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October 6, 2025
File No. 03.0035586.00

Mr. Mark Carruolo
North Smithfield Town Planner
Town Hall
83 Greene Street
North Smithfield, RI 02896

Re: GZA Peer Review
Pine Hill Road Quarry
North Smithfield, Rhode Island

Dear Mr. Carruolo:

GZA GeoEnvironmental Inc. (GZA) prepared this letter report in accordance with our June 16, 2025, Proposal for Peer Review, File No. 03.P000133.26 to the Town of North Smithfield ("Town"/"Client") pertaining to the December 5, 2024 Pine Hill Realty, LLC ("Applicant") Zoning Change Petition/Application for Amendment to Zoning Ordinance (the "Petition") associated with the active Pine Hill Road Quarry operated by Material Sand & Stone ("Material Sand") in North Smithfield, Rhode Island (the "Site", "Mine" or "Quarry").

GZA's summary is based on our review of the following:

1. Video recorded testimony provided by Mr. Robert F. Ferrari, PE; Mr. Richard J. Groll, Industrial Seismologist; and Mr. Mike Hammond, Mine Safety Health Administration (MSHA) compliance trainer, inspector and consultant on behalf of the Applicant;
2. Review of available geohydrologic, topographic and geologic data published by the United States Geologic Survey (USGS), local topographic data available on RI GIS, historical publicly available aerial photographs and maps of the Site and vicinity;
3. Publicly available five-year reports prepared by the U.S. Environmental Protection Agency (USEPA) for the nearby Western Sand & Gravel Superfund (WSG) and Landfill & Resource Recovery, Inc. Superfund (L&RR) properties; and
4. Mr. Anthony Urbano, PE, of GZA, participated in a Site tour on September 3, 2025.

GZA's summary provides our opinions regarding the accuracy, applicability, and conclusions provided by other experts regarding geohydrologic, air quality (dust and silica exposure), blasting impacts (vibrations and impacts on structures), seismology, geology and mine safety and GZA's interpretation and opinions of potential adverse impacts of the planned quarry expansion activities on the surrounding properties.

REGULATORY CONTROL AND OVERSIGHT

Although it is common and appropriate for residents to register concerns and complaints about neighboring land use with the local municipality, it is not commonly understood that the local municipality has limited authorities and the expertise, staff and budget to oversee and regulate the work of federal and state agencies. This not only pertains to mining operations, but to all industrial, commercial, institutional, and agricultural land uses and activities.



Blasting is regulated under Rhode Island blasting regulations outlined in General Laws Title 23, Chapter 28.28 and is regulated by Rhode Island Office of the State Fire Marshal. Questions on blasting should be referred to the Office of the State Fire Marshal and their website where responses to many of the questions raised at the February and March 2025 Town public hearings are addressed.

Rhode Island air quality regulations are regulated by the Rhode Island Department of Environmental Management (RIDEM), specifically its Office of Air Resources (OAR), in conjunction with the federal USEPA. RIDEM enforces state air quality regulations, while the EPA sets national standards under the Clean Air Act and provides oversight.

RIDEM regulates the state's groundwater quality, classifying groundwater resources and establishing quality standards under the authority of the Groundwater Protection Act of 1985. RIDEM is also the primary state agency that regulates surface water quality, establishing water quality standards and enforcing them through regulations like the Rhode Island Administrative Code. The USEPA provides a federal framework through the Clean Water Act, which states must implement and enforce, often through their own state environmental agencies like RIDEM.

An overview of federal, state, and local regulations governing quarrying operations is provided in **Appendix A**.

BACKGROUND

The Site (Assessor's Plat 7, Lot 38) is located at the north end of Pine Hill Road in North Smithfield, Rhode Island. It is comprised of 89-acres abutted on the west by WSG; undeveloped forest to the north and east, residential property to the south along Pine Hill Road, Pound Hill Road, and Douglas Pike; North Smithfield Auto Recycling to the southeast; and Doering Equipment to the southwest. The L&RR property is located 1,200 feet northeast of the Site.

We understand that most of the Site was grandfathered from the Town's Extraction of Earth Products regulation, but 32-acres were apparently added to the Site (common ownership) after the regulation was adopted by the Town. The Town is apparently considering whether or not the Site should be included in a new Industrial Special Management District Overlay which would allow continued use of the quarry operations across the entire 89-acre Site.

REVIEW OF EXPERT TESTIMONY

The authors of this report are experts qualified to opine on the technical issues addressed by the three experts, Messrs. Ferrari, Groll, and Hammond, who provided testimony before the North Smithfield Town Council Meetings ("Town Meetings") in February and March 2025. Based on the qualifications (curriculum vitae, resumes, etc.) and testimony provided by those experts at the Town Meetings, the three appear to be qualified to present on the matters they presented and opined.

GZA was retained to watch and listen to the testimony of Messrs. Ferrari, Groll, and Hammond, most of which was in form of answers to questions from the Town Plan Commission, Council and citizens. We did our best to capture all the concerns that were raised as reflected in our report. The concerns addressed below are based on the review of Town Meetings. There may be some concerns raised that are not addressed below but can be if and when GZA testifies at a future meeting. These issues include:

1. Infiltration Ponds
2. Groundwater
3. Blasting
4. Silica
5. Dust
6. Noise
7. Property values



The following briefly summarizes our key observations from the testimony for the Applicant.

Mr. Robert F. Ferrari, PE

Mr. Ferrari provided verbal testimony on the stormwater, groundwater, and the Infiltration Ponds. GZA agrees with Mr. Ferrari's testimony and responses to questions with no exceptions.

He indicated that surface water runoff, and a small amount of groundwater, is pumped from a sump located in the northeast corner of the Quarry and is discharged to the Infiltration Ponds located in the northwest area of the Site.

His testimony presentation focused primarily on the upgrades to the Infiltration Ponds in response to what was reportedly an abnormally wet period in late 2023 and early 2024. The upgrades included larger embankments around the ponds built to elevation 270 feet, he referred to as berms and engineered overflow structures or spillways at elevation 269 feet on the quarry side of the Infiltration Pond system embankments he referred to as weirs. The upgrades were intended to provide more protection against erosion during heavy precipitation events and prevent pond overflows from leaving the mine property.

Mr. Ferrari answered questions regarding potential impacts to the water quality and yield of nearby residential water supply wells and concerns regarding potential impacts to the two nearby Superfund sites. He also reported that limited testing of the pumped water from the sump revealed no evidence of contamination.

In response to questions about the impact of mining, water pumping and blasting on water supply wells, Mr. Ferrari was consistent in his messaging that it is important to know if the well in questions is installed in the sand and gravel or bedrock, well location, and well construction; information that he and presumably the Applicant do not have.

Mr. Ferrari clarified that the groundwater flow in the sand and gravel is different than in the bedrock which is limited to fractures which may be plentiful or sparse. He also clarified that most of the water pumped from the quarry, 90 percent given as example not measured, was from precipitation, with very little from the bedrock, indicating that the quarry is not a significant groundwater dewatering operation.

Mr. Ferrari stated that the Infiltration Ponds were modelled to provide the opportunity to have zero discharge of water to surface water. He also reported that water is not pumped into the Infiltration Ponds daily and sometimes is not pumped for days or weeks at a time.

Neighbors questioned whether there is a plan to sample residential wells, but Mr. Ferrari reported there is not a plan at this time, but the idea is being evaluated and that sampling of the mine sump water tested was clean as drinking water. A Village Council member responded that sampling is an action that may be discussed and considered.

