December 14, 2021

Mr. Joseph Waldman
Highgates Development Company
119 Glen Park Avenue
Toronto, Ontario M6B 2C6 Canada

Reference: **Broad Run Road – Karst Survey**
8000 Broad Run Road
Louisville, Jefferson County, Kentucky 40291
ECS Project No. 61-2612

Dear Mr. Waldman:

ECS Southeast, LLP (ECS) conducted a karst survey for the referenced site in accordance with ECS Proposal No. 61-P2311, dated April 27, 2021. The karst survey was conducted in general accordance with Chapter 4 Part 9 (Development on Karst Terrain, dated July 2008) of the Louisville-Jefferson County Land Development Code (LDC). The karst survey included the following elements: a visual reconnaissance of site conditions for the karst geologic features defined in the LDC; a review of current and historical aerial photographs; a review of soil survey information; a review of geologic maps; and a review of topographic maps.

Project Information:

The site included approximately 192.4 acres of undeveloped land. Some boundary areas of the site are steeply sloped and currently wooded but may be developed in the near future for construction of residential properties with green space or facilities for use in stormwater management and disposal.

Review of Published Documents:

The following geologic information is based on the review of the Jeffersontown and Mount Washington, 24K Quadrangles, Geologic Map, Kentucky, published by the United States Geological Survey (USGS), and information (aerial photos, geologic maps, and topographic maps, etc.) obtained from the Kentucky Geological Survey (KGS) Geologic Information Service website.

No apparent sinkholes or karst features were reported in the historical aerial photographs, soil survey information, or review of topographic maps. However, fourteen (14) karst features were recorded on the KGS website in the southwest (11 features) and northeast (3 features) portions of the site with diameters ranging from 30 to 120 feet. In addition, several features were reported near the south border of the site, with the closest approximately 50 feet south of the property's proposed southern border. These reported areas were visually evaluated as a part of this survey.

Geology:

The five (5) formations reportedly underlying the site are "Louisville Limestone", "Waldron Shale", "Laurel Dolomite", "Osgood and Brassfield Formations", and "Drakes Formation". The "knob" areas are underlain by the "Louisville Limestone" and "Waldron Shale" formations and the steep slope areas along the east and west boundaries are generally underlain by "Osgood and Brassfield Formations" and "Drakes Formation".

The majority of the site is reportedly underlain by the "Laurel Dolomite" formation which is designated as having a "Medium" karst potential. The karst potential is based on the tendency for the site to develop or have karst features as shown on the KGS Geologic Map Information Service. Karst potential designation is not definitively indicative of the actual presence or absence of karst activity at the site. According to the KGS Potential Classification definitions, the development of karst features is variable and dependent on site-specific conditions in formations designated as

a "medium" karst potential. Several karst features were reported within the site boundaries and most appears to be located in the southwest and northeast portions of the site. These reported areas were visually evaluated as a part of this survey. Refer to the attached **Karst Potential Map** for approximate location of mapped features.

Site Observations:

A site reconnaissance was conducted over several days on November 02, 2021 through November 11, 2021 by Ben Emery and William "Grant" Hess of ECS. Most of the site consisted of gentle rolling hills of previous agricultural fields. Two higher elevation "knob" areas were encountered in the north and south-central portion of the site and were approximately 12 to 18 feet higher in elevation relative to the adjacent open field areas. There is approximately 60 feet of fall across the western wooded area and approximately 180 feet of fall across the eastern wooded area.

Several remnant structures were observed throughout the site, including an old chimney, an old home foundation, and a pile of discarded rubble. Remnant structures were in close proximity to one another along the eastern border of the grass fields toward the east of the site. Several fill mounds, ranging from 2-15' in diameter and 2-6' in height were observed along the boundaries of the agricultural fields and appeared to be manmade. An existing stream was observed near the southwestern corner of the property. Several drainage swales, visible from available site documents, were observed extending downslope on the western portion (toward Big Run Creek) and eastern portion (toward Broad Run Road). Swales ranged from 3 to 40 feet wide, were frequently observed to contain exposed apparent rock and moist soils. An existing spring was observed in the northwestern portion of the site.

Rock outcroppings typically consisted of isolated boulders, gentle slopes, and/or near vertical wall exposures of approximately 2 to 10 feet in height with defined jointing and fractures were observed in areas of steep relief (typically EL 620 to 660). Near vertical apparent rock walls were observed within or adjacent to the drainage swales identified on the site's eastern wooded areas. Boulder to cobble-sized rocks were observed at the base of most outcrops, and solution channels were observed within the exposed apparent rock faces. Fracturing of the upper geologic formations was also observed throughout the outer wooded portions of the site. These fractures within apparent rock outcropping are typical in karst terrain.

One-hundred and seven (107) possible karst-related features were identified onsite. Refer to the attached **Karst Feature Location Plan** and **Site Photos** for the approximate location of observed site features and pictures of selected features. Brief descriptions of the features are provided in the table below. Areas and/or features with multiple designations (A, B, C, etc.) represent a series of linear features which appeared to be related to a common joint or similar lineation.

Feature	Description	Approximate Dimensions	Approximate Depth
F-1	Trench-shaped depression with soil sidewalls.	2.5' Wide 11' Long	2'
F-2	Closed depression. Evidence of apparent human disturbance with sidewalls lined by limestone blocks.	11' Wide 15' Long	5'
F-3	Closed depression with soil sidewalls.	10' Diameter	4'
F-4	Oval-shaped closed depression with soil sidewalls.	4' Wide 9' Long	3'
F-5	Oval-shaped closed depression with soil sidewalls.	7' Wide 17' Long	4'
F-6	Closed depression with soil sidewall and a partially closed throat encountered at the bottom of the depression.	7' Diameter	4'

Feature		Description	Approximate Dimensions	Approximate Depth
F-7		Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	8' Diameter	5'
F-8		Closed depression with soil sidewall and a partially closed throat encountered at the bottom of the depression.	7' Diameter	4'
F-9		A series of connected closed depressions and slot features in an area approximate 30 feet wide, 75 feet long and 2 to 6 feet deep.	30’ Wide 75’ Long	2-6’
	A	Closed depression with soil sidewalls.	4' Diameter	2'
	B	Closed depression with soil sidewall and a partially closed throat encountered at the bottom of the depression.	4' Wide 17 ' Long	4'
	C	Closed depression with soil sidewall and a partially closed throat encountered at the bottom of the depression.	7' Wide 16' Long	4'
	D	Closed depression with soil sidewall, partially closed throat encountered at the bottom of the depression, and partially filled with debris.	13' Diameter	5'
	E	Closed depression with soil sidewalls.	8' Diameter	4'
	F	Closed depression with soil sidewalls.	10' Wide 15' Long	6'
	G	Closed depression with soil sidewall and a partially closed throat encountered at the bottom of the depression.	5' Wide 30' Long	4'
F-10		Closed depression with soil sidewalls.	6' Diameter	3'
F-11		Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	12' Diameter	7'
F-12		Two (2) adjacent oval-shaped closed depressions with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	5' Wide 12-15' Long	6’
F-13		Closed depression with soil sidewalls.	6' Diameter	4'
F-14		Two (2) adjacent closed depressions with soil sidewalls and a partially closed throat encountered at the bottom of the depression.	10-15' Diameter	6’
F-15		Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	7' Diameter	4'
F-16		Closed depression with soil sidewalls.	20' Diameter	8'
F-17		Closed depression with soil sidewalls.	6' Diameter	4'

