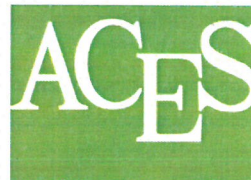


Geotechnical Survey Report

**Williams Properties / Stonestreet Development
Louisville, KY**

Prepared For:

**Beth Stuber, PE
Transportation Engineering Supervisor
Planning & Design Services
Department of Develop Louisville
444 South Fifth Street, Suite 300
Louisville, KY 40202**



**Prepared By:
Arnold Consulting
Engineering Services, Inc.
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Phone (270)780-9445
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August 16th, 2019

To: Beth Stuber, PE
Transportation Engineering Supervisor
Planning & Design Services
Department of Develop Louisville
444 South Fifth Street, Suite 300
Louisville, KY 40202

Re: Geotechnical Survey Report
Williams Properties / Stonestreet Development
Louisville, KY

A new multi-unit storage building development is proposed for construction in Louisville, Jefferson County, Kentucky. In accordance with your request, we are providing a Geotechnical Survey Report per the requirements of the Metro Louisville Land Development Code (MLLDC), Chapter 4, Part 7 "Development of Land on Steep Slopes". Our evaluation consisted of the following tasks:

- Review of the planned development
- Review of the USGS Geologic Quadrangle Map
- Review of the USDA NRCS Soil Survey
- A visual reconnaissance of the site
- Evaluation of the reviewed information and preparation of our findings and recommendations

Planned Development

The site is located at the northeast section of the intersection of Stonestreet Road and Dixie Highway as shown on the attached site location map. The site is currently heavily vegetated with trees and underbrush, contains a gravel drive and a relatively flat cleared area on the west side of the property, and a sloping area with a logging road on the northeastern portion of the property. Based on a topographic survey performed by our firm, the approximate maximum and minimum elevations on the subject property are 522 feet and 460 feet, respectively. Reviewing the existing slopes, the maximum slope is approximately 37% (rise of 18 feet in a run of 48 feet) and the slope with the largest change in elevation is 27% (rise of 41 feet in a run of 150 feet), determined in accordance with the MLLDC section 4.7.3.A.

The proposed development, shown in the attached Grading and Drainage plan, is to consist of a multi-unit storage building development and associated paved parking and driveway areas. The grading plan will consist of both cut and fill slopes.

Review of the USGS Geologic Quadrangle Map

The map review included portions of the following:

- "Geologic Map of the Valley Station Quadrangle and Part of the Kosmosdale Quadrangle, North-Central Kentucky (GQ-962), published on the USGS website,

- "Geologic Map of Parts of the Louisville West and Lanesville Quadrangles, Jefferson County, Kentucky (GQ-1202), published on the USGS website

These maps, with the site shown in Figure 1, indicated that the sloping areas subject to disturbance by the proposed development are likely underlain by Quaternary age Loess deposits at the surface which in turn are underlain by the Mississippian age Kenwood Siltstone Member of the Borden Formation. The Loess deposits can range in thickness from 0 to 30 feet and the Kenwood member is generally less than 40 feet thick but can be up to 100 feet thick. The Kenwood Member is typically interbedded within the Nancy Shale the New Providence shale members of the Borden Formation which can be up to 190 feet and 270 feet thick, respectively. Underlying all these units is the New Albany shale which extends to an unknown depth as the bottom of the unit has not been exposed.

The site is mapped in an area not prone to Karst in Core Graphic 14 – Karst Areas and Wellhead Protection Zones in the MLLDC Chapter 4.

Loess

Lithology: Soil

Reported Thickness: 0' to 30'

The Loess consists of silt and minor sand, is typically light olive-gray and weathers to a yellowish brown to grayish brown, or light brown to medium yellowish orange. Small irregular calcareous concretions are locally abundant near the unit's base. Exposures below elevation of 500 feet locally include interbeds of quartzose, silty, cross bedded fluvial and eolian sand with fine to very fine grains which are typically subangular to rounded. The Loess mantles most of the upland area, is thickest near the base of slopes bordering the Ohio River valley, particularly at the mouth of Big Run valley and on some east facing slopes, indicating deposition mainly by westerly wind. The Loess mantle of the Waverly Hills area is continuous with the Loess section at Johnstown area.