Mr. Richard J. Groll, Industrial Seismologist

Mr. Groll's testimony was technical yet understandable. He demonstrated a depth of knowledge of blasting history; the development and meaning of regulatory limits; blasting vibration propagation and attenuation, air over pressure, noise, vibration monitoring, and monitoring design; and his 20 years of monitoring at the Site. GZA agrees with Mr. Groll's testimony and responses to questions with no exceptions. Some highlights of his testimony are summarized below

Mr. Groll explained how blasting is monitored using a seismograph. He stated that each blast event at the quarry is monitored and reported to the Rhode Island State Fire Marshal's Office. Typically, about 12 blasts are performed each year that lasts around 0.6 seconds start to finish. Mr. Groll reported that seismographs are placed at up to 10 residential locations that include Pine Hill Road (2), Pound Hill Road (4), Old Oxford Road (1), Douglas Pike (2) and Diore Court (1); and when blasting in the east or west areas of the Site also monitor near the WSG or L&RR properties. It is GZA's experience that this is a significant number of seismographs for the size of the project. In GZA's experience that number of seismographs is significantly larger than the commonly placed 1 to 3 seismographs



It is noteworthy that the state requirement in RI Gen Laws 23-28.28-9.(c) "Seismograph required. - Each licensee shall be required to perform a seismograph test at the nearest structure to the blast prior to and during any blasting that would exceed the limits as set forth in subsection (b)".

Mr. Groll explained that the blasting results are compared to standards based on historic research by the US Bureau of Mines which resulted in development of a curve, known as the Z-curve, in the 1980 USBM report Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting.

The Z-Curve line establishes a limit above which damage becomes possible, but it is important to note that damage does not automatically occur once this limit is breached. Vibrations monitored over the past 20 years have been below the limits defined by the Z-curve, mostly by one or two orders of magnitude. Air over pressure monitoring have been below the regulatory limit of 135 dB, which Mr. Groll considers a political limit, not technical.

In response to a question concerning the white cloud seen following a blast, we agree with Mr. Groll's explanation that the rapid conversion of solid into a gas produces a cloud comprised predominantly by water with some carbon dioxide, carbon monoxide and nitrous oxide gases. He explained that the sunlight reflecting off the water vapor gives the appearance of a cloud, the same principle in our atmospheric clouds.

Concerns associated with noise were discussed in response to questions related to the removal of trees on the southern portion of the property. Mr. Groll stated that the noise from blasting is attenuated more by the difference in elevation created by the mine face than by the trees. GZA agrees that the elevation change and trees add noise buffering.

In response to the question if it would be beneficial to break up a blast into two blasts, Mr. Groll explained that two blasts are commonly designed to occur simultaneously, with each designed to have multiple timed blasts microseconds apart. GZA agrees with Mr. Groll's response and description of such a timed blast being analogous to thumbing a deck of cards and we believe that execution of two blasts microseconds apart – would be sensed over microseconds, has much less potential and perceived impact as having two blast hours or days apart.

Mr. Mike Hammond, MSHA compliance trainer, inspector and consultant

Mr. Hammond testified about his experience as an MSHA inspector with experience at 800 to 900 mines and addressed questions from the Town Council and citizens mainly pertaining to silica and dust. Mr. Hammond responses demonstrated a depth of knowledge and relevant experience to respond appropriately to the questions asked. GZA agrees with Mr. Hammond's testimony and responses to questions with no exceptions. Additional opinions in response to citizen comments and questions asked during his testimony, specifically silica, dust, and property values, are addressed later in this report.

CONCEPTUAL HYDROGEOLOGIC MODEL – SURFACE WATER AND GROUNDWATER

The following provides a conceptual hydrogeologic model of the Site to help set the basis for our understanding of the physical setting that can be altered to some extent by mining.

Topography

Client provided a pond overflow plan that included pond and vicinity elevation contours from NOAA LiDAR and instrument survey from October and November 2024 for the area of Infiltration Ponds in the northwest area of the Site; Pond Overflow Detail, Sheet 1 of 2, prepared by NWSI Northeast Water Solutions, Inc. for Material Corporation, Pine Hill Quarry Pond Improvements Project. Aerial photographs and our Site visit identified seven ponds in the northwestern area of the Site. The Pond Overflow Details drawing provides elevation contours for the southern two ponds along the west property boundary and elevation data for those two and one adjacent pond to the northeast. The other four ponds northeast of the referenced three ponds are reportedly sedimentation ponds and are not included on the drawing.



The ground surface near the ponds is generally near elevation 269 feet consistent with the crest elevation of the ponds. Based on Pond Overflow Culvert Invert elevations reported on the drawing, the water enters the ponds from the northeast ponds to three ponds labelled from north to south Infiltration Pond 1, Infiltration Pond 2, then Infiltration Pond 3. The water in the Infiltration Ponds appear to be designed to maintain elevations of less than 268 feet with a top elevation contour at 270 feet and Infiltration Pond 3 with two Proposed Concrete Overflow Weir east and south onto the Site at elevation 268 feet.

GZA reviewed the USGS 1954 topographic map of the area which provided conditions present prior to earthwork activities. The central portion of the Site was near elevation 335 feet (NGVD datum of 1929). A hill to elevation 370 feet in the southwest portion of the Site, and another hill to elevation 370 to 390 feet in the eastern portion of the Site (area identified as Ridge Hill). The grades in the far eastern portion of the Site dropped to about elevation 300 feet and the low point of the Site is near the northwest corner of the Site around elevation 265 feet.

There is no evidence of wetlands or surface water features on the Site in 1954 topographic plan and no wetland mapped by the US Fish & Wildlife National Wetland Inventory (NWI). The northerly flowing Tarkiln Brook is shown to be located about 500 feet west of the Site. NWI wetlands are near elevation 250 to 260 feet 100 to 900 feet northwest and east; and at elevation 285 feet about 1,400 feet south of the Site.

Topographic contours from the RIDEM 2011 topographic GIS Environmental Resource Map 2011 LiDAR survey included on the Town of North Smithfield GIS server, show the northern and western area of the quarry excavated to elevation 270 to 300 feet. Based on the 2011 topographic contours stormwater runoff within the quarry was to the west and northwest area of the Site.

The 2022 USGS LiDAR survey shows the excavation limits to elevation 290 feet in the north expanded to include about 15 acres south and the northeastern approximately 5 acres excavated to elevation 220 feet, with a small northeast area to elevation 215 feet. Aerial photographs from 2025 indicate the northeast excavation now extends further to the south with three stepped benches.

Precipitation and Surface Water

The National Oceanic and Atmospheric Administration (NOAA) reports that the statewide annual average precipitation in Rhode Island is about 45 inches. Based on the topography and quarry activities, precipitation that falls on the 89-acre property that does not evaporate will be diverted and available to be used, pumped to the Infiltration Ponds or be discharged off the Site, although we understand that there is no discharge off the Site. The maximum volume of precipitation that enters the Site, assuming no contributing surface flow from adjacent properties, is about 109 million gallons per year, or on average about 200 gallons per minute (gpm).

We understand from the Applicant during the Site visit and the testimony of Mr. Ferrari that water pumping to the Infiltration Ponds is routine, but not constant and may not occur for days or weeks. The water is pumped to the Infiltration Ponds using 6-inch centrifugal diesel-powered pump that may be capable of 1,000 to 2,600 gpm. The remaining water evaporates or infiltrates the bedrock. If the quarry pumps water from the sump at 1,000 gpm for 5 hours per day, that is equivalent to the average precipitation that enters the quarry.