Feature		Description	Approximate Dimensions	Approximate Depth
F-18		Closed depression with soil sidewalls.	7' Diameter	5'
F-19		Closed depression with soil sidewalls and partially filled with debris.	7' Diameter	4'
F-20		Large, closed depression that contained a smaller closed depression with soil/rock sidewalls at the bottom of the depression.	45' Diameter	7-11’
F-21		Two (2) adjacent closed depressions with soil sidewalls and a partially closed throat encountered at the bottom of the depression.	6-7' Wide 12-15' Long	4-5’
F-22		Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the depression.	5' Diameter	4'
F-23		Closed depression with soil sidewalls.	7' Diameter	3'
F-24		Two (2) adjacent closed depressions with soil sidewalls.	5-8' Diameter	3-4’
F-25		Closed depression with soil sidewalls.	6' Diameter	3'
F-26		Closed depression with soil sidewalls.	12' Diameter	10'
F-27		A long slot-shaped feature that contained several small openings (approximately 4 to 24 inches in diameter) with soil/rock sidewalls.	4-8' Wide 90-100' Long	3-5’
	A	Small opening with soil/rock sidewalls. Probe rod extended greater than 4 feet below the bottom of F-27.	2.5' Diameter	> 4’
	B	Small opening with soil/rock sidewalls. Probe rod extended greater than 4 feet below the bottom of F-27.	1' Diameter	> 4’
	C	Several small openings with soil/rock sidewalls. Probe rod extended greater than 4 feet below the bottom of F-27.	1-2' Diameter	>4’
	D	Small opening with soil/rock sidewalls. Probe rod extended to apparent rock approximately 3 feet below the bottom of F-27.	0.5-1' Diameter	3’
	E	Several small openings with soil/rock sidewalls. Probe rod extended to apparent rock approximately 3-4 feet below the bottom of F-27.	1-3' Diameter	3-4’
F-28		Closed depression with soil/rock sidewalls and a partially closed throat (approximately 10 inches in diameter) encountered at the bottom of the depression. Probe rod extended to apparent rock approximately 2 feet below the feature.	6' Diameter	1’

Feature		Description	Approximate Dimensions	Approximate Depth
F-29		Large, closed depression contained several small openings (approximately 7 to 12 inches in diameter) with soil/rock sidewalls.	3-8' Wide 25' Long	2-4'
	A	Small opening with soil/rock sidewalls. Probe rod extended to apparent rock approximately 2-3 feet below the bottom of F-29.	0.5’ Diameter	2.5'
	B	Small opening with soil/rock sidewalls. Probe rod extended to apparent rock approximately 0.5-1 feet below the bottom of F-29.	0.5’ Diameter	1'
	C	Small opening with soil/rock sidewalls. Probe rod extended to apparent rock approximately 1-2 feet below the bottom of F-29.	1' Diameter	1.5'
F-30		A long slot-shaped feature that contained several small openings (approximately 2 to 6 inches in diameter) with soil/rock sidewalls. Probe rod extended to apparent rock approximately 1-3 feet below the feature.	3-5' Wide 30' Long	3.5'
F-31		A series of connected closed depressions and slot features in an area approximate 4-9 feet wide, 30 feet long and 1 to 4 feet deep.	4-9' Wide 30' Long	1-4'
	A	Slot-shaped feature with soil/rock sidewalls and two (2) partially closed throats encountered at the bottom of the depression. Probe rod extended to apparent rock approximately 2 feet below the feature.	4' Wide 15' Long	3'
	B	Shallow closed depression with soil sidewall.	5' Diameter	1'
	C	Shallow closed depression with soil sidewall.	9' Diameter	2'
F-32		Closed depression with soil sidewalls and a partially closed throat (approximately 12 to 18 inches in diameter) encountered at the bottom of the depression. Probe rod extended to apparent rock approximately 3-4 feet below the feature.	7' Diameter	6'
F-33		Slot-shaped feature with soil sidewalls and a partially closed throat (approximately 6 inches in diameter) encountered at the bottom of the depression. Probe rod extended to apparent rock approximately 2 feet below the feature.	4' Wide 14' Long	3’
F-34		Shallow closed depression with soil sidewall.	5' Diameter	4'
F-35		Shallow closed depression with soil sidewall.	6' Diameter	3'
F-36		Shallow closed depression with soil sidewalls and a partially closed throat (approximately 8-12 inches in diameter) encountered at the bottom of the depression. Probe rod extended greater than 4 feet below the bottom of the feature.	2' Diameter	1-2'

Feature		Description	Approximate Dimensions	Approximate Depth
F-37		Shallow closed depression with soil sidewall.	3' Diameter	2'
F-38		Shallow closed depression with soil sidewall.	4' Diameter	3-4'
F-39		A long slot-shaped feature that contained smaller closed depressions and small openings (approximately 6 to 24 inches in diameter) with soil/rock sidewalls.	2-11' Wide 100-120' Long	3-5’
	A	Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	2' Diameter	3-4'
	B	Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	9-12' Diameter	3'
	C	Small opening with soil/rock sidewalls. Probe rod extended to apparent rock approximately 3-4 feet below the bottom of the feature.	0.5’ Diameter	3-4'
	D	Small opening with soil/rock sidewalls. Probe rod extended to apparent rock approximately 3 feet below the bottom of the feature.	2' Diameter	3'
F-40		Closed depression with soil sidewalls.	8' Wide 15' Long	5'
F-41		Two (2) adjacent closed depressions with soil sidewalls.	10-11' Diameter	5-6'
F-42		Closed depression with soil sidewalls.	10' Diameter	3'
F-43		Closed depression with soil sidewalls.	10' Diameter	3'
F-44		Closed depression with soil sidewalls.	5' Diameter	1.5'
F-45		Closed depression with soil sidewalls and a partially closed throat (approximately 12 to 18 inches in diameter) encountered at the bottom of the depression. Probe rod extended to apparent rock approximately 3 feet below the feature.	5' Wide 10' Long	4'
F-46		Closed depression with soil/rock sidewalls.	9' Diameter	3'
F-47		Closed depression with soil sidewalls.	5' Diameter	4'
F-48		Closed depression with soil sidewalls.	6' Diameter	1-2'
F-49		Closed depression with soil sidewalls.	17' Wide 55' Long	6'
F-50		Closed depression with soil/rock sidewalls.	10' Diameter	6'

