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Climate

The temperate climate of the region brings relatively cool summers and mild winters to the area. The winds through the region generally blow from the west/northwest at an average of 8-10 miles per hour. Yearly rainfall ranges in New Castle from 35" to 50" of rain/liquid precipitation and Happy Hollow of Sinking Creek Valley receives between 32" to 71" per year of liquid precipitation. Rainfall can come in high intensity short duration rains that amount to five inches of precipitation in 24 hours in New Castle. Orogenic effects bring us rain when a neighbor up the valley is in a rain shadow, and gets none.

Climate characteristics effect soils and are used in the taxonomy of soils. Our soils are mostly udic moisture regimes (Keys to Soil Taxonomy, 2014). Silver Lining Farm hosts a Virginia Department of Environmental Quality and U.S.G.S. State Observation Well (SOW 232) which measures water table fluctuations. Data collected thus far is shown in Figure 5. Our agreement to host the SOW 232 for 100 years will yield more data with time.

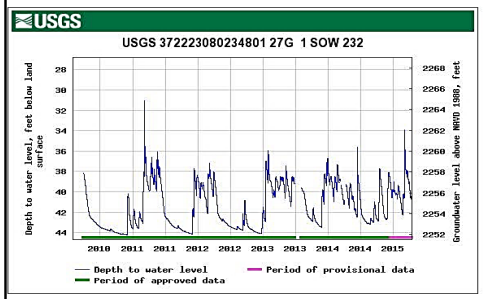

Figure 5. Water table fluctuations of SOW 232 from installation to April 2015. Low points on the graph were recorded during the period July to January. Note the water table has been higher longer in the recent past (USGS SOW 232, 2015).

SOW 232 Craig County, Virginia
Hydrologic Unit Code 05050002
Latitude 37°22'23.34", Longitude 80°23'47.99" NAD83
Land-surface elevation 2,296 feet above NAVD88
The depth of the well is 152 feet below land surface.
The depth of the hole is 160 feet below land surface.
This well is completed in the Valley and Ridge aquifers (N500VLYRDG) national aquifer.
This well is completed in the Knox Dolomite (367KNOX) local aquifer.

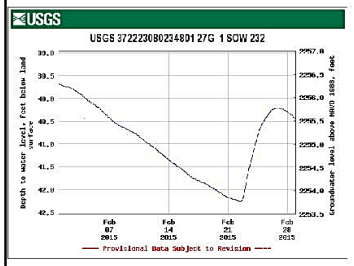

Figure 6a. Ice Umbrellas on the rocks in Little Creek were evidence of a higher (1") water level before temperatures dropped to below zero 19-21 February 2015. The SOW 232 watertable depression occurred as ice formed around the edges of the spring that emerges downhill of SOW 232. Little Creek, that flows past the rock outcrops along the lower Happy Hollow Rd. froze over in February 2015 and flowed at full bank when melt began on the 22nd of February 2015. The shows the short response time between SOW 232, our spring and surface water.

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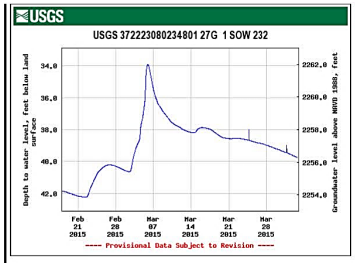

Figure 6b. This spike of 6 March 2015 shows the instrument's response to water table rise as a surge of water: snow melt and 1.1 inches of rain that day, enter the well (USGS SOW 232, 2015). In the other watershed of Meadow Creek, the turlough of Meadow Creek flooded on 5 & 6 March 2015.

However, summers can be extremely hot and dry, causing drought to occur. When the rain returns in the fall (often as a result of a tropical depression or storm in the vicinity) flooding may occur in low-lying areas of the County because of poor soil permeability, desiccated soil pores and natural compaction of colluvial and alluvial soils or rapid water rise in a confined (by rock) system. New Castle is situated in a debris flow/ alluvial fan position and is underlain by shales and sandstone. Dense, cemented fragic soils are common. Flash flood streams leave polished rocks. Fluctuating water tables in karst land may leave dry creek beds, that only flow surface water after all voids and caverns are flooded below the stream bed.

Temperatures in Craig County remain fairly mild year-round, with an average annual maximum temperature ranging in the low to mid 60s and the average minimum temperature ranging in the low to mid 40° F, fitting the mesic temperature conditions.

The Earthquake of 23 August 2011, centered in Louisa County, Virginia, was felt at the same time in New Castle as in Happy Hollow in the Sinking Creek Valley. The underlying geology carried the seismic wave down the Saltville Fault along Happy Hollow Rd. and under Buck Hill. Our house is on "Buck Hill", which is a remnant of resistant limestone bedrock, mantled by deep residuum. The earthquake cracked our rock walls in several places (displacement approximately 1 inch). I watched cobwebs and items on my window sill jiggle as the seismic wave passed. The Earthquake did not shake the roots of John's Creek Mountain. No sign of the earthquake was present in the SOW 232 water table fluctuation data. A feature of an earthquake is evidence of an abrupt up-down water spike in the well. The SOW 232 is situated on the John's Creek Mountain side of Happy Hollow Rd. The bedrock of Buck Hill is exposed at the road and is another candidate site for a collapsed valley floor of the karst periglacial lake.

Finer material in deposits also vibrated and karst collapse happened at the John Price farm. We shall visit the recent sinkhole development of the valley's sinkhole plain.

Why would we live here amid all of this danger: These dangers are not complicated by large, linear, man-made disturbances such as permanent structures involving the construction and aftermath of pipelines.

Mining

In the past, Oriskany iron ore was produced by underground and surface mining in northeastern Craig County. The iron ore was used primarily in local iron ore furnaces. Mining operations for iron ore ceased about 1925. Manganese deposits occur at several locations and have been mined in the vicinity of Simmonsville, New Castle, Paint Bank and on Sinking Creek Mountain southwest of New Castle. Limestone and dolomite have been quarried near New Castle, Simmonsville and Huffman for road stone and other uses. Samples of clay and shale from selected localities in the County have been tested and found to be potentially suitable for brick,

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tile, drain tile, pottery and lightweight aggregate. Sandstone in the County offers a potential source of construction and industrial stone (Caldwell, 1995, Sweet, 1985). The Castle Sand Quarry northeast of New Castle is an active sand mining operation. It is on our tour.

Soils

The U.S. Department of Agriculture, Natural Resources Conservation Service completed the *Soil Survey for Craig County, Virginia* in 2011.

The soils in a survey area occur in an orderly pattern that is related to the geology, organisms and natural vegetation, relief, climate and time. It is important to know geology to understand what is happening in the soil. Soils of New Castle and surrounding areas are largely deposits from another time, although more recent deposits from Craig's Creek, John's Creek and Meadow Creek are as recent as this last Tuesday. Evidence of flash floods in the form of very large boulder movement by the three main Creeks around New Castle further suggests the waters ability to remove all of the finer material, too. The shaly soils around New Castle are shallow over shale or are deposits. The geology of underlying sandstone may also influence the soils by transmitting water in a sand-karstic solution channel or solution channel of siliceous fragic nature to a larger stream. There are beautiful, small beaches of sand in the slipoff slopes along all of the mountain streams. Native fish use the gravel bars and ledges in the streams where exposed rock structure controls the water flow and its deposits.

Large colluvial material of shale or sandstone that moved, shattered, split into slabs of big rock, and moved a little more also trap mountain slope soil creep in zones of accumulation. Wetland soils, in an area too small for a large scale map, form in debris that does not drain. Spring Peepers and other amphibians trill for mates, almost year round in these mountain forest wetlands. The V-shaped valley of upper John's Creek has pockets of sorted sandy alluvium braided in a deposit on a drained wetland with quicksand. Shale bedrock outcrops in John's Creek and some of the lower slopes. Large sandstone knobs hold big rocks and some deep sandy soils higher on the slopes. The valley becomes split by Seven Mile Mountain and broadens near Craig Healing Springs, as it approaches New Castle.

Sinking Creek Valley deposits are reworked colluvium of sandstone and limestone, or calcareous Ordovician shale. Trilobites and shells have been found in the limy shales on Rt. 624, Little Mountain Road, past the Blueberry Farm. Deep paleosol soils form from limestone where disturbance has been minimal. Limestone rock weathered to clay generates expansive smectitic clays (shrink swell clay) and larger particles of sand and silt. The entire Sinking Creek Valley contains clay with high shrink-swell potential. Some of the paleosols have been covered/buried by younger deposits. The hillside well-drained soils on Buck Hill range in thickness from 0 inches to 15+ feet deep over light bluish-grey limestone. Lenses of the limestone have small, oval lenses of medium dark grey chert. The soils are loamy with increasing clay with depth. Black Manganese concretions and and soft masses are redoximorphic features from a fluctuating water table that stain the clay horizons deeper than six feet. These redoximorphic features formed at a time when the water table was high enough to reach these soils, or engulfed them.

Soils developed on mountain foot slopes found in Sinking Creek Valley formed in colluvium and alluvium of large rock slabs of Tuscarora and Juniata Sandstone or weathered Ordovician calcareous dolostone/limestone bedrock. The chemical weathering of neutral to basic limestone against acid sandstone dissolves into the ground water the softer minerals in the rocks or allows soils to grow as a weathering rind of the rock. Water affects the voids in the limestone to enlarge and connect over time as the water table fluctuates. Natural flushing and infilling of the porous bedrock happens as water supply increases and solution channels open and close, or collapse completely, closing underground flow of water. The backup of water or rerouting of water may replace air filled chambers in the bedrock caves, or surface as a karst intermittent lake or estival (water-reversible sinkhole). Water can be heard flowing under the large sandstone rocks along the flank of Sinking Creek Mountain near the Great Eastern Continental Divide. Large springs on the flank of Sinking Creek

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Mountain produce millions of clean, clear water every day. Some of the most productive springs lie in the path of a proposed utility corridor, PF15-3.

The soils formed in transported material (colluvium) from the ridge tops have higher sand contents and the soils formed in limestone have more clay. The soils formed in shale have a higher silt content and may be shallower than the soils formed in colluvium of either sandstone or limestone. Stream deposits contain sandstone, shale and limestone.

Craig County has six of the twelve Soil Orders: Mollisols, Inceptisols, Entosols, Alfisols, Spodosols and Ultisols.

Approximately 79% of the County's population relies on well water (1990 Census). Most wells in Craig County's mountainous areas are less than 300 feet deep and generally yield five to twenty gallons per minute. In the Potts Mountain area dry holes have been drilled as deep as 250 feet. Wells in the valleys are generally less than 200 feet deep and yield less than 40 gallons per minute. One of the deepest and most productive wells in the County penetrates shale and limestone at the Paint Bank Fish Hatchery. This well is 400 feet deep and was test pumped for 24 hours at 323 gallons per minute with only 89 feet of drawdown. All but five gallons per minute were obtained from calcareous shale at depths of between 300 and 400 feet. Artesian wells located near Route 311 have also been located and found to produce 1200-1300 gallons per minute. Sinking Creek Valley has a well 500 feet deep with 5-6 gallons/minute recharging its well. Some wells hit caverns that swallow well drilling equipment.

STOP 2: Maywood Wetland Mosaic

Maywood Wetland Mosaic is a wetland in a karst lake flood plain (west of the curve at Maywood). The area was a road-crew prison camp in the 1950's for a few years. Maywood School (east of the curve) was an active school until the 1970's, but the school site was known in 1887 as Fairview Academy (Johnston, et al, 2011). The stereo-pair aerial photograph below shows many straight line fractures that lead to Sinking Creek (Figures 7, 8, 9). Notice the old, abandoned stream meander, now high up on the hillside near the tree line. The farmer who farms that land occasionally finds chunks of concrete of old building foundations and walkways in the floodplain. The ground was compacted by the camp activities and extra water added by the roads adds to the flooding of this area during high rainfall years. Three hurricanes (Frances, Ivan and Jeanne) in September of 2004 left the area completely flooded five feet deep for several days. The soils are mapped by NRCS as drier than they actually are. The year round water table is less than 6 inches below the surface in the majority of the floodplain, creating a mosaic of wetlands with corresponding vegetation. This is another karst intermittent lake under the right conditions in our current climate. The area that floods extends to the south and past the dairy farm to the north, but the easy view of the land prevents us from seeing how big the floodplain, intermittent karst lake really is.

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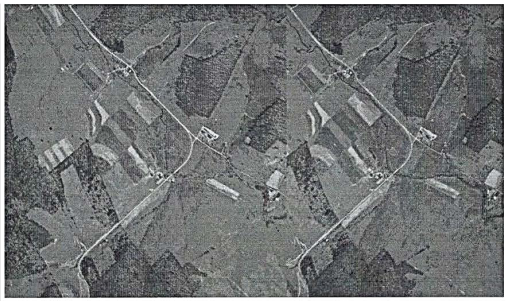

Figure 7 . Stereo-pair aerial photographs of Maywood. Notice the straight fracture the road follows. The intersection of fractures, low flood plain and continuous surface water here of Sinking Creek has created a mosaic of wetlands with drier land (Photo from DMME files).

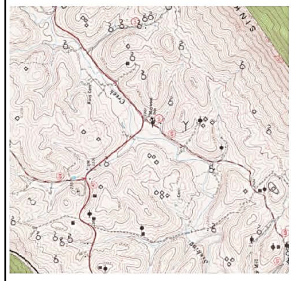

Figure 8. The flow of Sinking Creek is intersected by a fracture and another creek at Maywood. Water flows to the southeast corner of this map (Craig County Water Resources Inventory, 1992).

Figure 9. Sinking Creek on right looking south on Route 42, Cumberland Gap Rd. The road turns to the right, west. The area is called Maywood and is a mosaic of wetlands and drier land, in Craig County (photo by author). This area flooded in 2004 to form an intermittent lake.

Drive by: Heading northeast on Rt. 42, Olga Smith family's house on left. Spring house is nearby.

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STOP 3: Sinking Creek Store and John Price's recent sinkholes

Acid sandstone rubble blanket the mountain sides and approach the valley floor limestone soils and bedrock. The contact pits one chemistry against the other; the limestone dissolves slowly with the acid rain and acid sandstone contributions to the local groundwater. The limestone becomes cracked and cavernous out of sight. Sinkholes form where the overlying mat of vegetation, soils and rock become too weak to hold the weight, and the whole mess falls into the crack or cavity or fluctuating groundwater table. Usually the instigator is a water seep or underground stream meandering through the large blocks of sandstone rubble below the surface. The resultant landscape is called a sinkhole plain. Last ice age periglacial (and earlier) influences would also freeze water seeped into cracks and voids and cause additional physical deterioration of rock structure. Mr. Price has some sinkholes that opened recently, not long after the 2011 earthquake mentioned on this tour.

Drive by: Sign for Great Eastern Continental Divide

There is a sign near the Great Eastern Continental Divide where the watershed divide crosses Route 42, Cumberland Gap Rd., just west of New Castle. There is no surface water at the valley floor along Sinking Creek Mountain from the Great Eastern Continental Divide to the Big Spring (on right) across from the fish hatchery (on Rt. 42). The water sinks upgradient and rises out of the ground at the Big Spring, joins Meadow Creek and heads to the Atlantic Ocean.

Sinking Creek flows from the Great Eastern Continental Divide in Sinking Creek Valley in Craig County to the New River in Giles County. The high point on Sinking Creek Mountain marks the divide for three major creeks: Craig's Creek, Sinking Creek and Meadow Creek. While Craig's Creek and Meadow Creek flow to the James River and into the Chesapeake Bay and Atlantic Ocean, only Sinking Creek flows to the New River and on to the Gulf of Mexico. Johns Creek, Potts Creek, and Barbour's Creek also all flow to the James River.

STOP 4: Meadow Creek Turlough/Polje

Meadow Creek Turlough/Polje floods when conditions are right, frozen cold with high rainfall or sudden snow melt generates more water than what can pass through the sinkhole drain. The outlet cave is approximately 1 mile down gradient and can eject a forceful discharge for a short duration time (usually less than a week). The 1833 map and In and Around Craig County (1997) list and discuss the "sinks" and "rises" of these karst features.

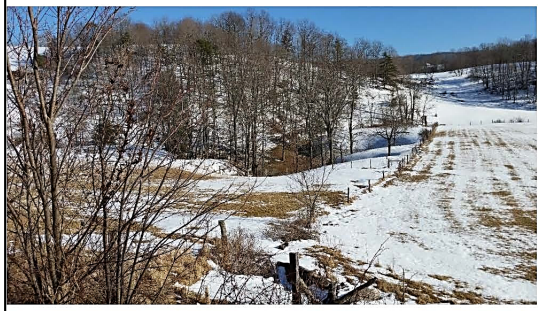

Figure 10. Collapsed sinkhole sink drains water flowing to the north through Meadow Creek watershed. Some winters the drain is too small to pass the water fast enough, and water backs up three miles upgradient from this point, forming an intermittent lake, Meadow Creek Turlough. (photo by author, 2015).

The intermittent lake that forms when the karstic sink drain gets plugged may be flooded for more than a month or less than a week. This is the drain of the Meadow Creek Turlough/Polje with water approximately 12 feet deep at the drain hole, Figure 10.

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A polje is a large, commonly flat-floored, closed depression in a karst area, of equivocal origin and a turlough is a seasonal lake, up to 5 km^2 in area, found in glacially influenced karst terrain, which fills and empties through springs and sinkholes (Keary 1996). Meadow Creek Polje now and Meadow Creek Turlough 10,000 years ago. Cavities in the limestone bedrock are enlarged through chemical and physical weathering. This area was certainly influenced by periglacial cold, melt and heaving. Notice the collapsed valley floor across the turlough, where the rock is exposed in the high wall (Figure 11). Evidence of periglacial cold at Mountain Lake and Huckleberry Knob and Meadow Creek Turlough indicate that Sinking Creek Valley, with its abundant water, would have been a connected, frozen, periglacial lake during the last ice age, and at other periglacial times as well. That is, Sinking Creek Valley would have been one long continuous periglacial lake, before this end of the valley collapsed, changing the watershed divide.

Figure 11. Left photo, Meadow Creek Turlough/Polje partially flooded March 2015 (photo by author).

Figure 12. Right photo, Meadow Creek Turlough/Polje dry March 2003 (photo by author).

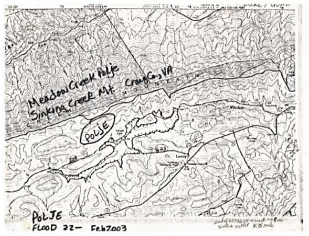

Figure 13. Meadow Creek Turlough/Polje outlined on topographic map (USGS Looney, VA Quardrangle, 1963). John's Creek Mountain is the ridge closest to the Meadow Creek intermittent lake feature. Route 623 intersects Route 624 at the broadest part of the intermittent lake.