Tarkiln Brook is a perennial stream located west and north of the Site flowing north with surface water elevation ranging from 260 feet to 250 feet and discharges into the Slatersville Reservoir less than 1,300 feet north of the Site. The USGS Quadrangle shows the Slatersville Reservoir surface water elevation at 249 feet.

Trout Brook and associated wetlands are located 1,600 to 3,400 feet east of the Site at elevation 245 to 235 feet, respectively. Trout Brook also flows north to the Slatersville Reservoir.



Groundwater

Groundwater was observed where it collects in the northeast area of the Site mined to elevation 215 feet. The mine floor at the sump was stated by Mr. Ferrari during the Site visit to be about elevation 210 feet.

Water was not observed entering the quarry walls at time of the Site visit, so it enters the sump below the ground surface, below elevation 210 feet. Based on the surface water elevations near the Site, natural groundwater elevation is expected to be higher than the surface water in Tarkiln Brook and Trout Brook and adjacent wetlands so may be about near or a few feet higher than elevation 255 to 260 feet. In the northeast area of the quarry, the groundwater elevation is about 210 feet, the lowest elevation that the water is pumped in the sump. Pumping appears to be lowering the groundwater elevation at the northeast areas of the mine from at least elevation 260 feet to elevation 210 feet, or about 50 feet.

Monitoring at the adjacent WSG property in 2022 reported consistent groundwater elevations with those we estimated at 255 feet near Tarkiln Brook and 258 to 259 feet near the Site west property boundary. Monitoring in 2024 reported similar ranges of 255 to 262 feet. The higher elevations (262 feet) may be associated with the “abnormally high levels of precipitation” during the fall of 2023 and spring 2024 reported by Olin Corporation and the US who reported “severe flooding”. Neither Olin Corporation nor the USEPA offered conclusions with respect to the Infiltration Ponds and higher groundwater elevations. In the eastern area of the Site pumping may be lowering the groundwater elevation from at least elevation 260 feet to elevation 210 feet, or 50 feet.

The April 23, 2025, Olin Corporation report provides near continuous groundwater elevation data collected between March 20, 2024, and March 19, 2025, from five shallow wells located near the perimeter of the landfill cap. The study found that groundwater elevations varied from elevation 255.2 feet to 262.5 feet during the 1-year test period, which was lower than the reported “critical elevation” of 266 feet (where the waste cell is present). They proposed, and USEPA approve, the installation of a telemetry system at monitoring well C-6S with hourly water elevation measurements. *“Well C-6S was chosen as a “sentry well” to monitor for any future impacts of quarry management activities since: 1) it is the closest shallow monitoring well to quarry operations, and 2) it was the monitoring well with the most affected by the overland flow of water when the quarry basin(s) overflowed in the winter of 2023-2024.”* Olin will monitor the water level transducer data from well C-6S on a weekly basis and prompt notification will be given to USEPA should the water level at C-6S near the critical elevation of 266 feet (i.e., the bottom of the waste material).

Based on quarry observations during the Site visit, reported water management, and area hydrogeology, aquifer dewatering is occurring in the Quarry, but the volume of groundwater pumped is relatively small (about 30 gpm). Groundwater use by residences near the quarry is understood with water supply wells presumably located near the residences evident on aerial photographs. Rhode Island does not maintain a public, searchable online database so well completion reports would need to be requested from RIDEM's Groundwater Section. Based on GZA's experience in the region, most of the wells in the area of the Mine are likely installed in the bedrock from 100 to 500 feet deep. There may be some sand and gravel wells, but without records, there is no way to know.

Surficial Geology

Based on the USGS surficial geology map of the area, approximately 30 acres in the central and northwestern portions of the Site are underlain by a kame delta with sandy, well sorted gravel over coarser or finer sands. Approximately 25 acres of sand and gravel were partially mined. The eastern and southwest portions of the Site are underlain by ground moraine (i.e., glacial till) then shallow bedrock. The glacial till is reportedly a low permeability, dense mixture of sand, gravel, silt, and cobbles with occasional boulders. RIDEM considers saturated gravelly strata greater than 40 feet thick as Groundwater Reservoirs. No such reservoirs are mapped at the Site and the nearest are mapped 500 to 1,500 feet from the Site.



Bedrock Geology

Based on the USGS bedrock geology map of the area, the Site includes a variety of bedrock types. The southwest portion is underlain by Scituate granite gneiss, the central and far eastern portion by the Esmond granite and area of Ridge Hill by the Blackstone series quartzite and quartz-biotite schist.

The Scituate granite gneiss is flesh-colored, coarsely crystalline massive granite gneiss that contains orthoclase (20-45%), albite (20-30%), quartz (25-30%), and biotite (2-5%), with traces of muscovite, epidote, magnetite, and apatite. The Esmond granite is a light-gray, pink, or flesh-colored, coarse- to medium-grained, massive, granitoid rock composed of microperthite (45-50%), albite (20-30%), quartz (20-25%), muscovite (0-3%), and biotite ((0-3%), with traces of magnetite and allanite. The quartzite is light gray, medium-grained, and locally cross-bedded. The rock contains 70 to 80% quartz, with 20 to 30% albite and traces of muscovite, magnetite and zircon making up the matrix. The quartz-biotite schist is a gray, fine- to medium-grained, strongly schistose rock comprised of quartz (50-60%), biotite (15-20%), albite (10-15%) and epidote (5-10%), with traces of chlorite, garnet, and magnetite.

Western Sand and Gravel Superfund (WSG) Property

The WSG, located in Burrillville abuts the Site to the west. The WSG facility has a 2-acre area with a surficial impermeable cap located adjacent to the east property boundary. The cap is over bulk waste contaminated soil that is reportedly above elevation 266 feet and below the top of the cap at elevation 280 feet. Contaminated groundwater migrated from the area of the surficial cap to the northwest (away from the Site). Private residential water supply wells which were located northwest of WSG were found to be contaminated. As a result, in 1994 the USEPA facilitated development of the Nasonville Water District with a public water supply well about 1,000 feet southwest of the Site (hydraulically upgradient to the WSG landfill) used to supply public water to the impacted residential homes.

The groundwater remedy for WSG is monitored natural attenuation. The groundwater contamination levels are decreasing with time, although recently two new contaminants of concern (PFAS and 1,4 dioxane) were detected in the bedrock beneath the WSG property. The detection of these contaminants does not indicate a new release, just new testing parameters.

As part of a 5-year periodic review of the WSG property, the USEPA expressed concern that the new stormwater and groundwater Infiltration Ponds, installed at the adjacent Pine Hill Road quarry (i.e., the Site) between 2018 and 2021, may be impacting the waste cells located beneath the surficial cap. One of the quarry Site's Infiltration Ponds is located about 50 to 70 feet from the waste cells. The 2022 report by Olin Corporation for the WSG property did not reflect higher groundwater elevations to validate that concern.

A USEPA March 2025 fact sheet indicated that a ground level monitoring program is on-going to evaluate the effect of the nearby Infiltration Ponds on the groundwater levels beneath the waste cell. In addition, the fact sheet indicated that severe flooding from December 2023 to April 2024 caused minor damage to the vegetative cover over the surficial cap. The fact sheet also indicated that overflow of the soil berms, erosion from precipitation, located between the Infiltration Ponds and the WSG cap, allowed some discharge of turbid water to Tarkiln Brook. The March 2025 USEPA fact sheet stated that their investigation is ongoing, and no conclusions have been made at that time.