Feature	Description	Approximate Dimensions	Approximate Depth
F-51	Closed depression with soil sidewalls.	7' Diameter	3'
F-52	Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	10' Diameter	5'
F-53	Closed depression with soil sidewalls.	12' Diameter	5'
F-54	Closed depression with soil/rock sidewalls.	7' Diameter	8'
F-55	Closed depression with soil/rock sidewalls and a partially closed throat (approximately 6 to 12 inches in diameter) encountered at the bottom of the depression. Probe rod extended to apparent rock approximately 2-3 feet below the feature.	22' Diameter	10'
F-56	Closed depression with soil sidewalls.	15' Diameter	6'
F-57	Slot-shaped feature with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression	2-2.5' Wide 17' Long	3.5’
F-58	Closed depression with soil/rock sidewalls.	11' Diameter	5'
F-59	Closed depression with soil/rock sidewalls.	8' Diameter	4'
F-60	Small opening with soil/rock sidewalls. Probe rod extended greater than 4 feet below the feature.	1' Diameter	> 4'
F-61	Closed depression with soil/rock sidewalls.	27' Diameter	4'
F-62	Closed depression with soil sidewalls.	4' Diameter	3'
F-63	Closed depression with soil sidewalls.	10' Diameter	6'
F-64	Closed depression with soil/rock sidewalls.	17' Diameter	5'
F-65	Closed depression with soil/rock sidewalls.	16' Diameter	6'
F-66	Closed depression with soil/rock sidewalls.	2' Wide 6' Long	2.5'

Feature	Description		Approximate Dimensions	Approximate Depth
F-67	Large, closed depression with soil/rock sidewall and contained two (2) small, closed depressions.		40' Wide 60' Long	5'
	A	Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the feature.	4-5’ Diameter	3'
	B	Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the feature.	3-6’ Diameter	2'
F-68	Small opening with soil/rock sidewalls. Probe rod extended greater than 4 feet below the feature.		1' Diameter	> 4'
F-69	Large, closed depression with soil/rock sidewall that contained slot-shaped features, closed depressions, and several small openings.		70' Diameter	14'
	A	Slot-shaped feature with apparent rock sidewalls.	10' Wide 15' Long	10'
	B	Small opening with apparent rock sidewalls.	2' Wide 6' Long	3-4'
	C	Several small openings with soil/rock sidewalls. Probe rod extended greater than 4 feet below the bottom of the feature.	0.5’ Diameter	4'
	D	Small opening with apparent rock sidewalls.	1' Diameter	> 4'
F-70	Large, closed depression with soil/rock sidewall that contained slot-shaped features, closed depressions, and several small openings.		40' Wide 70' Long	15’
	A	Slot-shaped feature with soil/rock sidewalls.	5' Wide 13' Long	5’
	B	Slot-shaped feature with soil/rock sidewalls.	5' Wide 40' Long	3’
	C	Several small openings with soil/rock sidewalls. Probe rod extended greater than 4 feet below the bottom of the feature.	9" Diameter	> 4'
F-71	Large, closed depression with soil/rock sidewalls that contains a smaller closed depression (approximately 6 feet in diameter and 1 foot deep) encountered at the bottom of the feature.		22' Wide 120' Long	8'
F-72	Shallow closed depression with soil sidewalls.		5' Diameter	0.5'
F-73	Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the depression.		5' Diameter	2.5'
F-74	Closed depression with soil/rock sidewalls.		10' Diameter	6'
F-75	Closed depression with soil/rock sidewalls.		20' Diameter	4'

Feature		Description	Approximate Dimensions	Approximate Depth
F-76		Closed depression with soil sidewalls.	5' Diameter	2'
F-77		Closed depression with soil/rock sidewalls.	20' Wide 35' Long	3'
F-78		Closed depression with soil sidewalls.	11' Diameter	3'
F-79		Large, closed depression with soil/rock sidewalls that contains a small opening (approximately 3 inches) encountered at the bottom of the feature. Probe rod extended greater than 4 feet below the feature.	12' Wide 20' Long	5'
F-80		Closed depression with soil sidewalls.	7' Diameter	1'
F-81		Closed depression with soil sidewalls.	7' Diameter	2'
F-82		Large, closed depression with soil/rock sidewalls that contains two (2) smaller closed depressions (approximately 3-6 feet in diameter and 0.5-2 feet deep) encountered at the bottom of the feature.	20' Wide 30' Long	2-4'
F-83		Large, closed depression with soil/rock sidewalls that contains two (2) smaller closed depressions (approximately 5-8 feet in diameter and 3 feet deep) encountered at the bottom of the feature.	13' Wide 33' Long	3-6'
F-84		Large, closed depression with soil/rock sidewalls that contains a smaller closed depressions (approximately 4 feet in diameter and 1 foot deep) encountered at the bottom of the feature. Probe rod extended greater than 3 feet below the feature.	8-20' Wide 25-30' Long	6’
F-85		Closed depression with soil sidewalls.	11' Diameter	3'
F-86		Closed depression with soil/rock sidewalls.	7' Diameter	5'
F-87		Closed depression with soil sidewalls.	7' Diameter	2.5'
F-88		Large, closed depression with soil/rock sidewalls and contained two (2) shallow closed depressions.	80' Wide 120' Long	6-8'
	A	Closed depression with soil sidewalls encountered at the bottom of the feature. Probe rod extended greater than 3 feet below the feature.	4’ Diameter	0.5-1'
	B	Closed depression with soil sidewalls and several partially closed throats (approximately 6-8 inches in diameter) encountered at the bottom of the feature. Probe rod extended greater than 3 feet below the feature.	4’ Diameter	0.5-1'

Feature	Description	Approximate Dimensions	Approximate Depth
F-89	Crescent-shaped shallow closed depression with soil sidewalls. Probe rod extended to apparent rock approximately 3 feet below the feature.	6' Wide 12' Long	0.5-1'
F-90	Shallow closed depression with soil sidewalls. Probe rod extended to apparent rock approximately 2 feet below the feature.	4-6' Diameter	4-8’
F-91	Closed depression with soil sidewalls.	6' Diameter	4'
F-92	Closed depression with soil sidewalls.	30' Wide 45' Long	5'
F-93	Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the depression.	7' Diameter	3'
F-94	Slot-shaped feature with apparent rock sidewalls.	6' Wide 28' Long	4’
F-95	Slot-shaped feature with apparent rock sidewalls and a partially closed throat encountered at the bottom of the depression.	4' Wide 75' Long	7’
F-96	Slot-shaped feature with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression.	4' Wide 16' Long	8’
F-97	Slot-shaped feature with apparent rock sidewalls. Bottom of feature inaccessible due to steep slopes.	4' Wide 20' Long	11’
F-98	Large, closed depression with soil/rock sidewalls that contains a slot-shaped feature (approximately 7 feet wide, 48 feet long, and 6 feet deep) encountered at the bottom of the feature.	30' Wide 70' Long	6-8’
F-99	Closed depression with soil sidewalls.	6' Diameter	4'
F-100	Large, closed depression with soil/rock sidewalls that was partially filled with debris.	50' Diameter	7'
F-101	Large, closed depression with soil/rock sidewalls that contains two (2) closed depressions within the feature.	70' Diameter	7'
	A — Closed depression with soil/rock sidewalls.	13' Diameter	4'
	B — Slot-shaped feature with soil sidewalls.	25' Long x 4' Wide	1'
F-102	Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the depression.	2' Diameter	4'
F-103	Closed depression with soil sidewalls and a partially closed throat encountered at the bottom of the depression.	8' Diameter	5'
F-104	Closed depression with soil sidewalls.	6' Diameter	4'