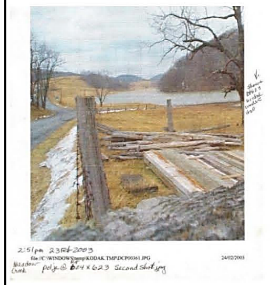

Figure 14. The Meadow Creek Turlough/Polje flooded in February 2003 looking north from Route 624 X 623. Route 623 is flooded to the right of photo.

The area of Rt 624 and Rt 623 was called Moccasin Hollow long ago.

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Release of lake melt water and physical weathering collapsed karstic rock, dropping the surface down, which changed water flows of the Sinking Creek Valley at the Great Eastern Continental Watershed Divide. Meadow Creek flows toward New Castle, Craig's Creek to the James River, Chesapeake Bay and on to the Atlantic Ocean. The rest of Sinking Creek Valley water flows to the New River. The Sinking Creek Valley hydrology changes at the hinge of this karstic collapse (Figure 2, note where north tip of Sinking Creek Valley hinges and drops to the east). Erosion by outpouring of glacial lakes removes overburden material (Posnansky, 1945) and exposes effects of the freeze/thaw cycles such as tilted slabs of rock (Mills, 1998).

It is proposed by the author that one long periglacial lake, snapped in two would become two periglacial lakes, with evidence on each side of the watershed divide in the landform of Sinking Creek Valley. Maywood is part of the periglacial lake that extended north up Sinking Creek beyond Bethel Church Rd, Route 626 and south on down the valley to Newport. Ice or rock dams of the periglacial lake would have blocked the flow of water, filled and frozen at least once, to the highest elevation possible. Excess valley water overflowed its confining rims to assist erosion. Dam breaks during ice melt would have released enough energy to move large rocks and empty the valley of loosened finer material quickly. Cavitation erosion is erosion caused by turbulent flow of meltwater at high velocity over rough bedrock under a glacier. The periglacial lake did not have the weight and force to grind as much material as a large thick glacier would. Some of the surface features of Sinking Creek Valley look like a drained lake with troughs around small islands of bigger loose rocks or resistant bedrock holding residual soils. Colluvium and alluvium derived soil deposits cover the rest of the valley floor. Other sections of the glaciated Ridge and Valley province in Pennsylvania (Potter, 2001 SEFOP) also exhibit vernal pools oriented with karst features caused by cavitation and debris flow deposits.

This evolution of landform and landscape is significant today because the intermittent nature of these lakes means that humans may attempt to build dwellings or other permanent structures in terrestrial environments that change with hydrological, seismical (Posnansky, 1945) or collapse phenomena, such as what is evident here in the watersheds of this study field excursion. The proximity of the surface soil and water with the water in karst rock of a long broad mountain valley lake also means that a lot of water has been stored in the rock and that it could fill above the surface again. The other meaning of the proximity of the subsurface water with the surface water (through karst channels and along rock faces) is that subsurface water becomes surface water and may become exposed to contaminants that would taint the stored clean, potable, cool water if it becomes underground water again.

Drive by: Leaving Meadow Creek by Rt 623 to travel Rt 42, Cumberland Gap Rd, to the left to New Castle, we come to hairpin turns to get us down the steep nose of the Sinking Creek Anticline. Notice the fish hatchery on the left, fed by the Big Spring on the right. There is a limestone quarry near the fish hatchery on the same side of the road as Big Spring. The Big Spring is the "rises" from the water that "sinks" upgradient from here to about where the sign for the Great Eastern Continental Divide sits.

Drive by: Upsections of rock plunging down to New Castle are visible in the roadcut along the nose of Sinking Creek Mountain/Sinking Creek Anticline. Tuscarora (whitish) and Rose Hill (dusky red) and Keffer (whitish) sandstones lean into the hillside at the roadcut. The complimentary sections of rock can been seen across the cascading waters of Meadow Creek. See the limited soil development and colluvium colors from the different parent material rocks along the whole soil and rock profile as we descend into New Castle (Figure 3). The view of New Castle and its fans will be seen from the overlook ahead.

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STOP 5: New Castle Overlook

Figure 15. Overlook on Rt 42, Cumberland Gap Rd. New Castle lies in a plain of alluvial deposits and old oceanic deposits, underlain by sandstones and shales. Castle Sand Plant in distant left of photo (photo by author, 2015).

New Castle is covered by several debris flows and alluvial fans, notice snow catchments along Craig's Creek and Virginia Mineral Springs, and beyond Castle Sand Quarry. John's Creek, Meadow Creek and Craig's Creek all flow to this area, leave deposits and carry on to the Atlantic Ocean.

STOP 6: Castle Sands Quarry and Titan Mid-Atlantic Aggregates (Titan America)

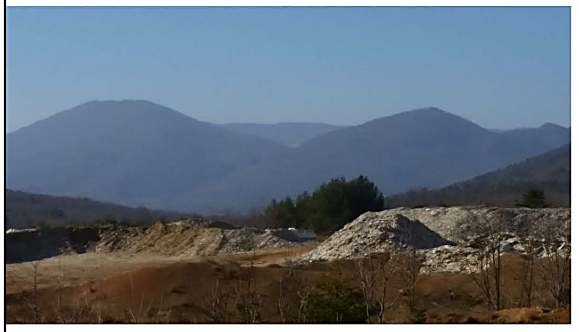

Figure 16. Castle Sands Company Quarry looking south, toward Rt 42 overlook. White material in right foreground is waste high silica siding to be reworked into new siding and other high silica sand products (photo by author, 2015).

Sinking Creek Mountain is approximately four miles distant in this photograph.

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Figure 17. Looking south to Sinking Creek Mountain from the high quarry on Pine Top anticline. Craig's Creek enters from the distant left side of the photograph, John's Creek from the distant right and Meadow Creek tumbles down the Sinking Creek Mountain in the middle right of the photo. High silica, friable Rocky Gap Sandstone and more recent water-borne deposits are mined northeast of New Castle, Virginia at Castle Sands Company Quarry by Titan America (photo by author). Several braided, mosaic water-borne deposits, red and reddish-brown clay rich lenses, bedrock and independent lithologies of large competent rock units and single grain sorted friable sandstone of minimal competence are in the picture above.

Figure 18. This is the quarry rock being mined in the south view in above photo. It is considered Rocky Gap (Ridgley) Sandstone (Froehling & Robertson, 1990). Ridgley sandstone in photo is quite friable (photo by author, 2015).

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Figure 19. Cobbles and other sorted, rounded stones deposited in distinct layers as evidence of alluvial and fluvial deposits at the Castle Sands Quarry (photo by author, 2015).

Figure 20. Banded black manganese oxides or iron oxides laid down in water borne deposit over more competent rock. See structure in bottom of photograph (close up photo by author, 2015).

Figure 21. Level deposits show corresponding high watermarks on the arch of the little anticline in the quarry. This view is of the long side of the anticline and shows a profile 30 feet tall, the arch of the anticline is at the north end of the quarry (photo by author, 2015).

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Figure 22. West wall of Castle Sands Company Quarry (mined by Titan America) showing rip-up and deposit of alluvial fan. Material is friable and somewhat sorted. Black material shows concentration of coating around a "ball" of rip-up rock. The rip-up rock has weak single grain structure but is pulverized and held in place by the matrix of yellowish brown material (slightly shaly, platy) (photo by author, 2015)

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Drive by: Virginia Mineral Springs

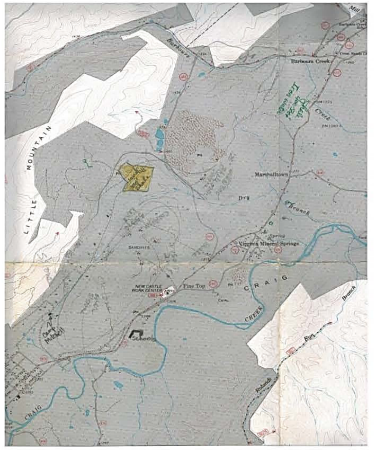

Figure 23. New Castle, Castle Sands Quarry and Virginia Mineral Springs locations (USGS 1:24000 New Castle, VA, 1979). New Castle to lower left, Castle Sands Company upper middle and Virginia Mineral Springs in middle right of figure.

A railroad spur went to New Castle past the Virginia Mineral Springs in the early 1900's. Train passengers could stay at the resort and take health in any one of the seven distinct mineral waters from springs that rose near or on the property (Caldwell, 1995)

Soils here have a perched water table due to a rather thick siliceous fragipan with iron and manganese oxide indurations. Water also flows through channels in the fragipans.

Figure 24. Stereo pair aerial photograph of Castle Sands Quarry and Virginia Mineral Springs locations (DMME, 1963). New Castle to lower left, Castle Sands Company upper middle and Virginia Mineral Springs in upper right of figure.

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STOP 7: Huckleberry Knob

Southeast of the Sinking Creek Mountain ridge, on the Craig Creek side of the mountain, are ancient, giant, rock block slides of Keefer sandstone over Rose Hill sandstone. These lie mainly in the George Washington Jefferson National Forest. The geomorphology (SEFOP, 1989) of the slides and the resultant flora and soil formations have been a topic for scientists of all degrees. This is protected land and is not to be disturbed nor the plants, animals, rocks or soils of any species to be taken.

Figure 25. View of east side Sinking Creek Mountain, Craig County, Virginia (photo by author). Knobs are found at several places in Appalachian Mountains, although these are the "type location" specimens that brought recognition to vernal pools nestled in their sagponds.

Figure 26. Close up view of knobs, east side Sinking Creek Mountain, Craig County, Virginia (photo by author),

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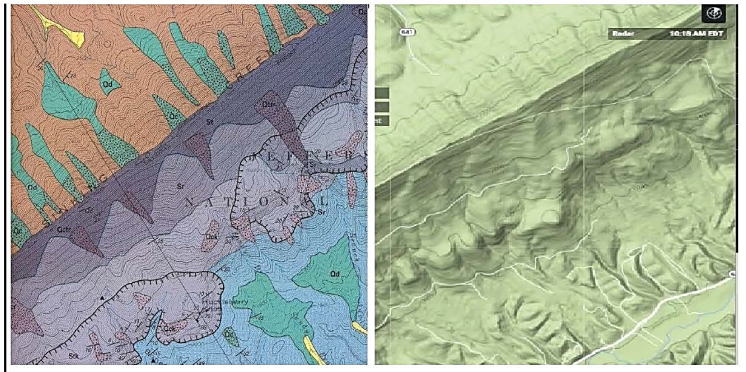

Figure 27. Huckleberry Knob as shown on left by Shultz (1986) and Google Map (2015).

Figure 28. O and A horizons of Huckleberry Knob soil sampled (photo by author with permission by Forest Service, 2015) and acid loving plants: laurel, rhododendron, red oak, chestnut oak, pine (pitch, Virginia, bull) moss, lichen. Soil pH ranges between 4.5 and 5.5.

Geomorphology of the knob: Ice wedges formed between slabs of Keefer sandstone during the last ice age which allowed big slabs of rock to slip on Rose Hill sandstone (Schultz, 1986, Schultz, et al,1989), forming steep slopes at the scarps and slopes that gently hold water and plant debris behind the giant rock blocks after they came to rest. Repeated additions of plant and slope material overlapped, blocked and sealed drainage outlets. Soils in this water holding landform contain pollens of plants that died more than 10,000 years ago and which no longer exist here. Ferrell (1989) described sampling 16 feet deep in a sagpond. Her descriptions fit hydric soil conditions and intermittent vernal pools. The 2002 VAPSS field excursion found a Spodosol remnant that had formed long ago but that no longer possesses the hydrology currently to maintain the moisture. Vernal pools contain ephemeral water and biota. Amphibians sing Spring time songs all throughout this field excursion study area.

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The Great Eastern Continental Divide follows to the head of Craig's Creek at elevation 2200 feet at Rt. 460 and Giles County route 621 and flows to the Chesapeake Bay. The drainage across the road is Poverty Creek, (Pandapas Pond) flows to the New River. Stream capture happens when a shorter distance steeper gradient eats away at resistant rock until it cuts into another drainageway and routes the headwaters to the steeper gradient side. Over time, the headward eroding stream becomes a longer, shallower gradient that erodes more slowly.

Sinking Creek Mountain and John's Creek Mountain are the same Great Eastern Continental Divide that continues between Poverty Creek and Craig's Creek and the watershed divide continues west to Salt Pond Mountain and Potts Mountain.

TABLE 1 Relevant Elevations

Place	Elevation
Sinking Creek Mountain high	3670 ft
Rt 42 at valley floor GECD sign*	2704 ft
Craig's Creek Valley floor at Rt 621 X Rt 460	2200 ft
Meadow Creek Turlough Rt 623 X Rt 624	2365 ft
Sinking Creek at Newport Rt 42 X Rt 460	1880 ft
Huckleberry Knob	2440 ft
Silver Lining Farm SOW 232	2296 ft
Mountain Lake	3875 ft
John's Creek Valley floor	1980 ft
John's Creek Mountain high*	3470 ft

*Great Eastern Continental Divide, GECD

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Day 2

Drive by: Mountain Lake periglacial rock break and heave (SEFOP, 1989) (Figure 29).

Figure 29. Mountain Lake stereopair aerial photographs (DMME files 1963) put into perspective the relief around Mountain Lake, elevation 3875 feet above sea level.

Mountain Lake is surrounded by large slabs of Juniata and Tuscarora sandstone tipped on edge by ice long ago. High water marks are visible when the lake waters are low. Mountain Lake would have frozen into a glacial/peri-glacial lake during the last ice age.

STOP 1: Mountain Lake Biological Station

Mountain Lake Biological Station Spruce Bog sphagnum moss associations and NEON Project

NEON Project: National Ecological Observation Network has stations set up across U.S.A. to monitor climate change. We shall visit the one at Mountain Lake Biological Station. This NEON station and Mountain Lake Biological Station lie adjacent to a protected Wilderness Area.

Drive by: Crest of John's Creek Mountain

John's Creek Valley floor level	1980 ft above sea
John's Creek Mountain high* elevation	3470 ft

*Great Eastern Continental Divide, GECD

Notice large sandstone slabs of rock on-edge, peri-glacial boulder streams, chevrons of broken shaly sandstone in road cuts and where the rock units truncate to another rock unit. Hard Juniata Sandstone lies to the Sinking Creek Valley side or hard Tuscarora Sandstone (John's Creek Valley side) cap the mountain, with dusky red Rose Hill sandstone down section, then whiter Keefer sandstone. Large rock blocks of Keefer

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Sandstone slid down this side of the anticline, too, but not as far. Notice the very large size of the "free" rocks, that loiter on the hillside. Boucher (personal communication, 2015) told me that the Giles County side of the crest had one foot of snow this Winter that stayed and didn't melt as soon as the valley snows. Mr. Boucher said the snows were two feet deep in John's Creek, on the other side of the crest, and it lingered, too. This demonstrates the cold aspect of the slopes as well as orogenic effects and microclimates in this region.

STOP 2: John's Creek episodic deposits

The Norfolk and Western Branch rail line extended to Potts Mountain Valley at Waiteville to haul out of the region's iron ore and timber in the early 1900's. Forests were cut extensively. Severe erosion took place. Remnants of trees more than 200 years old are few now and exist mostly along property borders.

John's Creek infill shows repeated episodic storage and release of sands and colluvial material from narrow "pinch" of fold to broader valley floor where sorted, landslide-suspended material is deposited. Evidence of sorting in soil horizons is inferred as water filled catchments upslope, possibly blocked/dammed by rocks or trees, allowed debris flow slurries to settle large material out of suspension, before incremental release of catchment's contents onto the valley floor. As rainfall and stream power increase, and storage points are hydrated enough to migrate downgradient, they do. Some of these "incremental fans" overlap or incise earlier deposits and eventually get reworked into the streams, where the sediments are then considered alluvial material. Taylor (2009) described overlapping alluvial and debris flow deposits of sandstone landscapes in the Appalachian Mountains.

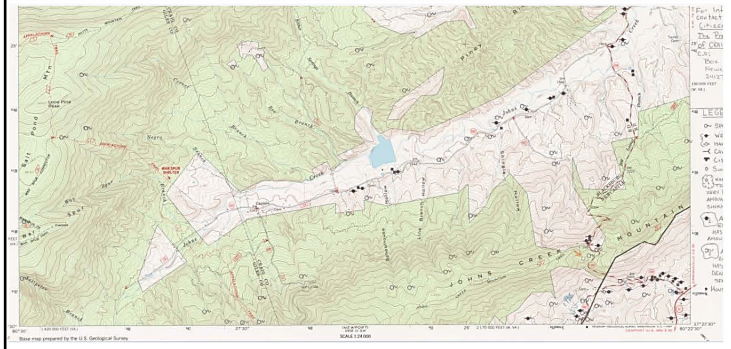

Figure 30. Part of upper John's Creek drainage (Craig County Water Resources Inventory, 1992 with USGS Waiteville Quadrangle, 1965).

The head of the John's Creek watershed marks the Great Eastern Continental Divide on John's Creek Mountain and Salt Pond Mountain. The water and debris flows migrate from John's Creek to New Castle where it joins Craig's Creek, to the James River and onto the Chesapeake Bay and Atlantic Ocean. The other side of the GECD flows water to the New River, north and west.

John's Creek, Oregon Creek and Dick's Creek have water control structures (dams) built in the 1970's to cope with high rainfall and flooding events. These "built" ponds and dams reduce the gradient of the creeks between the natural, colluvial/alluvial catchments in the valley floor. Settling areas get larger, water spreads out as the soils allow it to and the

IND325-1 cont'd

sponge of water and sediment become bigger and deeper. Forested side slopes contribute less soil, rocks and vegetation to Craig's Creek. Mass wasting of this area to any degree can expect to have a residency time in a catchment in this valley, unless there is a really big rainfall event or dam break, before it gets to New Castle.

Given the seismic thrombing of the Earthquake of 2011 felt in Happy Hollow, but not recorded by SOW232 on the John's Creek Mountain side of Happy Hollow, there is a likelihood that wet, sandy sediments could be influenced by an Earthquake, especially during water saturated seasons. Wet, sandy soils giggled will act like quicksand, flow and dewater. This sets up good conditions to form a fragipan, and in this valley, it would likely be siliceous cementation that would occur. The thixotropic nature of these sediments allows them to both hold a lot of very deep water and dry into a dense fragipan (or several) near the surface. Water coming off the mountain slopes still has to go somewhere. Several Elders of John's Creek talk about playing baseball in the field during dry seasons because the land became swampy after big rains. Trenches were dug to drain water out of flat lying fields that were farmed because it was too wet, sometimes even during dry spells.

The water also rises from below the sponge of soil in the catchment. Any hardpan that may have formed acts like a barrier. The water may flow in a channel of polished clean, clear sand grains, sandwiched between barriers or surface as free flowing water refreshed with air. John's Creek has weakly cemented soils that can go through both a wet and a dry phase where the potential fragic properties are morphologically masked. The critical threshold of an irreversible hard fragipan has not happened, yet.

