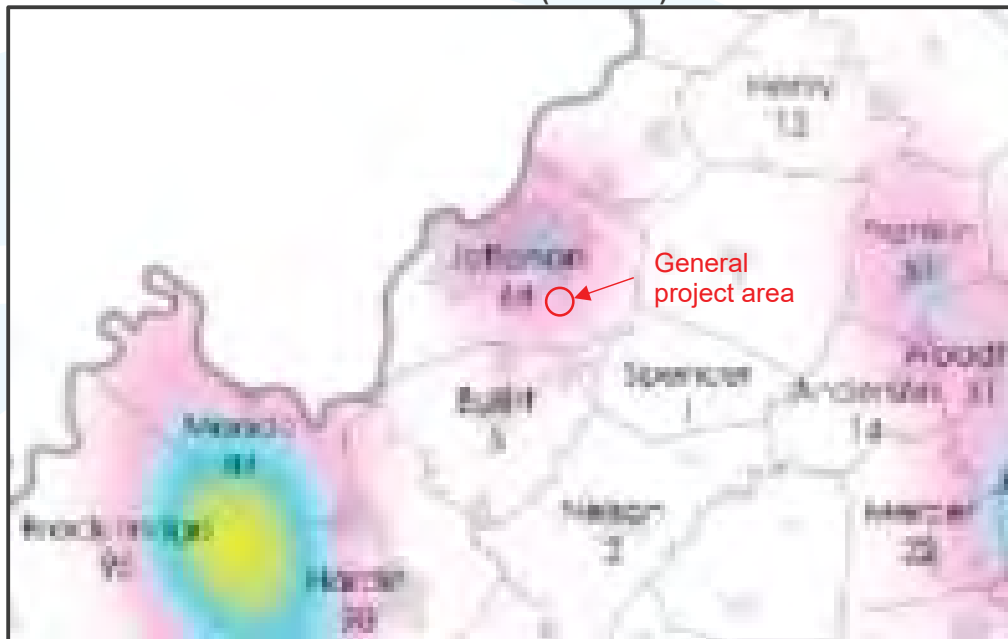
FIGURE 7 - CAVES OF KENTUCKY - 2019 (1)



(1) Kentucky Speleological Survey. (2022). "Caves of Kentucky – 2019". Retrieved from <https://ksscaves.com/index.php.caves>

Closer review of the image indicates the project site is located within an area identified as having relatively “low” cave density based upon the Site is within the light pink zone. Note that “low” cave density does not necessarily mean low karst potential. Please refer to the figure below for additional information.

FIGURE 8 - CAVES OF KENTUCKY – 2019 (Modified) (1)



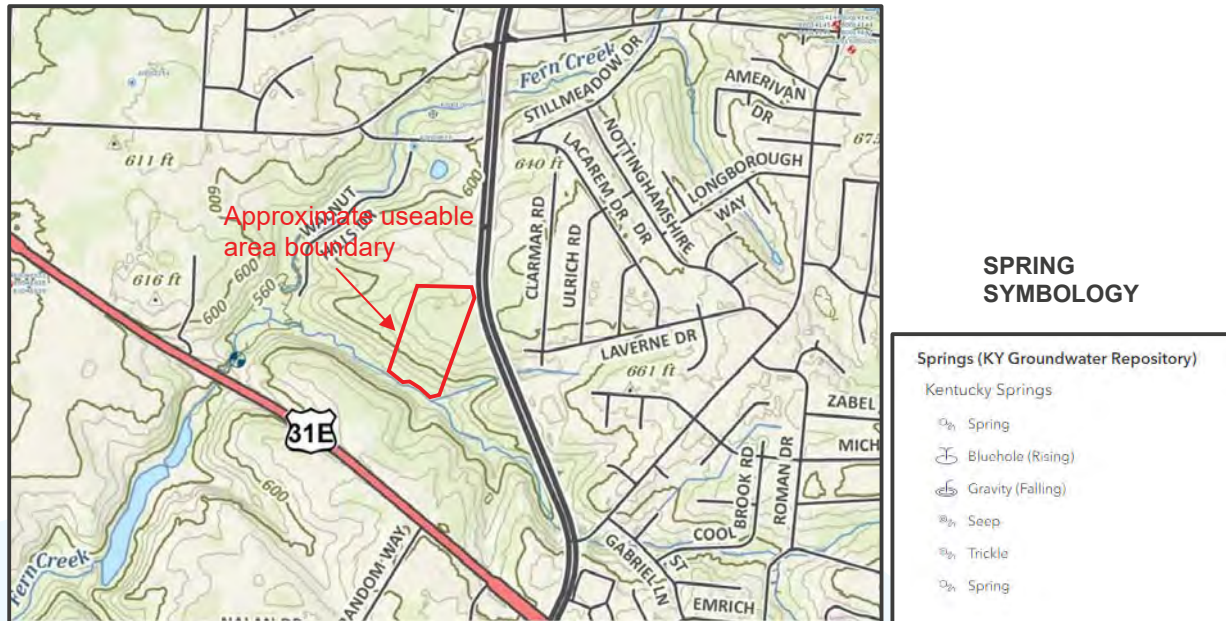
(1) Kentucky Speleological Survey. (2022). Adapted from "Caves of Kentucky – 2019". Retrieved from <https://ksscaves.com/index.php.caves>

Perhaps the most well-known series of caves near the project site (and located within Jefferson County) is the Louisville Mega Cavern, which is located approximately 5.3 miles northwest of the project site. This cavern has been modified to accommodate tourist attractions, a recycling center, and underground warehouses among other developments. However, the Louisville Mega Cavern is not a natural cave, as it was formed via mining of limestone rock starting in the early 1930's and through the 1970's.

3.2.2.4 SPRINGS AND STREAMS

Springs, which result from groundwater under hydraulic pressure head (due to change in elevation) are commonly associated with karst topography. The fissured and fractured nature of karst-susceptible rock formations act as conduits for spring water flow. However, our review of the Kentucky Groundwater Repository Water Wells and Springs Map did not reveal the presence of identified spring features on the site. However, a suspected spring house was observed near the southwest corner of the Site. Refer to Section 4.1 of this report for more information. A stream (apparent tributary of Fern Creek) bisects the combined property area and was considered as the southern boundary for the karst evaluation. Please refer to the image below for more information.

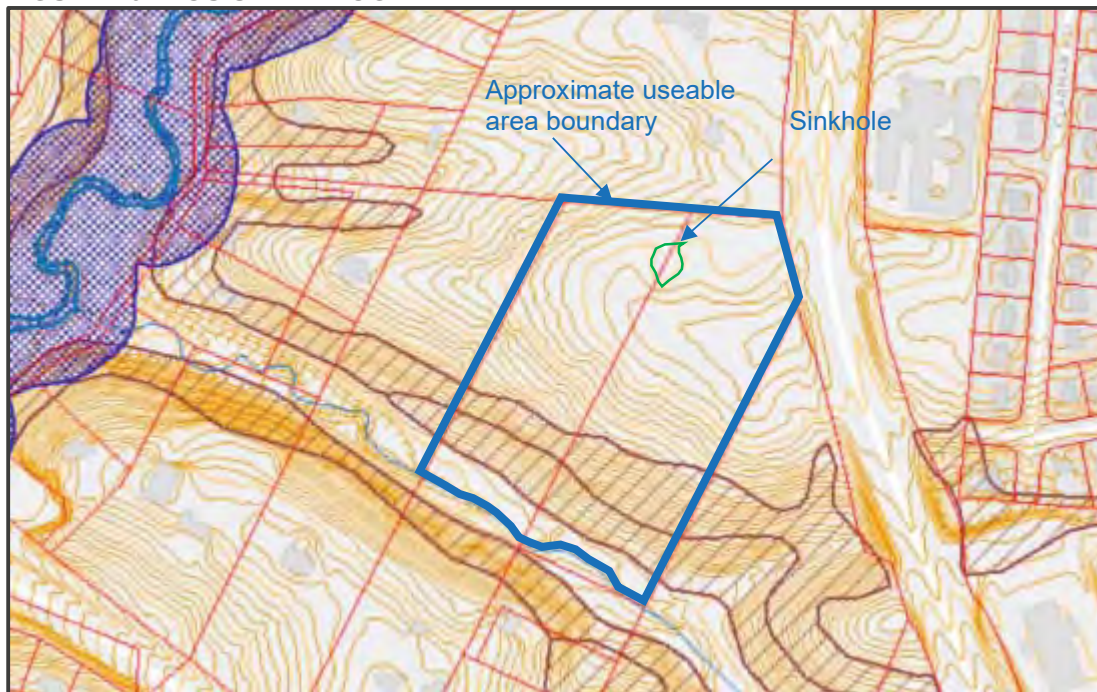
FIGURE 9 - WATER WELLS AND SPRINGS MAP ⁽¹⁾



(1) Kentucky Geological Survey. (2022). Kentucky Geologic Map Information Service. Retrieved from <https://www.kgs.uky.edu>.