Mr. Ferrari stated in his testimony that the recent repairs to the soil embankment (making the soil embankment wider and taller) are anticipated to prevent further discharge of surface water runoff from the Site to the adjacent WSG property.

Landfill & Resource Recovery, Inc. (L&RR) Superfund Property

The L&RR property is 1,200 feet northeast of the Site. The L&RR property has a surficial impermeable cap that was installed by the USEPA over the landfill. Groundwater contamination is present beneath the landfill that migrates east towards Trout Brook (away from the Site). The top of the bedrock beneath L&RR ranges from about 30 to 130 feet



below grade with the shallower bedrock encountered in the western portion of L&RR. The predominant contaminants in the bedrock are 1,4-dioxane, arsenic, and hexavalent chromium. Other contaminants at L&RR include VOCs and PFAS. The groundwater elevations at L&RR vary from about 256 feet to less than 240 feet.

A 5-year periodic review of L&RR, dated September 2024, indicated that during the public comment period residents expressed concern that dewatering activities taking place at the quarry Site might impact L&RR. The USEPA stated that they reviewed historical groundwater elevations at L&RR and found that no observed changes in groundwater elevations and flow directions. However, based on the residents' concern, USEPA will continue to assess if quarry operations impact L&RR groundwater flow direction through the USEPA's groundwater remedy design, operation, and maintenance.

Wellhead Protection Area Maps

GZA reviewed RIDEM's wellhead protection area (WHPA) maps of the area for public water supply wells. The Site is not located within the WHPA of any public water supply wells. The closest WHPA is for the Nasonville Water District wells. Those public water supply wells are in the overburden aquifer and the WHPA is 500 southwest of the Site.

GZA Site Visit

On September 3, 2025 GZA visited the Site to observe conditions on the property. GZA was accompanied by Mr. Ferrari, Mr. Groll, Mr. Robert Pezza (President of Material Sand and Stone), and Mr. Ryan Hurley (Applicant attorney) who were available to answer questions.

The Pine Hill Road entrance road and the floor of the quarry pit were watered down for dust control. The deepest portion of the quarry (about 150 feet from the top of a hill) was observed in the northeast corner of the property as noted above to be about elevation 220 to 210 feet. Steep quarry wall faces typical of hard rock quarries were observed and an excavated sump was in the northeast corner of the bottom of the quarry. The 6-inch diameter diesel-powered centrifugal pump reference above was located adjacent to the sump. Mr. Pezza stated that during the summer and fall the pump is manually operated every few days and for a few hours. The pumped water is discharged to the Infiltration Ponds located near the northwest area of the quarry. During the spring and after rain events the pump operates more frequently and for longer durations. Mr. Ferrari indicated he believed the surface water level of the sump was maintained around elevation 208 feet.

The central portion of the Site was used for processing and material stockpiles. The active sand and gravel and bedrock mine working faces in the central and east areas of the Site are north facing and are advancing to the south. The southwest area of the mine is used to excavate bedrock and has about 40 vertical foot rock faces. According to Mr. Pezza that area is generally used for mining rip rap. The quarry faces are 200 to more than 400 feet north of the southern property lines.

In the northwest area of the Site, Infiltration Pond No. 1 was partially filled with water. The other two Infiltration Ponds were dry with small, ponded areas at the bottom of the basins. The embankment that separates the Infiltration Ponds from WSG appeared stable.

According to Mr. Groll, the quarry owner installed a reverse osmosis water treatment system on a residential water supply located at Pine Valley Farm (1899 Pine Hill Road). This well is located about 600 feet south of the Site's property line. Mr. Groll indicated that he did not believe the blasting operations impacted the water quality of the well, but the treatment system was installed to address the property owner's concern.

According to Mr. Pezza, sand and gravel is processed on the Site and rock crushing operation is performed off-Site.



GZA SUMMARY of FINDINGS

Hydrogeology

1. Approximately 25 of 30 acres of sand gravel deposits were partially mined at the property over the past 55 plus years. The remaining unmined approximately 5 acres of sand and gravel are situated north of the southern portion of the property.
2. There are no Site monitoring wells to confirm the groundwater elevation. However, based on nearby stream and wetland elevations and reported groundwater elevations at the WSG and L&RR properties, GZA estimates that the groundwater elevation at the Site may be 255 to 260 feet in the central portion of the Site, and about elevation 210 feet in the northeastern area of the Site at the sump.
3. GZA agrees with Mr. Ferrari's testimony that the upgraded embankment on the west side of the Infiltration Ponds with grading to the east improved the pond systems and will help prevent future erosion and surface water runoff to the WSG property as occurred in 2023/2024.
4. The groundwater in the western portion of the Site flows west toward the WSG property. Although not a reason for the Infiltration Ponds, the Ponds will also further restrict the potential for WSG's contaminated groundwater in the sand and gravel of the WSG property from migrating beneath the Site by mounding groundwater along the western property boundary.
5. We agree with Mr. Ferrari's testimony that water that infiltrates through the ponds will enter the sand and gravel aquifer and flow off the Site through the ground, eliminating the need for surface water discharge to Tarkiln Brook. We agree that infiltration is a favorable process for management of stormwater consistent with the Rhode Island state Law that requires the use of low impact-design techniques as the primary method of stormwater control to the maximum extent practicable.
6. The groundwater elevation data collected from the WSG property between March 20, 2024 and March 19, 2025, indicates that the Infiltration Ponds have not risen the water table beneath the buried waste in the WSG landfill above elevation 266 feet. The water level readings in the spring of 2024 were obtained during an abnormally wet season and the USEPA plans to continue monitoring groundwater elevations.
7. We also note that the bedrock quarry operations in the southwest portion of the Site do not extend below elevation 270 feet and the assumed groundwater elevation. If future quarry operations in the southwest portion of the Site are planned to extend significantly below the groundwater elevation reported at the WSG property (generally less than 262 feet), GZA recommends the quarry operator have a hydrogeologic consultant evaluate whether those operations could draw groundwater contamination east from beneath the WSG property.
8. Based on the premise that the groundwater table surface mimics surface topography, the pre-mining groundwater elevation at the Site can only be assumed to be higher than the nearby surface water, wetlands, and the measured groundwater elevations in the downgradient WSG wells. Bedrock extraction in the northeast area of the Site to elevation 210 feet implies that bedrock dewatering is occurring. We agree with Mr. Ferri's testimony that a relatively small amount of water pumped from the sump is groundwater and that most of the pumped water is from precipitation which is consistent with our evaluation.
9. The zone of influence of this lowering of the water table will depend on the hydraulic conductivity of the bedrock, the degree of fractures within the bedrock, and the final depth of the excavation. We estimate that the groundwater table has been lowered by about 50 feet (from elevation 260 to 210 feet). The water table drawdown will be greatest adjacent to the quarry sump and generally decrease with distance from the quarry pit.



