



April 18, 2017

Mr. John Rayl  
9108 Snowy Egret Court  
Spotsylvania, Virginia 22553

**Subject: Hydrogeological Investigation Report, Proposed  
Barrington Subdivision, Spotsylvania County, Virginia  
(Our 17119)**

Dear Mr. Rayl:

GeoConcepts Engineering, Inc. (GeoConcepts) is pleased to present this hydrogeologic report for the subdivision referenced above. These services have been performed in accordance with our agreement dated April 4, 2017.

## 1.0 Site Description and Background

The proposed Barrington Subdivision development is located southwest of the intersection of Spotswood Furnace Road (Route 620) and River Road (Route 618) in Spotsylvania County, Virginia. The site is currently forested land, sloping generally towards the north and the Rappahannock River. Referencing the USGS 7.5-minute topographic quadrangle map (Salem Church, VA 2016) the topographic high of the site occurs along the southeastern edge and River Road at EL 300, and the low point is at EL 170 along Pipe Dam Run, with a perennial stream that cross the western portion of the site from south to north. An unnamed intermittent tributary of the Pipe Dam Run drains the eastern and central part of the site, running in two forks from southeast northwest. The steepest slopes occur along the Pipe Dam Run calculated at 30 to 40 percent based on topographic mapping.

It is our understanding that that the homes in the planned subdivision will be supplied with individual residential groundwater wells. There have been concerns raised by residents of an adjoining community that the proposed wells will impact the local groundwater supply, perhaps affecting yield in existing wells in the adjacent community.

## 2.0 Geology

### 2.1 Site Geology

Based on existing geological mapping (Mixon et al., 2000), the majority of the site is mapped as underlain by the Quantico Formation. In the area of the project site the Quantico is described as a gray to black slate and phyllite containing pyrite and graphite, and is highly fractured and folded. The Quantico is considered to be Ordovician in age based on its fossil content.

A small area of the southeastern part of the site is mapped as underlain by the Falmouth Intrusive Suite, a plutonic (volcanic) rock consisting of fine-grained monzogranite and pegmatite, fine-grained granodiorite, and rarely, tonalite. The Falmouth Intrusive Suite is dated to the Carboniferous Period.

It should be noted that GeoConcepts did not perform any subsurface exploration at the site, and our geological description is based on existing mapping, exclusively. A map showing the geology of the site is included as Map 1, Attachment A.

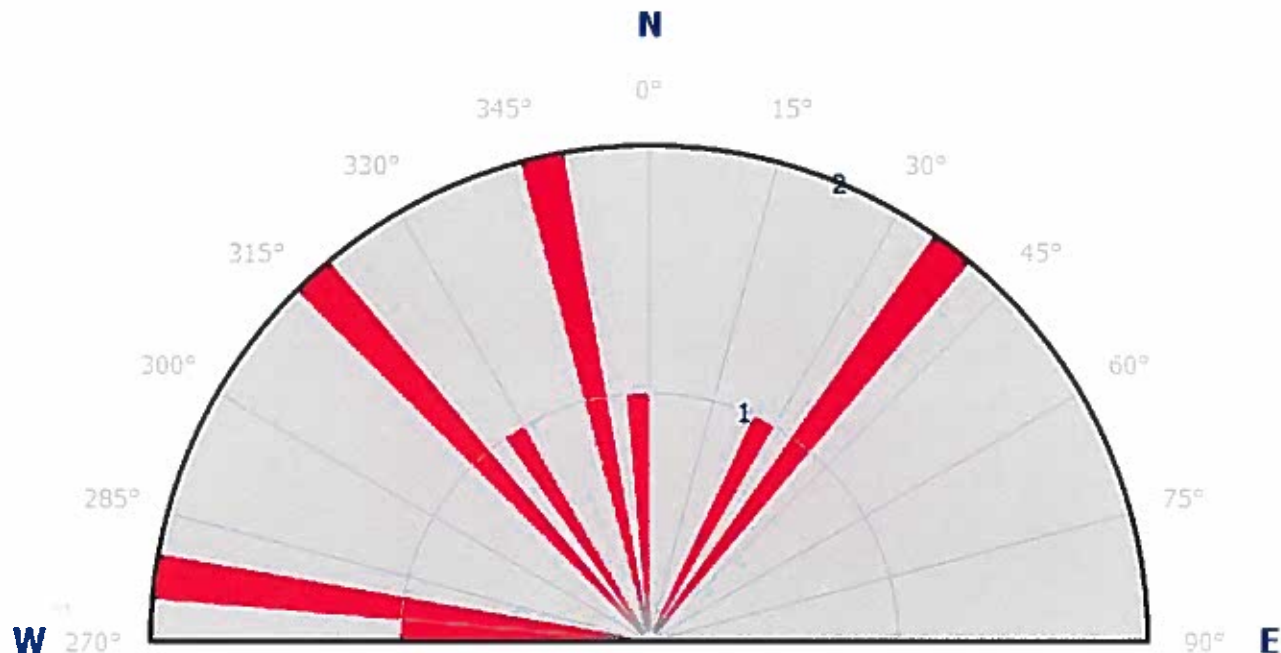
## 2.2 Regional Hydrogeological Setting

The proposed Barrington Subdivision site lies within the Central Virginia Volcanic and Plutonic Belt subsection of the Piedmont Physiographic Province of Virginia. This region is characterized by igneous intrusive and metamorphic rocks which tend to be highly folded, faulted and fractured. The bedrock is often mantled by a relatively thick layer of saprolite (highly weathered rock) and soil overburden. A shallow aquifer generally resides at the overburden/bedrock interface, and this shallow aquifer supplies the recharge to the deep bedrock aquifer by slow diffusion through fractures and faults.

