

December 6, 2019

Mr. Donald S. Robitzer, Jr.  
Sr. Vice President & COO  
The Commonwealth Group  
300 Water St., Suite 300  
Wilmington, DE 19801

RE: Geologic Study Report Update  
Kennett Gateway Development  
East Cypress Street and Ways Lane  
Kennett Township, Chester County, Pennsylvania  
RETTEW Project No. 113352001

Dear Mr. Robitzer:

RETTEW Associates, Inc. has prepared this updated Geologic Study Report for the approximate 13.5-acre Kennett Gateway Development project located south of the intersection of East Cypress Street and Ways Lane in Kennett Township, Chester County, Pennsylvania (the Site). This report is an update of the prior report dated October 21, 2019; the purpose of this update is to include the expanded project area, which now includes approximately two additional acres southeast of the prior project area. The attached **Figure 1** shows the Site and mapped geology. This report was prepared to provide hydrogeologic information to satisfy requirements under Kennett Township Ordinance 206.403C(2)(d) and (e) and 206.403D(2)(e), which relate to the identification of bedrock features such as fractures, faults, sinkholes, and bedrock outcrops, as well as identifying Site bedrock formations and their reported well yields and groundwater quality.

### **Hydrogeologic Setting**

The Site is located in the Piedmont Upland Section of the Piedmont Physiographic Province (Sevon, 2000). This Section is characterized by broad, rounded to flat-topped hills and shallow valleys, with low to moderate relief. Site topography slopes to the southwest. Based on Site topography, groundwater flow and surface water runoff at the Site are expected to flow southwest towards an unnamed tributary to the East Branch of Red Clay Creek located south of the Site.

According to the Pennsylvania Bureau of Topographic and Geologic Survey, the Site is underlain by two bedrock formations, including the Felsic and Intermediate gneiss (fgh) and the Setters Quartzite (Xsq). The majority of the Site is mapped as the Felsic and Intermediate Gneiss, with a smaller southern portion of the Site mapped as the Setters Quartzite. No geologic faults are mapped at the Site. The engineering and hydrogeologic characteristics of the two formations mapped at the Site are summarized below.

### Felsic and Intermediate Gneiss

According to *Engineering Characteristics of the Rocks of Pennsylvania* (Geyer and Wilshusen, 1982), the felsic and intermediate gneiss is light buff to light pink and fine to medium grained. Most of the mineral grains are about one millimeter in diameter. Primary minerals are quartz, microcline, hornblende, and



some biotite. Banding is poorly developed and massive. Its thickness is unknown. Bedding is poorly developed and massive. Joints have an irregular pattern, are moderately to poorly formed, moderately abundant, widely to moderately spaced, irregular and steeply dipping to vertical, and open. It is highly resistant to weathering with slight weathering to a shallow depth. Loose material consists of large rectangular blocks, and the mantle is thin. It forms hills of medium to high relief and natural slopes are steep and stable. It is difficult to excavate and has a slow drilling rate. It has good cut-slope stability. Foundation stability is good and should be excavated to sound rock.

According to Geyer and Wilshusen, surface drainage is good in the felsic and intermediate gneiss. It is a low permeability formation, and joints provide a very low secondary porosity. The median well yield is less than 20 gallons per minute (gpm). Well yields of 35 gpm or more may be obtainable from wells properly sited and developed. Wells should be at least 100 feet deep, but probably not over 200 feet for maximum yield. According to *Geohydrology of Southeastern Pennsylvania* (Low, D. and others, 2002), well records indicate yields range from zero to 600 gpm in gneissic rocks. Well yields of 5 gpm or less are reported from 155 wells, and 60 wells have reported yields of 100 gpm or greater. The median domestic well yield is 12 gpm, and the median high-demand well yield is 47 gpm. Water quality is generally low in dissolved solids, soft to moderately hard, and slightly acidic. Elevated concentrations of iron, manganese, nitrate, and radon and low pH are common water quality problems.

#### Setters Quartzite

According to Geyer and Wilshusen, the Setters Quartzite is light gray. The weathered outer portion is light brown to dark brown. It is coarse grained with micaceous layers. Maximum thickness is 150 feet. It is well bedded and flaggy. Joints have a seamy to platy pattern, are well formed, moderately abundant, widely spaced, steeply dipping, and open. It is highly resistant to weathering and slightly weathered to a shallow depth. Medium sized flat fragments result from weathering. Long continued weathering may result in complete disintegration to sand-sized particles. The overlying mantle is very thin. It forms rolling hills of medium relief. Natural slopes are moderate and stable. It is difficult to excavate except where highly weathered. Up to several feet below the surface may be moderately easy to excavate. It has a slow drilling rate.