Our review of the Louisville/Jefferson County Information Consortium (LOGIC) interactive GIS map indicated potentially steep slopes (represented by hatched zone) in the southern portion of the “useable area” as defined on the site concept plan. However, no development is planned in the area where steeper slopes were observed. Site topography (represented by 2-ft contour intervals) does not suggest obvious sinkhole activity, although the outline of the sinkhole previously identified on the karst potential map is visible (outer rim contour highlighted in green below). Shallow nuanced karst features are difficult to identify without closer contour characterization. The expanded boundary of Fern Creek (represented by the dark blue lines) represents the flood plain zone. Information obtained from LOGIC indicates the tributary along the southern boundary of the “useable area” is an intermittent stream as defined by the United States Geological Survey (USGS).

FIGURE 10 - LOUISVILLE LOGIC MAP ⁽¹⁾



(1) LOGIC online. (2022). Kentucky Geologic Map Information Service. Retrieved from <https://www.logic.org/logic-online>

3.3 TOPOGRAPHIC MAP AND HISTORICAL PHOTOGRAPH REVIEW

Review of the historical topographic maps from the referenced time periods did not reveal any remarkable changes in topography within the area for proposed development (i.e., north of the stream). However, the level of details varied between maps. A tributary connecting to the referenced creek was indicated on some of the maps. Based upon the topographic maps, this drainage way traverses below Hurstbourne Parkway and follows the existing site gradient. No evidence of closed depressions was indicated on the referenced maps. Please refer to Appendix A for site topographic map images from various time periods.

Review of available historical photography revealed similar information obtained from historical topographic maps discussed above. Changes in surficial conditions were observed for photographs obtained between 1955 and 2020. Earlier photographs depict the site as primarily consisting of an open field with sparse trees. A dark area is observed within the area of the existing sinkhole in the 1955 photograph and onward. However, the location of this feature was obscured over the years due to tree canopy covering the site. The 1983 image indicated overgrowth on the eastern parcel (4900 Hurstbourne Parkway) with what appears to be random trails. S. Hurstbourne Parkway is first observed in the 1993 image. Overgrowth was observed in the southern portion of the 5119 Bardstown Road property in the 1998 image. Both parcels were observed to be wooded with mature tree canopies in the 2004 image and on. No evidence of sinkhole activity was observed other than the previously referenced sinkhole feature. Historical photographs are included in Appendix A for reference.

4. VISUAL RECONNAISSANCE EVALUATION

4.1 VISUAL OBSERVATIONS

An SME representative visited the Site on May 23, 2022 to observe and document surficial conditions within the project site boundaries. In general, the Site primarily consists of rolling, densely wooded terrain. Access to the site was provided via the tree line bordering 4700 S. Hurstbourne Parkway on the north

side of the Site. A paved access drive approach extending from S. Hurstbourne Parkway (and terminating a short distance thereafter) was observed near the northeast quadrant of the Site. The surface of the northern approximately half of the useable area was undulating but relatively level in comparison to the southern portion of the referenced area, which slopes abruptly to the south (and towards the existing stream). A fence bordered the west and northern sides of the property. A dilapidated wooden fence was observed just inside the tree line along the northern border.

The site was overgrown with dense vegetation including brush, vines, and deciduous trees. The sinkhole feature referenced on the available geologic maps, LOGIC map, and site development plan was identified. The sinkhole was large, irregularly shaped feature of undetermined depth. Due to the feature's size and mature tree canopy, it was impractical to evaluate the depth or lateral dimensions via field measuring or via GPS. Various debris, including metal drums and cans, were observed in the sinkhole opening.

A suspected springhouse was observed near the southwest corner of the site, adjacent to the western property line for 5119 Bardstown Road and just north of the stream. This structure included stone walls on three sides and an A-frame metal roof. The ground surface near the spring was relatively moist, but no free water or spring discharge was observed emanating from the suspected spring house.

4.2 CONCLUSIONS AND PROPOSED SITE DEVELOPMENT

One mature, obvious sinkhole was identified within the proposed “useable” portion of the project site. This feature is located on the north-central portion of the site and spans between the physical address of 5119 Bardstown Road and 4900 S Hurstbourne Parkway. The feature is situated within a proposed access drive, between (and in close proximity to) two proposed housing units. Note that only limited visual observations could be made for this evaluation. Once the surface of the site is cleared, the site should be reviewed again for possible surface features related to karst formations.

Do not construct over active or possible sinkholes without further exploration, analysis and remediation (if feasible and where sinkhole features are identified). Where possible, adjust or modify the site plan by shifting proposed structure locations away from identified sinkhole features is preferable. However, this is not always possible without significantly impacting the project.

Sinkhole features identified within structural areas (i.e., building or pavements) will require remediation during construction or utilization of alternative foundation systems as directed by the Geotechnical Engineer of Record, assuming the proposed structure locations cannot be shifted. We recommend identified and suspected sinkhole features be evaluated prior to construction (ideally during the planning stage) to determine impacts on the proposed development. Characterization of identified anomalies can be performed by performance of additional test borings (beyond quantity per geotechnical evaluation scope), excavation, and/or geophysical surveys.

For this specific project, there is limited available space for development due to the presence of steep slopes along the southern portion of the defined “useable” area. Shifting the development further south will require careful consideration and engineering analysis to address development on slopes. Therefore, it is likely the development plan cannot be easily modified, and the sinkhole feature will require remediation prior to construction of buildings or pavements. Specialized foundation systems may also be required for structure(s) in close proximity to the existing sinkhole feature.

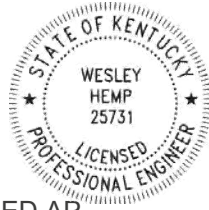
There is inherent risk associated with development on karst terrain as indicated by karst maps and the identified surface feature. Other identified possible karst features that have not yet been identified may require additional characterization prior to construction. General evaluation methodologies were discussed in the preceding paragraph. SME will provide general guidance regarding additional evaluation, sinkhole exploration, and general remedial methodologies in the forthcoming geotechnical evaluation report.

5. SIGNATURES

Report Prepared By:



Wesley J. Hemp, PE, PG (LA), LEED AP
Regional Office Manager/ Senior Project Engineer



Report Reviewed By:



Timothy H. Bedenis, PE, D.GE
Principal Engineer

APPENDIX A
PHOTOGRAPH LOG
HISTORICAL TOPOGRAPHIC MAPS (FIGURES 1 THROUGH 15)
HISTORICAL AERIAL PHOTOGRAPHS (FIGURES 16 THROUGH 32)



PHOTO NO. 1: Sinkhole – north central portion of site



PHOTO NO. 2: Sinkhole – north central portion of site

SME Project No.	089555.00
Photographs by:	Wes Hemp, P.E., P.G.
Date:	May 23, 2022
Project:	Hurstbourne Apartments Development
Location:	4900 S Hurstbourne Parkway and 5119 Bardstown Road, Louisville, Kentucky



PHOTO NO. 3: Sinkhole – north central portion of site



PHOTO NO. 4: Stream at southern boundary of useable area in southeast quadrant

SME Project No.	089555.00
Photographs by:	Wes Hemp, P.E., P.G.
Date:	May 23, 2022
Project:	Hurstbourne Apartments Development
Location:	4900 S Hurstbourne Parkway and 5119 Bardstown Road, Louisville, Kentucky