Feature	Description	Approximate Dimensions	Approximate Depth
F-105	Closed depression with soil sidewalls.	12' Diameter	4'
F-106	Closed depression with soil sidewalls and two (2) partially closed throat encountered at the bottom of the depression.	30' Diameter	7'
F-107	Closed depression with soil/rock sidewalls and a partially closed throat encountered at the bottom of the depression. Probe rod extended greater than 4 feet below the feature.	16' Diameter	5'

No other karst related features were identified during our site reconnaissance. However, the presence of karst features may be obscured by vegetation and other site features (i.e. fill, wooded areas or debris). The features identified during this survey should be further evaluated during any subsequent geotechnical exploration(s), or the site development and karst feature remediation phase of the project.

Karst Feature Remediation Guidelines:

Typically, karst features in this vicinity and similar to those identified in this survey can be stabilized for development, as needed, for the planned future use of the site. Remediation methods vary based on planned use of the specific area where a karst feature is located and the characteristics of each feature. Treatment methods may vary for features where buildings or other improvements are located, in contrast to features in non-sensitive areas. For this project the objective of the treatment of a feature is to reduce the risk of future subsidence and to decrease surface water infiltration in and around the active karst feature(s).

An experienced and qualified geotechnical engineer or geologist should be present during remediation to evaluate the characteristics as the feature is excavated, and to recommend specific treatment methods for each feature. Remediation of most karst features identified is anticipated to consist of excavation of the closed depression or slot-features to identify the active feature(s) and determine the appropriate stabilization method. Once the active karst throat or weathered apparent rock area is stabilized, an inverted filter (see attached **Karst Feature Remediation Section**) should be constructed within and over the feature(s).

The filter will reduce future loss of soil into the feature, reducing the risk of subsidence. The area can then be backfilled with clay, with the fill mounded above adjacent grade to reduce surface water infiltration. Clay fill placed in above the filter constructed in the karst features should meet the requirements for “CL” or “CH” according to the Unified Soil Classification System. The fill should be placed in one-foot lifts and compacted to at least 92% of the Standard Proctor maximum dry density, within 3% of the optimum moisture content. Placement and compaction of the fill in limited horizontal lifts will reduce porosity and surface water infiltration. Periodic observations and compaction testing are recommended to confirm the character and continuity of the clay caps. Grading the site to promote surface drainage in all areas and avoiding ponding water is also important in reducing future subsidence of existing karst features (including sinkholes) and reducing the development of additional karst features.

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

Respectfully submitted,
ECS Southeast, LLP

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Liz Blandford Newcomb, P.E.
Principal Engineer
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Attachments: Karst Feature Location Plan(s) – 6 pages
Karst Potential Map (obtained from KGS Geologic Map Information Service website) – 1 page
Site Photos – 33 pages
Karst Feature Remediation Section – 1 page

Karst Feature Location Plan

Broad Run Road – Karst Survey

8000 Broad Run Road, Louisville, Kentucky 40291

ECS Project No.: 61-2612

ECS Southeast, LLP

1762 Watterson Trail

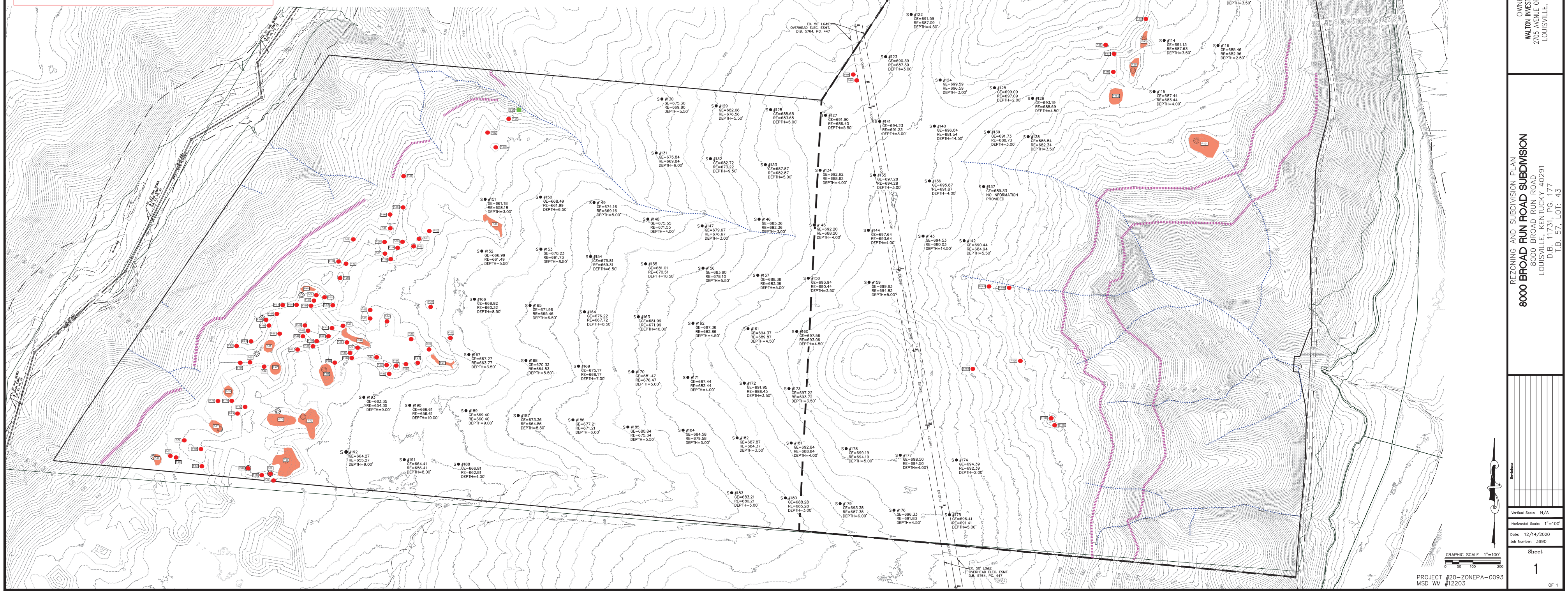
Louisville, Kentucky 40299

Tel. (502) 493-7100

LEGEND

- F-01 - Feature Location
- F-01 - Feature Location (defined area)
- Rock Outcropping
- Drainage Features
- S-01 - Existing Spring