10. The L&RR bedrock contamination plume is about 1,200 feet northeast of the Site and is migrating east, away from the Site. The USEPA reported that they have not yet seen any adverse impacts from quarry operations on groundwater levels and flow directions in the bedrock at L&RR.
11. However, groundwater in bedrock joints (cracks, faults or fractures) can flow long distances depending on the degree, character and direction of fractures and the change in hydraulic gradient. So contaminated groundwater in fractured bedrock at the L&RR property could travel the 1,200 feet distance between the quarry and the landfill if there are continuous or connected fractures providing a direct connection between the Quarry sump and L&RR.
12. Based on the bedrock dip directions and fault orientations reported on the 1952 USGS Geologic Map of the Georgiaville Quadrangle, Rhode Island, the primary orientation of joints in the bedrock in the area is expected to be generally north-northwest to -south-southeast, perpendicular to the direction of the L&RR property relative to the Site.
13. The quarry tested the sump water twice in 2023 and identified no evidence of contamination. Based on reported groundwater flow direction, the relatively low groundwater infiltration rates into the quarry, and the 2023 sampling, there does not appear to currently be a direct hydraulic connection.
14. Although the USEPA will continue to monitor the groundwater, and the Quarry dewatering will theoretically continue for decades, groundwater elevations between the sump and the L&RR is a reasonable solution to monitor for potential changes in groundwater elevations gradients and flow. One monitoring well on the Site and one between the Site and L&RR would be sufficient and can be compared with elevation data collected by the USEPA.
15. We acknowledge Mr. Ferrari's testimony that he and the Applicant do not know how the residential wells are constructed and agree that information is needed to predict if mining will impact wells. To understand water supply well construction near the quarry a database of nearby wells can be prepared. Development of a database would need to consider the area of interest on a technical basis versus a random selected distance.
16. An iterative approach can be adopted to develop a database and evaluate well construction based on the anticipated mine plan. One well off Old Oxford Road is less than 300 feet from the Site. It is unknown how far to extend a database for consideration of monitoring and which of these wells should be evaluated and if others should be included
17. A database can be developed to determine ground surface and water supply well elevations and engage a water well service contractor to confirm well construction and static water levels, well bottom and pump installation depths. After a mine plan is understood, the potential impact to residential water supply wells can be better predicted and monitoring can allow for proactive responses.
18. An iterative approach can be adopted to evaluate the potential for quarry operations to impact the chemistry or yield of nearby residential water supply wells is dependent on several factors, such as:
 - a. The proximity of the quarry operations to residential wells,
 - b. The ground surface topography and proximity of residential wells to perennial surface water features such as Tarkiln Pond, Tarkiln Brook, Trout Brook and their associated wetlands,
 - c. Extent of quarry operations relative to the groundwater table near the residences and potential for changes in hydraulic gradients or flow,
 - d. Residential well construction in the sand and gravel or bedrock,
 - e. The depth and magnitude of water bearing zones or joints intercepted in bedrock wells, and



- f. The specific capacity of the well and hydraulic conductivity of the aquifer.
19. Consideration of requests from residents for sampling water supply wells will need to consider several factors.
- a. The variations in geology between the sand and gravel and the three bedrock types will result in differences in geochemistry between neighboring wells in the area that may be reflected in the natural pH, total dissolved solids, metals like iron, potassium, manganese, sodium, and nonmetal elements such as radon and fluoride.
 - b. There is little if any risk of the quarry operations drawing contaminated groundwater from either the WSG or L&RR properties to the residential water supply wells south of the quarry.
 - c. The goal of monitoring and testing parameters would need to be vetted. Monitoring for changes in water quantity of a well would be based on groundwater levels measured in the water supply wells and/or monitoring wells.
 - d. Consideration of monitoring for changes in water quality versus for measurement of specific parameters to compare to a standard, some of which may already be exceeded due to natural chemistry or contamination sources.
 - e. Monitoring for changes in water quality require a reasonable baseline evaluation that ideally would be over several seasons and years.
 - f. Monitoring for changes in water quality and quantity that residents commented are associated with blasting is another consideration. Such monitoring would be targeted to residential water supply wells where residents believe they are directly affected and would need to be compared to a baseline and evaluated immediately following a blast.
20. Equipping one or more residential water supply wells, or bedrock monitoring wells, with a pressure transducer and datalogger will enable the Applicant to monitor changes in groundwater elevations and respond proactively to changes that may be attributed to the quarry.

Blasting Vibrations

- 21. Based on Mr. Groll's testimony, it appears that he established a local or regional industry standard of care for blast vibration monitoring that is greater than that performed in the majority of the US and is greater than the minimum state law requirement of a seismograph test at the nearest structure.
- 22. Mr. Groll testified that blasting vibrations would not damage well casings but acknowledged during a September 19, 2025, discussion with GZA that particles of rock or sediment in open bedrock wells could move and enter a well during a blast. GZA agrees with that statement and recognizes that it is well and geology specific and impossible to predict.
- 23. GZA has owned and utilized seismographs for decades and is involved at dozens of quarries and other rock blasting projects where vibration monitoring is routine. The results reported by Mr. Groll of vibrations monitored over the past 20 years below the limits defined by the Z-curve, and air over pressure below the regulatory limit are not surprising. For property owners that experience a blast within a structure, it can be attributed to human perceptibility verses what damage can be done to a structure.
- 24. The "cloud" observed following a blast is not toxic, and is comprised predominantly of water, carbon dioxide, carbon monoxide and nitrous oxide gases, not unlike our atmospheric clouds.
- 25. GZA agrees that execution of two blasts microseconds apart would be sensed over microseconds and has much less potential and perceived impact as having two blast hours or days apart.



Silica and Dust

26. The personnel sampling described by Mr. Hammond is consistent with the industry standard of care. His characterization that monitoring personnel working in the mines that have obvious direct contact and exposure to sand and dust serve as an effective proxy for neighbors hundreds of feet away.
27. Most questions to Mr. Hammond focused on silica. More importantly the concerns raised focus specifically on dust and particles of respirable crystalline silica (RCS) small enough to be inhaled, e.g., particles measuring below 10 micrometers in diameter (also called “microns”).
28. Air quality is a genuine concern with a history of study and development of best management practices (BMPs) and protections and has been a particular unique focus of research and study by Mr. Krumenacher providing an opportunity to provide expert testimony on this matter due to the large number of focused questions during Mr. Hammonds testimony.
29. Silica is ubiquitous and concerns over crystalline silica dust and silicosis in the quarry industry are legitimate, but the issue is not a new or lightly considered issue by the quarry industry. A detailed technical summary addressing respirable crystalline silica and silicosis and relevant research is provided in **Appendix B**.
30. Air emissions from quarry operations include fugitive emissions, point source emissions, and mobile source emissions from the combustion of fossil fuels in an engine. Most states require preparation and implementation of fugitive dust control plans to address mine areas, blasting, stockpiles, and roads and describe conditions to implement dust suppression activities. Dust is controlled on quarry sites by paving heavily used trucking routes, routine sweeping, and application of water. In Rhode Island, fugitive dust control is mandated by RIDEM under Air Pollution Control Regulation 250-RICR-120-05-5 requires quarries to prevent airborne particulate matter from travelling beyond the property line of the emission source without taking adequate precautions to prevent particulate matter from becoming airborne.