According to Geyer and Wilshusen, surface drainage is good in the Setters Quartzite. It is a low permeable formation, and secondary porosity is of low magnitude. The median well yield is 20 gpm. Best yields can be obtained from fractured, weathered zones at the top of bedrock. Water levels show strong seasonal influence. Water is usually soft and of good quality. According to Low and others, well records indicate well yields range from 1 to 110 gpm. Well yields of 5 gpm or less are reported from eight wells. Only 4 of 20 wells with yields of 20 gpm or greater are deeper than 200 feet. Domestic wells have a median well yield of 14 gpm, and high demand wells have a median well yield of 50 gpm. Water quality is generally low in dissolved solids, soft to moderately hard, and slightly acidic. Elevated concentrations of nitrate and radon and low pH are common water quality problems.

#### **Fracture Trace Analysis**

Potential fracture traces at the Site were analyzed using aerial photographs from the years 1937, 1968, 1971, and 2019, as well as using available online topographic and 3D elevation imagery. The imagery was reviewed to identify natural linear features on the ground surface that may be the surficial expression of deeper bedrock fractures or joints. One potential fracture trace, oriented northeast-southwest, which appears to coincide with a historic linear drainage feature, was identified at the Site (see **Figure 1**).

### **Sinkholes and Rock Outcroppings**

No sinkholes or rock outcrops are mapped or were observed at the Site. No carbonate geologic formations, which sinkholes are more commonly associated with, are present at the Site based on geologic mapping and previous Site investigations. RETTEW visited the Site several times between 2018 and 2019 and did not observe sinkholes or rock outcroppings.

### **Previous Site Studies**

RETTEW conducted a Phase I Environmental Site Assessment as summarized in the report dated August 31, 2018. No Recognized Environmental Conditions (RECs) were identified that would indicate potential for groundwater impacts. Multiple soil/debris piles containing apparent construction debris were observed and identified as a noteworthy item. A water supply well and on-lot septic system for the residence were also identified.

Geo-Technology Associates, Inc. prepared a report titled Report of Geotechnical Exploration dated September 2018 for the Site. This report should be referenced for detailed geotechnical information for the Site. Eleven borings were characterized and identified fill consisting of soil mixed with gravel and debris (asphalt and concrete fragments) extending to depths of 2 to 13 feet across the Site. The 11 borings were extended to depths of 7 to 15 feet, with only one boring encountering refusal at seven feet on a possible boulder or partially weathered bedrock, and no bedrock encountered in the ten remaining borings.

Geo-Technology Associates, Inc. excavated 10 test pits and collected soil quality samples to investigate suspect fill at the Site and summarized the findings in their report dated November 14, 2018. The soil sample analytical results showed that the analyzed constituents were either not detected or at concentrations below applicable Pennsylvania Department of Environmental Protection Statewide Health Standard Medium Specific Concentrations.

### **Conclusions**

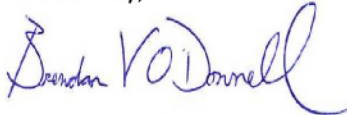
The conclusions of this study that provide information for Kennett Township Ordinance 206.403C(2)(d) and (e) and 206.403D(2)(e) are summarized below.

- The Site is underlain by two bedrock formations, including the Felsic and Intermediate Gneiss (Gneiss) and the Setters Quartzite (Quartzite).
- No sinkholes, bedrock outcroppings, or faults were identified at the Site.
- One northeast-southwest trending potential fracture trace was identified at the Site.
- Groundwater well yields in the Gneiss range from zero to 600 gpm, with reported median well yields of 20 gpm, 12 gpm (domestic), and 47 gpm (high demand).
- Groundwater well yields in the Quartzite range from 1 to 110 gpm, with reported median well yields of 20 gpm, 14 gpm (domestic), and 50 gpm (high demand).
- Potential for groundwater contamination is low. Water quality potential for each formation based on literature review is summarized below.
  - Gneiss - Water quality is generally low in dissolved solids, soft to moderately hard, and slightly acidic. Elevated concentrations of iron, manganese, nitrate, and radon and low pH are common water quality problems.

- Quartzite - Water quality is generally low in dissolved solids, soft to moderately hard, and slightly acidic. Elevated concentrations of nitrate and radon and low pH are common water quality problems.
- One water supply well was identified at the Site. Any wells present at the Site that are no longer used must be properly abandoned by a Pennsylvania licensed well driller prior to Site development to prevent a potential pathway for groundwater contamination.
- Engineering characteristics of each formation based on literature review is summarized below.
  - Gneiss - It is difficult to excavate and has a slow drilling rate. It has good cut-slope stability. Foundation stability is good and should be excavated to sound rock.
  - Quartzite - Natural slopes are moderate and stable. It is difficult to excavate except where highly weathered. Up to several feet below the surface may be moderately easy to excavate. It has a slow drilling rate.