Note: Locations are approximate



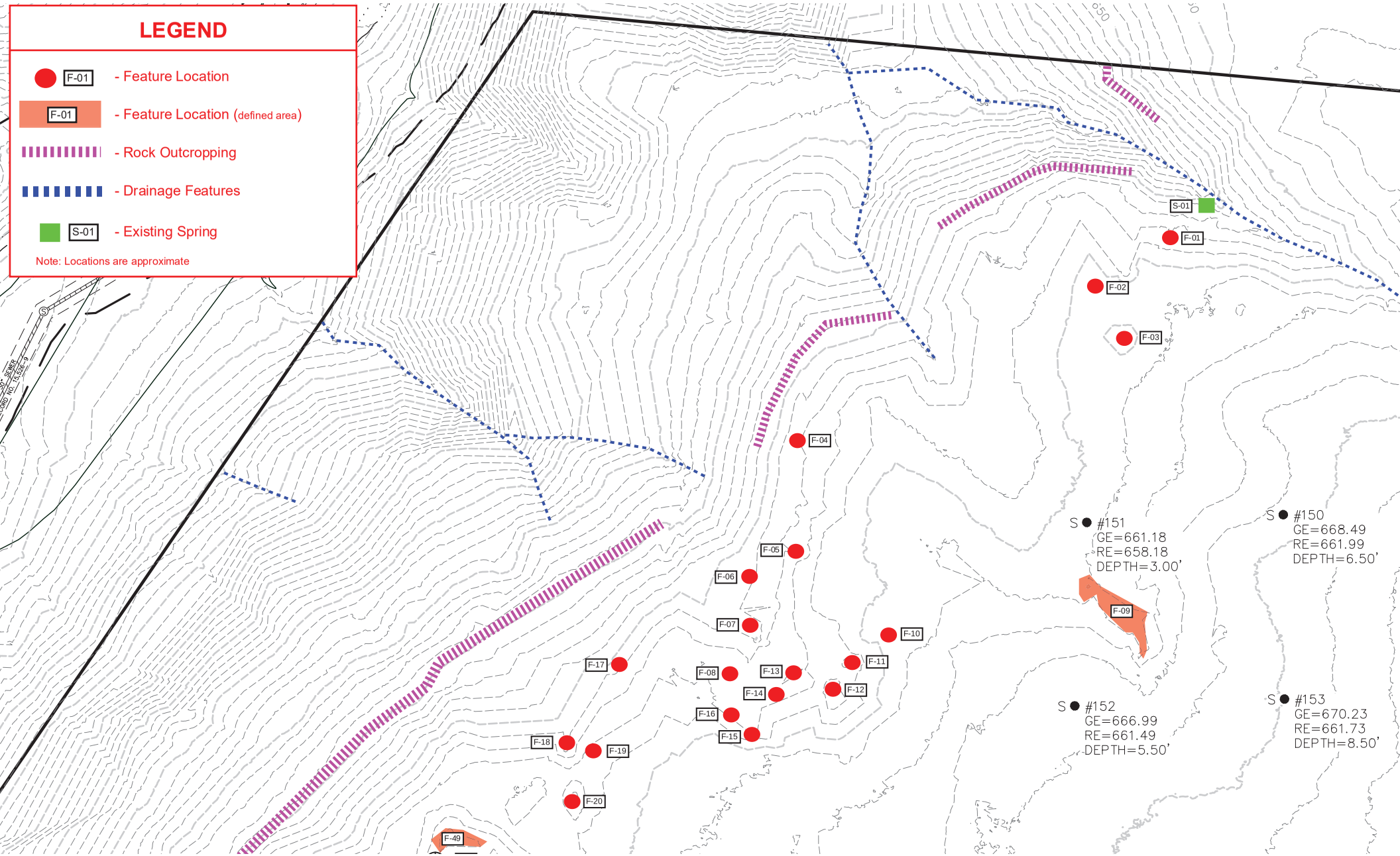
Karst Feature Location Plan - Northwest Section
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
ECS Project No.: 61-2612

ECS Southeast, LLP
1762 Watterson Trail
Louisville, Kentucky 40299
Tel. (502) 493-7100

LEGEND

- F-01 - Feature Location
- F-01 - Feature Location (defined area)
- Rock Outcropping
- Drainage Features
- S-01 - Existing Spring

Note: Locations are approximate



Karst Feature Location Plan - Southwest Section
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
ECS Project No.: 61-2612

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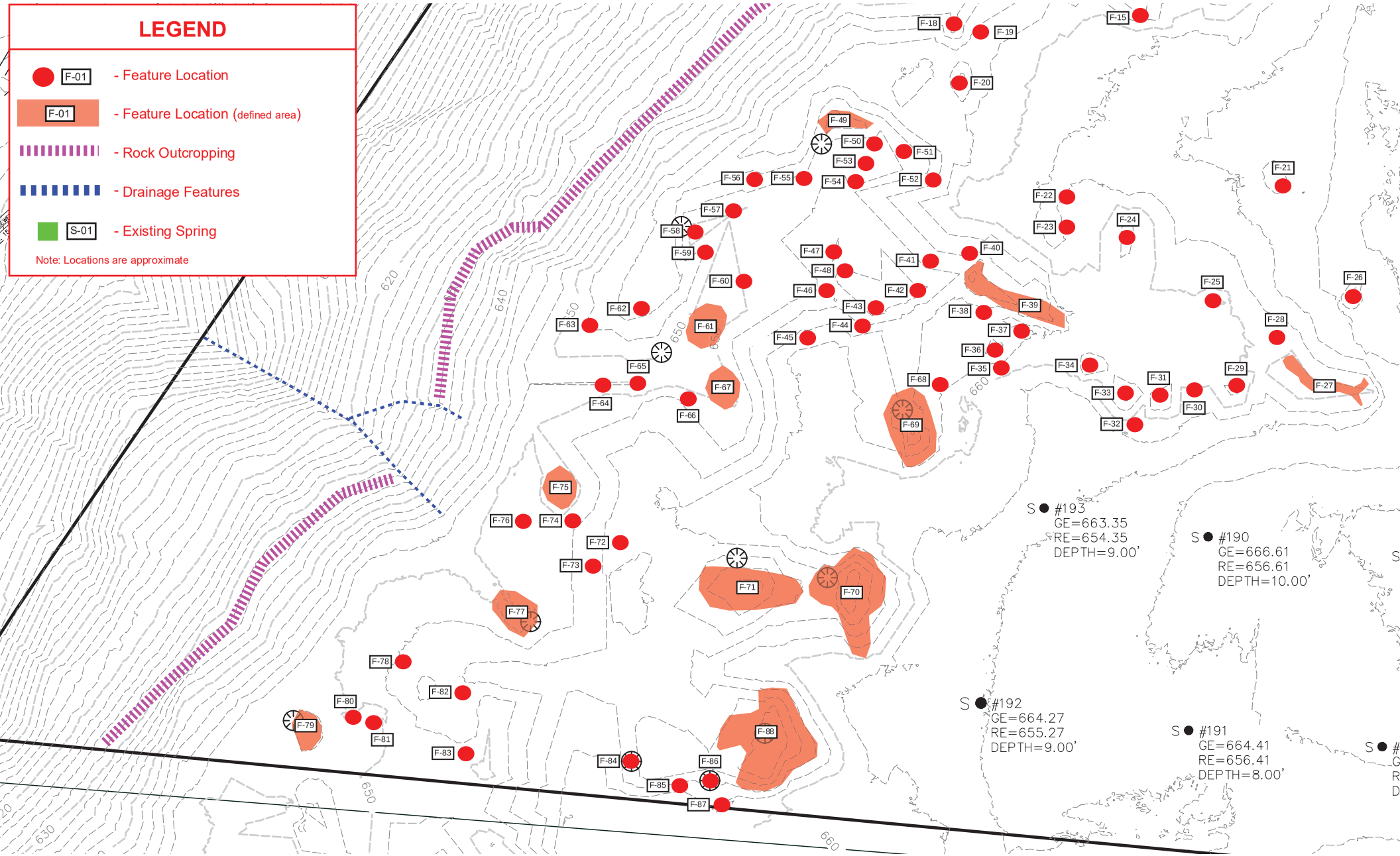