Considering these soils as reversible weakly cemented, flowing sand lobes and gravel lobes, migrating from catchment to catchment, with thixotropic tendencies, John's Creek is a very good candidate for another gush of sand to be delivered to New Castle. It is a time dependent, critical load bearing, shear thinning, agitating event of good size, that would make the sediment storage catchments release the contents, again. Debris fans influenced by sandstone landscapes have been described by Taylor (2009) and Taylor and Kite (2006), and resemble some of what we see in John's Creek Valley where fans may lie dormant for a long time.

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Soil Map—Craig County, Virginia, Giles County, Virginia, and Jefferson National Forest, Virginia
(soil units map)
Natural Resources
Conservation Service
Web Soil Survey
National Cooperative Soil Survey
3/19/2015
Page 1 of 5
4137100 4137800 4138500 4139200 4139900 4140600 4141300
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84
0 1000 2000 4000 6000
Feet
0 450 900 1800 2700
Meters
Map Scale: 1:30,800 if printed on A landscape (11" x 8.5") sheet.

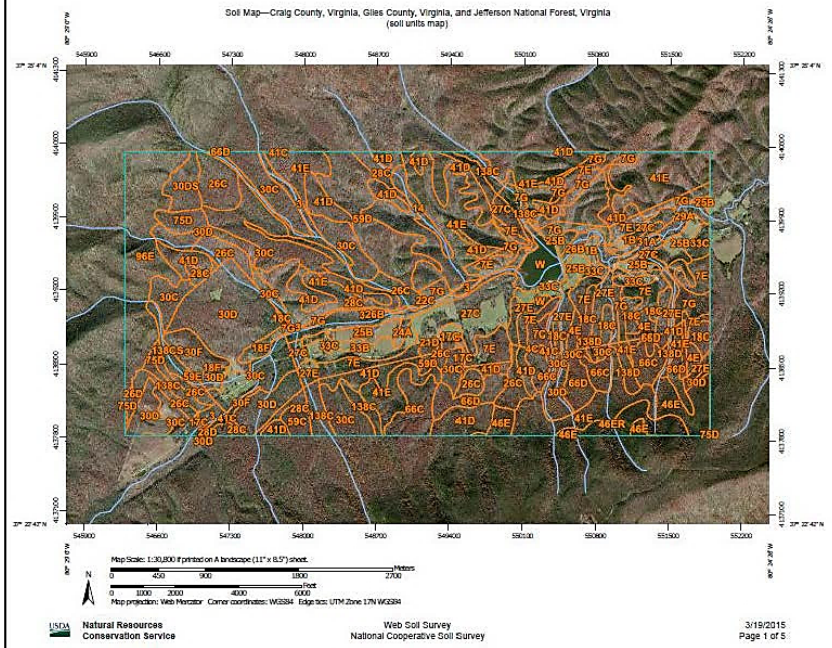

Figure 31. Soil map units in John's Creek Valley along upper John's Creek, Craig County, Virginia (websoilsurvey, 2015). The soils map shows lobes of finer soils and gravelly soils where the reworking of soils and rocks from upslope get deposited. The author found layers of sorted grains in the broader floodplain of John's Creek.

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Table 2 Map Unit Legend for John's Creek soils

Soil Map—Craig County, Virginia, Giles County, Virginia, and Jefferson National Forest, Virginia

Map Unit Legend

Craig County, Virginia (VA045)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1B	Ramsville loam, 2 to 8 percent slopes, rarely flooded	78.8	0.4%
4C	Ballplay fine sandy loam, 8 to 15 percent slopes, very stony	1.4	0.0%
4E	Ballplay fine sandy loam, 15 to 35 percent slopes, very stony	28.0	0.2%
11C	Berks-Weikert complex, 8 to 15 percent slopes	74.4	0.4%
11E	Berks-Weikert complex, 15 to 35 percent slopes	137.4	0.7%
12D	Berks-Weikert complex, 35 to 70 percent slopes	142.3	0.8%
17C	Duffield silt loam, 8 to 15 percent slopes	10.4	0.1%
18C	Hazelton loam, 8 to 15 percent slopes, very stony	66.7	0.3%
21D	Dekalb silt loam, 15 to 25 percent slopes	4.3	0.0%
22C	Jefferson gravelly loam, 8 to 15 percent slopes	1.2	0.0%
24A	Monongahela silt loam, 0 to 3 percent slopes, rarely flooded	6.8	0.0%
25B	Vandalia silt loam, 3 to 8 percent slopes	77.7	0.4%
25BB	Dekalb very stony loam, 3 to 8 percent slopes, frequently flooded	68.7	0.3%
27D	Dekalb gravelly fine sandy loam, 8 to 15 percent slopes, extremely stony	142.0	0.8%
27E	Dekalb gravelly fine sandy loam, 15 to 35 percent slopes, extremely stony	87.6	0.4%
29A	Philo fine sandy loam, 0 to 3 percent slopes, occasionally flooded	20.1	0.1%
31A	Pope fine sandy loam, 0 to 3 percent slopes, frequently flooded	7.1	0.0%
34B	Shelocta silt loam, 3 to 8 percent slopes	39.0	0.2%
34C	Shelocta silt loam, 8 to 15 percent slopes	22.7	0.1%
W	Water	45.6	0.2%

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Craig County, Virginia (VA045)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Subtotals for Soil Survey Area		**1,004.0**	**26.7%**
Totals for Area of Interest		**3,765.5**	**100.0%**

Giles County, Virginia (VA071)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
18F	Gilpin very stony silt loam, 30 to 65 percent slopes	19.6	0.5%
30C	Nolichucky very stony sandy loam, 7 to 15 percent slopes	80.7	2.1%
30D	Nolichucky very stony sandy loam, 15 to 30 percent slopes	234.0	6.2%
30F	Nolichucky very stony sandy loam, 30 to 65 percent slopes	37.9	1.0%
Subtotals for Soil Survey Area		**372.1**	**9.9%**
Totals for Area of Interest		**3,765.5**	**100.0%**

Jefferson National Forest, Virginia (VA606)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
3	Craigsville cobbly sandy loam, 0 to 5 percent slopes, frequently flooded	55.5	1.5%
14	Botetourt loam, 0 to 5 percent slopes, rarely flooded	20.9	0.6%
17C	Sherando very cobbly sandy loam, 3 to 15 percent slopes	1.6	0.0%
26C	Jefferson loam, 3 to 15 percent slopes	145.8	3.9%
26D	Jefferson loam, 15 to 35 percent slopes	6.9	0.2%
28C	Shelocta channery silt loam, 3 to 15 percent slopes	41.8	1.1%
28D	Shelocta channery silt loam, 15 to 35 percent slopes	0.9	0.0%
30C	Laidig cobbly fine sandy loam, 3 to 15 percent slopes	283.8	7.5%
30D	Laidig cobbly fine sandy loam, 15 to 35 percent slopes	65.3	1.7%
30DS	Laidig cobbly fine sandy loam, 15 to 35 percent slopes, extremely stony	34.5	0.9%
41C	Berks-Weikert complex, 3 to 15 percent slopes	6.6	0.2%
41D	Berks-Weikert complex, 15 to 35 percent slopes	264.7	7.0%
41E	Berks-Weikert complex, 35 to 60 percent slopes	686.6	18.2%

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Jefferson National Forest, Virginia (VA806)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
46E	Dekalb cobbly sandy loam, 35 to 60 percent slopes, very stony	68.9	1.8%
46ER	Dekalb-Rock outcrop complex, 35 to 60 percent slopes, extremely stony	46.8	1.2%
59C	Gilpin channery silt loam, 3 to 15 percent slopes	15.7	0.4%
59D	Gilpin channery silt loam, 15 to 35 percent slopes	127.4	3.4%
59E	Gilpin channery silt loam, 35 to 60 percent slopes	1.4	0.0%
66C	Ballegap sandy loam, 3 to 15 percent slopes	106.9	2.8%
66D	Ballegap sandy loam, 15 to 35 percent slopes	70.9	1.9%
75D	Lily gravelly sandy loam, 15 to 35 percent slopes	33.0	0.9%
96E	Dekalb-Dekalb, shallow complex, 35 to 60 percent slopes, very stony	182.0	4.8%
138C	Oriskany very cobbly sandy loam, 3 to 15 percent slopes, very stony	76.9	2.0%
138CS	Oriskany very cobbly sandy loam, 3 to 15 percent slopes, rubbly	20.1	0.5%
138D	Oriskany very cobbly sandy loam, 15 to 35 percent slopes, very stony	24.4	0.6%
Subtotals for Soil Survey Area		2,389.4	63.5%
Totals for Area of Interest		3,765.5	100.0%

NRCS Soil Survey staff can map soil units larger than five (5) acres. Soils can vary within five acres and so, for ease, the dominant soil characteristics are mapped. The whereabouts of the gravelly or coarser or finer descriptions indicate how far lobes of sediment travelled when they flowed in a debris or alluvial fan. Heavy and unsorted rocks fall out of solution/turbid water early and finer grains get sorted and settle as the water can no longer carry them. Sometimes episodes overlap and built raised lenses or dam islands, that then later trap the next muddy waters. We saw this at the Castle Sands Company Quarry, lithified.

The author described soils in the upper floodplain of John's Creek and called it Nicelytown Series:

Fine-loamy, siliceous, semiactive, mesic Aquic Paleudults

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Soil Description of John's Creek floodplain soil:
Craig County Tax map number 91-A-9
Upper John's Creek, floodplain
Pit 1 Nicelytown Series: Fine-loamy, siliceous, semiactive, mesic Aquic Paleudults, not quite fragic enough to call it fragic (Moomaw Series)

Ap 0-9"; yellowish brown (10YR5/4) silt loam, medium moderate subangular blocky structure; friable, slightly sticky, slightly plastic; many medium roots; many medium tubular pores; krotavina (animal burrows); clear sand grains; 50 minutes per inch percolation rate; <5% small stones or rocks; clear smooth boundary to

Bw1 9-19"; reddish yellow (7.5RY6/6) gravelly silt loam; fine to medium weak to moderate subangular angular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few fine tubular pores; krotavina; weak (siliceous) sand bridging; 70 min/in perc rate; >35% sorted gravels; pale greys showing as pit dries; clear smooth boundary to

Bw2 19-24"; reddish yellow (7.5YR6/6) gravelly silt loam; fine to medium weak to moderate subangular angular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few fine tubular pores; krotavina; weak siliceous sand bridging; slightly denser than above 75 min/in perc rate; >35% sorted gravels; clear smooth boundary to

C1 24-27"; brownish yellow (10YR6/6) gravelly silt loam; fine to medium weak to moderate subangular angular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few fine tubular pores; krotavina; siliceous silt coatings, possibly fragic when dry; slightly denser than above 85 min/in perc rate; >60% sorted gravels; many medium and thick black manganese precipitations/concretions/ concentrations and many medium black manganese stains; clear smooth boundary to

C2 27-32"; brownish yellow (10YR6/6) gravelly silt loam; massive and rock controlled structures; friable, slightly sticky, slightly plastic; no roots; no pores; 100+ min/in perc rate; > 60% sorted gravels and channers;

C3 32-40"; yellowish brown (10YR5/6) gravelly silt loam; massive and rock controlled structures; friable, slightly sticky, slightly plastic; no roots; no pores; cemented; 110+ min/in perc rate; > 60% sorted gravels and channers;

IIC 40-54+"; light grey (10YR7/2) silt loam; massive and rock controlled structures; friable, slightly sticky, slightly plastic; no roots; no pores; 120+ min/in perc rate; less gravel than above 20% gravels and channers; many medium and thick black manganese precipitations/concretions/ concentrations and many medium black manganese stains

These soils were moist at the time I described them and they passed water slowly. These are probably reversibly fragic: that is, dry they become quite hard; moist, they look innocent; and wet, the soils become a sponge. Sponge soils can have a slow slump, constant positive water pressure, exposed water. These soils have been trenched to dry the soils for farming. Oxygenated water flowing through sandy soils becomes polished clean. The only place on Earth that the endangered James Spinymussel lives is in this headwater area, sponge soils, of John's Creek, Oregon Creek, Dick's Creek of Craig County, Virginia.

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Conclusions:

Mr. Jay Larimore with the National Oceanic and Atmospheric Administration presented conclusions of climate variability through time and showed a map indicating regional moisture and temperature regimes now and modelled expectations of the future 100 years (Larimore, 2009). Several considerations he made were:

Conclusions of Mr. Larimore:

1) The intensity of storms and drought will increase with time
2) For part of that time, the area of our tour will have more precipitation, primarily as rain.
3) High intensity rainstorms erode soils at a greater rate than low intensity rainstorms
4) It can be expected that more erosion will take place over the next 100 years.
5) Vegetation holds soil in place. Wilderness areas are a stable environment that can tolerate more rainfall and disperse water more slowly, lessening erosion
6) Influences of population pressure will continue to enhance erosion

Furthermore, the conclusions of this Author are:

7) If ever there was a finger to protect, it is the finger of the Sinking Creek Valley of Craig County and all of the surrounding mountains of the Great Eastern Continental Divide.
8) Consider this region a "NO-BUILD-ZONE" due to the high risk of damaging clean water here.
9) Given that the deposits we have seen almost all show large scale catastrophic slope movement at times of episodic high rainfall, it can be expected that more erosion will take place over the next 100 years.
10) Wilderness and undisturbed areas enhance the physical stability of an environment to be able to tolerate more rainfall and disperse water more slowly, lessening erosion, lessening infilling of sediments and decreasing the risks of water contamination by decreasing erosion and mass wasting
11) Influences of population pressure will continue to effect erosion into all damplands, wet lands and intermittently wet lands unless adequate buffers such as "No-Build-Zones" are created
12) Geologic Power will change a stable landscape and the Saltville Fault is still active (as of 2011)
13) Periglacial influences were presented in the 1989 SEFOP excursion and are considered here to extend to the Sinking Creek Valley periglacial lake and the Meadow Creek Turlough as one long periglacial lake
14) Sinking Creek Valley has calcareous colluvium, calcareous residuum and calcareous fragipans
15) Siliceous fragipans formed in siliceous colluvium surrounding the Sinking Creek anticline
16) Siliceous fragipans and Calcareous fragipans both impact water movement through the soil profile
17) Weakly cemented fragipans may also rewet to act and look like non-cemented soils, peri-fragic
18) Episodic migration of alluvial and saturated debris flow material sorts the bed load trailing, in some places, individual perfectly formed quartz crystals
19) Steep mountain slopes erode for many reasons
20) John's Creek Mountain and Sinking Creek Mountain ridges have steep slopes to headwater springs
21) John's Creek Valley has evidence of weakly cemented, deep, sorted, thixotropic, peri-fragic, episodic, epi-migrating deposits that may have ice-dam, peri-glacial periodicity
22) Craig's Creek side of Sinking Creek Mountain also has evidence of weakly cemented, deep, sorted, thixotropic, peri-fragic, episodic, epi-migrating deposits that may include peri-glacial periodicity
23) Humans need clean water
24) Humans can enjoy clean water between episodes of geologic unrest
25) James Spinymussels need clean water

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Conclusions, continued:

26) Humans and James Spiny mussel can co-exist in Oregon Creek, Dick's Creek and John's Creek Valley watershed

27) The raised valley of Sinking Creek and upper John's Creek gets cold and stays cold longer than the valleys at lower elevations. Sub-zero temperatures, ice wedging and heaving still happen here, above ground and below ground. Water storage is underground, in sand grains to karst to big slab rocks of sandstone. This has been the purpose the this year's Southeast Friends of the Pleistocene Field Excursion, to show you uncommon, limited availability, natural, endangered landscapes and landforms, water cycling, fantastic geology and soils in a beautiful clean cold wet land experience.

28) Humans can protect the clean water

29) Sinking Creek Valley stores cool, clean, fresh, free-flowing, natural water, underground, free; not in a bottle of unknown source. This is the source water for Chesapeake Bay as well as the Gulf of Mexico. There are more miles of the Great Eastern Continental Divide in Craig County than any other county in the Commonwealth of Virginia. Our common wealth of fresh water it is.

30) Protect the Source waters that are still clean.

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Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia, Second Version. Nan Gray, © 2015 Soil Works, Inc.

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The information of Craig County's natural environment and natural resources was obtained from numerous sources including: the Virginia Division of Mineral Resources, the Department of Environmental Quality, Virginia Department of Forestry, U.S. Forest Service and the USDA Natural Resources Conservation Service and private Citizens of Craig County, including me. I have lived in Happy Hollow since 1987 and recorded precipitation events since 1996.

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About the Author

Nan Gray is a Licensed Professional Soil Scientist, has a Master of Science degree in Agronomy from the University of Illinois and a B.S. in Chemistry from Wilmington College, Wilmington, Ohio. Ms. Gray is also the President of Soil Works, Inc., a SWAM and DBE business. The author and her husband, Eric Day (Entomologist) have lived in Sinking Creek Valley since 1987 and are also Farmers of fresh, local, mountain grown, organic asparagus. They thrive in Craig County, Virginia.

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Appreciation to these folks who influenced me with this undertaking

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National Ecological Observatory Network (NEON)
Natural Resource Conservation Service
Soil Science Society of America
Mountain Lake Biological Station
other SEFOP field excursions
U.S. Forest Service
Virginia Department of Environmental Quality
National Society of Consulting Soil Scientists

IND325-1
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Announcement for the Southeastern Friends of the Pleistocene (SEFOP) Annual Field Trip:

SEFOP 2015: Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

April 25-26, 2015 THIS EVENT HAS PASSED

The trip will explore the soils and surface processes of damplands, intermittently wet lands and wetlands in karst, alluvium/colluvium, sagponds, fens and seeps in Craig, Giles and Montgomery Counties, Virginia; Mountain Lake Biological Station Spruce Bog and NEON project, the lake at Mountain Lake, mosaic wetlands at Maywood in Sinking Creek Valley; the intermittently wet land turlough/polje of Meadow Creek; the Castle Sands Quarry near the Virginia Mineral Springs of New Castle; the ancient, giant rock-block landslide emplacement of Huckleberry Knob and its sagpond on Sinking Creek Mountain, and episodic infill features of John's Creek Valley where the endangered James spinymussel lives are all on the tour and more!

Day 1 will run from ~8 am – 5+ pm, Start in Sinking Creek Valley and end up in Craig's Creek Valley. Day 2 from ~8 am – 2 pm, start in Sinking Creek Valley, up to Mountain Lake, then John's Creek Valley.

Free primitive camping and delicious clean water will be available starting Friday night at a farm about 30 minutes North of Blacksburg, via 460 W to Newport and northeast on Route 42. The trip will depart from this location on both days. Or folks may find their own lodging in Blacksburg, VA.. Participants will be responsible for their own transportation and all of their own meals.

Cost: $$$ THIS EVENT HAS PASSED

We shall stop at New Castle for lunch Saturday. You may pack your own lunch or order a box lunch for Saturday when you confirm the trip. All other food and fieldtrip/camping necessities should be brought with you, including

Hardhat

Safety glasses

Hard toe boots

for the quarry visit.