Please contact me at (717) 205-2214 or bodonnell@rettew.com if you have any questions or need additional information.

Sincerely,



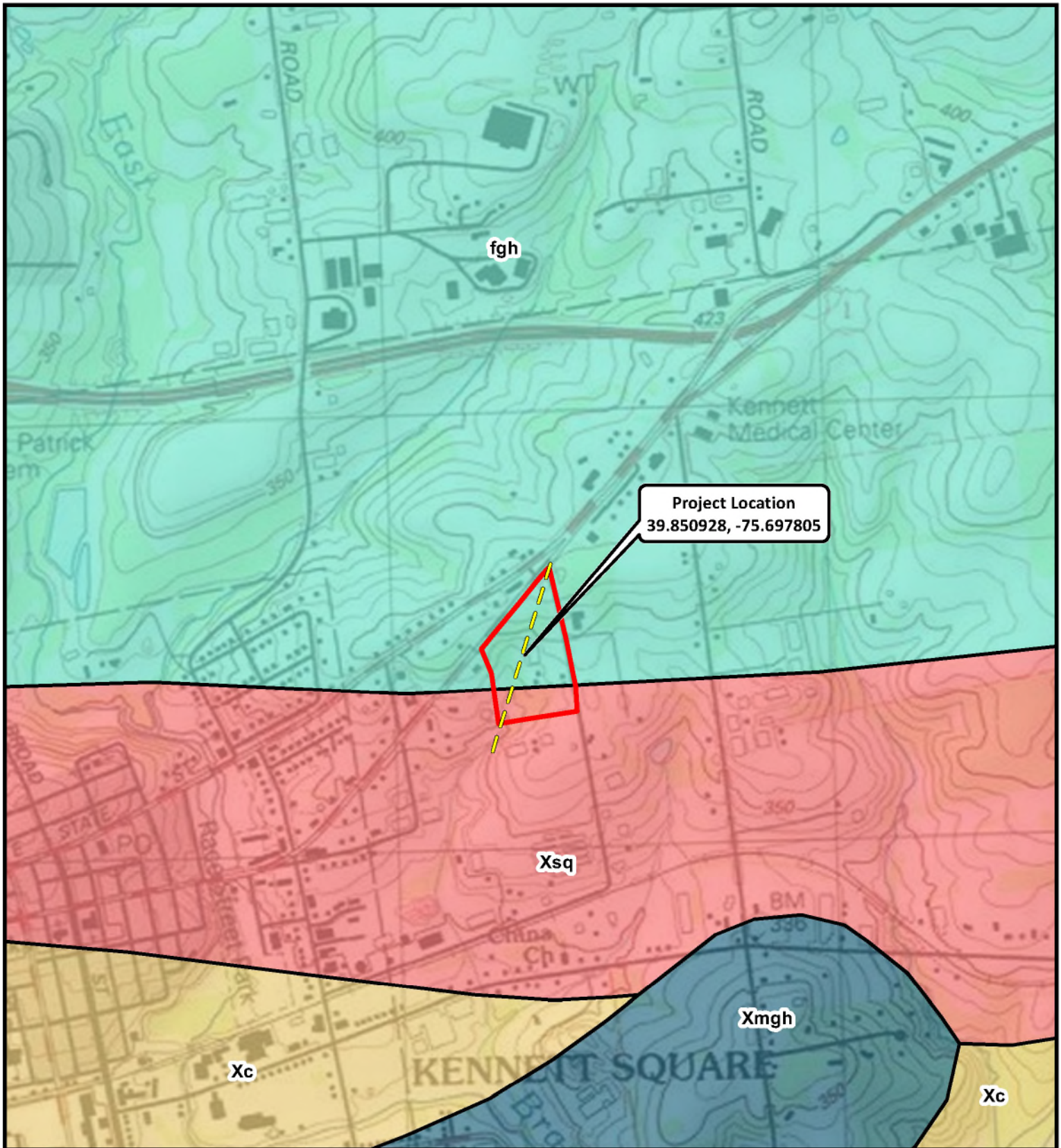
Brendan O'Donnell, PG  
Senior Geologist









copy: Kevin Ember, RLA (RETTEW)

Enclosure

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**Project Location**  
39.850928, -75.697805

-  Inferred Fracture Trace
-  Approximate Site Boundary
- Geologic Formation**
-  Xc - Cockeysville Marble
-  XmgH - Mafic gneiss
-  Xsq - Setters Quartzite
-  fgh - Felsic and intermediate gneiss

**The Commonwealth Group**  
**Kennett Gateway Development**

**Figure 1 - Geology Map**  
Kennett Township, Chester County, PA  
Project No. 113352001