Noise

31. Noise is regulated by the Town Ordinance Chapter 229. GZA offers no opinion on the noise generated at Material Sand, adjacent business and nearby roads.
32. Like any land use from industrial to agricultural and residential, quarrying is not silent. Some amount of noise is inevitable. When made aware, and when feasible, most land users will make equipment changes to eliminate, reduce, or refocus noise; and quarry operators are no different. Primary responsibility for the control of noise rests with state and local governments. Twelve states and the District of Columbia have noise statutes and regulations, most of which are applicable to quarry operations. In most local jurisdictions noise standards are regulated at the local level through ordinances, but no universal standards are applied
33. Noise is regulated in all industries for worker safety and health. In the quarry industry, the MSHA imposes limits on noise based on established guidelines considered protective of workers. Noise reduction beyond that is subject to local noise ordinances or is a voluntary good business practice. Noise is also sometimes regulated at a local level for aesthetic and quality of life reasons or public welfare. Chapter 229 sets the standards applicable to all land uses. Noise complaints associated with new quarry development often reference quality of life and moving to the country for quiet and tranquility. Such comments do not recognize the fact that it is impossible to live without noise or recognize the magnitude of noise created by the complainants.
34. This author lives in an extremely tranquil rural area adjacent to public land, a scenic hiking trail, and a river. Also, within ¾-mile are a sand and gravel quarry, agricultural cropland, cattle pasture, county highway, railroad, neighbors with contracted or self-performed landscaping maintenance, and aircraft at low and high altitudes. Except for extreme wilderness areas, noise is prevalent everywhere and it is created by everyone without



exception. It is difficult to respond to individuals that object to a proposed quarry because it may make a perceptible noise on top of all the other noises that the objector is partially responsible for. Nobody wants unnecessary and annoying noise, but we cannot expect to live the way we do and live in silence.

35. Quarry operations control noise through a selection of equipment that has a lower noise rating where feasible and available. On stationary equipment, barriers can be installed to shield, reflect, or absorb noise to limit its propagation beyond property boundaries as suggested by Mr. Groll. Heavy equipment manufacturers have improved engine design to the point where the backup alarms commonly produce the highest noise level and have become the subject of more noise complaints than the equipment itself due in part to its unpredictability when heard.¹ Although the standard high decibel (about 90 to 110 dB) beeping alarm can be heard for a half-mile or more it can be difficult to pinpoint in closer quarters. This shortcoming defeats the usefulness from a worker safety perspective, especially if more than one piece of equipment is operating and different types of backup alarms are being used. Unfortunately, the noise can become so ubiquitous that it becomes an annoyance, can be easily ignored, and accidents happen.
36. Backup alarms are not only required, but they are necessary, and they are intentionally designed to be heard and capture attention. An obvious drawback to this important safety tool is its ability to be heard at great distances. Backup alarms are evolving and can vary the decibels based on sensors that measure ambient noise and object detection. Directional white noise multi-frequency alarms focus in the area of risk rather than in all directions away from the equipment in an audible “ssh-ssh” locatable sound.

Property Values

37. A negative impact on property values was raised as a concern at the March 2025 public hearing and cited as a reason to deny the Applicants request. Property value is an important and often emotional topic with implications that not only affect individual property owners with the concerns and the mining company at the center of the discussion, but also the local community.
38. Concerns about the potential impact on property value are present for almost every land-use change proposed in a neighborhood or near residential property and is one of the most commonly cited concerns associated with mining and quarrying and one of the most misunderstood. Despite personal feelings, the facts do not support the claim. Material Sand operations will not negatively impact property values in the Town.
39. A summary of research pertaining to property values and mining is provided in **Appendix C**.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The following summary, conclusions and recommendations are based on our review of the testimony, Site visit, discussions with the above-named individuals, independent research and our experience.

1. The Town has limited authorities and the expertise, staff and budget to oversee and regulate the work of federal and state agencies. This not only pertains to mining operations, but to all industrial, commercial, institutional, and agricultural land uses and activities.
2. GZA considers the testifying experts, Messrs. Ferrari, Groll and Hammond, to be credible and agrees with the testimony and responses to questions of with no exceptions.
3. Quarry operations in the northeast area of the Site has lowered the water table in the bedrock by about 50 feet. Current quarry operations in other areas of the Site do not appear to be below the groundwater table.

¹2011, January, David C. Holzman, *Environmental Health Perspectives, Vehicle Motion Alarms: Necessity, Noise Pollution, or Both?*, accessed December 6, 2020, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3018517/>



4. Current quarry operations do not appear to be adversely affecting conditions at the two nearby Superfund sites (WSG and L&RR). To evaluate the potential impact of dewatering, a groundwater monitoring well could be installed near the northeast area of the bedrock quarry and one between the Site and L&RR to compare with groundwater elevation data from L&RR to evaluate potential groundwater elevation changes that may suggest contaminated groundwater flow towards the Site
5. If groundwater elevations indicate that dewatering is causing hydraulic gradients and groundwater flow to be toward the Site from contaminated wells at the L&RR property, the wells can be used to sample the groundwater for analytical laboratory testing.
6. Material Sand should consider a mine plan relative to the groundwater table surface to evaluate whether future quarry operations may potentially affect nearby residential water supply wells or contaminated groundwater from WSG. If future mining operations in the southwest portion of the Site are planned to extend below the groundwater table, then we recommend a hydrogeologic consultant evaluate whether the dewatering could draw groundwater bedrock contamination east from beneath the WSG property.
7. If future mining operations in the sand and gravel in the northern and central area of the Site are planned to extend below the groundwater table, we recommend the quarry operator have a hydrogeologic consultant evaluate whether the dewatering will impact nearby residential water supply wells.
8. An evaluation of potential impact to residential water supply wells would require a database of nearby wells to include ground surface and water supply well elevations, well construction and static water levels, well bottom and pump installation depths. Equipping one or more residential water supply wells, or bedrock monitoring wells, with a pressure transducer and datalogger will enable the Applicant to monitor changes in groundwater elevations and respond proactively to changes that may be attributed to the quarry.
9. Blast vibrations and air over pressure monitored over the past 20 years are reported by Mr. Groll to be below the regulatory limits. Mr. Groll's standard of care for blast monitoring is a benefit to the neighbors, Town and Material Sand.
10. The personnel sampling described by Mr. Hammond is consistent with the industry standard of care. His characterization that monitoring personnel working in the mines that have obvious direct contact and exposure to sand and dust serve as an effective proxy for neighbors hundreds of feet away.
11. Silica is ubiquitous and concerns over crystalline silica dust and silicosis in the quarry industry are legitimate, but the issue is not a new or lightly considered issue by the quarry industry and is not considered to be a risk to neighbors from the Material Sand operations.
12. Dust is controlled at the Site by paving the trucking routes, routine sweeping, and application of water to comply with Pollution Control Regulation 250-RICR-120-05-5 that requires quarries to prevent airborne particulate matter from travelling beyond the property line of the emission source without taking adequate precautions to prevent particulate matter from becoming airborne.
13. Noise is regulated by the Town Ordinance Chapter 229. GZA offers no opinion on the noise generated at Material Sand, adjacent business and nearby roads.
14. Concerns about the potential impact on property value are present for almost every land-use change proposed in a neighborhood or near residential property and is one of the most commonly cited concerns associated with mining and quarrying and one of the most misunderstood. Despite personal feelings, the facts do not support the claim. Material Sand operations will not negatively impact property values in the Town.



We trust this information satisfies your current needs. If you have any questions, please do not hesitate to contact the undersigned.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

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Attachments Appendix A
 Appendix B
 Appendix C



APPENDIX A

Overview of Regulations

Appendix A

Overview of Federal, State, and Local Regulations Governing Quarrying Operations

Construction aggregate quarrying and all other mining are governed by statutes and laws, rules and regulations, and local ordinances established by a multitude of government and regulatory agencies at the federal, state, and local levels. The magnitude and depth of regulatory control and oversight of nearly every aspect of quarrying that includes land use, environmental protection, and public safety, provide the matrix within which quarrying is performed sustainably. Although all quarrying is heavily regulated, some people claim it is an “unregulated industry”. Members of the general public may be unaware of the extensive protective measures that guide, and in some cases dictate all mining processes and shipping of the essential building materials of our society. These regulations are designed to prevent widespread negative effects no different than those applicable to every other industrial, agricultural, and commercial enterprise.