If you are interested in this trip and plan to join us, please contact me directly.

P.S. THIS EVENT HAPPENED 25-26 April 2015 in a perfect cold intermittent rain and cool temperatures, when a bonfire felt especially good and the company, engaging.

IND325-1
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ROAD LOG GUIDE DAY 1 SEFOP Annual Field Excursion for 2015:

Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

SEFOP Road Log Day 1, 25 April 2015

Base Camp Silver Lining Farm
Turn north out of drive way and drive up Happy Hollow Rd.
Turn right at Rts 658 X 662
Turn left onto Rt 42, Cumberland Gap Rd.
Park at Maywood Triangle, Stop 2

Continue upgradient, northeast on Rt 42
Olga Smith Family House on left and Farm

Park at Sinking Creek Store, Stop 3
Walk up John Price driveway to see active sinkholes

Continue northeast on Rt 42
Notice sinkholes and surface water of Sinking Creek

Great Eastern Continental Divide
Continue on Rt 42
Turn left onto Rt 624
Notice gushing spring emerge from hillside – this is the "rises" of water outlet of polje on left
Go approximately 1 mile
Polje "sinks" and larger lake floor of polje/turlough on left

Turn left onto Rt 623, Stop 4
Waggle over to Rt 42
Turn left onto Rt 42
Notice Fish Hatchery on left, Big Spring on right, limestone quarry on right
Notice Sandstone blocks on left roadcut
Continue down mountain on Rt 42 to overlook on right, Stop 5

Continue down mountain to Rt 311, New Castle
Turn left onto Rt 311
Turn right onto Rt 615
Park at Mick or Mack Grocery Store for lunch

Turn left out of parking lot onto Rt 615

Turn left onto Rt 609
Continue on Rt 609 to Castle Sand Plant Quarry, Stop 6
Park on left side of road

Continue north on Rt 609
Turn right onto Pleasant Valley Rd
Turn right onto Rt 615
Notice landform of Virginia Mineral Springs area on left

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cont'd

ROAD LOG GUIDE continued DAY 1 SEFOP Annual Field Excursion for 2015:

Continue on south Rt 615 to New Castle
Turn left onto Rt 311

Turn right onto Craig's Creek Rd., Rt 621
Continue to Caldwell Fields
Park in parking lot on left

Consolidate group into as few vans as possible
Drive to Huckleberry Knob, Stop 7 (this will take 25 minutes)
Return to parking lot

Turn right onto Rt 621
Continue to Rt 460
Turn west-right to Newport and Base Camp, east-left to Blacksburg
Turn right onto Rt 42 at Newport
Continue northeast on Rt 42, 8.5 miles

Turn left onto Rt 662, Happy Hollow Rd.
Continue on Rt 662, 0.7 mile
Turn left onto Tanyard Trail and Happy Hollow Rd. Base Camp

IND325-1
cont'd

ROAD LOG GUIDE DAY 2 SEFOP Annual Field Excursion for 2015:

Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

SEFOP Road Log Day 2, 26 April 2015

0.0 Base Camp Silver Lining Farm
Turn north out of drive way and drive up Happy Hollow Rd.
Turn right at Rts 658 X 662
Turn right onto Rt 42, Cumberland Gap Rd.
Continue to Newport

Turn right at Rt 42 X Rt 460 and head west
Continue on Rt 460 to Mountain Lake Rd., Rt 700
Turn right onto Mountain Lake Rd.
Continue on Mountain Lake Rd to top of mountain
At Mountain Lake Hotel turn left onto Rt 613
Travel Rt 613 to Mountain Lake Biological Station, Stop 1

Leaving the MLBS turn left onto Rt 613
Turn onto Rt 700 past Mountain Lake Hotel
Turn left onto Cork Screw Rd., Rt 602
Turn left onto Rt 601 to go up and over John's Creek Mountain

Notice larges plates of sandstones, broken and heaved up at 30 degrees.

Continue down John's Creek Mountain into John's Creek Valley on Rt 601.
Turn right on to Rt 632, John's Creek Rd., Stop 2
Notice flood plain shape and sizes of deposit material.

Continue on John's Creek Rd to Rt 658. *

Turn right onto Rt 658 and go up and over the Great Eastern Continental Divide on John's Creek Mountain
Turn right onto Rt 662, Happy Hollow Rd
Arrive Base Camp, turn right onto Tanyard Trail

* If time permits we may see Craig Healing Springs
Continue on Rt 632 to Maggie, turn left onto Rt 658, Dick's Creek Rd.
Craig Healing Springs is near Rt 658 X Rt 569
Turn right onto Rt 569
Turn right onto Rt 632
Continue on Rt 632 back to Maggie
Continue on Rt 632 to Rt 658 over John's Creek Mountain
Turn left onto Rt 658

Deny Mountain Valley pipeline application and choose the "No Action" option.

IND326-1 This is a proposed continuous ditch and pipeline with highly disturbed, highly compacted fill material replacing healthy functioning soil and FERCs DEIS says no impact to rock or soil...what is better than a healthy functioning soil and all of the ecosystem benefits that a healthy soil offers? Nothing better than healthy soils making healthy water. The soils and geology would be forever impacted, that is not the same as no impact. Can't see the forest for the trees...

The whole function of ecosystem services is to have healthy soils that produce clean potable water. We have that here. Do not allow land disturbances anywhere there is clean water. * *Deny MVP any more time, money or permits.* * *Deny MVP application.* **Decide healthy soil makes clean water, and these areas are not suitable for the proposed land use.* **Decide the MVP approximate ROW is an unsuitable land use for the entire route.* * *Decide the best action is "No Action" with MVP.*

IND326-1 Soils are addressed in section 4.2 of the EIS. See the response to CO14-2 regarding compaction.

INDIVIDUALS

IND327 – Elizabeth Struthers Malbon

20161208-5005 FERC PDF (Unofficial) 12/7/2016 8:56:55 PM

To: Federal Energy Regulatory Commission

From: Elizabeth Struthers Malbon
1391 Breckenridge Drive
Blacksburg, Virginia 24060

Re: Mountain Valley Pipeline, CP16-10-000
DEIS: soil and water in forested areas of karst topography

Date: December 7, 2016

IND327-1

As a resident of the Preston Forest Subdivision in Blacksburg, Montgomery County, Virginia, I am writing to express my disbelief and dismay at the naivety of the Draft Environmental Impact Statement (FERC/DEIS-D0272) of the Mountain Valley Pipeline (Docket Number CP16-10-000) concerning soil and water in forested areas, especially areas of karst topography.

The DEIS does admit, in its initial description of the "General Environmental Setting" on page 4-2, that "The terrain is an unglaciated plateau with rugged hills underlain by carboniferous rock." That should be a signal that careful study is needed before planning to dig a trench for a 42"-diameter pipeline. Yet a few pages later the DEIS also admits that "Surficial geology that would be crossed by the MVP has not been mapped in detail in the project area" (4-10). So, MVP proposes to initiate such a project without a detailed mapping of what it is likely to find? That is not encouraging.

Again, the DEIS does admit that there are serious challenges to address when considering such a mammoth destruction/construction project in such terrain (admittedly as yet unmapped): "Geologic hazards including seismicity (e.g., earthquakes) surface faults, soil liquefaction, landslides, flash flooding, karst terrain and subsidence, shallow bedrock, aid producing rocks and soils, and blasting were evaluated for the proposed projects" (4-21). Certainly, the officials of MVP have learned some new terms from our local experts since their first appearance in Montgomery County, when they had never heard of "karst topography"! Now the DEIS does provide this statement about "Karst Topography": "Karst features such as sinkholes, caves, and caverns can form as a result of the long-term action of groundwater on soluble carbonate rocks (e.g., limestone and dolostone). These features could present a hazard to the pipeline due to cave or sinkhole collapse. Because karst features provide a direct connection to groundwater, there exists the potential for pipeline construction to contaminate groundwater resources when crossing those features (see section 4.3.1.2)" (4-34). Yet MVP seems not to have learned respect for the realities of the mountains and valleys on which we live, including the fragility of soil and water resources in forested areas of karst topography.

An example of MVP's lack of serious respect for realities on the ground (and in the ground) is found in the words of the Executive Summary of the "Major Conclusions": "We determined that construction and operation of the projects would result in limited adverse environmental impacts, with the exception of impacts on forest" (ES-14). That is quite an

IND327-1 See the response to comment IND257-1 regarding surficial geology. Soils are addressed in section 4.2 of the EIS; water in section 4.3. The EIS addresses karst terrain in section 4.1. See the response to comment IND62-1 regarding Dr. Kastning's report. See the response to comment CO14-1 regarding blasting. See the response to comment IND3-1 regarding drinking water.

IND327-1 cont'd

exception, especially given that the DEIS admits just pages earlier that "The MVP pipeline route would mostly cross forest (81 percent)" (ES-7)! So, on 81% of the land the MVP proposes to cross, MVP admits that there would be more than "limited adverse environmental impacts." I cannot agree more.

I am certain that by now the FERC and MVP are well aware of the report by Ernst H. Kastning, "Geologic Hazards in the Karst Regions of Virginia and West Virginia: Investigations and Analysis Concerning the Proposed Mountain Valley Gas Pipeline," July 3, 2016 (available online at https://powhr.org/kastning-karst-study/). Dr. Kastning, a geoscientist, hydrologist, and engineer with over fifty years of experience and more than 100 scholarly publications, states in his Executive Summary: "The conclusion of this report is that the karst and associated hazards constitute a serious incompatibility with the proposed pipeline. The effect of these threats on the emplacement and maintenance of the line, as well as the potential hazards of the line on the natural environment, renders this region as a 'no-build' zone for the project" (Kastning Report, 1). Thus, from both an environmental point of view and an engineering/business point of view, Dr. Kastning recommends not this or that mitigation, but not building a pipeline in this area at all. If MVP officials have no concern for the environment (a view considerable evidence in the DEIS does suggest), it would seem they would have concern for the engineering and business challenges that would affect their profit margin for themselves and their shareholders.

I, however, *do* have environmental concerns—for myself and others, in this generation and those to follow. My husband and I live in one of those forested areas—the 81%—where the "adverse environmental impacts" would surely be more than "limited." Although our residential property was on the original route proposed by MVP, the routes have changed a number of times since then, and our property is no longer on the preferred proposed route. But our concern was never a matter of "not in my backyard." The earth is our backyard. Still, the presently preferred proposed route skirts our neighborhood, and we would certainly feel the environmental impacts should the MVP be constructed. Here I will focus on the threats to soil and water.

The karst topography of our area of Montgomery County involves limestone channels and caves, to say nothing of abandoned coal mines, throughout, plus an extremely thin layer of topsoil, with some bedrock outcroppings. We could not dig down to pour the footers for our one house without making an impact on groundwater resources and requiring additional mitigation measures. In fact, our house sits about 6 inches to a foot higher than was originally planned because the contractor ran into bedrock when digging the foundation. How does MVP expect to dig and blast a trench for a 42"-diameter pipeline without doing irreparable damage to the soil and the water of this karst topography?

When a small portion of our property was graded for a driveway (just a driveway, not a deep trench) to provide access for construction equipment, an underground stream was inadvertently cut through. The contractor, working with us, placed a series of French drains underground to redirect the water thus disturbed and send it on its way on down the hill to the natural stream that crosses the midpoint of our long and narrow lot. Even then, when construction was completed and, a year later, we paved our driveway, one portion of that underground stream still pours across our driveway when rains or spring

IND327-1 cont'd

snowmelts are heavy. Additional mitigation measures again were required; I constructed a "stream," lined with native stone (easily obtained any time I dig a hole to plant a shrub or flower—not with a shovel, which is useless here, but with an adze or pick ax). Eventually we had the driveway repaved with a spillway into this constructed "stream" for this water, trying to take its natural course down the hill to the stream that eventually feeds into the New River, our area's major water supply. So, for MVP to imagine that they can dig miles and miles of an approximately 7-10-foot trench in this neighborhood, or at the edge of this neighborhood, with no serious impacts to groundwater resources seems ludicrous—and dangerous. The DEIS conclusion about groundwater is *not* reassuring: "Construction activities are not likely to significantly impact ground water resources because the majority of construction would involve shallow excavations" (5-3). Is 10 feet shallow? Shallow grading for our driveway cut into a seasonal underground stream. And what is a significant impact to ground water? If 100% of a household's water is contaminated or a family's well is 100% dry (or even 50% reduced in flow), *that* is significant.

IND327-2

We, like all our neighbors, are very concerned about our well. Without our well, our house would be unlivable. In the originally proposed route of the MVP, our next-door neighbor's house would have been destroyed. There is simply not enough room between the existing power line and their detached garage, well, and house even for the final corridor for the pipeline, much less the construction corridor. (One wonders about the lack of planning for that original route!) That proposal would have put our house next to—and downhill from—this proposed major construction project. Although MVP officials repeatedly told local audiences that mostly they would be digging this trench, not blasting it, they have always gotten laughs from those of us who have tried to dig on Brush Mountain. The men struggling to dig a relatively small trench for our TV and internet cable said, "Everybody knows this mountain ain't nothing but a rock." Apparently not everybody knows; MVP seems not to know. To create a trench large enough for a 42"-diameter pipeline across Brush Mountain WILL require blasting. And it seems impossible to believe that such blasting would not cause significant impact to the underground streams that supply all our wells. Fragile limestone channels will collapse. Our well, no longer adjacent to the proposed pipeline, would still be endangered because these limestone channels under Brush Mountain are connected in ways that do not show up at the surface. The Kastning report points out that researchers with the Virginia Karst Project of the Department of Conservation and Recreation found dyes in groundwater in karst terrain to travel over four miles (Kastning report, 21)! Again the DEIS conclusion about groundwater is *not* reassuring: "In the event of construction-related impacts [which would only be *considered* within 150 feet, or 500 feet in karst terrain, of the pipeline and aboveground facilities and would have to be proved according to MVP's standards not the homeowner's needs], the Applicants [MVP] would provide an alternative water source" (5-3). And what alternative water source might that be? Bottled water as a replacement for a fully functioning well? Water trucks periodically? The town of Blacksburg is not in a position to offer town water to the residents of my neighborhood. Town engineers are among the many who know that "this mountain ain't nothin' but a rock."

IND327-3

In addition, septic drain fields would be endangered by the blasting required to construct such a deep trench across Brush Mountain, as well as by the erosion that would inevitably take place. Drain fields are essential to the return of water to the aquifer in a purified state.

IND327-2 See the response to comment CO14-1 regarding blasting. See the response to comment IND3-1 regarding drinking water.

IND327-3 Section 4.3 of the final EIS has been revised to address potential project impacts on septic systems on private property.

IND327-3 cont'd

Like most homes in Preston Forest, we have various exploratory holes on our property, made in the search for a small portion of land that would "perc" sufficiently to support a septic drain field. On our land, only one spot was found, uphill from our house, so we have to have a pump for distribution. Our drain field is closer to the road than our house—and would have been very close to the proposed original route of the MVP. I wonder how many other homes, closer to the currently preferred proposed route now than ours, are in a similar situation. Were this project to be built, the roads on Brush Mountain would have huge construction equipment rumbling up and down them for years, disturbing not only residential quiet and traffic but potentially causing underground shifts as well. A functioning and uncompromised drain field is required to make a home on Brush Mountain livable. The town of Blacksburg is not in a position to supply town sewer lines in a mountainous area of karst topography.

IND327-4

From the initial contacts in Montgomery County through the publication of the DEIS, Mountain Valley Pipeline officials have consistently either ignored or minimized the huge risk of serious soil erosion in forested areas. And, as the DEIS admits, 81% of the area that the MVP proposes to cross would be forest, where more than "limited adverse environmental impacts" (ES-14; ES-7) are expected. When a wide swatch of land is cleared of all trees and vegetation that hold the thin and fragile soil on the hillsides (that's all we have here, hillsides, no flat surfaces), the rains that fall cannot stay on the hillside and soak in. They just run quickly downhill, taking what little bit of top soil might survive the initial digging and blasting downhill to streams that lead to other streams (including the one behind my house) and eventually to the New River, turning these natural streams into muddy and silted-up channels and endangering a major water supply of the area. In the DEIS, I have found no reforestation plan for the construction corridor that is proposed to be cleared beyond the permanent pipeline corridor. Such a plan would require not only planting appropriate hardwood trees to replace those cut and uprooted, but continuing to maintain those trees with water and deer protection until the trees were established, probably at least five years. Sowing grass seed on the 50-foot permanent pipeline corridor and walking away would do very little to stop erosion under normal weather conditions, and heavy rainfall would turn whole mountain sides into muddy rivers and cause exponential loss of soil.

When we built our house, we too disturbed the land. But we worked hard to minimize that disturbance, forbidding the use of heavy equipment beyond a narrow perimeter of the house in the construction phase, and less than that later. And still, we had to work hard to arrest erosion caused by creating a terrace for one house with a small footprint (we built up instead of out). My father, with experience in the Civilian Conservation Corps of the New Deal era, helped me build our first brush dams to slow the flow of rainwater on the newly cleared (but minimal) paths for sewer lines and electric lines. We mulched the cuts near the house heavily with double-shredded tree bark for years, slowly coaxing the growth of ground covers there and thus enabling the sloping ground to absorb rainwater and not just create runoff. We were intentional about this. We knew that construction in an area like ours requires minimal disturbance and careful mitigation, planned in advance and carried out consistently—for years. We made that commitment. We have not tried to limit our liability, as has MVP, LLC. We sense no commitment from MVP even to recognize the scope of the problems, much less avoid them or try to mitigate them (not always possible, of

IND327-4 See the response to comment IND70-1 regarding erosion. As discussed in section 4.2 of the EIS, the Applicants would separate topsoil from subsoil in residential and agricultural areas. Sinkholes are addressed in section 4.1 of the EIS. The MVP is not expected to have any impacts on the commenter's parcel, which is located about one mile away from the pipeline.

IND327-4 cont'd

course—once a bat cave is destroyed, one cannot "mitigate" it back; once a stream is destroyed; it cannot ever be the same again).

Like some of my neighbors, we have a couple of small sinkholes near our house (unless they are part of one larger sink hole). Adding topsoil by several 40-pound bags every year for safety's sake was working for a number of years, but now I cannot keep up. One can only imagine how many sinkholes MVP will encounter when digging and blasting this proposed trench through or skirting our neighborhood. But we worry more about the sinkholes they will not notice, the sinkholes and limestone caves that will be just under this enormous 42" pipeline, the sinkholes that may well cave in from the weight of the pipeline when it is buried and filled with pressurized fracked gas. Then unsupported sections of pipe would be in danger of developing cracks and leaking into the groundwater and polluting whatever underground streams were not destroyed in the construction phase. We had our well water tested again recently, and the results confirmed what our taste tells us: it is an excellent well, supplying us with pure, safe water, sufficient in both quality and quantity. We and all the residents of Brush Mountain would like to keep it that way, and we know the destruction/construction proposed by the MVP would pose a serious threat.

