

**Boyd Tavern Market  
TMP 94-39  
Tier 3 Groundwater Assessment  
Groundwater Management Plan**

Prepared for:

Shimp Engineering, P.C.  
Charlottesville, VA

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## **Key Findings**

**Hydrogeologic setting:** Located in gently rolling topography in eastern Albemarle County, the property is underlain by about 45 feet of soils and saprolite, and fractured mica schist and metagraywacke bedrock. The parcel is at the crest of a low divide between the Middle Rivanna and Mechunk drainages, about 1000 feet east of the Mountain Run fault zone.

**Groundwater availability:** Favorable.

**Are hydrogeologic conditions favorable to proposed use?** Yes.

**Contamination threats on record within 2000 feet of parcel?** None.

**Additional contaminant threats observed in field reconnaissance?** None.

**Anticipated impacts of proposed use on existing users of groundwater:**

None.

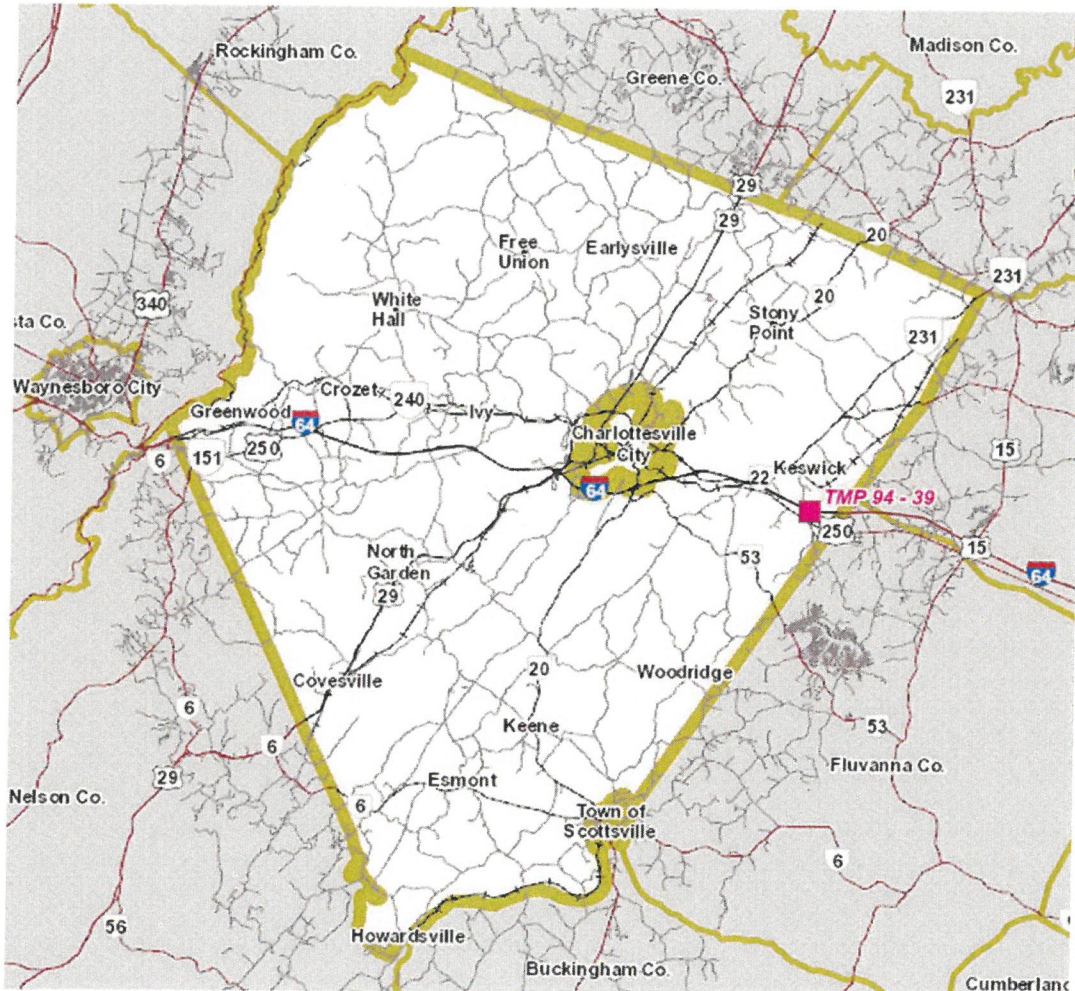
**Groundwater management plan:**

Implement runoff-neutral development to the extent possible.

## Project Overview

The proposed development is a convenience store to be located on Black Cat Road (Rt. 616) immediately southwest of Interstate 64 interchange 129, in eastern Albemarle County (Figure 1).