Kenwood Siltstone

Lithology: Siltstone

Reported Thickness: 0' to 120'

The Kenwood is generally less than 40 ft thick, but its maximum thickness is 120 ft. The shale in the Kenwood is like that of the rest of the New Providence and is dark greenish to bluish gray and weathers to a lighter color. The siltstone is gray to dark gray and weathers to light gray with limonitic stains. It is generally in well-indurated, more or less planar beds ranging from 0.1 to 20 ft in thickness. In places, the siltstone fills channels, and there is evidence that in places, it was deposited as a turbidite. Maximum siltstone content of the member is to the east.

Nancy Member

Lithology: Shale

Reported Thickness: 30' to 190'

The Nancy Member is a silty shale, medium to olive gray in color, weathers to a yellowish gray to light olive gray. It can be clayey, locally calcareous, and unevenly fissile. It forms steeper slopes and shows less tendency to slump than does the clay shale of the underlying unit. The basal area intergrades with New Providence Shale member within interval of as much as 30 feet and the contact is generally obscured by the Loess mantle.

New Providence Shale Member

Lithology: Shale

Reported Thickness: 125' to 270'

The New Providence Shale Member is a silty clay shale, olive gray to grayish green in color, weathers to yellowish gray to light greenish gray, and is locally iron stained. It's upper tongue is separated from similar unit below by Kenwood Siltstone member, which pinches out in subsurface to the southwest. Contains scattered light brown to dark yellowish brown discoidal sideritic ironstone concretions, commonly 0.3 foot by one foot in diameter, especially in the lower part. The unit is micaceous, plastic when wet, and tends to slide and slump. Clay filled worm tracks are common. The base is distinct, marked by persistent zone of brownish gray phosphatic nodules associated with scattered glauconite.

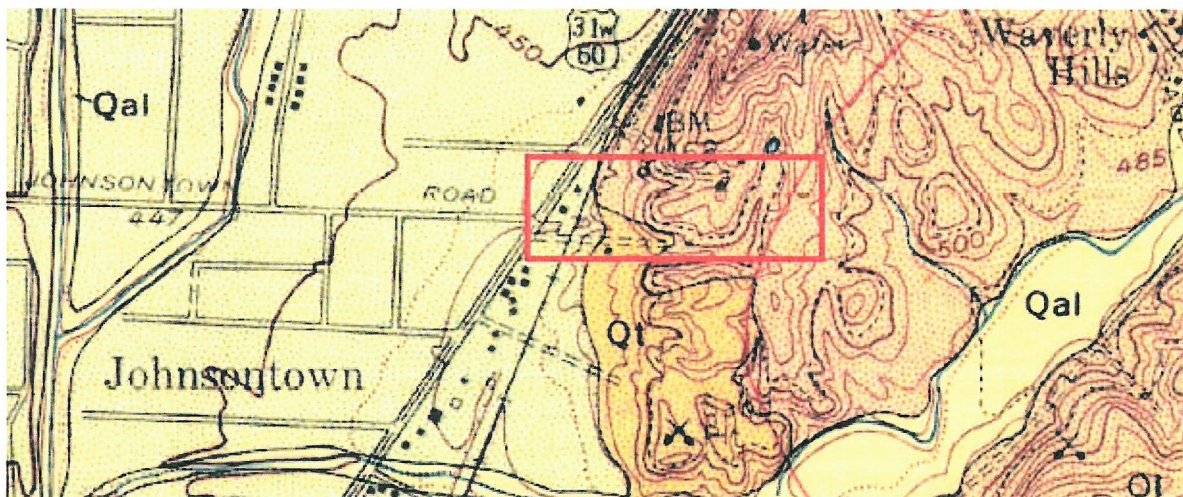


Figure 1 - Site Geology

Review of the USDA NRCS Soil Survey Map

The USDA "Web Soil Survey" indicated 3 soil types for the site as shown in the Figure 2. Descriptions of these soil types are summarized below.