The general rule of fairness is "if you break it, you've bought it." Our wells, septic systems, houses, driveways, roads, and land on Brush Mountain are not broken now. Why should we sacrifice our water, our land, our homes, our safety, and our quality of life for the profits of an outside corporation, who has made it plain that they are working hard to limit their liability (LLC) and maximize their quick profits? The true and full costs should be paid for by the those who enjoy the profits, not by others. And because the damage to soil and water proposed by MVP would be beyond even their deep pockets to pay for—some of it being irreparable—good business sense would suggest what Dr. Kastning's report suggests: karst topography is a no-build zone for pipelines.

From our beginning on Brush Mountain, we have taken the attitude of stewards of the earth as we constructed our house in this beautiful but fragile terrain. We have maintained that attitude as we have maintained our home and our land. Most recently, we have added solar panels to the roof of our house, already maximally situated for passive solar heat gain, in order to reduce our carbon footprint. We chose this neighborhood for the woods and the stream, for the plant life and the wildlife. We have seen nothing in the MVP reports—from the original written and oral reports to the current DEIS—or in the litigation history of the parent companies who have been sued for environmental destruction elsewhere, to make us think that MVP understands such an attitude at all. We in Montgomery County value our water, our watershed, our mountains, our valleys, our land, our heritage. It is clear that MVP sees what we value as obstructions that can be confiscated for their corporate gain and require no mitigation. There is no basis for a working relationship here. We are not prepared to give away our forests, soil, and water. We refuse to be a sacrifice zone. We implore the Federal Energy Regulatory Commission to deny a permit to Mountain Valley Pipeline (Docket Number CP16-10-000) on the basis of the predictable and irreversible environmental risks to soil and water of its proposed construction and maintenance as revealed in the Draft Environmental Impact Statement.

INDIVIDUALS
IND328 – Lillian H. Moore

December 7, 2016

Ms. Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: Mountain Valley Pipeline proposal, Docket No. CP 16-10

Dear Ms. Bose and Members of the Commission,

IND328-1 I am a more than 50-year resident of the Appalachian Mountain region of Virginia and am truly distressed to hear of the proposed desecration of our beautiful mountains by the construction of a pipeline through the area, and even more distressed to learn that there are thoughts of putting this pipeline through the town of Newport, VA.

A major concern is the disruption of the environment due to the construction of the pipeline. And a concern of equal if not greater importance is the potential destruction to a vast area if there ever is leakage or spillage resulting in fire or contamination of the environment by hazardous gasses and the results thereof.

I could fill pages with comments, but I am sure that you probably are aware of most of them. Suffice it to say that, as a concerned citizen of both our local and global environment, I implore you to complete an accurate, unbiased Environmental Impact Study based on thorough scientific analysis of factors including the well-informed, professional comments from local experts living near the impacted area. Please consider your conclusions carefully and conscientiously. Thank you.

Sincerely,

Lillian H. Moore, Ph.D.

University Distinguished Professor Emerita
Microbiology
Virginia Tech

Cc: US Forest Service, comments-southern-georgewashington-jefferson@fs.fed.us
US Bureau of Land Management, vcraft@blm.gov, mliberat@blm.gov
Appalachian Trail Conference, lbelleville@appalachiantrail.org

IND328-1 See the response to comment CO14-3 regarding spills. See the response to comment IND92-1 regarding leaks. See the response to comment LA5-1 regarding preparation of the EIS.

December 7, 2016
Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Dear Ms. Bose and Members of the Commission,

IND329-1 The Draft Environmental Impact Statement (DEIS) must conform to NEPA (40 CFR 1502.14) and Commission policy. The FERC's review of alternatives was inadequate.

NEPA Policy

§1502.14 Alternatives including the proposed action.

This section is the heart of the environmental impact statement. Based upon the information and analysis presented in the sections on the Affected Environment (§1502.15) and the Environmental Consequences (§1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and provide a clear basis for choice among options by the decisionmaker and the public. In this section agencies shall:

a. Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which are eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

b. Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.[1]

FERC's Inadequate review of Hybrid Route Alternatives

Hybrid Alternative Route 1 A, is described as a route that:

> …includes the northern half of the proposed route, and the southern half of Alternative Route 1 as described in Section 10.5.2 of Resource Report 10, with the switch being at about MP 135 of the proposed route. Hybrid Alternative 1A is approximately 309 miles in length and is collocated with existing utilities for approximately 68 miles (22 percent). Based on aerial flyover review there is approximately **50 miles of severe side slope crossed by the southern half of Route Alternative 1**. Based on a model run to evaluate severe side slope along the entire Hybrid Alternative 1A,

[1] 40CFR Parts 1500-1508, PURPOSE, POLICY, AND MANDATE; p. 15-16

IND329-1 Section 3 of the final EIS has been revised to discuss the Hybrid 1A and 1B Alternatives.

IND329-1 cont'd

the alternative crosses about 169 miles of side slope.[2]

Severe side slope comprises 16% (50 ÷ 309) of the Hybrid Alternative Route 1A.

Hybrid Alternative Route 1B is described as:

> …the northern half of Route Alternative Route 1 as described in Section 10.5.2 of Resource Report 10, and the southern half of the proposed route, with the switch being at about MP 135 of the proposed route. Hybrid Alternative 1B is approximately 315 miles in length and is collocated with existing utilities for approximately 77 miles (24 percent). Based on aerial flyover review there is approximately **50 miles of severe side slope crossed by the northern half of Route Alternative 1**. Based on a model run to evaluate severe side slope along the entire Hybrid Alternative 1B, the alternative crosses about 176 miles of side slope.[3]

Severe side slope comprises 15.9% (50 ÷ 315) of the Hybrid Alternative Route 1B.

Interestingly, there are "approximately **50 miles of severe side slope** crossed by the southern half of Route Alternative 1**,**"[4] and "approximately **50 miles of severe side slope** crossed by the northern half of Route Alternative 1**.**"[5] Consequently, this indicates to the reader that the Alternative Route 1 would cross **100 miles of severe side slope**. However, in MVP's response to EIR #1 dated January 27, 2016, they indicated, "Alternative 1 would cross about 165.1 miles of side slope;"[6] making no mention of "severe side slope." This **discrepancy is significant** because, if the math is correct, 61% (100 ÷ 165.1) of the "side slope" for Alternative Route 1 should be classified as "severe."

MVP uses "severe side slope" in its text as noted above, but in FERC's DEIS Table 3.4.2-1 (see attached Appendix), the feature is listed as just "side slope."[7] The absence of distinctions between "severe side slope" versus "side slope" is confusing for readers and decision makers. What constitutes the difference between "side slope" and "severe side slope?" Surely, construction is made more challenging on slopes that are rated as "severe." A word search of the DEIS for "severe side slope" reveals one hit, which is located in the Route Alternatives section. Erroneous data located in the DEIS on p. 3-22, states:

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[2] Submittal 20160421-5195(31403829), p. 185
[3] Submittal 20160421-5195(31403829); p. 186
[4] Submittal 20160421-5195(31403829), p. 185
[5] Submittal 20160421-5195(31403829), p. 186
[6] Submittal 20160127-5356(31190455), p. 78
[7] DEIS; p.3-24

IND329-1 cont'd

> …Alternative 1 crosses about 51 more miles of steep slopes and 42 more miles of severe side slope, which would represent significant construction challenges including the need for extra workspaces to achieve a level working area and an increased risk of future slope instability following restoration. Given consideration of these factors, we conclude that Alternative 1 does not offer a significant environmental advantage when compared to the corresponding proposed route.[8]

However, the feature measured in the DEIS Table 3.4.2-1, is described as "side slope," not "severe side slope." These contradictions imply:

1. That the "side slope" in Table 3.4.2-1 is in fact "severe side slope." Thus, the distance of Alternative 1 of 165.1 miles minus the Proposed Route of 122.8 miles equals the "42 more miles of severe side slope," **or**

2. The Alternative Route 1 really has **100 miles of severe side slope.** Different portions of it are used to form Hybrid Alternative 1A and Hybrid Alternative 1B, and we know from previous MVP statements provided above that **each** Hybrid Route has approximately 50 miles of "severe side slope." Yet Table 3.4.2-1 indicates Alternative 1 has only 42 more miles of "severe side slope" than the Proposed Route, hence it appears that the DEIS has erroneous data. This type of contradictory or conflated data can lead readers and decision makers to believe that the Hybrid Alternative 1A was dismissed prematurely by MVP. MVP likely based its dismissal upon erroneous data.

In EIR #2, MVP provided data in the Table entitled, *Comparison of Hybrid Alternative 1A, Hybrid Alternative 1B, and the Proposed Route*. Mileages for "side slope" were presented as the Hybrid Route 1A with 169.1 miles, Hybrid Route1B with 176.1 miles and the Propose Route with 122.8 miles.[9] Clearly, the Proposed Route was favored with fewer "side slope" miles, and MVP dismissed both Hybrid Routes based upon **"additional construction challenges."**[10] **However, FERC never required MVP to provide the data to support this dismissal.**

This premise, the **early dismissal of the Hybrid Alternative Route 1A**, is challenged in the submittal of Carl Zipper, Ph.D., which suggested:

> This claim should be evaluated by FERC, given that most of the southern half of Hybrid Alternative 1A runs in close parallel to the proposed route, and thus in similar orientation to the southwest-to-northeast grain of the mountain ridges and intervening valleys that characterize this terrain. One would expect long lengths of "severe sideslopes" to occur along pipeline segments that run parallel to the grain of the mountains, but the

[8] DEIS, p. 169 of 781
[9] Submittal 20160422-5012(31404063), p. 22 of 58
[10] Submittal 20160421-5195(31403829), p. 185

IND329-1 cont'd

orientation of Hybrid Alternative 1A relative to that grain is similar to that of the proposed route. Furthermore, the applicant has proposed mitigation measures for sidehill construction[6] in light of the 123 miles of sideslope construction that are said to occur along the proposed route; but the applicant's text describing Hybrid Alternative 1A makes no mention of sideslope mitigation.[11]

In FERC's EIR #1 and #2, the applicant was required to answer:

> 3. …supplement all alternative comparison data tables to also include the following parameters: steep side slopes, not just steep vertical slopes (miles); areas with landslide potential (feet or miles); interior forest (miles and acres affected during both construction and operation); major river crossings (number); number (and length crossed) of NRHP listed or eligible sites; and streams with drinking water designation (number).[12]
>
> 8. Revise the environmental resources tables for all alternative routes in comparison to the proposed route to include data on the miles of side slopes crossed. Use that newly supplied data to support the **contention** that some of the alternatives (such as Alternative 1, Modified Alternative 1, and Hybrid Alternative 1) located along severe side slopes would not be suitable because they "represented insurmountable construction challenges.[13]
>
> 3. As requested in our EIR dated December 24, 2015 (RR10 Nos. 3 and 8), provide a full data comparison data table and associated assessment for Hybrid Alternative 1 that contains side by side data for three routes: the proposed route, Hybrid Alternative 1A (northern half of the proposed route combined with the southern half of Alternative Route 1), and Hybrid Alternative 1B (northern half of Alternative Route 1 combined with the southern half of the proposed route).[14]

FERC failed in its duty to insist that EIR # 1 and #2 be answered completely by the applicant.

An additional update from MVP on October 20, 2016, to the DEIS Table 3.4.2-1 (Updated for MVP October 2016 Proposed Route), indicates that **the side slope for the Proposed Route has been increased from 122.8 miles to 158.2 miles**, which is significant. A mere 6.9-mile of side slope (165.1 - 158.2 = 6.9) separates Alternative 1 from the Proposed Route, while the Hybrid Alternative 1A has only 10.9-miles (169.1 – 158.2 = 10.9) more side slope than the Proposed Route.

Did the applicant underreport the side slope mileage in the Proposed Route so that it would be considered 'more favorable' when compared to both the Alternative 1 and the Hybrid Alternative 1A?

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[11] Submittal 20161121-5048(31787582)
[12] Submittal 20151224-3000, p. 41
[13] Submittal 20151224-3000, p. 41
[14] Submittal 20160331-4008, p. 27

IND329-1 cont'd

Advantages of Hybrid Alternative 1 A

Hybrid Alternative 1 A has many advantages over the October 2015, Proposed Route:

> Out of 27 "features" compared by MVP for the Proposed Route versus the Hybrid Alternative 1A, 12 features were essentially unchanged, 1 was unanswered, **9 were more favorable for the Hybrid Alternative 1A**, and 5 were more favorable for the [Oct 2015] Proposed Route.[15]

The DEIS compares Alternative Route 1 to the Proposed Route; however, it fails to evaluate Hybrid Alternative 1A. In Table 1, submitted by Carl Zipper,[16] Ph.D., he compares Hybrid Alternative 1A, to both the Alternative 1 and the October 2015 Proposed Route.

When compared to the 2015 Proposed Route, the Hybrid Alternative 1A has reduced impacts to several resources:

- **41 fewer landowner parcels,**
- **16 fewer miles of karst terrain,**
- **100 fewer miles of shallow bedrock,**
- **0 miles of NRHP crossings**
- **fewer consites crossed**
- **fewer miles of forested land, and**
- **"it crosses the Blue Ridge Parkway, the Jefferson National Forest, and the Appalachian National Scenic Trail adjacent to existing 138-kilovolt (kV) overhead electric transmission lines."**[17]

National Register of Historic Places (NRHP)

The Hybrid Alternative 1A avoids **14 miles of Historic Districts**: Big Stoney Rural Historic District (eligible), Greater Newport Rural Historic District 035-0412, Newport Historic District 035-0412, North Fork Rural Historic District 060-5474, Coles-Terry Rural Historic District 080-5689, Bent Mountain Historic District, the Blue Ridge Parkway Historic District, Cahas Mountain Rural Historic District 033-0393.

NEPA 1502.25 requires "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with environmental impact analysis and related surveys and studies required by the National Historic Preservation Act of 1966 (16U.S.C. 470 et seq)."[18] It is clear

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[15] Submittal 20160509-5041(31448050)
[16] Submittal 20161121-5048(31787582)
[17] Submittal 20160421-5195(31403829), p. 185
[18] 40CFR Parts 1500-1508, PURPOSE, POLICY, AND MANDATE; p. 19

IND329-1 cont'd

that the policy of NEPA would encourage inclusion of any "eligible" Historic Districts in the evaluation of impacts to resources rather than their exclusion.

When reviewing the MVP updates for the DEIS, a **significant error** for the Proposed Route becomes apparent. DEIS Table 4.10.6-1 (Updated for MVP October 2016 Proposed Route),[19] lists both the crossings of and distances from Historic Districts in the vicinity of the project (see attached Appendix). The crossing distances for Greater Newport Rural Historic District, North Fork Rural Historic District, Coles-Terry Rural Historic District, Bent Mountain Historic District, and the Blue Ridge Parkway Historic District, when summed, total **14.0 miles.** This contradicts with the **10.11 miles** listed in the DEIS Table 3.4.2-1 (Updated for MVP October 2016 Proposed Route).[20] **The table provided by MVP to FERC is clearly incorrect** and it presents the Proposed Route in a more favorable light for selection (see attached Appendix). Stated differently, crossing 10 miles of Historic Districts is troubling enough, but crossing 14 is even worse. The Hybrid Alternative 1A is clearly superior to the Proposed Route in this "feature."

Consite Avoidance

Hybrid Alternative 1A avoids the Virginia Department of Conservation & Recreation's (VDCR) Clover Hollow, Canoe Cave, Slussers Chapel, Old Mill, and Blake Preserve Conservation sites. It also avoids the New River Sizemore Conservation easement adjoining the Cascades. The 2015 Proposed Route still has a **significant footprint** in the Canoe Cave, Slussers Chapel and Old Mill consites.[21,22, 23,24,25,26]

Furthermore, the Indian Creek watershed of Monroe County, WV, the Mount Tabor Sinkhole Plain and their combined allogenic recharge zones would be avoided by the Hybrid Alternative Route 1A.[27]

US Forest Service Lands

The 2015 Proposed Route crosses 3.4 miles of Forest Service (FS) land and 4.8 acres of Old Growth Forest, whereas the Hybrid Alternative Route 1A crosses only 1.6 miles of FS land and zero acres of Old Growth Forest. The Proposed

[19] Submittal 20161020-5175(31746171), p. 121 of 153
[20] Ibid, p. 23 of 153
[21] PF 15-3 Submittal # 20150420-5031 (30501643)
[22] PF 15-3 Submittal # 20160420-0068 (3050549)
[23] Submittal # 20160520-5051 (31472765)
[24] Submittal # 20160909-5315 (31679600)
[25] Submittal 20161115-5042(31779665)
[26] Submittal 20161121-5048(31787582)
[27] Submittal 20160509-5041(31448050)

IND329-1 cont'd

Route requires a green field cut / crossing over Peter's Mountain which is adjacent to the Peter's Mountain Wilderness area, but Hybrid Alternative Route 1A crosses adjacent to an existing ROW for a 138-kV overhead electric transmission line.

Summary

Of the multiple features listed in the Comparison Tables required by FERC, it is disturbing that **both the side slope mileages and the Historic Districts were underrepresented by the applicant**. With this new information recently disclosed, it is abundantly clear that the DEIS was released prematurely. The Alternatives were neither adequately assessed based upon empirical data nor "to the fullest extent possible;"[23] hence, FERC has not discharged its duty and is noncompliant with NEPA.

Respectful Submitted,

Louisa Gay

Appendix

[23] 40CFR Parts 1500-1508, PURPOSE, POLICY, AND MANDATE; p. 15-16

IND329-1
cont'd

TABLE 3.4.2-1

Comparison of Route Alternative 1 and the Proposed Route

Feature	Route Alternative 1	Proposed Route
General		
Total length (miles)	323.8	301.0
Length adjacent to existing right-of-way (miles)	101.0	22.0
Land disturbed within construction right-of-way (acres) a/	4,892	4,556
Federal Lands and Federally Managed Areas		
National Forest System lands crossed (miles)	1.6	3.4
National Forest Wilderness crossed (miles)	0.0	0.0
Appalachian National Scenic Trail crossings (number)	1	1
Blue Ridge Parkway crossings (number)	1	1
National Forest – US Forest Service-designated old growth forest crossed (feet)	0	1,700
National Forest – US Forest Service-designated old growth forest affected by constr. (acres)	0	4.8
National Forest – trails crossed (number)	15	2
National Forest – inventoried roadless areas crossed (feet)	0	4,990
National Forest – inventoried semi-primitive areas crossed (feet)	8,660	13,540
NRHP designated or eligible historic districts crossed (miles)	5.0	10.1
Human Environment		
Populated areas within 0.5 mile (number) b/	11	8
Landowner parcels crossed (number)	1,609 c/	1,495
Residences within 50 feet of construction workspace (number)	65	63
Resources		
Forested land crossed (miles)	237.6	245.2
Forested land affected during construction (acres)	3,608.7	3,720.0
Forested land affected during operation (acres)	1,441.2	1,486.0
Interior forest crossed (acres)	1,565.2	2,365.2
Wetlands (NWI) crossed (feet) d/	5,525	3,299
Forested wetlands crossed (feet) d/	1,657	1,721
Forested wetlands affected by construction (acres)	2.9	3.0
Forested wetlands affected by operation (acres)	1.9	2.0
Perennial waterbody crossings (number) d/	133	97
Major (>100 feet) waterbodies crossed	7	5
New River crossings (number)	2	0
Shallow bedrock crossed (miles)	217.3	214.9
Steep slope (>20 percent) crossed (miles)	171.4	120.0
Side slope crossed (miles)	165.1	122.8
Landslide potential crossed (miles)	232.2	224.2
Karst area crossed (miles)	56.2	53.3

165.1-122.8 = 42

a/ Assuming 125-foot-wide construction right-of-way.
b/ City or town limits as shown in Environmental Systems Research Institute (ESRI) data.
c/ Estimated assuming similar size and number of landowner parcels would be crossed by the alternative as those crossed by the corresponding segment of Proposed Route.
d/ National Wetlands Inventory (NWI) and National Hydrography Dataset (NHD) data used in order to provide a common comparison between the two routes since field surveys were not conducted along the alternative.