Figure 1

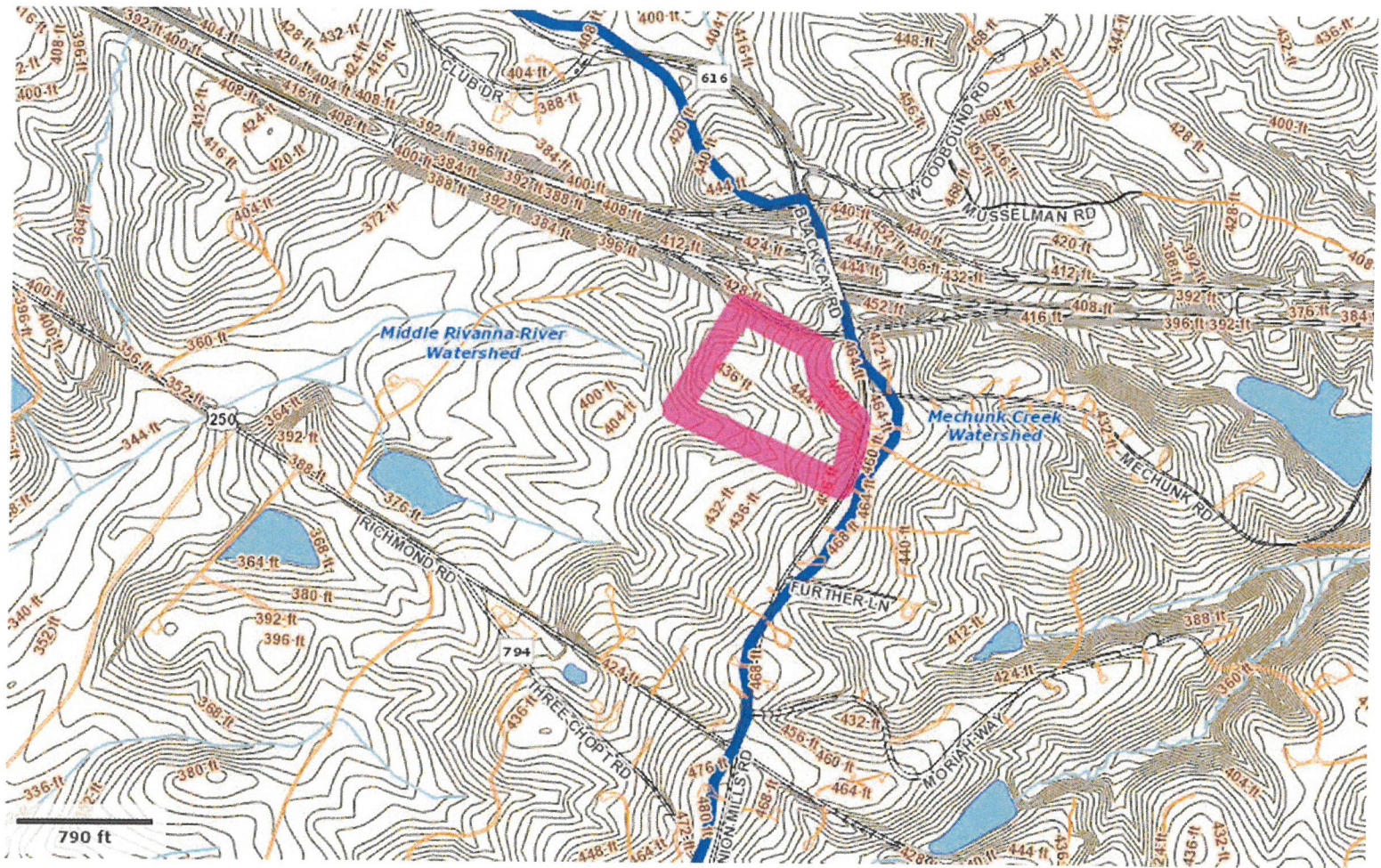


The parcel includes 12.486 acres located on a drainage divide between the Middle Rivanna River and Mechunk Creek drainages (Figure 2). The parcel slopes gently westward, with elevations ranging between about 420 and 460 feet above sea level. Existing land cover on the parcel is mixed forest in the eastern portion and open field in the remainder. Surrounding land use is a mix of small lot residential, farmland and forest. A site plan showing the proposed development layout and approximate land disturbance is attached to this report.



Projected average daily water consumption for the facility, based on historical records of water usage in a similar facility operated by the applicant, is 800 gallons. Wastewater will be disposed of through an on-site drainfield. There is no existing well on the parcel.