Karst Feature Location Plan - Northeast Section
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
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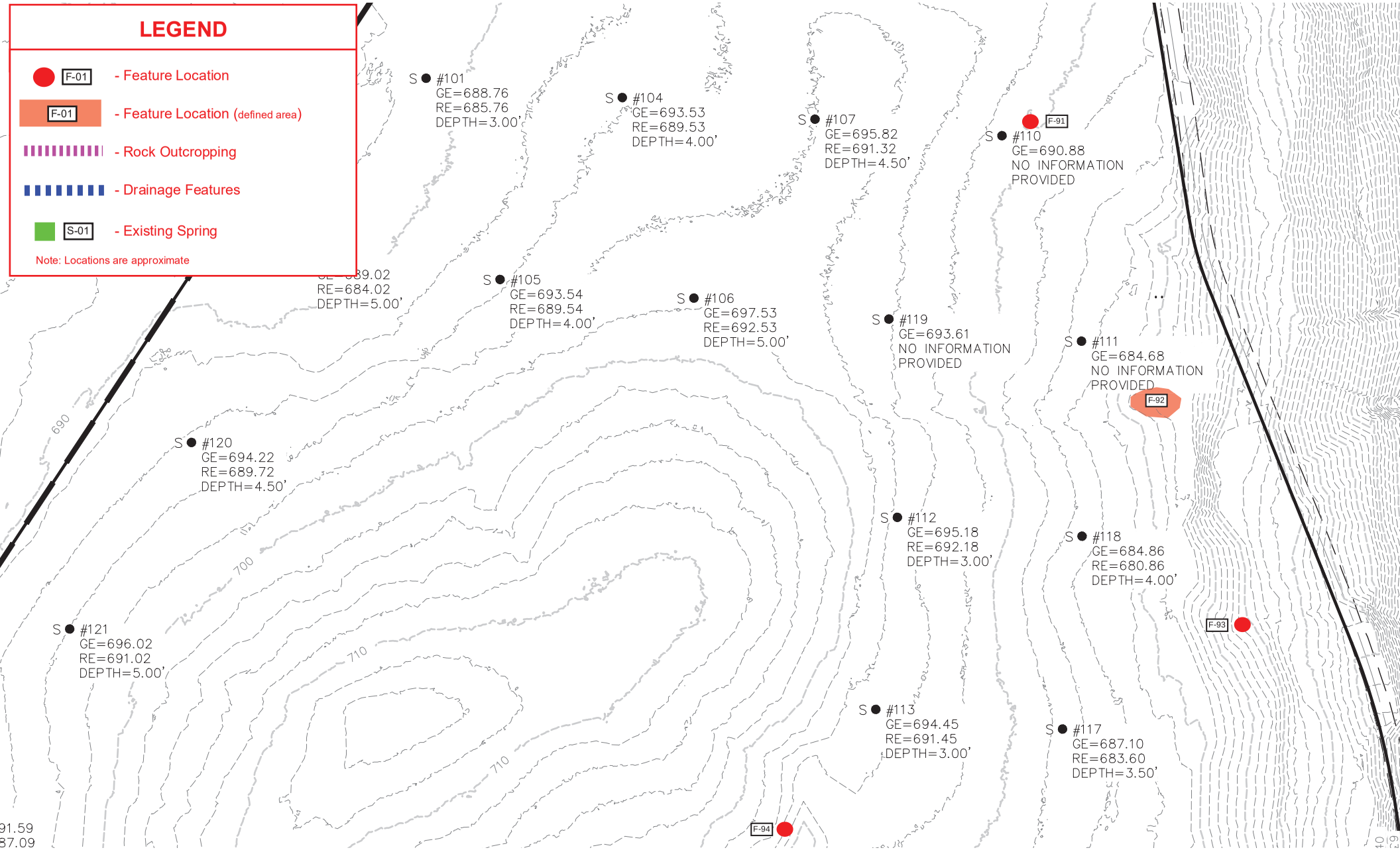
LEGEND

- F-01 - Feature Location
- F-01 - Feature Location (defined area)
- Rock Outcropping
- Drainage Features
- S-01 - Existing Spring