Referencing a report by the Virginia Division of Mineral Resources on the groundwater resources of Spotsylvania County (Subitzky, 1968), the Quantico slate is an impervious fine-grained rock with little primary porosity. As such, water circulates primarily through seams found along joints (fractures), fault planes, and bedding planes, and not through pores in the bedrock itself. Due to its intense folding and development of cleavage, the Quantico Slate has the potential for better water production than the less highly metamorphosed rocks of the Piedmont. It has been reported (Cady, 1933) that the Quantico Formation wells average 200 feet or less in depth, with yields ranging from 1.5 to 7 gallons per minute (gpm). The average yield per hundred feet in wells from 0 to 100 feet in depth is 3 gpm, and from 101 to 200 feet in depth is 4 gpm. The Quantico Formation aquifer is considered suitable for residential wells.

## 2.3 Fracture Analysis

Bedrock fractures often manifest themselves on the surface as straight stream segments, long linear erosional structures, linear depressions in the ground surface, and as linear areas of more vigorous vegetation growth. To locate possible bedrock fractures, topographic maps, aerial photographs, and LIDAR data are used. Fracture trace analysis of the Barrington Subdivision site indicates the presence of several fractures that occur on and adjacent to the subject site, and the orientations of these fractures are shown as a rose diagram on Figure 1. A map of the fracture traces is included as Map 1 in Attachment A.



**Figure 1. Rose diagram of fracture traces based on regional topographic fracture analysis.**

Referencing the Fredericksburg VA 30 x 60 Geologic Quadrangle Map, a significant syncline (downward fold in the bedrock) crosses the site from southwest to northeast, one of three parallel mapped folds present on or adjacent to the site. The Pipe Dam Run valley is developed parallel to the synclinal fold that crosses the site.

Of the twelve (12) fractures traced on and/or adjacent to the site, three were approximately parallel with the fold axis, and nine were conjugate with the fold axis. Three of the conjugate fractures were nearly perpendicular (90°) to the fold axis. The majority of fracture lineaments located at the Barrington site appeared to be discontinuous, and did not seem to extend into the adjacent subdivision to the southwest.

The presence of an igneous intrusion in the southeastern part of the site also suggests a water-bearing zone may be present where the intruded volcanic rock contacts the surrounding Quantico Formation. Igneous rocks are typically intruded through pre-existing fracture zones and weaknesses in the existing bedrock matrix. The fact that this intrusion is aligned parallel with several of the traced fractures that run from north to south suggests a significant fracture set may be present along this same orientation.

The presence of these numerous on-site fractures suggests that sufficient water should be available in the local aquifer to supply individual residential wells. However it should be noted that actual determination of the site's water resources can only be made by advancing test wells and performing pumping tests on the wells installed. It is not possible to tell from analysis of surface expressions of fracture lineaments how large the fracture set is and/or how much water a specific fracture set might be able to supply. In metamorphic rocks like the Quantico Slate prior studies have demonstrated that the aquifer resides both in fractures, and in openings that extend along the dip of the rocks as well.

## 3.0 References Cited

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Cady, R. C., 1933, Preliminary Report on the Ground-Water Resources of Northern Virginia, Virginia Geological Survey, Bulletin 41.

Mixon, R. B., Pavlides, L., Powars, D. S., Froehlich, A. J., Weems, R. E., Schindler, J. S., Newewll, W. L., Edwards, L. E., and L. W. Ward, 2000, Geologic Map of the Fredericksburg 30' x 60' Quadrangle, Virginia and Maryland, USGS, Geological Investigations Series Map I-2607.

Subitsky, S., 1968, Geology and Ground-Water Resources of Spotsylvania County, Virginia, Virginia Division of Mineral Resources.

## 4.0 General Limitations

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The analysis and recommendations presented herein have been completed in accordance with generally accepted engineering practices. No warranties, expressed or implied, are made as to the professional advice presented herein.

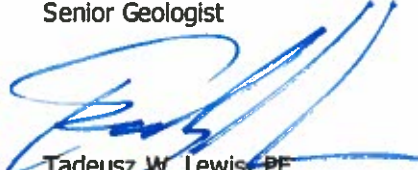
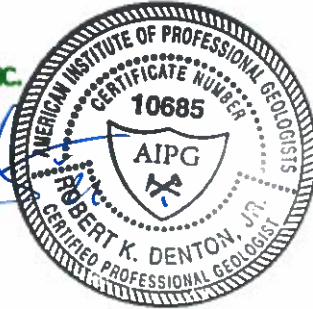
We appreciate the opportunity to be of service for this project. Please contact the undersigned if you require clarification of any aspect of this report.