Figure 2: Watershed boundaries and topography, TMP 94-39



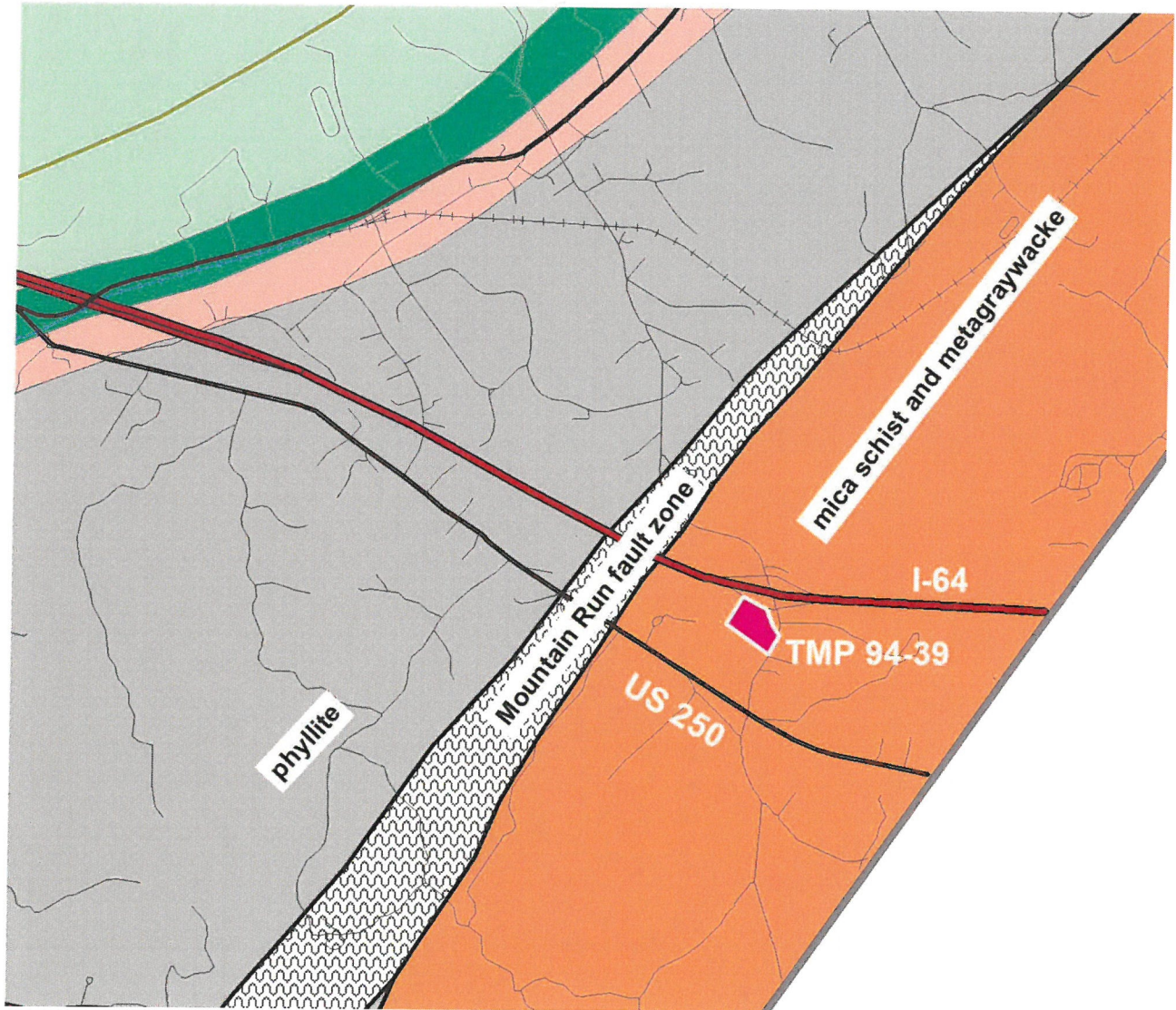
## Hydrogeologic Assessment

### Bedrock geology, fracture density and water well productivity

The parcel is located a few hundred feet east of a regional geologic structure known as the Mountain Run fault zone. This zone of fractured bedrock rock including limestone juxtaposes mica phyllite to the west against schist and metagraywacke to the east. Bedrock on the parcel includes schist and metagraywacke which are likely to be heavily fractured due to proximity to the fault (Figure 3). No bedrock exposures were observed on the parcel during field reconnaissance.



Figure 3 : Bedrock geology in the vicinity of TMP 94-39  
(adapted from the 1993 Virginia Geologic Map)