PHOTO NO. 5: Springhouse near southwest corner of useable area



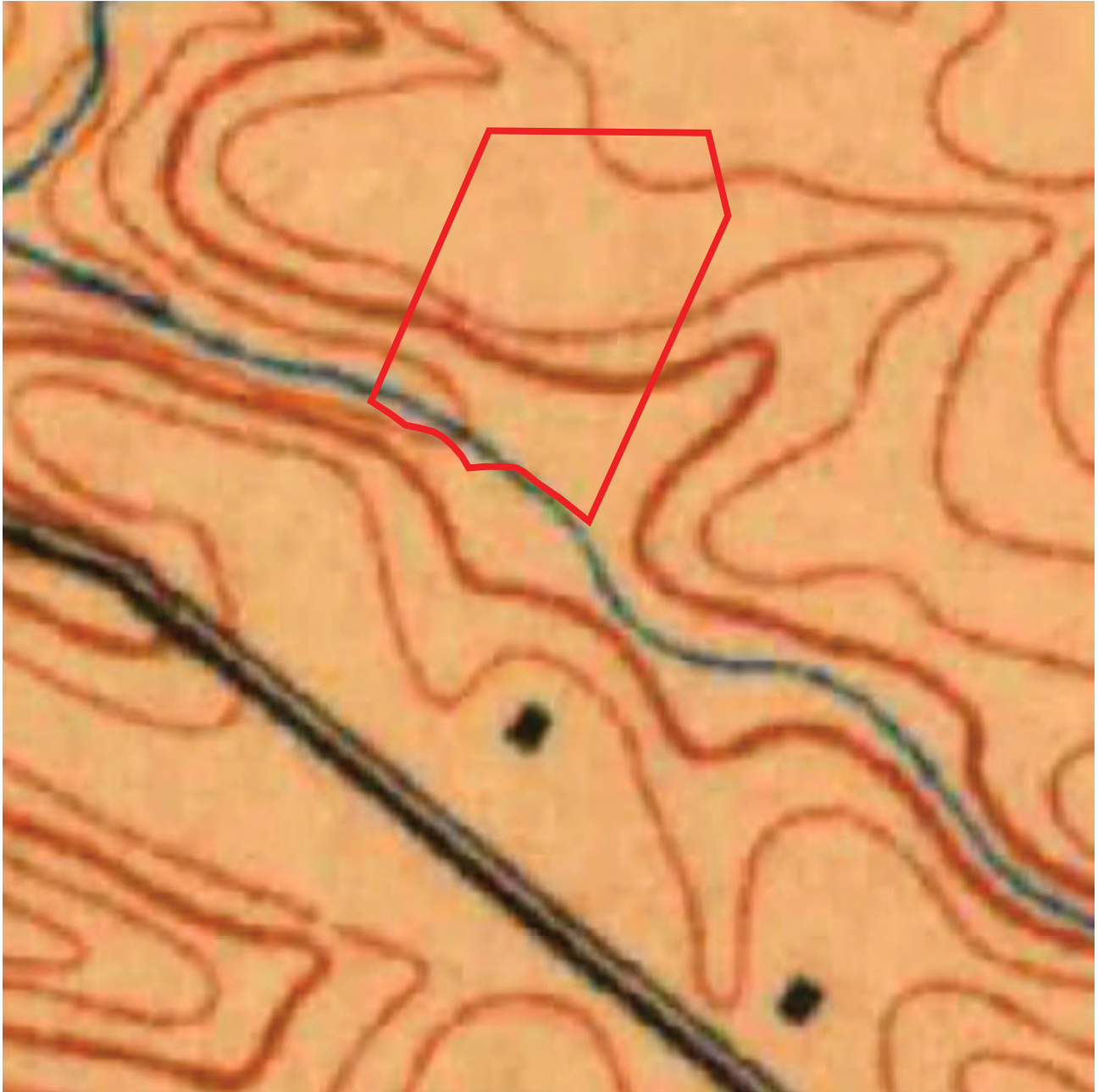
PHOTO NO. 6: Stream at southern boundary of useable area near southwest corner

SME Project No.	089555.00
Photographs by:	Wes Hemp, P.E., P.G.
Date:	May 23, 2022
Project:	Hurstbourne Apartments Development
Location:	4900 S Hurstbourne Parkway and 5119 Bardstown Road, Louisville, Kentucky



PHOTO NO. 7: Stream at southern boundary of useable area in southwest quadrant

SME Project No.	089555.00
Photographs by:	Wes Hemp, P.E., P.G.
Date:	May 23, 2022
Project:	Hurstbourne Apartments Development
Location:	4900 S Hurstbourne Parkway and 5119 Bardstown Road, Louisville, Kentucky



LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1907 HISTORICAL TOPOGRAPHIC MAP
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**

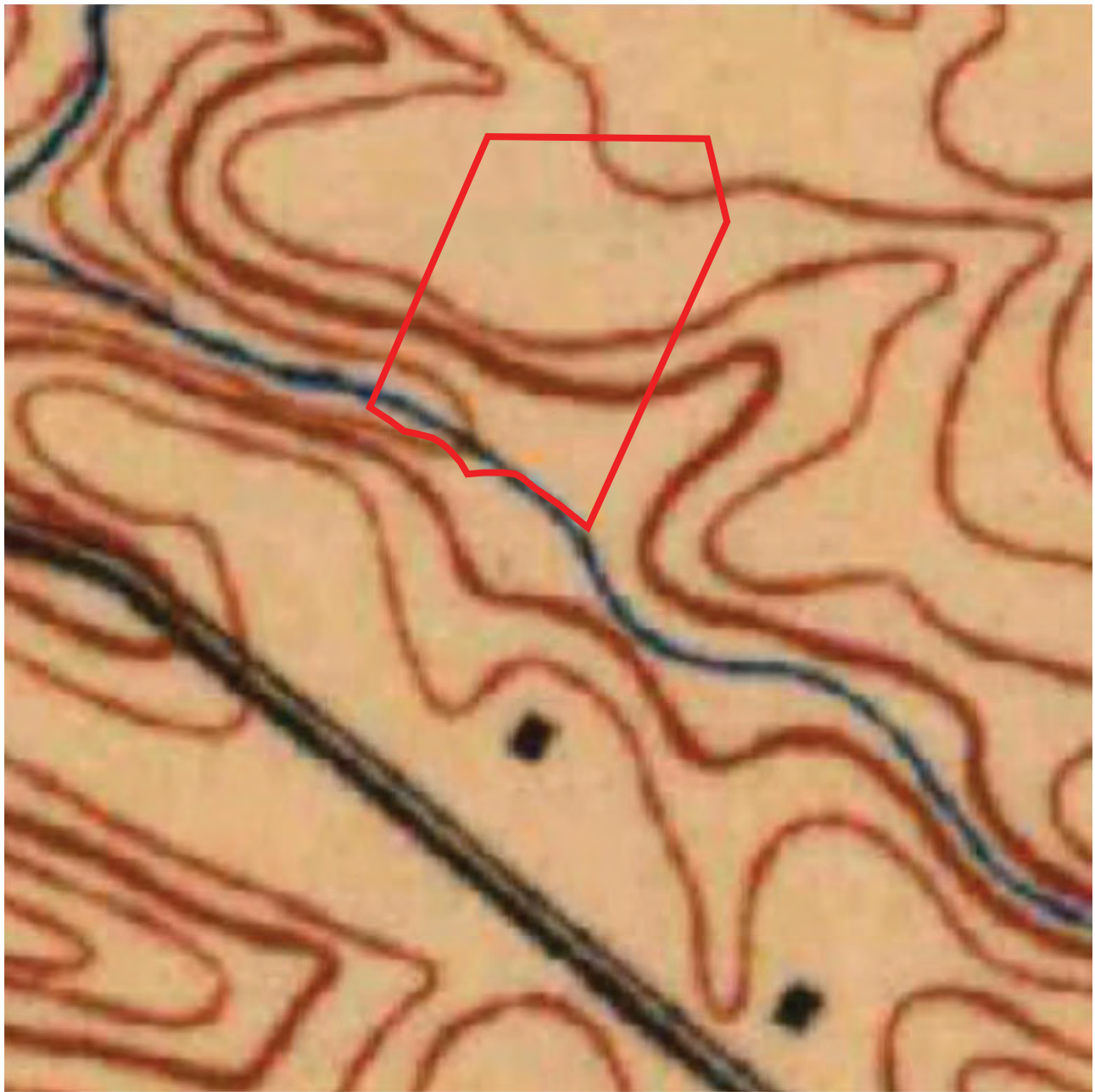


Figure No. 1

Received August 3, 2022

Planning & Design Services

22-ZONE-0076



LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1922 HISTORICAL TOPOGRAPHIC MAP
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



www.sme-usa.com

Figure No. 2

Received August 3, 2022

Planning & Design Services

22-ZONE-0076



LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1941 HISTORICAL TOPOGRAPHIC MAP
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**