Figure 2 - Soil Data Map with Approximate Property Location

Predominant Soil Type

AfF Alford silt loam – 25 to 50 percent slopes
 Parent Material: Thick fine-silty noncalcareous loess over silty residuum weathered from siltstone.
 Well drained, no flooding or ponding
 Low Plasticity
 Typical Profile:
 0 to 84 inches – silt loam

Other Vicinity Soil Types

AfC Alford silt loam – 6 to 12 percent slopes
 Parent Material: Thick fine-silty noncalcareous loess over silty residuum weathered from siltstone.
 Well drained, no flooding or ponding.
 Low Plasticity
 Typical Profile:
 0 to 84 inches – silt loam

CeF Carpenter silt loam – 25 to 50 percent slopes
 Parent Material: Fine loamy colluvium derived from shale and siltstone over loamy residuum weathered from shale and siltstone.
 Well drained, no flooding or ponding
 Low to Moderate Plasticity
 Typical Profile:
 0 to 6 inches – silt loam
 6 to 38 inches – channery silty clay loam
 38 to 45 inches – very channery silty clay loam
 45 to 68 inches – weathered bedrock

Ua and UahC are urbanized land references.

Visual Reconnaissance of the Site

A visual reconnaissance of the site was performed on August 12th, 2019. Photos of the existing conditions were taken and are shown below. In general, the photos taken are an accurate representation of the site as a whole. No indications of slope instability including tilting or fallen trees due to slope movement, tension cracks, displaced soil, or any other evidence of slope instability were noted.



Picture A



Picture B



Picture C



Picture D



Picture E



Picture F



Picture G



Picture H



Picture I



Picture J



Picture K



Picture L

See Site Map for location of pictures

Evaluation and Recommendations

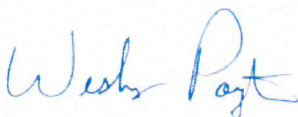
Based on our review of the above information and our experience on similar developments, it is our opinion the on-site slopes were stable at the time of our reconnaissance.

Based on the existence of slopes greater than 30% and the overall size and scope of the development which includes multiple buildings with both cut and fill slopes in excess of 10 feet in height, it is our opinion that a full-scale geotechnical investigation report be performed prior to building permit issuance to provide recommendations for appropriate foundation types and bearing capacities, engineered fill, pavements, and slopes.

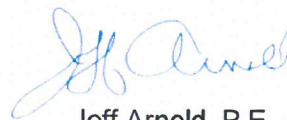
We appreciate the opportunity to perform this geotechnical survey report and are looking forward to working with you on this project. If you have any questions regarding this report or if we may be of any additional assistance regarding any geotechnical aspect of the project, please do not hesitate to contact us.

Sincerely,

Arnold Consulting Engineering Services, Inc.