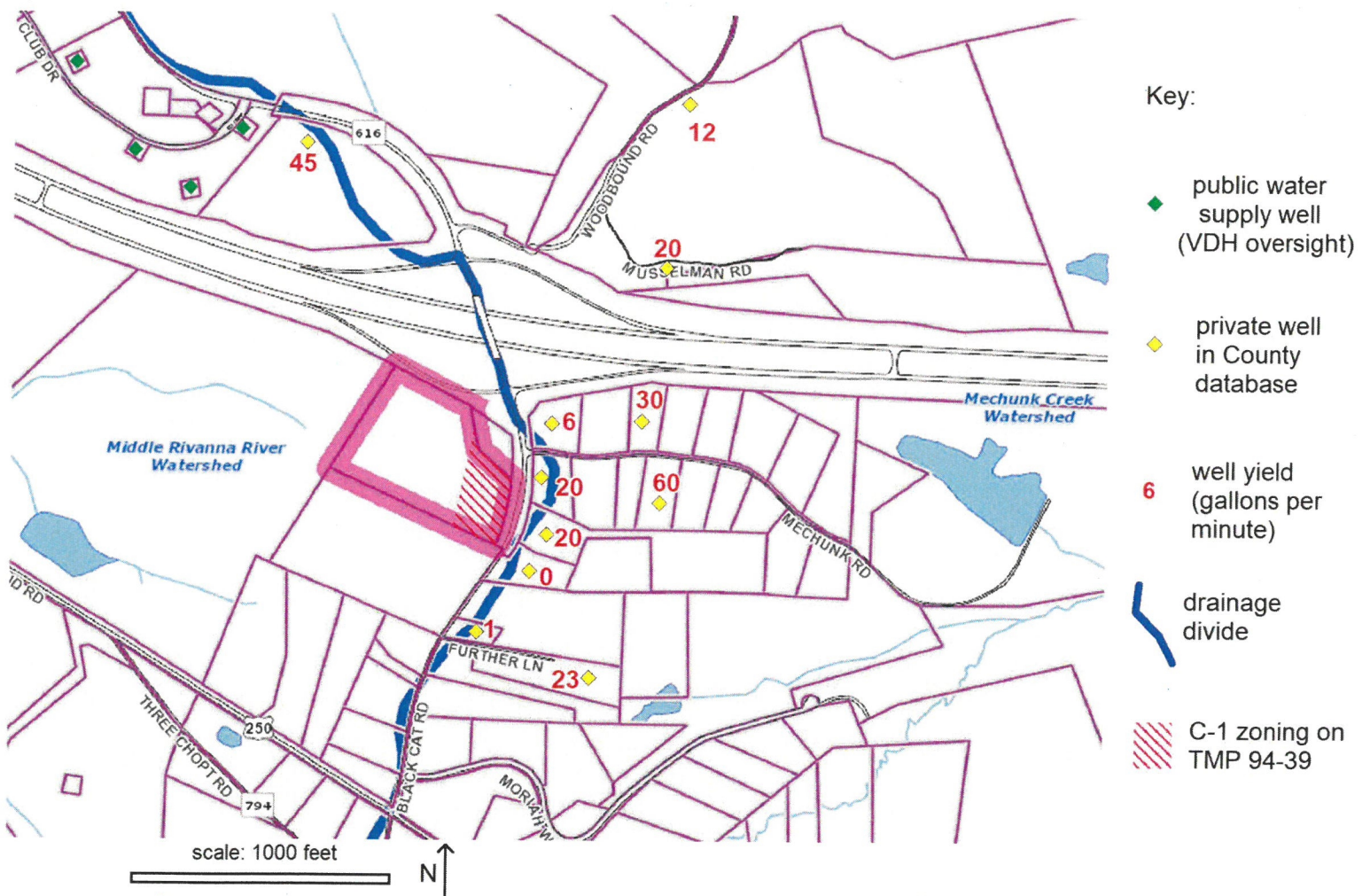
In the absence of good bedrock exposures with which to directly observe bedrock fractures, the yields of randomly-sited water wells can be used as a proxy for fracture density. Table 1 (below) summarizes data from 290 wells in the County database that were constructed in the same bedrock formation as underlies this property. The average yield of this group of wells is 7.7 GPM (gallons per minute), which is low to moderate relative to average yields from other geologic formations in the county. (Note that dry holes or “zero” GPM wells are under reported in the database).



Geologic map unit	yield (gallons per minute)	total well depth (feet)	casing length (feet)	count
CZpm (mica schist and metagraywacke)	average: 7.7 maximum: 75	average: 179 maximum: 630	average: 50.4 maximum: 322	290

There are 11 domestic wells in the database and 4 public water supply wells within 2000 feet of the property (Figure 4). The average yield of the 11 nearby domestic wells is 21.5 GPM. This is almost 3 times the overall county-wide average for wells drilled in this geologic formation. The greater yields are likely due to increased bedrock fracture density in proximity to the Mountain Run fault.