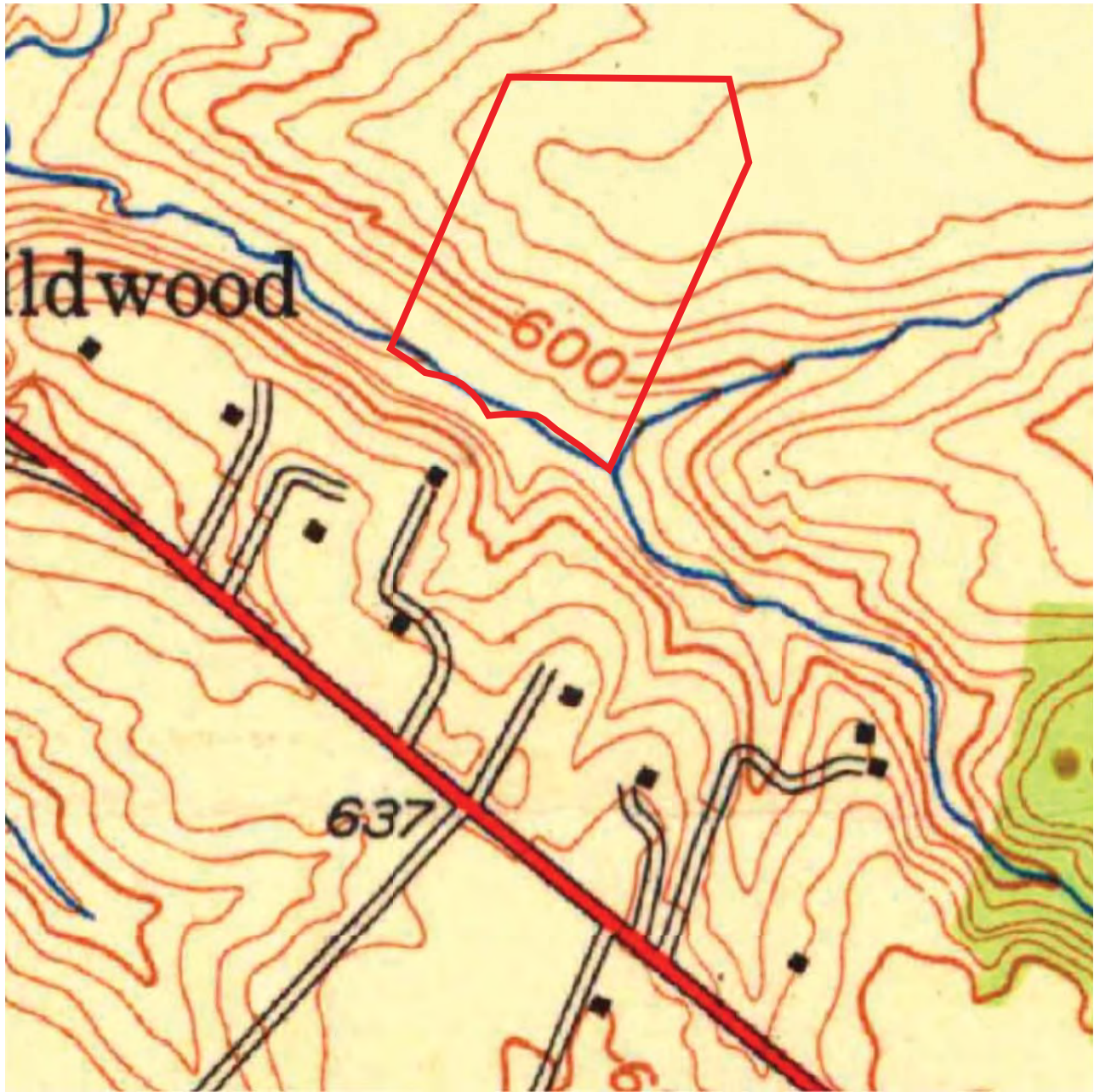


Figure No. 3

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1951 HISTORICAL TOPOGRAPHIC MAP
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**

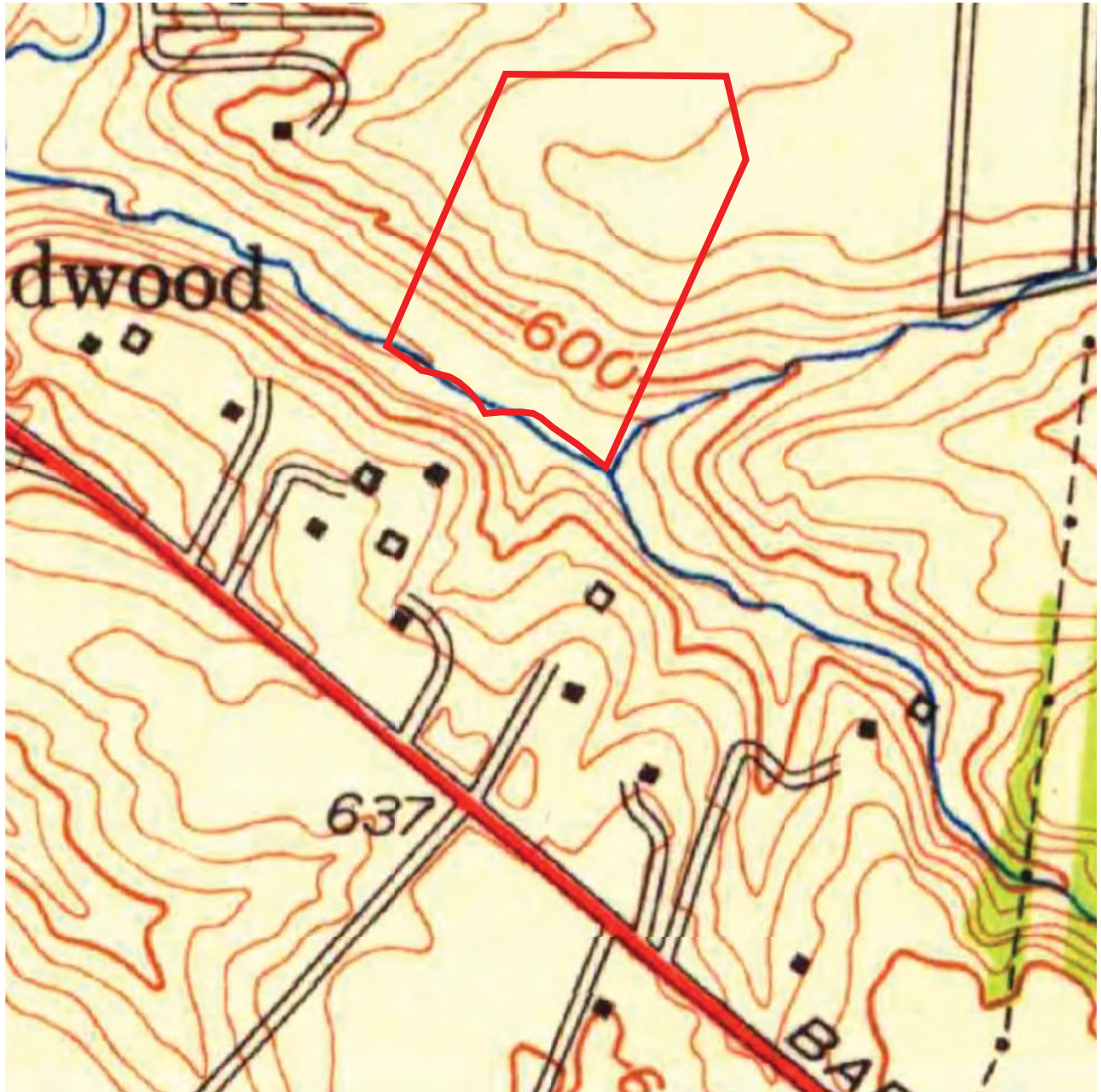


Figure No. 4

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

1956 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



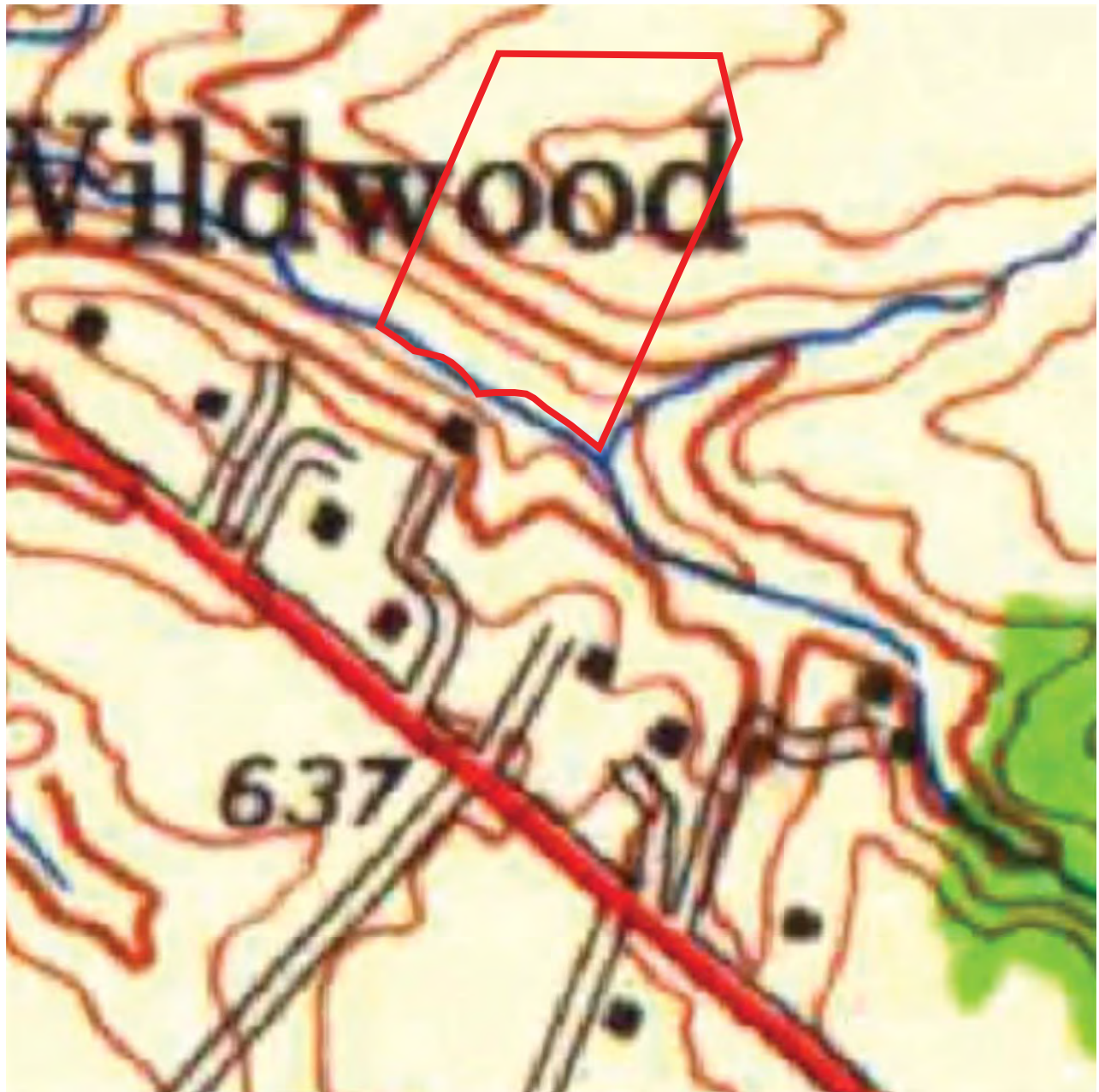
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Figure No. 5