Note: Locations are approximate



Karst Feature Location Plan - East Central Section
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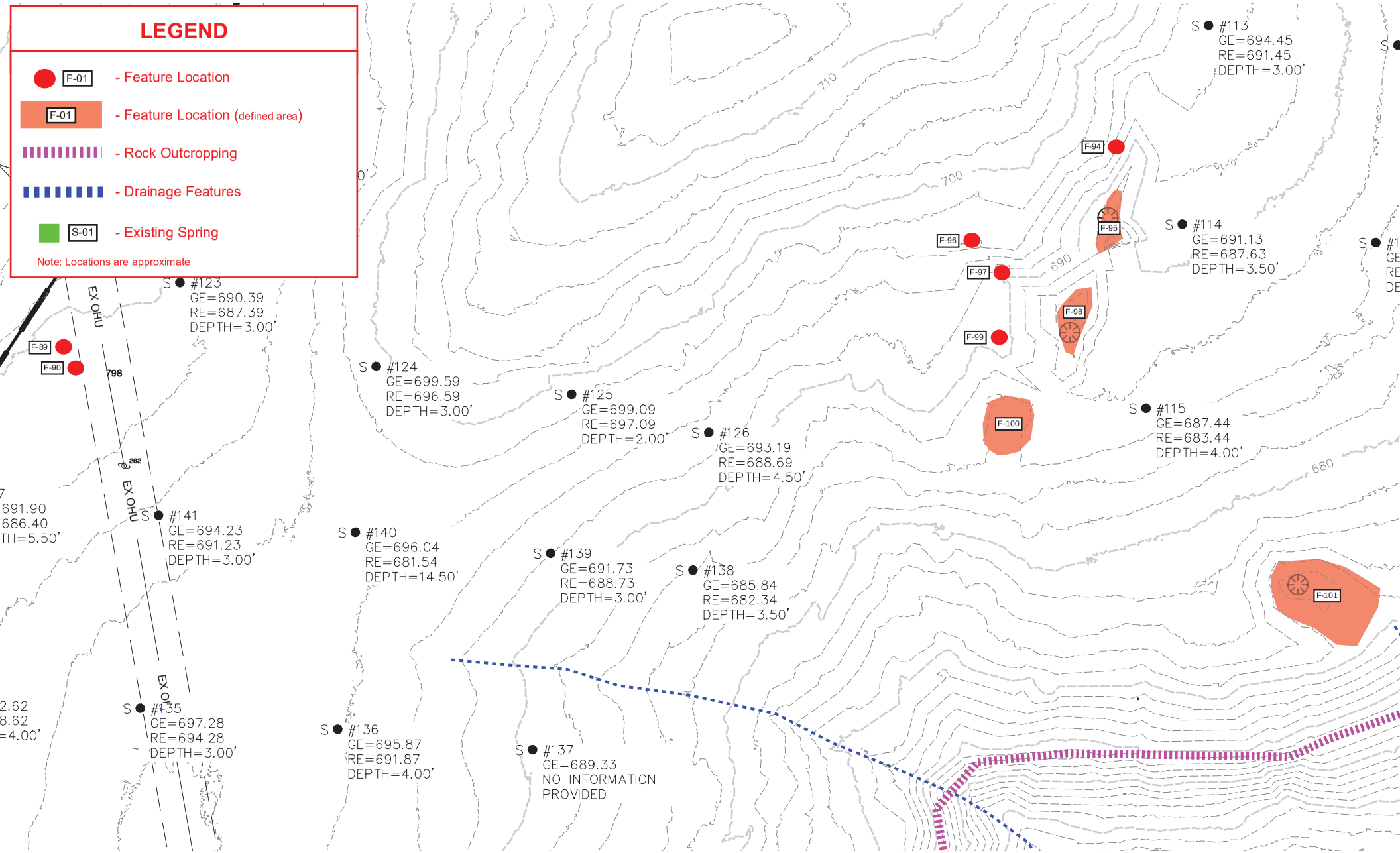


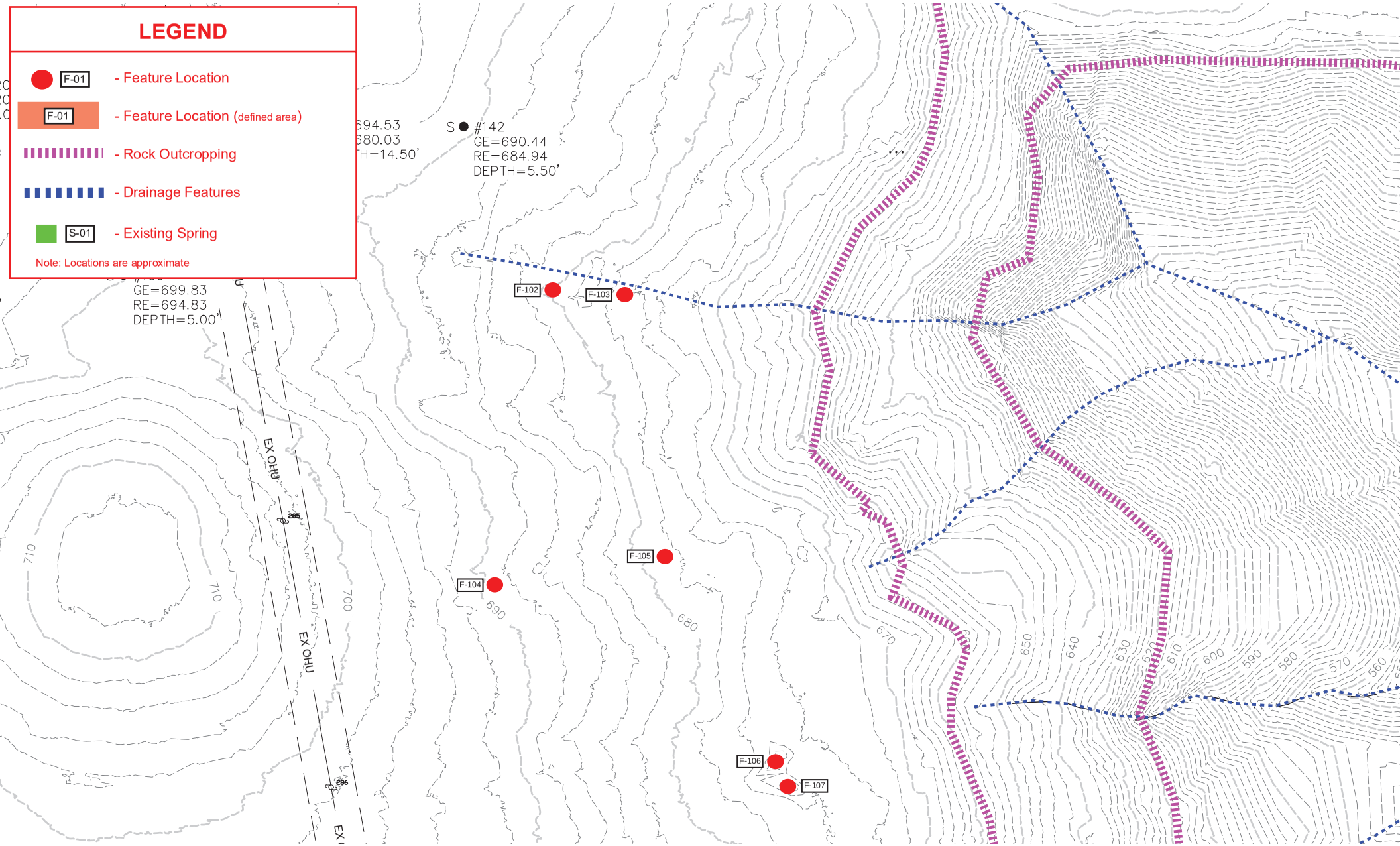
Karst Feature Location Plan - Southeast Section
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
ECS Project No.: 61-2612

ECS Southeast, LLP
1762 Watterson Trail
Louisville, Kentucky 40299
Tel. (502) 493-7100