New quarries and quarry expansions increasingly generate controversy, often dominated at the local level by a small yet vocal group of critics. Generally, detractors promote a narrative based upon misconceptions that call into question the adequacy of regulatory control and oversight of quarrying. The industry critics often attempt to sway public opinion by portraying quarrying as an unregulated industry running roughshod over local communities, harming the environment by polluting local streams and public health with dust, detracting from the quality of life with noise, and distressing public infrastructure with road deterioration. This characterization is absolutely untrue, as the thousands of communities with a history of local quarrying are aware.

Throughout the U.S., most federal and state environmental, health, safety, transportation, and other regulations apply to essentially all industries. With some exceptions, regulations tend not to be industry-specific because doing so would create an unmanageable patchwork of rules and regulations that would be less effective and more difficult to enforce. A standardized approach of universal regulatory authority regardless of industry type provides the framework by which all industries operate by the same rules and are equally protective of the environment, human health, safety, transportation, and other issues.

Fueling the claims that quarrying is unregulated may be triggered by the lack of an industry-specific state “quarry regulation” or “quarry law,” similar in nature to the in-depth rules regulating landfills. Critics of quarrying are either unaware of the manner that environmental and other regulations are applied or simply choose to portray the industry as unregulated to end existing ventures and prevent future operations.

Quarry industry leaders have expressed support of regulations; strict operating standards that protect the environment; and the health and safety of employees, as well as the public. Such a stance assumes that the regulations are based on sound science and are applied equally across all quarry operations. When developed at the federal or state level, regulations are applied equally throughout the regulated community. When developed independently by dozens of counties and hundreds of townships within a state, impartiality is virtually impossible.

Decades of research by experts in health, safety, environment, blasting, and other areas, and the application of existing rules and regulations in quarrying operations establish the following five key assertions:

1. Quarrying and all nonmetallic mining, which includes construction aggregate, is one of the most highly regulated industrial businesses in the U.S.

2. Potential known impacts on the environment and public health, safety, and welfare are addressed by existing laws, regulations, and additionally on the quarry permitting process through zoning ordinances in many jurisdictions.
3. Balancing the demands of every community through adherence to the complex regulatory control and oversight of the quarrying industry results in a sustainable and reliable source of construction aggregate and other minerals.
4. The appropriate and applicable technical resources are available to demonstrate point number 1 and validate point 2 and point 3.
5. State policy on redundant, overlapping, and inconsistent regulations (see Section 2.1.1) is needed to fairly improve regulatory efficiency.

The five key points are strong arguments where some disagreement may arise without the benefit of valid research or justification.

Two general levels of regulatory control apply to all industries. The first level involves permits, licenses, or other written approvals required to operate a facility. These are comprehensive and generally require substantial lead time, including a thorough permit application, review, and approval process. Examples include those promulgated and implemented according to federal statutes such as the Clean Air Act (CAA), Clean Water Act (CWA), and federal explosives licenses.

The second level involves activities that are self-implementing and not otherwise governed by a formal permit issued according to statutorily-driven regulations. Self-implementing regulations are established and must be carried out by the regulated community without direct approvals and oversight. Regulatory agencies have the right to audit facilities and records to confirm compliance. With self-implementing regulations that do not require a permit, the federal, state, or local government has the implementation burden, and the regulated community bears the compliance burden. Examples of self-implementing regulations include:

- Mine Safety and Health Administration mine safety rules;
- oil storage under the Spill Prevention, Control, and Countermeasures (SPCC) Rule;
- Safe Drinking Water Act (SDWA);
- Toxic Substances Control Act (TSCA);
- Resource Conservation and Recovery Act (RCRA);
- federal and state waste handling and disposal; and,
- a long list of many others.

In essence, these rules are like automobile safety and road speed limits: compliance is up to the individual, but the government inspects and audits.

As a cost of doing business, quarry companies employ environmental, safety, health, and other professionals. Furthermore, quarry firms retain consultants and join industry associations to monitor available sources of information. These measures help operations maintain compliance with existing standards and remain aware of potential and proposed changes. The extensive regulatory scheme applies to all aspects of industrial and commercial operations, including quarrying. This structure developed because of lengthy evaluation and rulemaking processes that include detailed, rigorous scientific study, public and stakeholder input, and legislative decision making, a process that takes years to finalize.

Consequently, with the constant awareness of regulatory changes, quarrying operations must constantly seek out and recognize:

- background studies;
- best management practices (BMPs); and,
- guidance established by regulatory agencies, governmental and nongovernmental scientific bodies, scientific societies and associations, industry associations, non-governmental organizations, and others.

These measures provide the regulated community with an understanding of why the regulation is in place, not just the mechanics of the regulation. Unless one is involved in the quarrying industry, the depth of regulatory understanding is not evident to the general public.

Laws (Statutes) written by Congress provide the authority for the federal regulatory agencies such as the U.S. Environmental Protection Agency, Mine Safety and Health Administration, and others, to draft legal regulations. Federal regulatory agencies often empower state and local agencies to support the enforcement of these regulations. These agencies can go above and beyond federal regulations to write their own rules. Regulations explain the technical, operational, and legal details necessary to implement the laws. Despite subtle differences between regulations and rules, the terms are commonly used interchangeably.



APPENDIX B

Silica Summary

Appendix B

Silica

1. Air quality is a genuine concern with a history of study and development of best management practices (BMPs) and protections and has been a particular unique focus of research and study by Mr. Krumenacher providing an opportunity to provide expert testimony on this matter due to the large number of focused questions during Mr. Hammonds testimony. A detailed technical summary addressing respirable crystalline silica and silicosis and relevant research is provided in Appendix A.
2. Prolonged exposure to such particles, known as respirable crystalline silica, can cause silicosis, a preventable but potentially fatal lung disease in occupational settings. Particulate matter (PM) includes airborne particles equal to or smaller than 10 microns in aerodynamic diameter; likewise, PM4 and PM2.5 measure the concentration of airborne particles with an aerodynamic diameter of 4 or 2.5 microns, respectively, and smaller. As a point of reference, a typical human hair is about 50-70 microns thick.
3. Particles sized PM10 are inhalable but are generally too large to deposit in the distal (deep) airways of the lungs; whereas PM4 and PM2.5 are of concern because these particle sizes are small enough to be inhaled and travel to the distal airways where alveolar respiration occurs. Particles sized PM4 and smaller are often referred to as the respirable fraction of airborne particulate. Studies have investigated concentrations of PM4 as crystalline silica in Minnesota and Wisconsin, allowing for an evidence-based discussion about the potential for a public health threat from RCS and quarrying activity.
4. Silicosis is an inflammation of the lung and other respiratory tissues that eventually causes fibrosis, a hardening of the lungs, reducing the ability to breathe efficiently. Symptoms include shortness of breath while exercising, fever, fatigue, and loss of appetite. Silicosis also renders an individual to be more susceptible to infection and diseases such as tuberculosis and lung cancer.
5. The American Lung Association reports the silicosis death rate in the U.S. is generally low. Between 1996 and 2005, the age-adjusted death rate due to silicosis was 0.8 per million population. Even the low death rate is higher than necessary, considering deaths caused by occupational exposure to RCS can be prevented by complying with safety procedures and preventative measures outlined by the MSHA and OSHA.
6. In quarrying and other industrial environments, comprehensive silicosis prevention programs include implementing engineering controls such as local exhaust ventilation and filtration; not using compressed air for cleaning surfaces; using water sprays to control airborne dust; using surface wetting to prevent dust from becoming airborne when cutting, drilling, grinding, etc.; administrative and work practice controls; personal respiratory protective equipment; medical monitoring of exposed workers; and worker training.
7. While task-based RCS exposures may be elevated, the concentrations of dust during quarry operation are controlled to be lower than occupational exposure limits. Much of the material handling is done when the material is wet or moist, and workers who may be exposed to dust are not in confined buildings near the source of dust, where concentrations may be relatively high if building ventilation is inadequate. Additionally, much of the heavy equipment (front end loaders, excavators, haul trucks, etc.) used in quarry operations contain engineering controls (ventilation) to prevent ambient RCS from entering the cab and the machine operator's personal breathing zone.
8. The U.S. Department of Health & Human Services Centers for Disease Control and Prevention lists primary and secondary sources of particle pollution as factories, cars and trucks, and construction