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1959 HISTORICAL TOPOGRAPHIC MAP
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



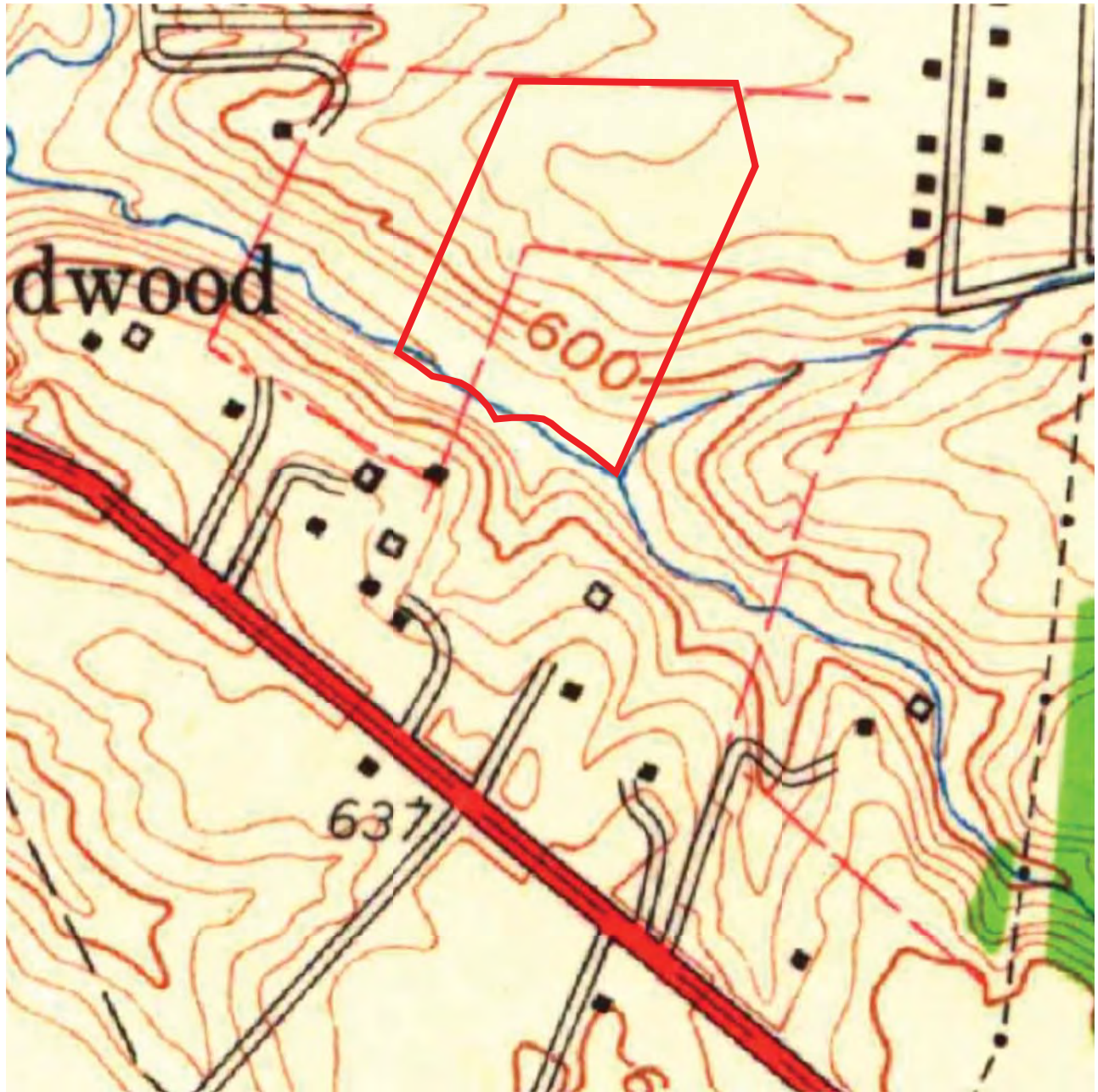
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Figure No. 6

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

1961 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



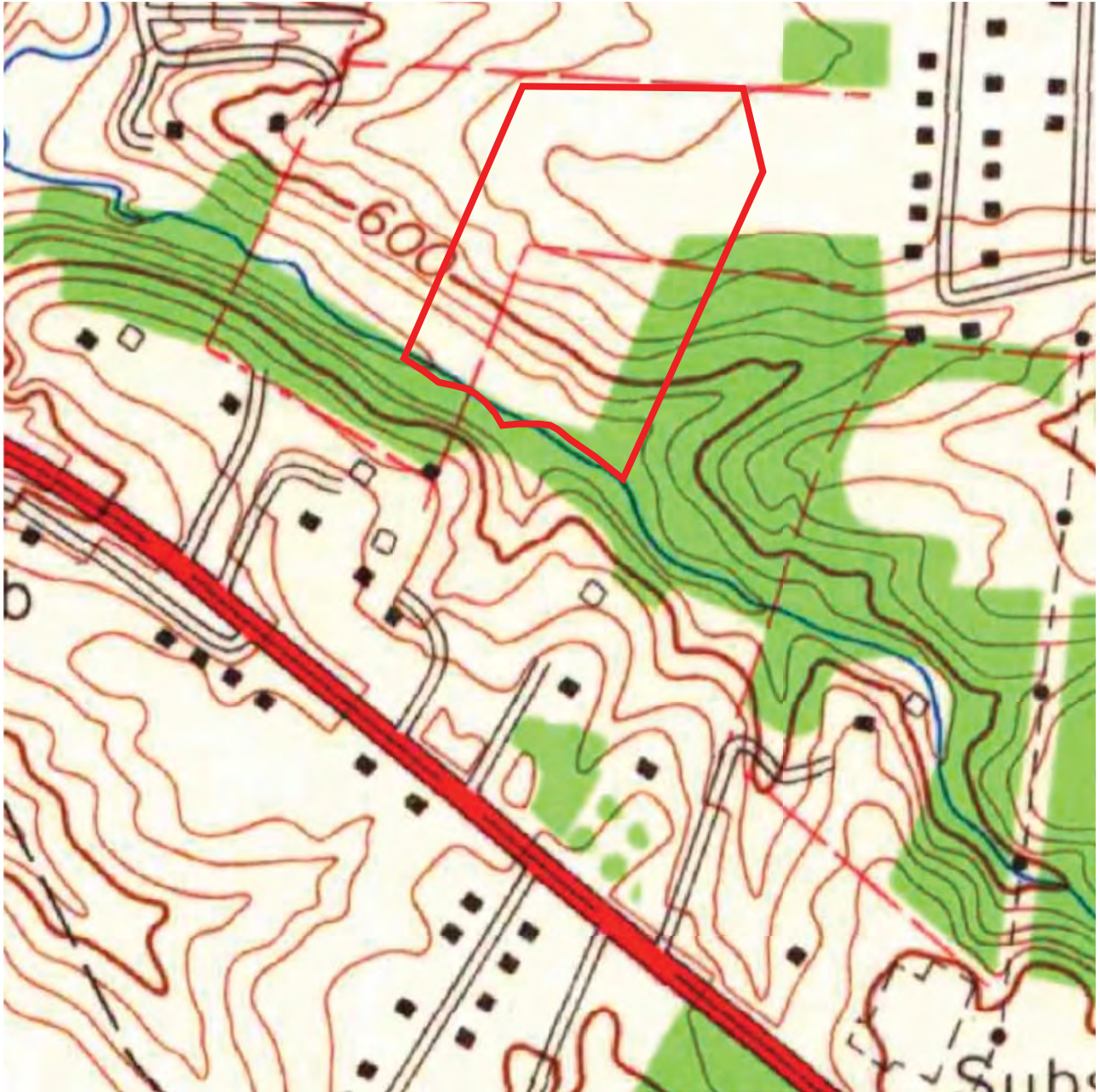
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Figure No. 7