IND329-1 cont'd

Table 1. Comparison of Hybrid Alternative 1A, Alternative 1, and the Proposed Route.

Features	**Hybrid Alt. 1A**	Route Alt. 1	Pro-posed Route	Notes
General				
Total length (miles)	309.2	323.8	301	
Length adjacent to existing right-of-way (miles)	68.4	101	22	
Land disturbed within construction right-of-way (acres)	4682.6	4892	4556	
Federal Lands and Federally Managed Areas				
National Forest System lands crossed (miles)	1.6	1.6	3.4	
National Forest System lands crossed (miles greenfield)	0	0	3.4	a, b
National Forest Wilderness crossed (miles)	0	0	0	
National Forest Wilderness adjacency (miles)	0	0	1.8	a, c
National Forest Outstandling Ecological Core areas (acres)	0	0	40	a, d
Appalachian National Scenic Trail crossings (number)	1	1	1	
Appalachian Trail crossings - Greenfield	0	0	1	a, b
Blue Ridge Parkway crossings (number)	1	1	1	
Blue Ridge Parkway crossings- Greenfield	0	0	1	a, b
National Forest– USFS-designated old growth forest crossed (feet)	0	0	3000	a, e
National Forest – USFS-designated old growth forest affected by constr. (acres)	0	0	9	a, e
National Forest – trails crossed (number)	n/a	15	2	f
National Forest – inventoried roadless areas crossed (feet)	0	0	4990	
National Forest – inventoried semi-primitive areas crossed (feet)	n/a	8660	13540	
NRHP designated or eligible historic districts crossed (miles)	0	5	10.1	
Human Environment				
Populated areas within 0.5 mile (number) b/	12	11	8	g
Landowner parcels crossed (number)	1,446	1,609	1495	h
Residences within 50 feet of construction workspace (number)	n/a	65	63	i
Resources				
Forested land crossed (miles)	236.9	237.6	245.2	
Forested land affected during construction (acres)	3594.9	3608.7	3720	
Forested land affected during operation (acres)	1436.5	1441.2	1486	
Interior forest crossed (acres)	2106.1	1565.2	2365.2	
Wetlands (NWI) crossed (feet)	2090	5525	3299	
Forested wetlands crossed (feet)	1518	1657	1721	
Forested wetlands affected by construction (acres)	2.6	2.9	3	
Forested wetlands affected by operation (acres)	1.7	1.9	2	
Perennial waterbody crossings (number)	116	133	97	
Major (>100 feet) waterbodies crossed	7	7	5	
New River crossings (number)	2	2	0	
Shallow bedrock crossed (miles)	114.9	217.3	214.9	
Steep slope (>20 percent) crossed (miles)	138.8	171.4	120	
Side slope crossed (miles)	169.1	165.1	122.8	
Landslide potential crossed (miles)	220.8	232.2	224.2	
Karst area crossed (miles)	37.3	56.2	53.3	

C. E. Zipper Ph.D. Submittal 20161121-5048(31787582)

IND329-1 cont'd

Notes to Table 1:

a - data added by CEZ; all other data are as provided by the applicant in the DEIS (TABLE 3.4.2-1) and in "Comparison of Hybrid Alternative 1A, Hybrid Alternative 1B, and the Proposed Route", Attachment DR2 RR10-3a as referenced above in footnote 4.

b - Mountain Valley Pipeline's submittal 20160421-5195 FERC Docket CP16-10 (as referenced above) states that "Hybrid Alternative 1A crosses the Blue Ridge Parkway, the Jefferson National Forest, and the Appalachian National Scenic Trail adjacent to existing 138-kilovolt (kV) overhead electric transmission lines".

c - estimated by CEZ from Figures 1.11-1 and 1.11-2 in the Mountain Valley Pipeline application, Resource Report 1. Approximately 0.8 miles of the proposed route is directly adjacent to Peters Mountain Wilderness, and appoximately 1 mile is located within approximately1200 feet from the Brush Mountain Wilderness, but within the Brush Mountain Inventoried Roadless Area. that adjoins that wilderness.

d - calculated by CEZ based on 2.6 miles length through Ecological Core Areas as designated on DEIS Figure 4.4.1-3 (p. 4-135; p. 372 of 781).

e - DEIS table 1 states that 4.8 acres of old growth would be affected, but elsewhere the DEIS states that 9 acres of old growth (equivalent to 3064 feet length for a 125-foot wide corridor) would be affected.

c - The assertion that 15 separate trails would be crossed over a 1.6 mile length is not supported - no supporting information is presented.

h - these data are estimated as distances to town and city boundaries, and not as areally defined clusters of homes, and is not necessarily reflective of residential impacts. For example, the proposed route runs along the outskirts of a major residential near Blacksburg VA, but does not come with 1/2 mile of the town limigs.

g - landowner parcels over alternative routes were estimated by Mountain Valley

l - Minor adjustments to proposed reduced direct residential proximities, but such analyses have not been conducted for the Alternative 1 route. No residential proximities are reported for Alternative 1A.

C. E. Zipper Ph.D. Submittal 20161121-5048(31787582)

Note: an error was observed in the table, "g" refers to landowner parcels and "h" refers to town limits.

IND329-1
cont'd

DEIS TABLE 4.10.6-1
(Updated for MVP October 2016 Proposed Route)

Previously Recorded Historic Districts in the Vicinity of the Mountain Valley Project

Name of the District	County/State	Distance From Pipeline
Pence Spring Hotel Historic District	Summers, WV	0.47 25 mile from MP 171.0
Alderson Historic District	Monroe, WV	5.5 miles from MP 166.4
Salt Sulphur Spring Historic District	Monroe, WV	6.5 miles from MP 181.9
Union Historic District	Monroe, WV	8.0 miles from MP 178.8
Appalachian National Scenic Trail Historic District	Monroe, WV Giles, VA	Crossed at MP 196.3
Newport Historic District	Giles, VA	0.003 mile from MP 212.911.6
Greater Newport Rural Historic District	Giles, VA	Crossed between MPs 210.8209.7-–216.95.7
North Fork Valley Rural Historic District	Montgomery, VA	Crossed between MPs 226.3-228at MP 224.1
Lafayette Historic District	Montgomery, VA	0.524 mile from MP 234.883
Oak Hill Old German Baptist Brethren Community Rural Historic District	Montgomery, VA	0.961.0 mile from MP 267.365.7
Coles-Terry Rural Historic District	Roanoke, VA	Crossed between MPs 240.32—243
Bent Mountain Historic District	Roanoke, VA	Crossed between MPs -243-246
Blue Ridge Parkway Historic District	Roanoke & Franklin, VA	Crossed at MP 244.2246-246.50
Cahas Mountain Rural Historic District	Franklin, VA	1.738 miles from MP 254.4
Boones Mill Historic District	Franklin, VA	Greater than 0.5 mile from1.42 mile from MP 258.77
Penhook Historic District	Franklin, VA	Greater than 0.5 mile from0.74 mile from MP 283.1 MP 272
Lynchburg & Danville Railroad Historic District	Pittsylvania, VA	Crossed at MP 298.45.5

GNRHD: 216.9 - 210.8 = 6.1 miles
NFRHD: 228 - 226.3 = 1.7 miles
C-TRHD: 243 – 240.3 = 2.7 miles
BMHS: 246 – 243 = 3 miles
BRPHD: 246.5 – 246 = 0.5 miles
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14 miles

1 of 1

IND329-1
cont'd

DEIS TABLE 3.4.2-1
(Updated for MVP October 2016 Proposed Route)

Comparison of Route Alternative 1 and the Proposed Route

Feature	Route Alternative 1	October 2016 Proposed Route
General		
Total length (miles)	323.8	301.0303.4
Length adjacent to existing right-of-way (miles)	101.0	22.029.4
Land disturbed within construction right-of-way (acres) a/	4,892	4,556
Federal Lands and Federally Managed Areas		
National Forest System lands crossed (miles)	1.6	3.4
National Forest Wilderness crossed (miles)	0.0	0.0
Appalachian National Scenic Trail crossings (number)	1	1
Blue Ridge Parkway crossings (number)	1	1
National Forest – US Forest Service-designated old growth forest crossed (feet)	0	1,700
National Forest – US Forest Service-designated old growth forest affected by constr. (acres)	0	4.8
National Forest – trails crossed (number)	15	2
National Forest – inventoried roadless areas crossed (feet)	0	4,990
National Forest – inventoried semi-primitive areas crossed (feet)	8,660	13,540
NRHP designated or eligible historic districts crossed (miles)	5.0	10.110.0
Human Environment		
Populated areas within 0.5 mile (number) b/	11	8
Landowner parcels crossed (number)	1,6091,424 c/	1,4951,334
Residences within 50 feet of construction workspace (number)	65	6366
Resources		
Forested land crossed (miles)	237.6	245.2248.3
Forested land affected during construction (acres)	3,608.7	3,720.03,762.1
Forested land affected during operation (acres)	1,441.2	1,486.01,504.8
Interior forest crossed (acres)	1,565.2	2,365.22,459.1
Wetlands (NWI) crossed (feet) d/	5,525	3,2993,601
Forested wetlands crossed (feet) d/	1,657	1,721
Forested wetlands affected by construction (acres)	2.9	3.0
Forested wetlands affected by operation (acres)	1.9	2.0
Perennial waterbody crossings (number) d/	133	9795
Major (>100 feet) waterbodies crossed	7	5
New River crossings (number)	2	0
Shallow bedrock crossed (miles)	217.3	214.9202.5
Steep slope (>20 percent) crossed (miles)	171.4	120.0128.6
Side slope crossed (miles)	165.1	122.8158.2
Landslide potential crossed (miles)	232.2	224.2225.6
Karst area crossed (miles)	56.2	53.341.7

a/ Assuming 125-foot-wide construction right-of-way.
b/ City or town limits as shown in Environmental Systems Research Institute (ESRI) data.
c/ Estimated assuming similar size and number of landowner parcels would be crossed by the alternative as those crossed by the corresponding segment of Proposed Route.
d/ National Wetlands Inventory (NWI) and National Hydrography Dataset (NHD) data used in order to provide a common comparison between the two routes since field surveys were not conducted along the alternative.

Hybrid Alternative 1 A crosses "0" NRHP miles; the Proposed Route crosses 14 miles.

165.1 - 158.2 = 6.9 miles

1 of 1

12

INDIVIDUALS

IND330 – Elisabeth Hauser

20161207-0013 FERC PDF (Unofficial) 12/07/2016

CP16-10 et al.

PIPELINE November 2, 1916

Elisabeth Hauser – 741 Miracle Rd. – Rocky Mount, VA 24151

IND330-1 **My understanding is that Franklin County is to serve as a conduit for a pipeline crossing through Virginia and North Carolina to SC, where the gas/oil will be put on the international market. Not for domestic use, with no benefit to Franklin County whatsoever.**

Environmental concerns outweigh any perceived plus for Franklin County by far. Pipeline will be going THROUGH (not over or under) creeks, streams and rivers. At those sites the trees must be kept permanently free of tree cover for the life of the pipeline. Storm runoff and soil erosion will dirty streams. In addition, herbicides will be used to keep the trees defoliated... carcinogenic and otherwise harmful chemicals will wash directly into our waterways, endangering aquatic and wildlife along with our very aquifers.

IND330-2 **Many residents will sacrifice the peace they've found in rural living by the ever-presence and noise of large machinery and constant dust from same... explosions from dynamiting the bedrock to lay the pipe---explosions which ALSO may cause the disruption of present aquifers, destroying water delivery and waste systems already in place. When the ground moves, so does everything around it.**

IND330-3 **Not only those closest to the sites in question, but ALL Franklin County residents will suffer a devaluation of their property because of proximity to a potential danger that occurs at least twice a week on national news! No one wants an explosion, but they happen. So another expense for ALL residents is the increase of homeowner's insurance costs.**

IND330-4 **FRESH WATER concerns outweigh all others in my view. Leakage of any kind into our waterways and/or aquifers will taint our beautiful county forever. There is no undoing of that problem once it occurs, and the danger is ever present---during construction and further use.**

IND330-1 The MVP pipeline would begin in Wetzel County, West Virginia and end in Pittsylvania, Virginia. It would not extend into North Carolina and South Carolina. Water resources are discussed in section 4.3 of the EIS. As stated in section 2.4 of the EIS, the pipeline would be installed about 24 to 48 inches below waterbodies. See the response to comment LA1-7 regarding herbicides. See the response to comment IND70-1 regarding erosion.

IND330-2 As discussed in section 4.11.2 of the EIS, noise would be temporary during construction. Dust is discussed in section 4.11.1 of the EIS. See the response to comment CO14-1 regarding blasting. See the response to comment IND3-1 regarding drinking water.

IND330-3 See the response to comment IND 2-1 regarding safety. See the response to comment IND12-1 regarding property values and comment IND2-2 regarding homeowner's insurance.

IND330-4 See the response to comment CO14-3 regarding spills. See the response to comment IND92-1 regarding leaks. Wildlife is discussed in section 4.5 of the EIS.

IND330-4 cont'd

Finally, there is but a BIT of beautiful forest and valley land left largely untouched by the hand of "progress," which is our own sacred treasure. Deer, foxes, an occasional bear, raccoons and songbirds have been able to survive within these hidden pockets until now. When this environment is scarred with man's machinery, and the deep woods necessary for continuation of species are erased, there may as well be no more Franklin County. The wildness---the very reason for attracting so many nature seekers—will be gone.

All because some very wealthy people want to "cut through" Franklin County on their way to greater riches south of here.

No, thank you.

Elisabeth Hauser
741 Miracle Rd.
Rocky Mount, VA 24151
lisbeth1@jetbroadband.com
540.483.0317

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1 A
Washington, DC 20436

RE: Draft Environmental Impact Statement for the Mountain Valley Pipeline (Docket No. CP16-10-000) and Equitrans Project (Docket No. CP16-13-000)

INDIVIDUALS

IND331 – William S. and Virginia K. Brink

CP16-10 et al.

William S. Brink
Virginia K. Brink
268 Teel Court
Rocky Mount, VA 24151
(540) 420-3935, 420-2874

ORIGINAL

RE: Comments to Federal Energy Regulatory Commission (FERC)
Rocky Mount, VA November 3, 2016

IND 331-1

We purchased our property over 24 years ago. It consists of a log home on more than 13 acres, in the Teel Brooke subdivision. The home is privately situated, with Teel Creek at the back of the property. Many Teel Brooke residents are not even aware the house is here, and that was part of the appeal in buying the property. It is our only significant asset.

The current routing of the pipeline shows it just on the other side of Teel Creek, not technically on my property but rendering it as undesirable as if it cut through the woods behind the house. It has ruined the appeal of the property. It will never be the untouched, natural land that it is today.

I had planned on putting the home and acreage on the market for sale in the Spring of 2017, if a realtor would agree to accept the listing. Under normal circumstances, it should be an easy sell. But what if nobody steps up to the plate to buy it? That tells me that **I have been damaged,** damaged by MOUNTAIN VALLEY PIPELINE. I should be able to recover damages in the amount of the market value of the property, and turn the property over to the pipeline people for them to do with whatever they wish. But will I be able to do so? Me... against MOUNTAIN VALLEY PIPELINE corporate lawyers? Even those property owners where the MVP has offered payment for an easement, the amounts offered have been a joke.

IND 331-2

I would not want to live in a home that presents significant safety risks, where much of the charm of a country home has been trashed by MOUNTAIN VALLEY PIPELINE. Let me ask MOUNTAIN VALLEY PIPELINE and the FERC representatives present here: "Would you want to relocate your families to a property next to a 42-inch gas pipeline that could spring a leak and explode without warning? Or maybe you would prefer moving your family next to a refinery in West Texas? How does Big Spring, Texas sound? Does any of that sound like something you would want?"

I STRONGLY URGE MOUNTAIN VALLEY PIPELINE to **re-route the pipeline to avoid residential properties such as mine, with NEW ROUTING to better avoid residential and other sensitive areas.**

It's interesting, yet troubling, to note that the MOUNTAIN VALLEY PIPELINE has been curiously re-routed since its inception, to avoid coming close to the farms and properties of local people of influence and authority. Interesting....

IND331-1 See the response to comment IND12-1 regarding property values. The proposed MVP pipeline would be about 1,600 feet from the commenter's home.

IND331-2 See the response to comment IND2-1 regarding safety. See also the response to comment IND196-5.

IND 331-2 cont'd

A few notes that should be considered:

Think of massive pipeline explosion in Appomattox, Virginia back in 2008. Oh, that won't happen again. Yeah, right.

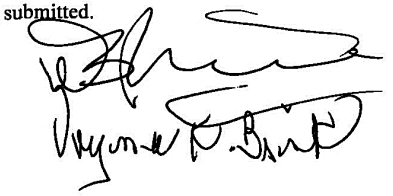
Think of the two catastrophic pipeline gasoline pipeline explosions in Alabama.... one just happened, the other about a month ago. Alabama's governor has declared the State a disaster.

I lived and worked in Alaska for several years, including the period of construction of the Alaska Pipeline. There were instances of falsifying welding inspections which, if not caught, would have had devastating consequences. What was not caught....? What shortcomings to the MOUNTAIN VALLEY PIPELINE might not be caught?

My comments will likely be worthless. It is my view that the project has already received approval, or maybe the promise of approval, by FERC and other authorities, and that hearings such as this one today are to try to show the public that the "powers" truly do care. Would any company have already spent so much money for planning, surveying, and perhaps lining the pockets of some who could help make it happen?

Respectfully, but sadly, submitted.