Sincerely,

**GEOCONCEPTS ENGINEERING, INC.**



Robert K. Denton Jr., CPG, LPSS  
Senior Geologist



Tadeusz W. Lewis, PE  
Principal

RKD/TWL/  
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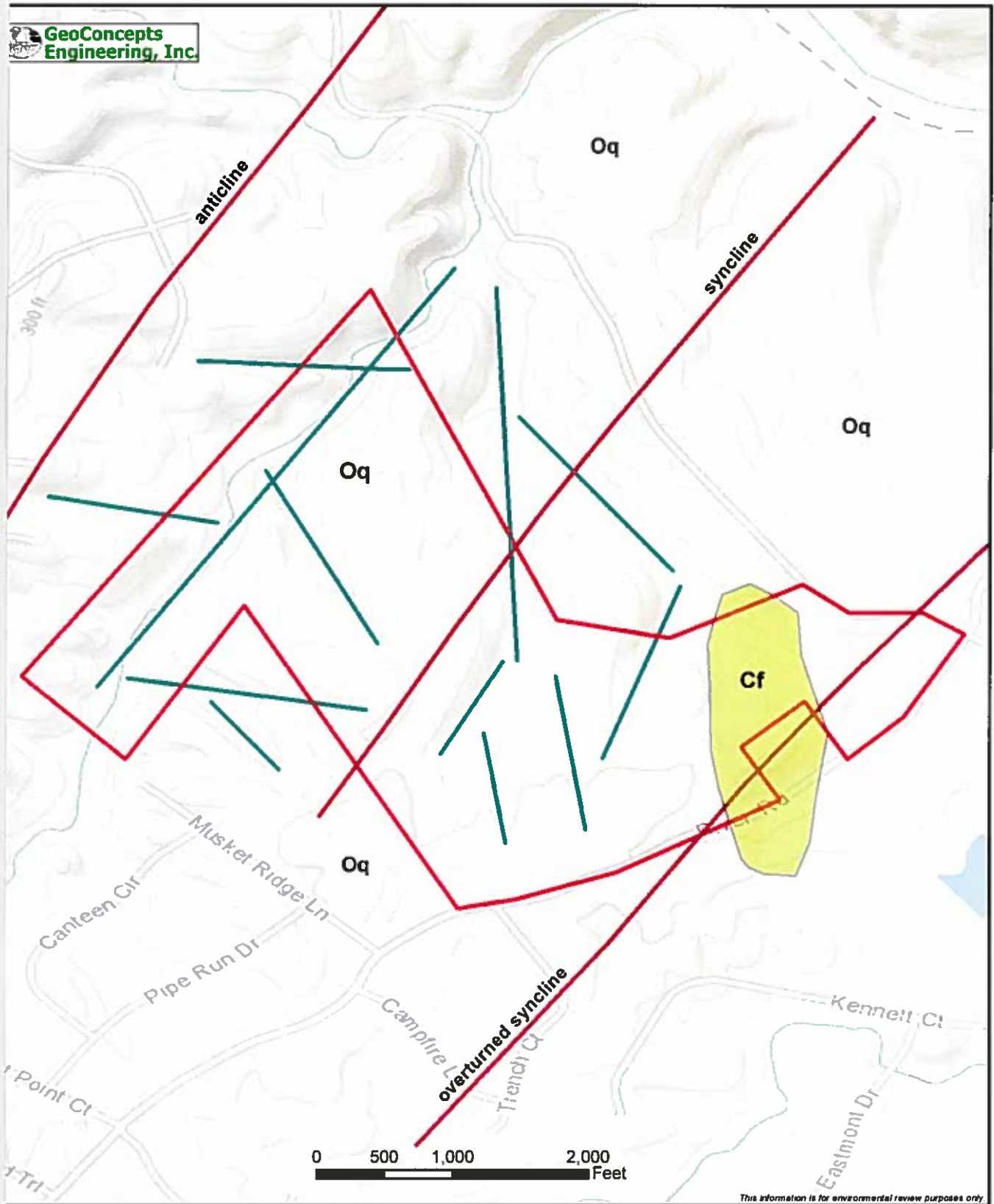
**ATTACHMENTS**

Attachment A            Map 1 – Site Geology and Fracture Trace

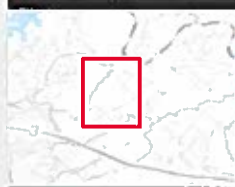
# Attachment A

## Map

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*This information is for environmental review purposes only.*



- Fractures
- Folds
- Approx. Site Boundary
- Oq = Quantico Formation
- Cf = Falmouth Intrusive Suite

**FIGURE 1. SITE GEOLOGY  
BARRINGTON SUBDIVISION  
Spotsylvania County, VA  
Project No. 17119**