Figure 4: Existing water wells and known yields in the vicinity of TMP 94-39



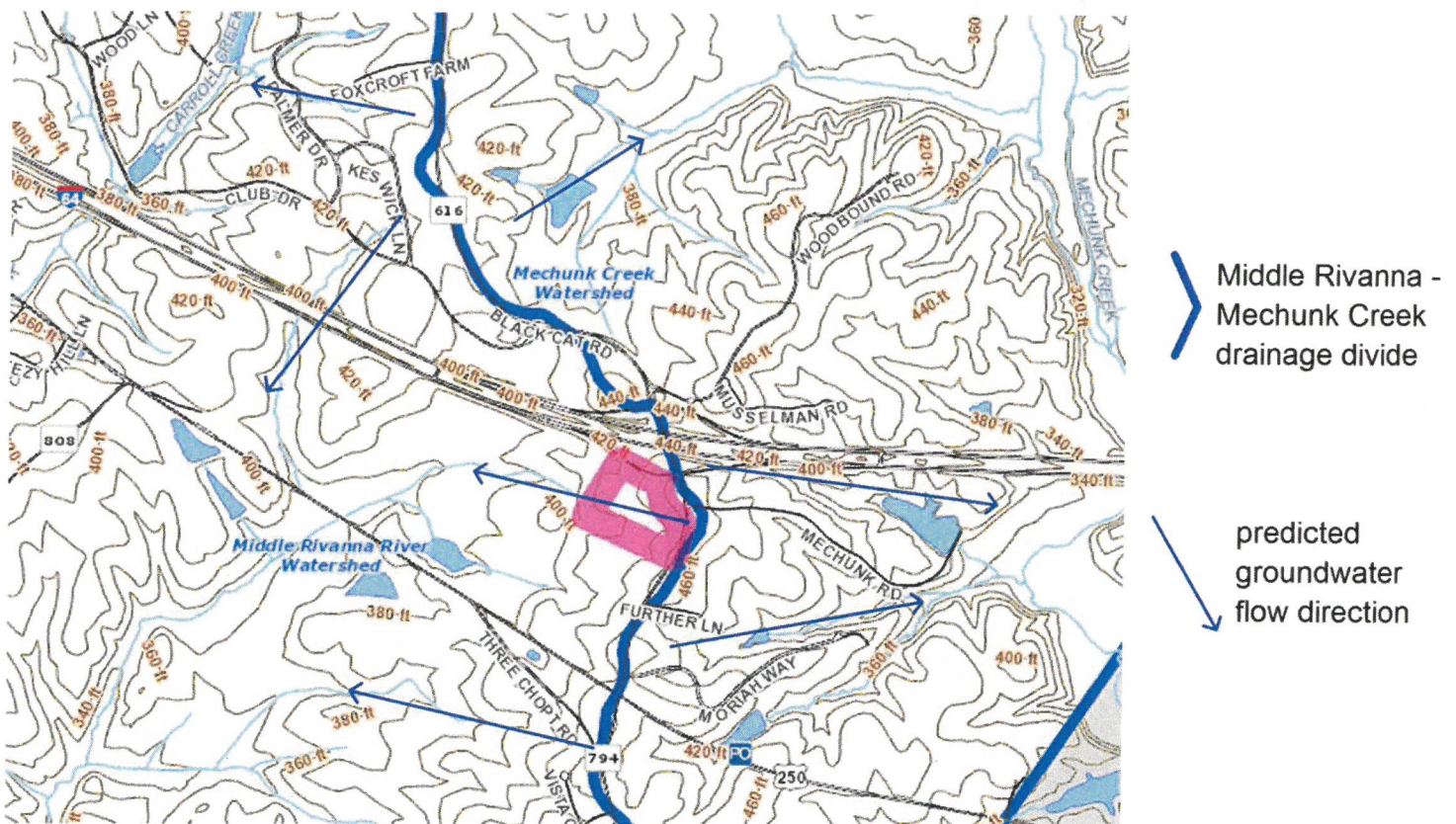


## Groundwater recharge and flow paths

Groundwater recharge and flow in the Virginia Piedmont begins at the surface where rainwater soaks into soils, saprolite and weathered rock. The groundwater percolates downward to enter fractures in the underlying bedrock. At shallow levels, recharge and flow direction are influenced by both topography and the thickness and character of soils and saprolite.

The proposed site is positioned on the western flank of a local drainage divide, with the divide almost coinciding with the eastern margin of the parcel (Figure 5). Because there is no adjoining land topographically above the parcel, the parcel does not receive hydraulically-driven shallow recharge from off-site.