WILLIAM S. BRINK
VIRGINIA K. BRINK



Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1 A
Washington, DC 20436

RE: Draft Environmental Impact Statement for the Mountain Valley Pipeline (Docket No. CP16-10-000) and Equitrans Project (Docket No. CP16-13-000)

INDIVIDUALS

IND332 – Alvin E. Wray

20161207-0034 FERC PDF (Unofficial) 12/07/2016

DEIS/MVP CP16-10-000
EQUITRANS CP 16-13-000

IND 332-1

1. will destroy our family farm best pasture & best hayfield
2. Construction will disrupt and contaminate the aquifers and wells on our property as well as having an impact on the streams and rivers flowing to Smith Mountain Lake.
3. Negatively impact our cattle production during construction and limit the use of our land for future cattle business by not allowing heavy equipment or certain types of farming over the pipeline area.
4. Decrease property values for resale however there is no assurance from the local government that real estate taxes will reflect in lower land values
5. Just the threat of a pipeline on our property has lost a sale of property and rendered it virtually worthless.
6. The pipeline is not being built for public use but by private corporations for profit.

IND 332-2

7. If the pipeline explodes it would cause complete destruction of the area of over 1000 feet on each side of the pipeline, the "blast zone" and could cause complete destruction of the mountains including the Blue Ridge Mountains.
8. An explosion would annihilate property and persons within the blast zone.
9. MVP has not assumed any liability for death and destruction in the event of an explosion and in fact has asked the landowners to sign easements which would hold them harmless in such event.
10. Proposed easements are biased in favor of the pipeline and not the landowner.

Submitted by,

Alvin E. Wray
638 Rhododendron Rd.
Callaway, VA
24067

540-334-2845
wrayfarm2@aol.com

Alvin E. Wray

11-2-16

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SECRETARY OF THE
2016 DEC -7 A 11:23
FEDERAL ENERGY
REGULATORY COMMISSION

IND332-1 As discussed in section 4.8.2 of the EIS, impacts on agricultural lands would be short-term, lasting during the period of construction and restoration and a few years later. The Applicants would ensure that livestock have access to water sources during construction; or an alternative source of water would be provided. The Applicants would compensate farmers for loss of crop production during the construction and restoration period. Typically, compensation would be at least 100 percent of the value of the crop at current market prices. Following pipeline installation, the right-of-way would be restored to near pre-construction conditions and use, and agricultural practices could resume. Except for orchards, crops and pasture can be planted directly over the entire right-of-way. Usually, individual landowners decide on the type of seeds to be planted over the restored right-of-way in agricultural lands. If crops in the right-of-way are not as productive as portions of the farm outside the right-of-way for the first several growing seasons after restoration, the Applicants may compensate landowners for that difference. Water resources are discussed in section 4.3 of the EIS. We do not require pipeline companies to provide heavy equipment crossings at regular intervals along the pipeline for landowners. However, if a landowner's current or future property use includes the use of heavy equipment (logging or heavy farming equipment), easement negotiations could include the identification and construction of suitable equipment crossings designed to facilitate existing uses and protect the pipeline. In general, most farm equipment would be able to cross the pipeline right-of-way without the need for a heavy equipment crossing. See the response to comment IND12-1. See the response to comment FA11-12 regarding need.

IND332-2 See the response to comment IND2-1 regarding safety. See the response to comment IND28-3 regarding financial responsibility. See the response to comment IND18-2 regarding emergency response.

December 8, 2016

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Dear Ms. Bose and Members of the Commission,

IND333-1

The Draft Environmental Impact Statement (DEIS) must conform to NEPA (40 CFR 1502.14) and Commission policy. FERC's review of reliability and safety was inadequate.

NEPA Policy

§1502.22 Incomplete or unavailable information

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

For the purposes of this section "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.[1]

Reasonably Foreseeable Consequences

1. Flooding

In submittals by Thomas Bouldin[2], Louisa Gay[3,4], and Other Virginian's[5], flooding was a noted concern in West Virginia (WV). *Adequate evidence exists to indicate that flooding in WV is both common and severe* (USGS West Virginia Water Science Center website). In response to the flooding in WV on June 23, 2016, it was noted:

> The **Proposed route runs through six West Virginia counties that received Federal Disaster designations a few days following the floods.** These six north-to-south counties are Webster, Nicholas, Fayette, Greenbrier, Summers and Monroe. **The 116.2 miles of pipe through these Disaster-status counties**

[1] 40CFR Parts 1500-1508, PURPOSE, POLICY, AND MANDATE; p. 19
[2] Submittal #20160318-5172
[3] Submittal #20160627-5299
[4] Submittal #20160915-5157(31690938)
[5] Submittal #20161115-5030(31779613)

IND333-1 See the response to FA11-2 regarding the adequacy of the draft EIS. Reliability and safety are discussed in section 4.12 of the EIS. A revised discussion of flash flooding is provided in section 4.3 of the final EIS. A discussion of recent storm events has been added to the final EIS. Section 4.3 of the final EIS has been revised to include updated scour analysis information filed by Mountain Valley since issuance of the draft EIS.

IND333-1 cont'd

constitute over 38% of the entire 303.4-mile Proposed route (DEIS Table 2.1-2, updated for Oct 2016 proposed route).[6]

Several concerns following the flooding were:

- Route surveys completed prior to the floods would likely no longer be valid in the aftermath of the floods.
- In the months that have passed since the flash floods, we have not seen an Environmental Information Request (EIR) from the FERC to Mountain Valley requesting updated surveys and stream assessments.
- The magnitude of the forces exerted by those flood waters was such that at least some ground truths directly observed and measured in Mountain Valley's pre-flood surveys will be no longer valid for design and construction. If ground truth field investigations in such a large portion of its Proposed route are not updated, Mountain Valley's due diligence responsibilities with respect to its work could be called into question.
- Would Mountain Valley's design criteria and construction methods have been sufficient to maintain the pipeline's integrity across all slopes and stream crossings?
- Would the region-wide power outages, road washouts, bridge washouts and landslides have allowed MVP's emergency response plans to have been successfully executed had the pipeline's integrity been compromised?
- Would access to the Stallworth Compressor Station in Fayette county have been maintained?

Regrettably, the DEIS has only one brief paragraph on flash flooding in the Environmental Consequences section for the Mountain Valley Project, p. 4-109. It states:

> Seasonal and flash flooding hazards are a potential concern where the proposed pipeline would cross or be near major streams and small watersheds. Although flooding itself does not generally present a risk to pipeline facilities, bank erosion and/or scour could expose the pipeline or cause sections of pipe to become unsupported. All pipeline facilities are required to be designed and constructed in accordance with 49 CFR 192. These regulations include specifications for installing the pipeline at a sufficient depth to avoid possible scour at waterbody crossings. Mountain Valley is conducting a scour analysis to determine, in part, the depth of trench that would be required at waterbody crossings to avoid scour (see our recommendation below).[7]

[6] Submittal #20161115-5030(31779613)
[7] DEIS, p. 4-109

IND333-1 cont'd

Unfortunately, egregious errors were discovered in MVP's Scour analysis, by Mr. Thomas Bouldin,[8,9] which challenges the competency of the contractors employed by MVP for this analysis. **It is equally disturbing that FERC's own reviewers did not discover the error prior to Mr. Bouldin's submittal.**

IND333-2

2. Potential Risks to Public Health[10]

In EIR # 1, FERC requested MVP answer this question:

> 2. As previously requested in our comments dated August 11, 2015, describe other actual or potential components of natural gas, with emphasis on likely other or trace components that may be particular to any known source areas for the natural gas to be transported. Describe potential risks to public health from leakage, venting, compressor stations, or any other project component, along with any plans to avoid, minimize, or mitigate potential impacts.[11]

C.E. Zipper, Ph.D., noted the applicant's response failed to consider:

> …the "potential components" that would be formed via synthesis within the pipeline. In the text that follows we use the term "fluid," meaning "a substance that flows" – in this case, a mixture of gases and liquids that may also carry small solid-phase particles and is a more accurate description of the material to be transported than "gas."
>
> Hydrocarbon synthesis typically occurs under high pressures. The proposed Maximum Allowable Operating Pressure (MAOP) is 1480 pounds per square inch (psi), approximately 100 times standard atmospheric pressure and a high pressure that would be adequate to enable hydrocarbon synthesis within the pipeline. Hydrocarbon synthesis can be catalyzed by the presence of non-hydrocarbon gases with potential to bond or react with hydrocarbons, such as H_2O, O_2, N_2, and CO_2. We do not have access to MVP's tariff but we have obtained tariffs by other eastern US natural gas pipelines that specify allowable H_2O, O_2, N_2, and CO_2 contents. Hence, we expect that MVP's proposed tariff allows some content of those substances as well, and that such substances would be available to aid hydrocarbon synthesis within the pipeline.
>
> From an environmental standpoint, the presence of liquid hydrocarbons in the transported fluid is critical to the evaluation of the applicant's proposal due to the potential for pipeline leak or rupture, especially if leak or rupture were to occur in karst terrain. The applicant states that gas entering the pipeline may contain up

[8] Submittal # 20160318-5172
[9] Submittal # 20160606-5063
[10] Personal Communications C.E. Zipper, Ph.D.
[11] Submittal #20151224-3000, p. 43 of 54

IND333-2 As discussed throughout the EIS and in section 4.9.2.8, significant impacts to human health are not expected due to construction or operation of the projects (see air and noise in section 4.11, water resources in section 4.4). The potential health effects regarding methane are discussed in section 4.12 of the EIS.

IND333-2 cont'd

to 1% of "pentanes plus," which we interpret to mean hydrocarbons that would occur in liquid state under project area's ambient environmental conditions during most of the year. It is reasonable to expect that certain synthesized compounds would also occur as larger molecular structures than those accepted for transport, and would also occur as liquids in the ambient environment if released - meaning that hydrocarbon synthesis, if occurring within the pipeline, would likely increase the transported fluid's liquid hydrocarbon content. It appears that MVP expects synthesis to occur given that "filtration and separation equipment" is proposed for installation at all compressor stations.

Due to the large diameter, extensive length, and high pressure of the proposed pipeline, a leak or rupture has potential to release a quantity of transported fluid. Hence, even if a small fraction of the transported fluid were constituents capable of damaging environmental quality or human health as water contaminants, those constituents' identities and potential quantities would have significance relative to potential consequences of leak or rupture. Yet, despite FERC's request to "potential risks to public health from leakage," MVP has failed to describe the nature of the fluid intended for transport.

FERC also requests information about potential atmospheric releases, and the applicant has failed to provide a complete answer to this part of the question. The applicant does describe "emergency venting" and states that "the contained gas volume in the section of pipe to be vented is small and will dissipate rapidly." They decline to quantify the maximum volume it would consider as "small," and fail to state the basis for its presumed ability to forecast the nature of the venting to be employed in response to such "emergencies." The applicant's assertions that emergencies, if occurring, would produce "small" gas volumes is unusual given the fact that emergencies, by their very nature, are typically difficult to predict and forecast.

Additionally, the applicant's response fails to describe releases from compressor stations that it expects due to blowdown events. The application describes blowdown releases at several locations (e.g. Resource Report 9, pp. 9-9, 9-10, 9-29, 9-46); and Resource Report 9 (Appendix 9-B Operational Emissions Calculations, Table 7, VOC and HAP Blowdown Emissions, pp. 265, 287, and 302 of 974) and describes both blowdown and emergency shutdown (ESD) releases as separate and distinct events. Hence, it is clear that MVP is not considering blowdowns to constitute emergencies, and that MVP has failed to provide a complete answer to the second part of the FERC question.

The applicant has described "filtration and separation equipment" to be installed at compressor stations. Should such equipment be used to remove liquid hydrocarbons from the transported gas stream, those removed compounds would require temporary storage and eventual disposal. The applicant has failed to describe how these operations would be managed so as to prevent evaporative emissions to the atmosphere, or to limit evaporative emissions as

IND333-2 cont'd

needed to "avoid, minimize, or mitigate potential impacts" (quoting from the FERC question) to public health.

FERC's question concerns "potential risks to public health," have not been addressed by MVP. In the application, MVP states that it anticipates compressor stations will discharge hazardous air pollutants (HAPs) to the atmosphere through venting (Resource Report 9, Appendix 9-B Operational Emissions Calculations, Table 7, VOC and HAP Blowdown Emissions, p. 265, 287, and 302 of 974). According to US EPA, "Hazardous air pollutants are those known to cause cancer and other serious health impacts." US EPA classifies more than 180 air-pollutant gases as HAPs (https://www.epa.gov/haps), which can vary widely in toxicity and allowable exposure levels (see Agency for Toxic Substances and Disease Registry, http://www.atsdr.cdc.gov/toxicsubstances.html). Other parties have documented the occurrence of specific HAPs in the near proximity of natural gas pipeline compressor stations, including ethylbenzene, benzene, toluene, and formaldehyde (see Environmental Health Project, Summary of Minisink Monitoring Results; and Environmental Health Project; Environmental Health Project, Summary on Compressor Stations and Health Impacts. Both documents can be accessed via Google search on the titles; see Macey GP et al., 2014, Environmental Health 13:82, DOI: 10.1186/1476-069X-13-82). The tariff's we have access to describe no limits for ethylbenzene, benzene, toluene, and formaldehyde in gasses accepted for transport. Furthermore, our reading of scientific literature suggests that certain of these constituents (especially formaldehyde, CH_2O, but also others may form from other hydrocarbons and natural gas contaminates (O_2, etc.) via high-pressure synthesis reactions.

Despite FERC's request, MVP has also failed to "describe other actual or potential components of natural gas" and to "potential risks to public health from leakage, venting, compressor stations," that may result from non-hydrocarbon components of transported fluids. For example, sulfur (as H_2S), mercury and radon are common as volatile contaminants of natural gas generally and in gas from the Marcellus shale source region. Other metals and metalloids including iron, arsenic, and lead (as Pb^{210} produced by radon decay) have been documented as measureable components of products transported by natural gas pipelines gas with iron and other non-volatile metals occurring as products of internal corrosion (for supporting documentation, see US EPA, 2001, document EPA/600/SR-01/066; S Mokhtab et al. 2012, Handbook of Natural Gas Transmission and Processing, 2nd Edition, Elsevier Publishing, Chs. 1 & 19; J Wylde, 2011, Pipeline & Gas Journal 238(8); TS Khan, 2015, Journal of Natural Gas Science and Engineering 25: 66-76; TS Khan et al., 2015, Journal of Natural Gas Science and Engineering 27: 769-775; JM Godoy et al., 2010, Journal of Environmental Radioactivity 83: 101-111; EL Rowan & TF Kraemer, 2012, US Geological Survey Open-File Report Series 2012–1159; AL Mitchell et al., 2016, "Lung cancer risk from radon in Marcellus shale gas in northeast US homes." Risk Analysis, DOI 10.1111/risa.12570; and other publications). Certain of these

IND333-2 cont'd

constituents are of concern due to their potential to occur as volatile components of vented-gas releases.

Non-hydrocarbon components of transported fluids are also of concern due to likelihood that such would form fine (< 2.5 micron in size) solid-phase particles ($PM_{2.5}$), and the potential that such would be released to the atmosphere with vented gases. $PM_{2.5}$ particles are known to cause to cause negative human health effects when present in ambient air at concentrations above human-tolerance levels (See US EPA, https://www.epa.gov/criteria-air-pollutants/naaqs-table). Other parties have described elevated concentrations of PM2.5 particles near natural gas compressor stations that include short-term high-concentration events (see Environmental Health Project, Summary of Minisink Monitoring Results). Both scholarly and industry publications describe accumulation of solid-phase particles, called "black powder," which can be comprised of highly toxic constituents (e.g. arsenic, chromium, molybdenum, thorium, etc.) as well as more common constituents such as iron in natural gas pipelines (see TS Khan et al. 2015, Journal of Natural Gas Science and Engineering 27: 769-775; and JM Godoy et al., 2005, Journal of Environmental Radioactivity 83: 101-111). Black powder commonly occurs a <2.5 micron solid-phase particles. The applicant neither describes mechanisms to ensure that solid-phase particles, such as those that constitute black powder accumulations, will not be discharged into the ambient atmosphere during blowdown and emergency ventings nor estimates discharge quantities.[12]

IND333-3

3. Pipeline Ruptures and Blast Radius

In EIR #1 the USFS (3/9/2016, p. 2) asked MVP to identify the possible causes of an unanticipated explosion of the pipeline, and to discuss the potential effects of an unanticipated explosion on the forest, its users, and the potential for wildfires.

C. E. Zipper, Ph.D., noted the applicant's response was not complete:

> US Pipeline and Hazardous Materials Safety Administration (PHMSA) compiles data on pipeline Incident Reports. For natural gas pipelines, incidents subject to reporting are defined by 49 CFR 191.3 and include leaks of greater than 3 million cubic feet, events that cause property damages valued at $50,000 or more or fatalities, and other events considered a significant by the operators. PHMSA classifies incidents by type and by cause. Explosions are considered to be one type of reportable incident.
>
> The PHMSA-recorded incidents for natural gas transmission pipelines over the 2002-7/29/2016 period show that of 1551 reported incidents, 85 were explosions; and pipeline corrosion was the most common cause for explosions. It is also

[12] Personal Communications C.E. Zipper, Ph.D.

IND333-3 As discussed in section 4.12 of the EIS, the Applicants would design, construct, operate, and maintain the proposed facilities in accordance with the DOT's Minimum Federal Safety Standards in 49 CFR 192. As cited in multiple locations in the draft EIS (primarily in section 4.12), PHMSA data were used to inform the assessment.

IND333-3 cont'd

noted that natural force damages were found to cause 5 explosions. The PHMSA data indicate that 4 of those 5 natural-force induced explosions were caused by events of types that are of special concern for the proposed Mountain Valley Pipeline: landslides (2) and subsidence (2). Residents of affected areas have expressed concern with potential for landslides and karst-induced collapse (a form of subsidence) to affect the proposed pipeline and have criticized the Landslide Mitigation Plan and Karst Mitigation Plan prepared by the applicant, claiming they are inadequate.

Corrosion, the number one cause of the explosions documented by PHMSA, can occur both internal to the pipeline and along external surfaces. The Mountain Valley Pipeline would be vulnerable to both internal corrosion and to external corrosion. MVP indicates internal corrosion will be monitored by inspecting "the pipeline using devices known in the industry as smart pigs at least every seven years, as required by 49 CFR Part 192, or more frequently if the baseline integrity assessment requires. These devices run inside the pipe and provide indications of internal and external metal loss, deformation, ovalities, dent detection…"[13] The applicant plans to use epoxy-coated pipe and to install cathodic protection to prevent external corrosion.

As well as serving as a potential direct cause of for explosion, corrosion can make the pipeline structure more vulnerable to failure via subsidence and landslides (and, hence, to natural-force-induced explosion) by weakening the pipeline shell's structural strength and therefore degrading its ability to perform as designed if subjected to external stress caused by subsidence or landslide.