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

1967 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



Figure No. 8

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

1972 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



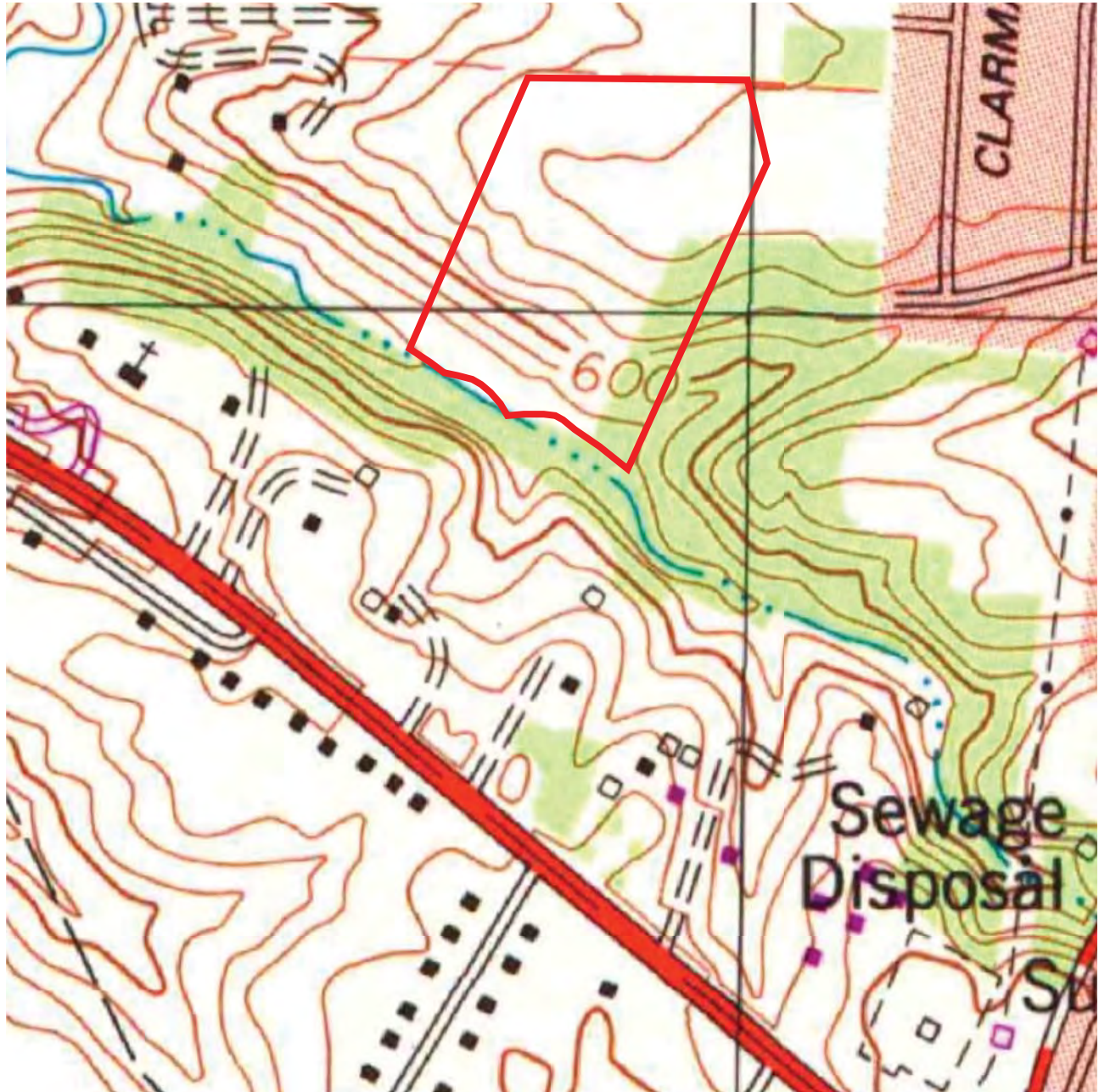
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Figure No. 9

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

1983 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



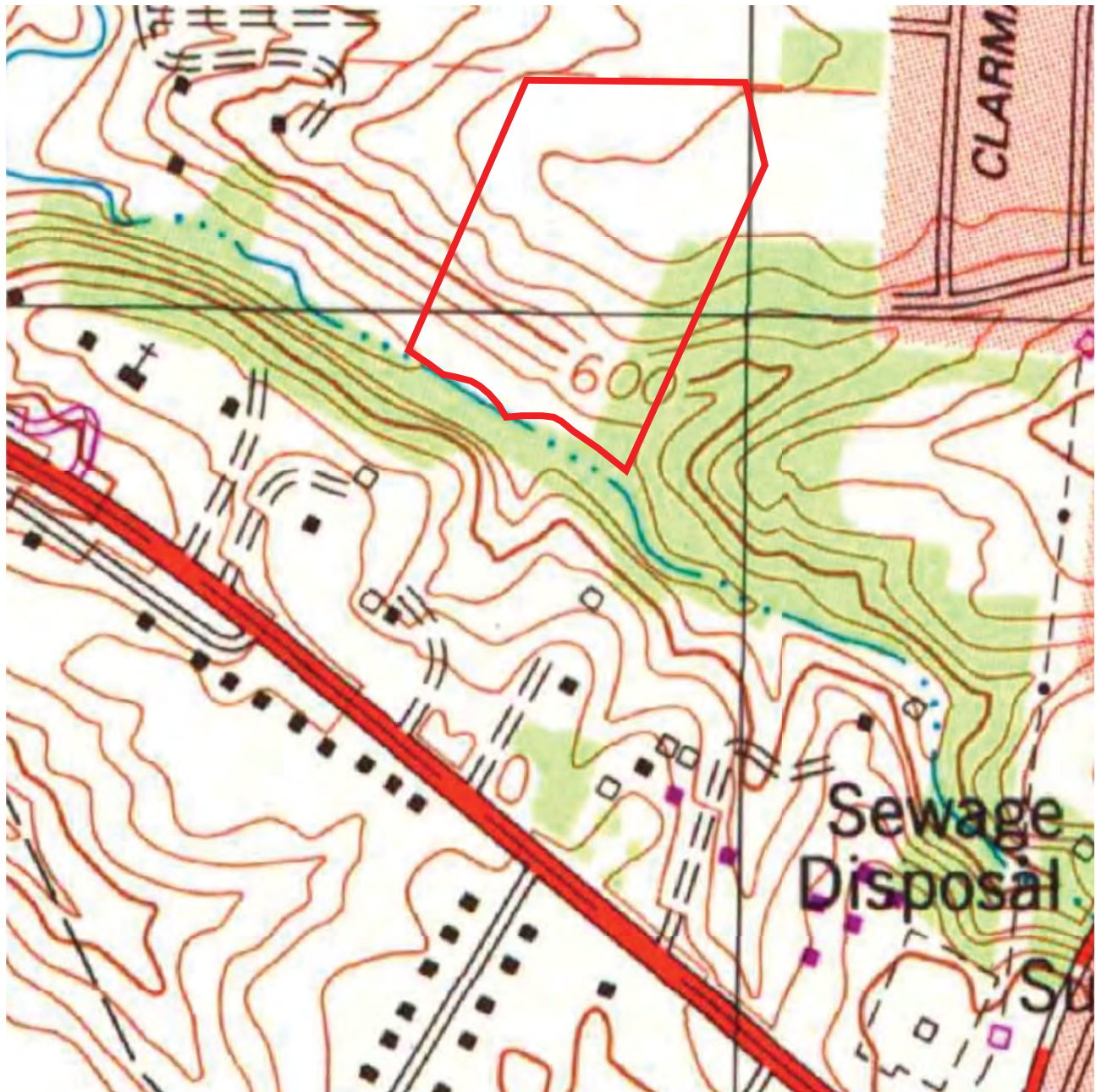
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Figure No. 10