Figure 5: Drainage divide and predicted shallow groundwater flow paths in the vicinity of TMP 94-39



On the basis of surface topography, shallow-level groundwater flow on the parcel is predicted to be westward, toward discharge into Limestone Creek.



USDA soils mapping shows the parcel contains Nason and Tatum soils (Figure 6). These are classified as well-drained and moderately permeable, meaning they serve as a favorable sponge to soak up rainwater and feed it downward to recharge bedrock fractures.

Figure 6: USDA soils mapping (Nason 62B, 62C; Tatum, 80B)



Casing lengths are a good indicator of the thickness of the soil and saprolite “sponge”. The average length of casing reported for the 11 nearby domestic wells in the County database is 43 feet. This represents a significant volume for potential groundwater storage on the parcel.

At deeper levels, below the soil-saprolite “sponge”, groundwater in bedrock fracture networks on the parcel would potentially receive recharge from off-site, including possible connection with the highly productive fractured rock aquifer associated with the Mountain Run fault zone. Overall natural flow at deeper levels is likely southwestward, driven by a regional gradient toward discharge into the Rivanna River (2.5 miles southwest of the site).



### Water budget estimate

It is instructive to review the proposed use of water relative to the amount of water available to the C-1 zoned portion of TMP 94-39 (3.28 acres; Figure 4) from natural recharge.

Annual regional precipitation: **44 inches**

Conservative estimate for the percentage of precipitation contributing to groundwater recharge, subtracting runoff and evapotranspiration:  
**15%**

Annual regional groundwater recharge: **6.6 inches**

Average regional daily groundwater recharge: .0181 inches = **.0015 feet**

Daily recharge per acre: .0015 feet X 43560 square feet per acre = **65.6 cubic feet recharge per acre**

Gallons recharge per day per acre: 65.6 cubic feet X 7.48 gallons per cubic foot = **491 gallons per day per acre**

Gallons per day recharge on C-1 zoned portion of parcel: 491 gallons per acre X 3.28 acres = **1610 gallons per day**

Gallons per day recharge to the parcel from off-site up-drainage lands: **0**

Predicted maximum daily groundwater withdrawal on site: **800 gallons.**

These numbers indicate that the proposed net use of groundwater is substantially less than naturally occurring recharge on the parcel. A significant portion of the groundwater withdrawn will be returned to the ground on site via the drainfield.

### Potential for proposed use to affect existing users of groundwater

The proposed use of groundwater is unlikely to affect existing nearby domestic wells because 1) the proposed usage is substantially non-consumptive (most water pumped from the ground will be returned to the ground through an on-site drainfield); 2) the usage is very modest relative to available on-site recharge; and 3) the site is separated from nearby existing users of groundwater by a drainage divide.