The applicant's response to the inquiry on blast radius is incomplete. Given that the subject heading under which the question has been placed ("Evacuation Distance for Natural Gas Pipeline Leaks and Ruptures based on Blast Radius"). It is reasonable to expect that the USFS is asking the applicant to provide information about distances over which potential effects of unanticipated explosions would likely occur.

In Resource Report 11, p. 11-8, the applicant states "The proposed 42-inch-diameter pipeline with a MAOP of 1,480 psig would have a potential impact radius of 1,115 feet," and states that the calculation is based on a formula contained within 49 CFR 192.903. The application does not define the term "potential impact radius." That term is derived from 49 CFR 192.903, which defines the term as "radius of a circle within which the potential failure of a pipeline could have significant impact on people or property."

Additional information is cited below, for the purpose of providing a more precise description of the potential impact radius and its meaning. The formula for calculating potential impact radius was developed by a study sponsored by the

[13] Submittal 20151023-5035; RR 11, p. 11-23

IND333-3 cont'd

Gas Research Institute (MJ Stephens, A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines. Gas Research Institute Contract No. 8174. October 2000. http://pstrust.org/docs/C-FERstudy.pdf). That study states that the formula defines "the area within which the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure." The study report document also states "The model upon which the hazard area equation is based consists of three parts: 1) a fire model that relates the rate of gas release to the heat intensity of the fire; 2) an effective release rate model that provides a representative steady-state approximation to the actual transient release rate; and 3) a heat intensity threshold that establishes the sustained heat intensity level above which the effects on people and property are consistent with the adopted definition of a High Consequence Area (HCA)."

An independent third party has evaluated damage areas due to recent pipeline explosions by studying aerial imagery of such explosions' aftermaths, including imagery produced by news organizations (http://williamahuston.blogspot.com/2016/05/salem-twp-westmoreland-twp-pa-pipeline.html). This party has observed that the radius of areas subjected to visible burn ("burn radius") often exceeds the potential impact radius. For the cases analyzed, those exceedances have ranged from 77 to 649 feet.[14]

IND333-4

4. Emergency Responder Status

In EIR #1 MVP was asked to provide an analysis of the status of existing emergency responders for equipment, labor (volunteer or paid) and capabilities.

In a submittal by Dr. P. Ferrante, Ph.D., incomplete information in MVP's response was noted, they were:

1) The response given by MVP includes only Fire Departments and **no Emergency Medical Service (EMS) agencies are listed**. In many locales Fire and EMS are separate agencies and often located in separate stations. All emergency responding agencies should be identified including EMS agencies.

2) There is **no assessment of the emergency responder force**, i.e., number of responders, number of volunteer, number of career, level of training, and staffing level per 24-hour shift. Of the fire departments listed, 87% are staffed by volunteers only. I believe there would be a similar trend with EMS agencies if they are listed. Level of training of the responders in the agencies can vary and should be assessed.

3) There is **no analysis of the capabilities of the emergency responders**, but just a blanket statement that they are trained. There is no assessment of the

[14] Personal Communications C.E. Zipper, Ph.D.

IND333-4 See the response to comment IND18-2 regarding emergency plans.

IND333-4 cont'd

training level and qualification of the individual fire departments listed regarding their capability of handling an incident from a 42-inch, high-pressure natural gas pipeline. This should also be prepared for the EMS agencies along the route. MVP alluded to the fact that the local emergency responders would only be managing secondary fires and public safety. It appears that MVP does not have a high regard for the local community in the face of a possible pipeline incident that could be catastrophic. The burden of training and equipping the local responders will be placed on the small communities along the pipeline route.

4) There is **no assessment of the equipment** available at these small, local fire and rescue emergency response agencies. The pipeline traverses remote areas that can be difficult to access with most emergency vehicles. MVP has not assessed the capability of the emergency agencies to be able to reach the patient(s) within a critical response time.

5) Many hospitals along the pipeline are small with limited emergency capabilities. MVP has not assessed the emergency care available in these communities, **nor have plans been prepared for the emergency evacuation** of severely injured patients.[15]

The DEIS indicates that MVP intends to establish relationships with local fire departments and first responders, educating them on the hazards of natural gas, the facilities, including emergency shutdowns, and periodic response drills and tabletop exercises.[16]

The Applicants' communications with local emergency responders may involve individual meetings, group meetings, or direct mailings to build and maintain a relationship with the appropriate emergency personnel and ensure their knowledge and familiarity with emergency shutdown (ESD) and isolation systems and protocol. In addition, the Applicants would perform and financially support periodic emergency exercises and mock emergency drills with local government, law enforcement, and emergency response agencies, subject to agency availability and willingness to participate. Additional training materials, including the PHMSA – Emergency Response Guidebook, National Association of State Fire Marshals – Pipeline Emergencies textbook, would also be made available to emergency personnel. Mountain Valley would also continue to support fire department budgets, equipment, and training needs through donations from the EQT Foundation.[17]

Even though the DEIS statement above provides more information than the applicant has provided previously, it still fails to provide answers to the specific concerns outlined above by Dr. Ferrante.

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[15] Submittal #20160907-5211(31668078)
[16] DEIS, p. 4-307
[17] DEIS, p. 4-468

IND333-5

Summation

Flooding in WV is both common and severe and therefore *one example* of a **reasonably foreseeable future event** that may have significant adverse impacts to the pipeline if constructed, and those that live nearby. Can FERC state with certainty that following the WV, June 23, 2016 flood, that MVP re-surveyed all affected waterbodies in those counties?

> The absence of flash flooding discussions in the DEIS, and the report's failure to recognize that the Disaster-status counties are marked by high landslide susceptibility, are signals that the DEIS has not sufficiently studied and accounted for flash floods and their associated effects along the Proposed route. The natural forces that brought calamity across a rugged landscape are the **very same forces** that would threaten the structural integrity of Mountain Valley's pipeline. More profoundly, such a choice also means that the FERC thinks residents of the six Disaster-status counties will view as entirely reasonable the construction of the pipeline through their region.[13]

Respectful Submitted,

Louisa Gay

[13] Submittal #20161115 5030(31779613).

IND333-5 See the response to comment IND333-1 above.

INDIVIDUALS

IND334 – Anne Lusby-Denham

20161207-0028 FERC PDF (Unofficial) 12/07/2016

DETS/MVP CP16-10-000
EQUITRANS CP16-13-000

Comments to FERC on proposed Mountain Valley Pipeline

Nov. 2, 2016

Anne Lusby-Denham

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SECRETARY OF THE

2016 DEC -7 A 11:22

FEDERAL ENERGY
REGULATORY COMMISSION

IND334-1 I am a minster's wife and retired social worker/mental health therapist. I stand in strong opposition to the proposed Mountain Valley Pipeline for many reasons. A major one is that Virginia's coastline is second only to New Orleans in its vulnerability to sea level rise; as a result, the stakes are just too high for our state let alone Franklin County to continue pursuing costly infrastructures such as pipelines that will make climate change worse. Robert Howarth from the Dept. of Ecology and Environmental Biology of Cornell University states: " When methane emissions are included, the greenhouse gas footprint of shale gas is significantly larger than that of conventional natural gas, coal, and oil. Because of the increase in shale gas development over recent years, fossil fuel emissions rose between 2009-2013 despite a decrease in carbon emissions." If we continue the present course of fracked gas pipelines, this dangerous trend will continue. I ask FERC representatives, why would your agency continue to approve projects such as the Mountain Valley Pipeline that will end up reeking havoc on our state, our country, and our planet? Surely everyone connected with FERC must have family members, perhaps children and grandchildren, whose lives could be affected by your decisions. I have two grandchildren, and a third on the way, who are very much on my mind as I speak today.

IND334-2 Although I feel what I have already stated is the most compelling reason to oppose this pipeline, there are additional reasons. A 42" pipeline has never been built in the state of Virginia, and particularly through land that is full of karst geology, is mountainous, with many forested areas. In the event of a rupture a pipeline of this size transporting 23,144 cubic feet of gas per second and pressurized at 1,440 pounds per square inch would overwhelm emergency personnel in Franklin County and surrounding counties as well. The potential for a catastrophic explosion and subsequent fire in the forest and mountains of Southwest Virginia would be devastating and for the most part uncontrollable. EQT/Next Era cannot give us any assurance that the gas would be shut off before major damage is done. It is not realistic, and we know that many ruptures and explosions have happened and are happening with other pipelines. The other major concern with ruptures is damage to the water supply. As many others have pointed out, and as I pointed out to the Roanoke County Council when this project first came to light, Water is Life! And none of us can live without it. There will be risks to our water supply if this project goes through, and the project should be shelved due to this risk alone, but as I already have stated there are plenty of other risks involved, particularly increasing climate change which affects everyone not just the people of Virginia, as well as explosions that could be devastating to our area.

IND334-3

IND334-4

IND334-5 I would also like to touch on the subject of eminent domain—especially eminent domain that is taken for corporate benefit rather than public benefit. This gas damages our land as it goes on its way to markets abroad. It upends the lives of farmers and homeowners along its pathway, ruining their property values and despoiling the natural beauty of their land. If this were your land or the land of

IND334-1 GHGs and fugitive emissions are discussed in section 4.13 of the EIS.

IND334-2 See the response to comment LA1-4 regarding existing 42-inch-diameter natural gas pipelines.

IND334-3 See the response to comment IND2-1 regarding safety. See the response to comment IND18-2 regarding emergency response. As stated in section 4.12 of the EIS, if unexpected pressure changes are noted that indicate the possibility of a leak, the gas controller on duty can either shut down the pipeline MLVs upstream and downstream of the apparent leak and/or dispatch field technicians to investigate the pressure change. According to information provided by Mountain Valley, the remotely controlled MLVs could be controlled both locally and remotely and would close within 2 minutes following issuance of a remote signal to close.

IND334-4 See the response to comment IND3-1 regarding drinking water.

IND334-5 The U.S. Congress passed a law that stated that a company that obtains a Certificate from the FERC has the ability to use eminent domain. As stated in the EIS, the FERC would prefer if the company would negotiate mutual agreements with landowners for its easement. See the response to comment IND2-3 regarding export.

IND334-5 cont'd | your loved ones would you consider this project to be worth it, given all of the risks and problems I have mentioned? I hope and pray that it is not.

Anne Lusby-Denham
Roanoke, Va.

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1 A
Washington, DC 20436

RE: Draft Environmental Impact Statement for the Mountain Valley Pipeline (Docket No. CP16-10-000) and Equitrans Project (Docket No. CP16-13-000)

INDIVIDUALS

IND335 – Kathleen Taylor

20161207-0039 FERC PDF (Unofficial) 12/07/2016

Docket #CP16-10-000 **Reference: Mountain Valley Pipeline**

IND 335-1 My name is Kathleen Taylor and I live at 1305 Iron Ridge Rd in Rocky Mount in Franklin County Virginia. I am a former Director of The Northeastern Connecticut Conservation District and served on the board of the Putnam Connecticut Inlands Wetlands Commission. In serving in these positions I learned a great deal about the importance of protecting our Wetlands and Natural resources and the guidelines established by FERC to do so.

I am deeply troubled by the handling by FERC of the Mountain Valley pipeline Project proposed by EQT and NextEra. I believe FERC has failed to adequately review the project before releasing its draft environmental impact study. Legal and environmental experts have identified major gaps in FERC's analysis, including:

1. The core issue of whether the massive project is needed to meet natural gas demand
2. Whether other alternatives including energy efficiency, solar and wind would be more environmentally responsible sources;
3. A complete analysis of the cumulative, life-cycle climate pollution that would result from the pipeline
4. Any accounting of other environmental and human health damage from the increased gas fracking in West Virginia that would supply the pipeline, and finally
5. Thorough analysis of damage to water quality and natural resources throughout the pipeline route.

IND 335-2 IND 335-3 IND 335-4 IND 335-5

IND 335-6 Lara Mack, Virginia Campaign Field Organizer with Appalachian Voices. "This would be the first fracked-gas pipeline of this size to cross the Alleghany and Blue Ridge mountains. Running a massive gas project through the steep, rugged terrain laced with dozens of rivers and tier one headwater streams is a perfect storm for major damage to our water resources. FERC also fails to meaningfully address the safety issues and other concerns so earnestly voiced by hundreds of homeowners and landowners along the route."

IND 335-7 Next, experts at Massachusetts-based Synapse Energy Economics have concluded that the supply capacity of the Virginia-Carolinas region's existing natural gas infrastructure is more than sufficient to meet expected future peak demand. Two proposed and highly controversial interstate pipelines are not needed because existing pipelines can supply more than enough fuel to power the region through 2030.

The study concludes that the Atlantic Coast Pipeline and the Mountain Valley Pipeline – projects strongly opposed by local governments, businesses and thousands of mid-Atlantic neighbors – would be financially beneficial to utility companies and investors while burdening customers with higher bills to cover the cost of the unnecessary construction.

These are projects that would damage our land and water, take private property, and destroy our public recreational lands when FERC has not even determined if they are truly necessary and makes it seem as if FERC is valuing corporate profits over the public welfare.

FERC's mandate is to protect our natural resources above all. I demand that you do so.

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IND335-1 See the response to comment FA11-12 regarding need.

IND335-2 See the response to comment IND40-1 regarding renewable energy.

IND335-3 Climate change, GHGs, and cumulative impacts are discussed in section 4.13 of the EIS.

IND335-4 See the response to comment IND241-1 regarding induced development and comment IND2-3 regarding hydraulic fracturing.

IND335-5 Section 4 of the EIS provides an assessment of water resources and other natural resources such as vegetation, geology, soils, and wildlife.

IND335-6 See the response to comment LA1-4 regarding other existing 42-inch pipelines in mountainous terrain. See also the response to comment IND2-1 regarding safety.

IND335-7 See the response to comment FA11-12 regarding need. System alternatives are discussed in section 3.3 of the EIS.

INDIVIDUALS

IND335 – Kathleen Taylor

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INDIVIDUALS

IND336 – Chris Anne Carter

20161207-0047 FERC PDF (Unofficial) 12/07/2016

Chris Anne Carter

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2016 DEC -7 A 11:24
FEDERAL ENERGY
REGULATORY COMMISSION

November 2, 2016

ORIGINAL

The Honorable Norman C. Bay and Commissioners
Federal Energy Regulatory Commission
888 First Street NE
Washington DC 20426

RE: docket CP16-10-000 Mountain Valley Pipeline

Dear Chairman Bay and Commissioners:

IND336-1 I am a concerned citizen of Franklin County. I am against MVP for several reasons. The main reason this 42"pipeline is not for domestic use. Roanoke gas can provide natural gas via Clearbrook to Franklin County if we have the demand. At present the demand is at 30% not nearly the 60% they need. The citizens of Franklin County will not benefit in any way from the pipeline.

MVP cannot be trusted due to their underhanded business practices, their lack of sharing information and their continual lies to the citizens.
Just a few of the areas of concern-
View shed. Property values (eminent domain)
Water shed. Safety

IND336-2 Franklin County has grown over the years, due in part to retirees coming to the area. They come to enjoy the view shed, our mountains, lakes and rivers. Younger people are also enjoying the rivers, lakes and hiking trails. Over 60% of the residents of Franklin County will have their view shed negatively impacted with the MVP permanent pathway.

The Franklin County motto is, the land between the lakes, but this will be destroyed with all the sedimentation and contamination due to the 145+ waterway crossings. Recreational water activities will also be affected at the lakes as well as the rivers. Private wells and springs will be destroyed or contaminated due to the disruption of the water shed.

IND336-3 Property values will decrease, who would purchase a home or farm with the pipeline going thru it? Residents have had appraisals done, if the pipeline is built, their property value will

IND336-1 The MVP is for domestic use of natural gas; read section 1.2 of the EIS. See the response to comment CO2-1 regarding benefits. Visual impacts are discussed in section 4.8 and water resources in section 4.3 of the EIS. See the response to comment IND2-1 regarding safety. See the response to comment IND12-1 regarding property values.

IND336-2 Visual impacts are discussed in section 4.8 of the EIS. See the response to comment FA11-15 regarding sedimentation and turbidity at waterbody crossings.

IND336-3 See the response to comment IND12-1 regarding property values.

IND336-3 cont'd

decrease by at least 30% according to the appraisers. A for profit private corporation taking citizens land is just not right!

IND336-4

Safety is another major concern, with over 300+ property owners and many more residents, who are in the blast zone or evacuation zone. I will not live in a home that could be incinerated and my family killed at any time. Our county does not have the equipment, manpower or training to handle an "incident". Available water supply to fight a fire, along with our county road system will hamper any type of rescue. Just getting to a turn off valve could be problematic. Neither our county nor surrounding counties have the equipment, manpower or training to fight a fire, gas leak or devastation which would occur with a leak or explosion.

Do not grant a permit to the proposed Mountain Valley Pipeline! Their surveys are sketchy at best; they operated in Franklin County without concern for people or property. They have not done due diligence.

Sincerely,

Chris Anne Carter

Chris A. Carter

Chris CARTER
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210 Maple Avenue, Rocky Mount, Virginia 24151 540-489-1866

IND336-4 See the response to comment IND2-1 regarding safety. See the response to comment IND18-2 regarding emergency response. See the response to comment IND334-3 regarding valve shut-off time.

INDIVIDUALS
IND337 – Iris Moye

November 2, 2016

ORIGINAL

Docket # CP16-10-000 or CP16-13-000

My speech given on November 2, 2016 at Franklin County High School.

IND337-1 I am here this evening to speak out to the Mountain Valley Pipeline Executives in regard to their plans to (literally) ram a pipeline down our throats. My ancestors settled in the valley about 5 miles North of Boones Mill, VA. This property has been in our family ever since, and my son and his wife are the 8th generation to live and raise a family there. I believe if my family were to be displaced in any way, it would be a travesty; and a crime.

The property is in the shadow of Cahas Mountain, a very perfect example of the type of terrain that is mentioned in many articles regarding your rape of this part of our state. It is a fact, proven by people who have already gone through this agony, that their well water is affected, their land is affected and their farm animals are affected. This is over and above the horrible mess the pipeline will make of the beautiful areas you seek to take over and destroy.

I know I speak for every landowner who is in the path of this terribly destruction, that you have come for a fight and you will get one. No more platitudes about how the damage in "minimal" or "limited". No more wailing about needing clean energy. Gas is not "clean". It is proven that the best use of clean energy is solar power. And you who are so much into the environmental impact, and new businesses coming along and new jobs- will, the jobs will be gone as soon as the pipeline is finished.

I have mailed a copy of this letter to the Federal Energy Regulatory Commission along with a one and a half page of reasons why WE DON'T NEED A PIPELINE!!!

Thank you for the time,

Iris Moye

Please see the attached for the remainder of my case against the MVP.

(3 pages total)

IND337-1 Your family would not be displaced by the MVP. Impacts on water resources is discussed in section 4.3 of the EIS; farmlands are addressed in sections 2, 4.2, and 4.8. See response to comment IND40-1 regarding renewable energy.