LEGEND

- F-01 - Feature Location
- F-01 - Feature Location (defined area)
- Rock Outcropping
- Drainage Features
- S-01 - Existing Spring

Note: Locations are approximate



Kentucky Geologic Map Information Service

December 9, 2021

1:9,028

0 0.1 0.2 0.4 mi

0 0.175 0.35 0.7 km

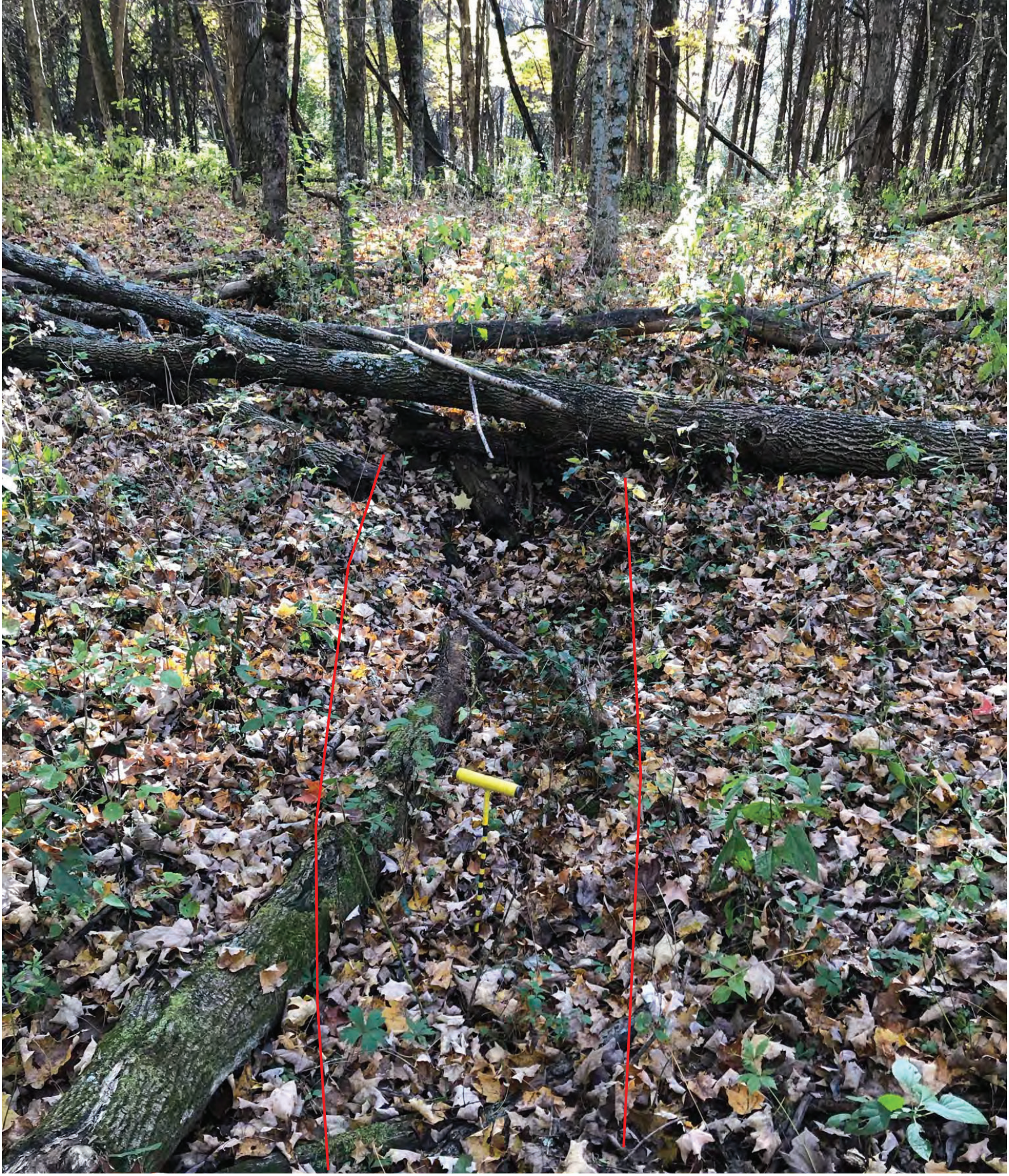
Kentucky Geological Survey

Karst Potential Map

Broad Run Road – Karst Survey

8000 Broad Run Road, Louisville, Kentucky 40291

ECS Project No.: 61-2612



Site Photos (F-01)
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
ECS Project No.: 61-2612

Site Photos (F-02)
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
ECS Project No.: 61-2612

Site Photos (F-05)
Broad Run Road – Karst Survey
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Site Photos (F-09)
Broad Run Road – Karst Survey
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Site Photos (F-16)
Broad Run Road – Karst Survey
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Site Photos (F-20)
Broad Run Road – Karst Survey
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Site Photos (F-23)
Broad Run Road – Karst Survey
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Site Photos (F-24)
Broad Run Road – Karst Survey
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Site Photos (F-28)
Broad Run Road – Karst Survey
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Site Photos (F-30)
Broad Run Road – Karst Survey
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Site Photos (F-39)
Broad Run Road – Karst Survey
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Site Photos (F-39 continued)
Broad Run Road – Karst Survey
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Site Photos (F-43)
Broad Run Road – Karst Survey
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Site Photos (F-69)
Broad Run Road – Karst Survey
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Site Photos (F-69 continued)
Broad Run Road – Karst Survey
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ECS Project No.: 61-2612

Site Photos (F-69 continued)
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
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Site Photos (F-69 continued)
Broad Run Road – Karst Survey
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Site Photos (F-70)

Broad Run Road – Karst Survey

8000 Broad Run Road, Louisville, Kentucky 40291

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Site Photos (F-70 continued)
Broad Run Road – Karst Survey
8000 Broad Run Road, Louisville, Kentucky 40291
ECS Project No.: 61-2612

Site Photos (F-70 continued)
Broad Run Road – Karst Survey
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Site Photos (F-71)
Broad Run Road – Karst Survey
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Site Photos (F-71 continued)

Broad Run Road – Karst Survey

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Site Photos (F-71 continued)
Broad Run Road – Karst Survey
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Site Photos (F-73)
Broad Run Road – Karst Survey
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Site Photos (F-77)
Broad Run Road – Karst Survey
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Site Photos (F-88)

Broad Run Road – Karst Survey

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Site Photos (F-88 continued)
Broad Run Road – Karst Survey
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Site Photos (F-88 continued)
Broad Run Road – Karst Survey
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Site Photos (F-88 continued)
Broad Run Road – Karst Survey
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Site Photos (F-95)
Broad Run Road – Karst Survey
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Site Photos (F-97)
Broad Run Road – Karst Survey
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Site Photos (F-103)
Broad Run Road – Karst Survey
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Site Photos (F-107)
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Karst Feature Remediation Section (Typical)