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

1987 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY

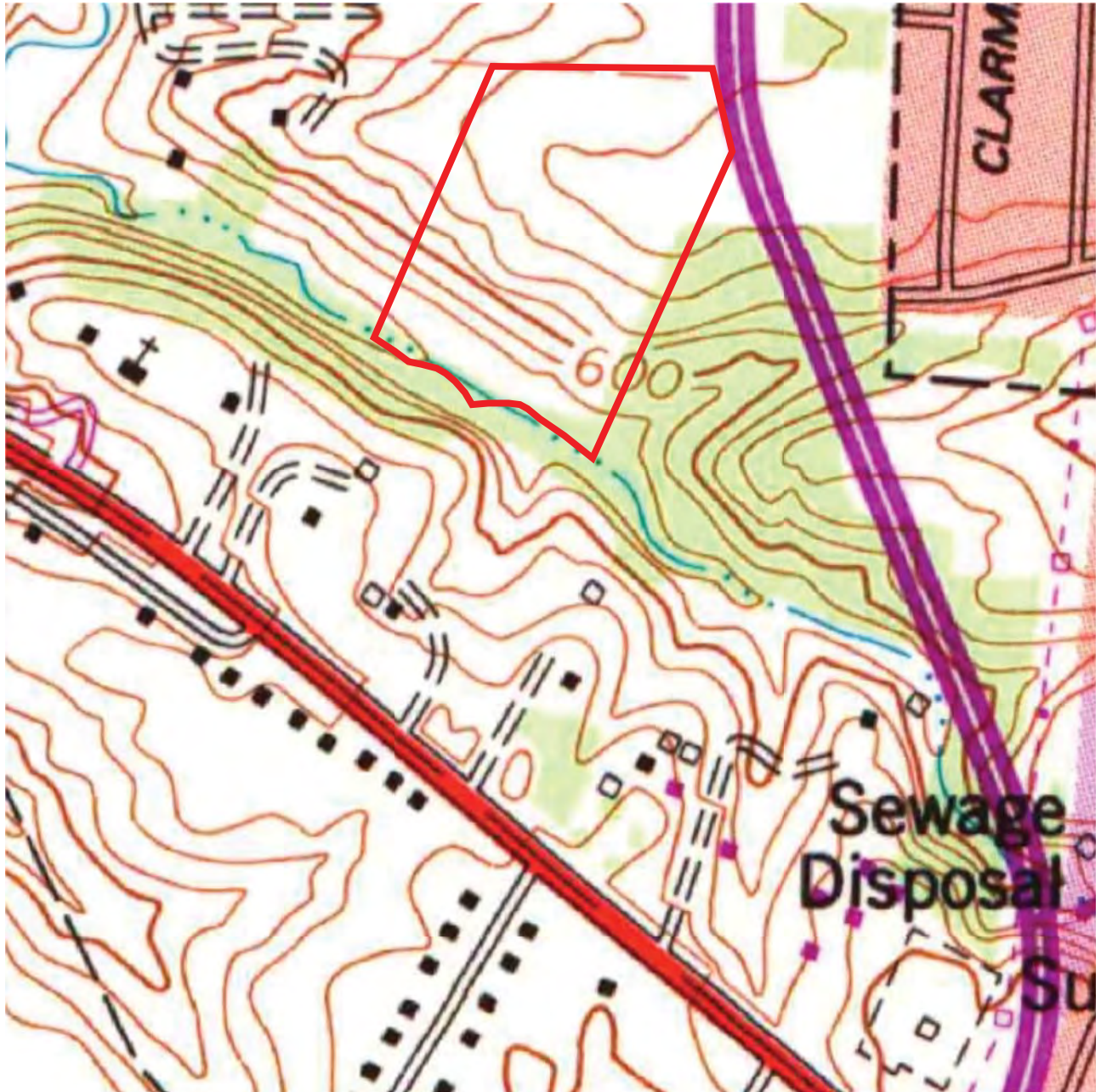


Figure No. 11

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

2013 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



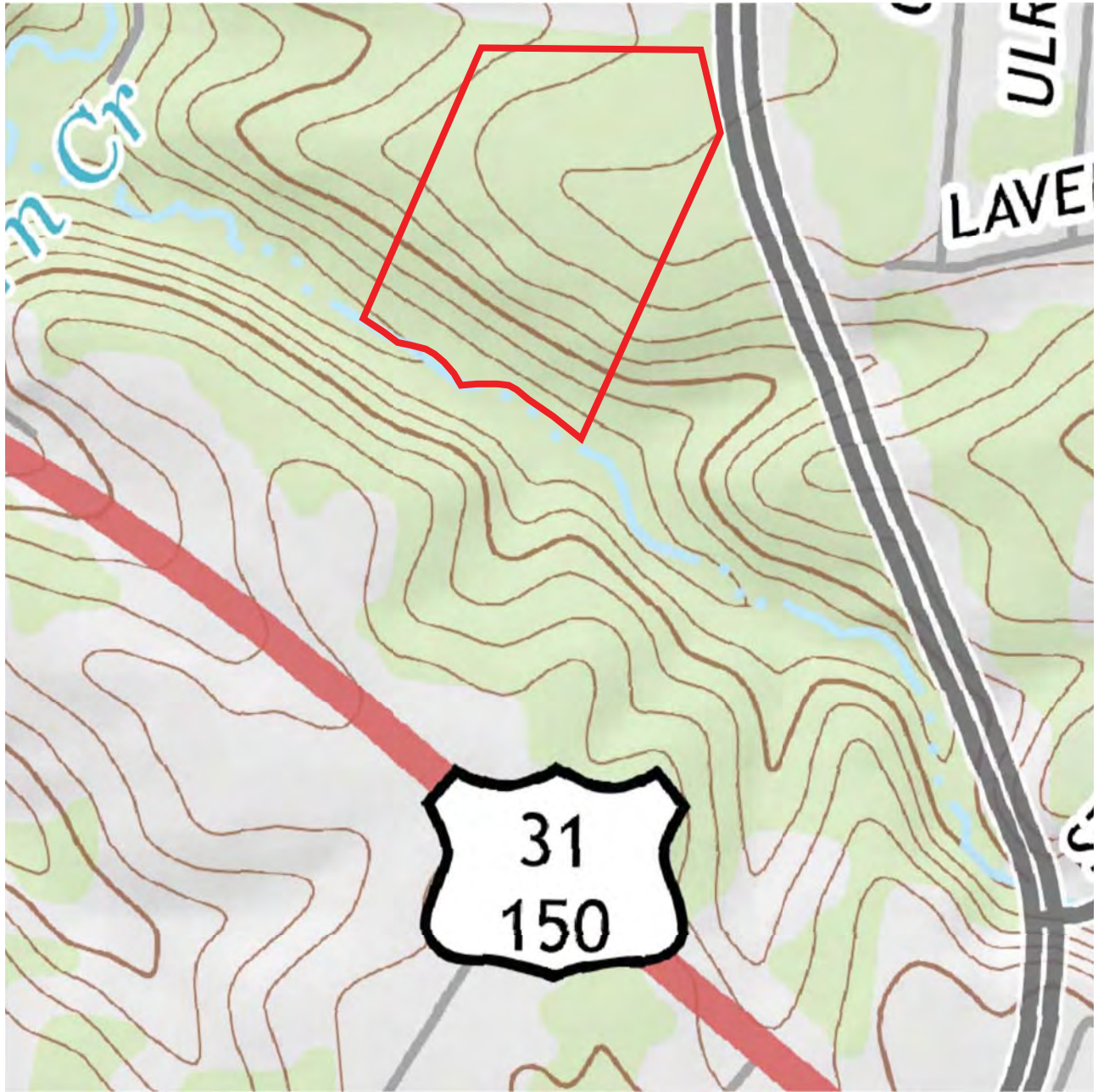
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Figure No. 12

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-07-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2013 HISTORICAL TOPOGRAPHIC MAP
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**