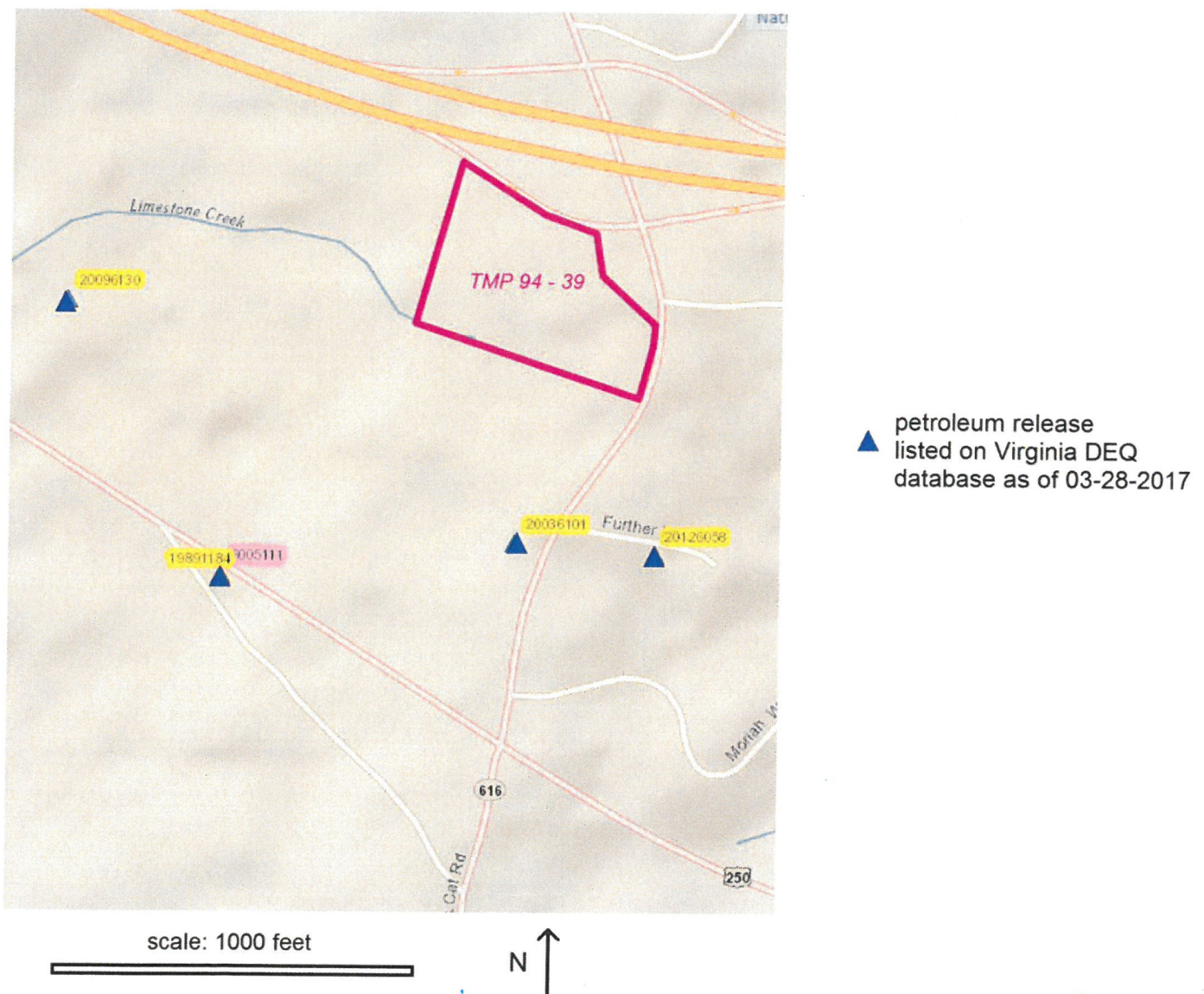
Significant quantities of groundwater are being withdrawn at the Keswick Hall community well field, about 1500 feet northwest of the site. It is very unlikely there will be interference between these wells and a future well on TMP 94-39 because 1) the proposed usage is very modest and substantially non-

consumptive; and 2) dominant recharge feeding the Keswick wells is predicted to be from the northeast, away from the parcel under study.

### Contaminant threats

There are four documented petroleum releases on the current Virginia DEQ database within 2000 feet of the parcel (Figure 7). Each of these is listed as a "closed case", meaning remediation no further action is required. None poses a threat to TMP 94-39.

Figure 7: Contamination threats in the vicinity of TMP 94-39





### Reserve wellfield

The C-1 zoned portion of the parcel is sufficiently large that there should be room to site a replacement well in the event of failure of the primary well.

### **Groundwater management plan**

Implement runoff-neutral development to the extent possible.

Attachment: Site Plan

95-39 SP (2.6.17).PDF

Submitted by Nicholas H. Evans, CPG # 2801 001041

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