Wesley Poynter, E.I.T.
Staff Professional



Jeff Arnold, P.E.
Principal

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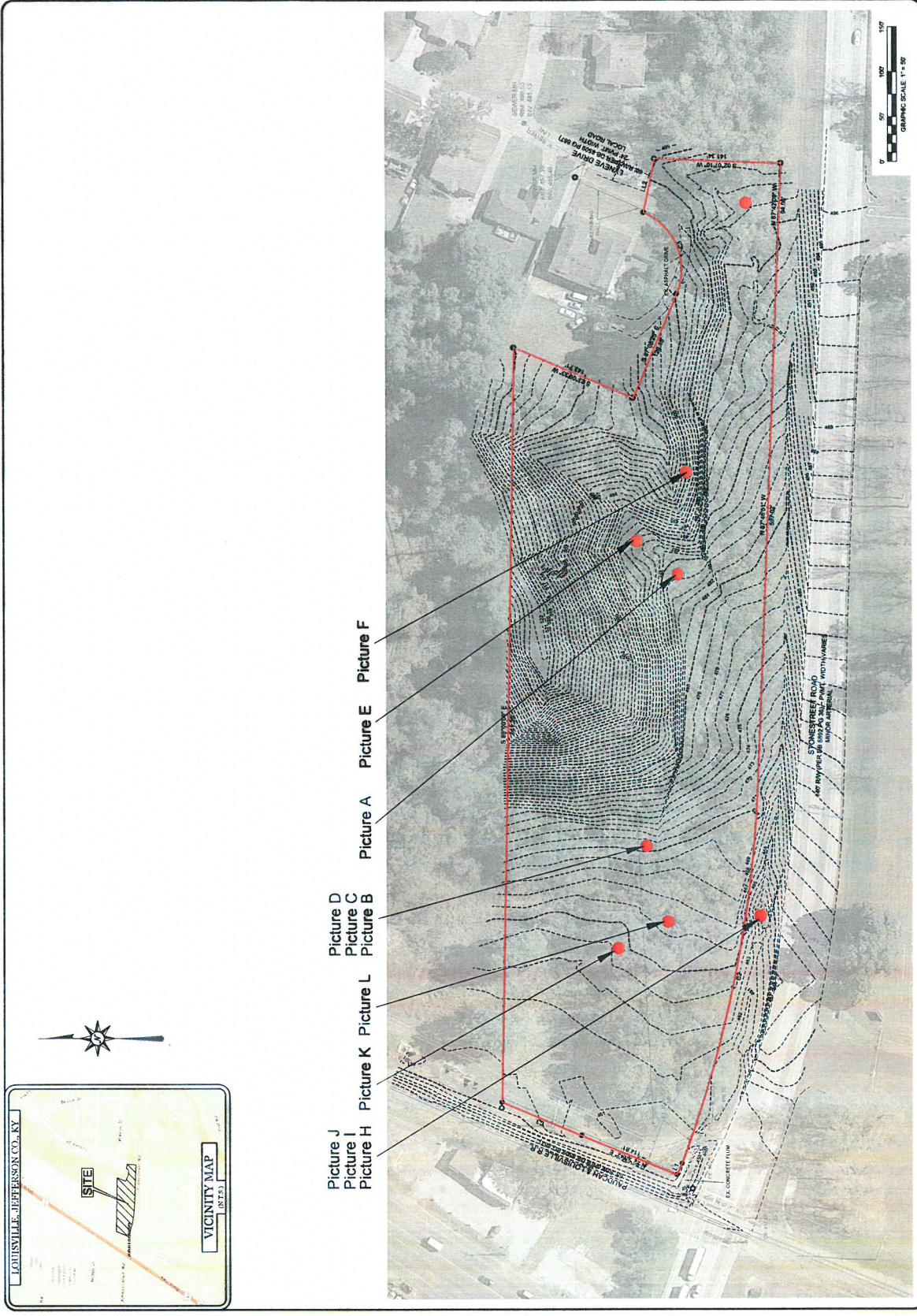
WILLIAMS PROPERTIES
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 LOUISVILLE, KY

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SM
 Site Map



- Picture J
- Picture I
- Picture H
- Picture K
- Picture L
- Picture B
- Picture C
- Picture D
- Picture A
- Picture E
- Picture F

St. Germain, Dante

From: Stuber, Elizabeth W.
Sent: Thursday, August 22, 2019 11:11 AM
To: St. Germain, Dante
Subject: RE: Williams Stone Street

Dante,

In general, there is a mix of stable and not so stable materials on this site. At this time, there does not appear to be any movement of the soils but the thick root layer of the heavy vegetation will prevent most surface movement. In detail:

1. A full Geotech before the construction plans are done is recommended by the consultant and should be a BE.
2. The Loess soils on-site should have limited exposure during construction
3. Any New Providence Shale must have less than 24 hours exposure and no exposure to rainfall
4. There a drainage pipe in the northeast corner of the site that is at a very steep angle. It should be designed not to rise up and also have significant energy dissipaters at the outlet.
5. They are also recommending stabilizing the 2:1 slopes with turf reinforcement matting and using low maintenance vegetation. You may want to consider this for a BE also.

Beth Stuber, PE
Transportation Engineering Supervisor

From: St. Germain, Dante <Dante.St.Germain@louisvilleky.gov>
Sent: Tuesday, August 20, 2019 12:02 PM
To: Stuber, Elizabeth W. <Elizabeth.Stuber@louisvilleky.gov>
Subject: FW: Williams Stone Street

Beth,

Please review the attached geotech ASAP. I need before LDT on Thursday. Thanks!

Dante St. Germain, AICP
Planner II
Planning & Design Services
Department of Develop Louisville
LOUISVILLE FORWARD
444 South Fifth Street, Suite 300