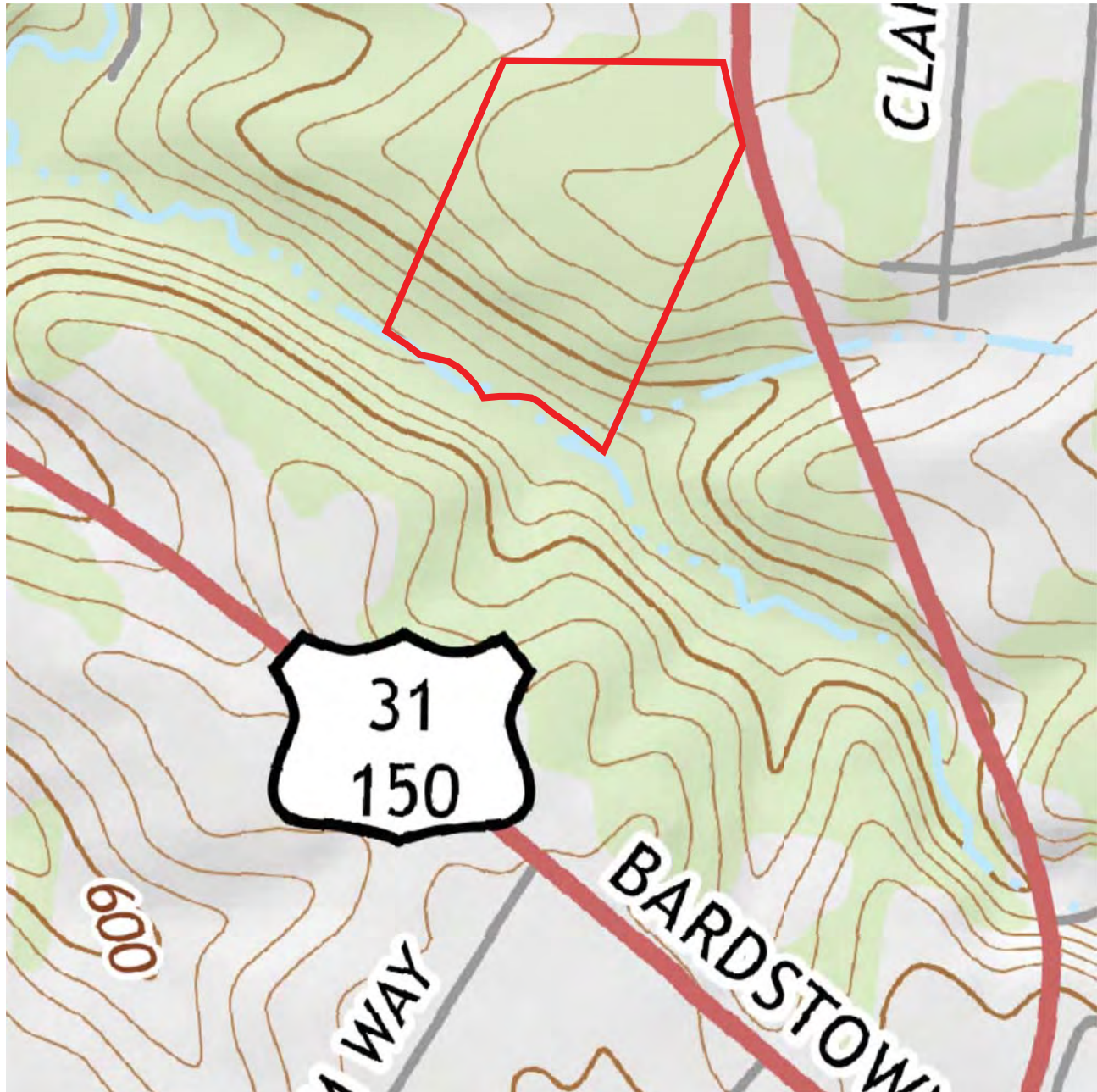


Figure No. 13

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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

2016 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY

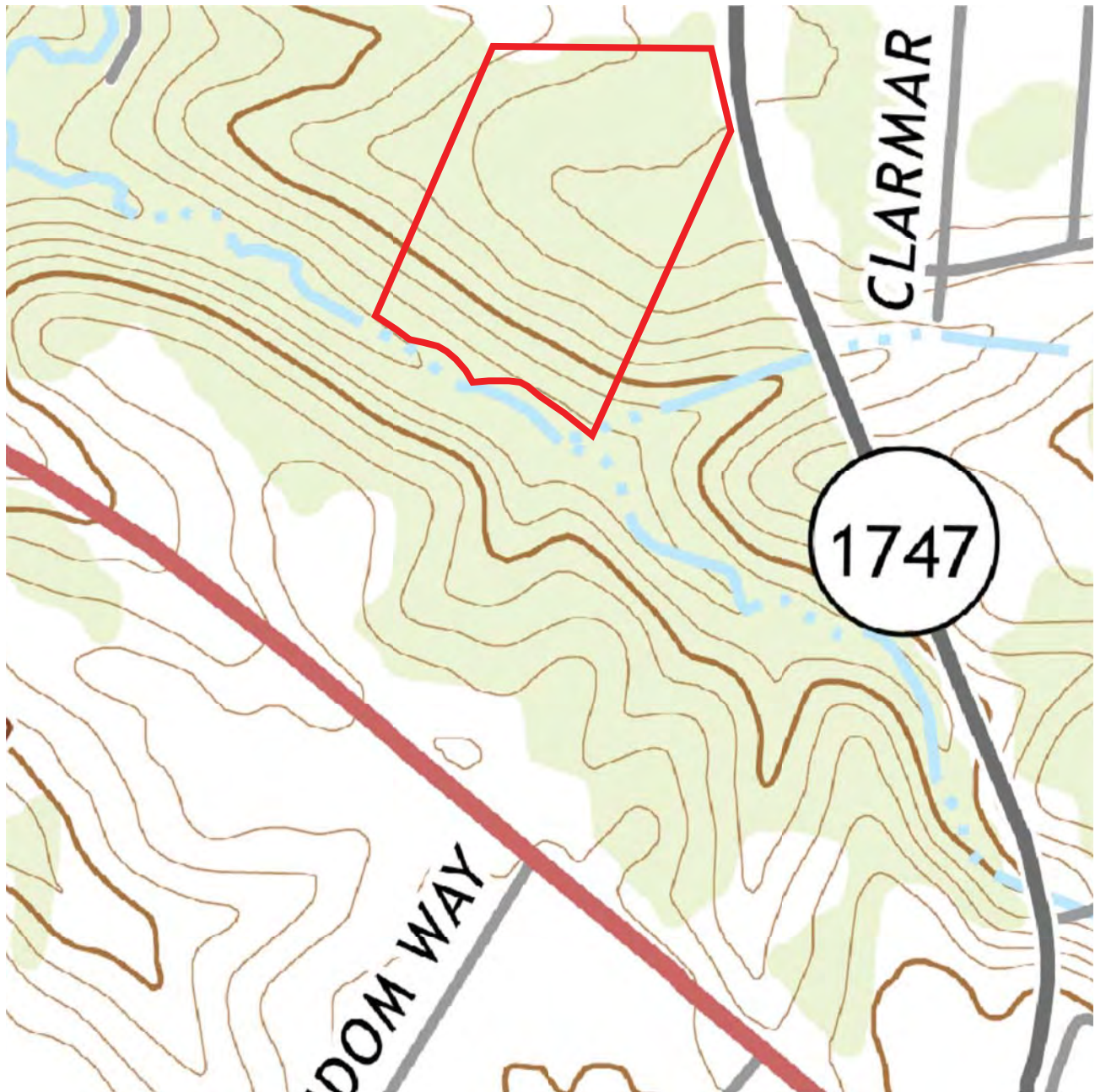


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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date
		06-07-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

2019 HISTORICAL TOPOGRAPHIC MAP
HURSTBOURNE APARTMENTS
4900 S HURSTBOURNE PKWY & 5119
BARDSTOWN ROAD
LOUISVILLE, KENTUCKY



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— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date
		06-03-22
	Drawn By	WJH
	Designed By	WJH
	Scale	NTS
	Project	089555.00

**1955 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1959 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1971 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1983 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1986 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1993 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**1998 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
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LEGEND

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NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2002 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2004 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
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— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2006 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2008 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2010 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2012 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
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LEGEND

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NOTE:
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 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2014 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
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LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM WWW.HISTORICAERIALS.COM
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2016 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



Figure No. 30
 22-ZONE-0076

Received August 3, 2022

Planning & Design Services



LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY

NOTE:
 IMAGE OBTAINED FROM GOOGLE EARTH
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.



No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2018 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



Figure No. 31

Received August 3, 2022

Planning & Design Services

22-ZONE-0076



LEGEND

— APPROXIMATE USEABLE AREA BOUNDARY



NOTE:
 IMAGE OBTAINED FROM GOOGLE EARTH
 SITE BOUNDARY INFORMATION APPROXIMATED FROM ON-LINE LOGIC MAP
 AND DRAWING TITLED "CONCEPT PLAN - 4900 S HURSTBOURNE PARKWAY"
 DATED 12/22/2021, PREPARED BY MINDEL SCOTT.

No.	Revision Date	Date	06-03-22
		Drawn By	WJH
		Designed By	WJH
		Scale	NTS
		Project	089555.00

**2020 HISTORICAL AERIAL
 HURSTBOURNE APARTMENTS
 4900 S HURSTBOURNE PKWY & 5119
 BARDSTOWN ROAD
 LOUISVILLE, KENTUCKY**



Figure No. 32

Received August 3, 2022

Planning & Design Services

22-ZONE-0076

APPENDIX B
INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT
GENERAL COMMENTS

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report’s Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals’ misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

conspicuously that you’ve included the material for information purposes only. To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists.*



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GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.



*Passionate People Building
and Revitalizing our World*