sites. Based on studies in 51 countries, sources of urban ambient PM2.5 air pollution is from traffic (25%), industrial activities (15%), domestic fuel burning (20%), unspecified sources of human origin (22%), and natural dust and salt (18%).

9. Studies of rural air quality and pollution by the University of Iowa reported by PHYS.ORG examined differences between urban and rural areas analyzing data collected by the Iowa Department of Natural Resources between April 2009 and December 2012 in Linn and Polk Counties in Iowa. The data showed PM2.5 concentration higher at the urban locations compared to rural locations, especially for particles associated with gasoline- and diesel-powered engine exhaust, as much as 230% higher. Secondary nitrates that form by chemical reactions in the atmosphere also had slightly higher concentrations in rural areas.
10. Because silica is ubiquitous, concerns over crystalline silica dust and silicosis in the quarry industry are legitimate, but the issue is not a new or lightly considered issue by the quarry industry. In 1936, the National Industrial Sand Association (NISA) was created to focus collective resources on silicosis. That same year, NISA participated in the National Conference on Silicosis and the U.S. Secretary of Labor formed four committees that focused on silicosis prevention. From 1936 through 2018, research on silicosis and other health and safety concerns was the key focus of NISA. "NISA companies have been voluntarily conducting dust monitoring and medical surveillance in their workplaces for more than 30 years and, as a result, have virtually eliminated silicosis from their workplaces."
11. The culmination of decades of research resulted in the development of two landmark documents that address the silicosis issue applicable to all of the quarrying industry;
 - a. April 2010, National Industrial Sand Association, The Occupational Health Program for Exposure to Crystalline Silica in the Industrial Sand Industry, 276 pages.
 - b. January 2012, Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Report of Investigations 9689, Dust Control Handbook for Industrial Minerals Mining and Processing, 284 pages.
12. Although silicosis is an occupational hazard for workers in industries that involve exposure to RCS, fears of a public outbreak of the disease as a result of quarry operations are not supported by air monitoring data gathered by the Minnesota Pollution Control Agency (MPCA), the WDNR, and established professionals such as Dr. John Richards and Ted Brozell, , whose research at industrial silica sand mining operations have provided the best available dataset on RCS levels near quarries and processing sites in the Midwest. The research at industrial sand operations provides extremely conservative data because industrial sand is greater than 99% silica, more than any other material quarried, while crystalline silica comprises 12% of the Earth's crust, and any activity that disturbs rock or soil can contribute to ambient crystalline silica concentrations. Air quality near industrial sand operations was reported thoroughly in 2017 and concluded "industrial silica sand mining does not pose a threat to air quality or the public health" and that "every scientific study in which federally approved air sampling methodologies and equipment were employed has concluded industrial sand facilities do not generate hazardous concentrations of respirable crystalline silica dust."
13. Air emissions from quarry operations include fugitive emissions, point source emissions, and mobile source emissions from the combustion of fossil fuels in an engine. Most states require preparation and implementation of fugitive dust control plans to address mine areas, blasting, stockpiles, and roads and describe conditions to implement dust suppression activities. Dust is controlled on quarry sites by paving heavily used trucking routes, routine sweeping, and application of water. In Rhode Island, fugitive dust control is mandated by RIDEM, the Rhode Island Department of Environmental

Management (DEM) under Air Pollution Control Regulation 250-RICR-120-05-5 requires quarries to prevent airborne particulate matter from travelling beyond the property line of the emission source without taking adequate precautions to prevent particulate matter from becoming airborne.

14. Residents of communities near quarries have raised concerns that dust blowing from trucks hauling sand from industrial sand mines could be a source of hazardous respirable silica particles along transportation routes. The industrial sand from those mines is 99.9 percent silica. Those concerns prompted authorities from the Minnesota Pollution Control Agency (MPCA) to conduct ambient air monitoring along a busy truck route in Winona, Minnesota. Using the PM₄ data gathered from that monitor, MPCA concluded dust from hauling industrial sand near the air monitoring location was not a threat to public health. MPCA data reported that dust concentrations did not reach detectable concentrations on 94.7% of the days sampled over seven months. When air monitors did detect dust, it was in concentrations near 15% of the chronic health benchmark used by MPCA and the source was unknown.
15. MPCA selected the town of Stanton in rural Minnesota as a reference site against which to compare RCS levels it recorded in Winona, a city with a population of almost 30,000. Stanton does not have quarries or major transportation routes but does have other sources of RCS, such as farm fields and unpaved roads. Stanton registered higher levels of RCS than Winona. MPCA concluded, "Airborne silica is a fairly ubiquitous pollutant and is not unique to silica sand mining and processing facilities."
16. Most states require preparation and implementation of fugitive dust control plans to address mine areas, blasting, stockpiles, and roads and describe conditions to implement dust suppression activities. Dust is controlled on quarry sites by paving heavily used trucking routes, routine sweeping, and application of water. In Rhode Island, fugitive dust control is mandated by the Rhode Island Department of Environmental Management (DEM) under Air Pollution Control Regulation No. 5. The regulation requires that "reasonable precautions" be taken to prevent particulate matter from becoming airborne during construction, demolition, and other activities involving materials that could cause dust.
17. Quarry operations are required to take actions to prevent and minimize fugitive particulate matter emissions, perform an annual survey to identify uncontrolled sources of particulate matter emissions, and prepare a written fugitive dust control plan. An example fugitive particulate matter emissions survey provided by the USEPA for a gravel operation confirms the potential emission sources to be haul roads, conveyors, crushers, screens, stackers, and stockpiles and that the primary remedy is the use of water.



APPENDIX C

Property Values Summary

Appendix C

Property Values

1. A negative impact on property values was raised as a concern at the March 2025 public hearing and cited as a reason to deny the Applicants request. Property value is an important and often emotional topic with implications that not only affect individual property owners with the concerns and the mining company at the center of the discussion, but also the local community.
2. Concerns about the potential impact on property value are present for almost every land-use change proposed in a neighborhood or near residential property and is one of the most commonly cited concerns associated with mining and quarrying and one of the most misunderstood. Despite personal feelings, the facts do not support the claim. The proposed use will not negatively impact property values in the Town.
3. Concerns about the potential impact on property value are present for almost every land-use change proposed in a neighborhood or near residential property. There are few, if any, exceptions. Such a personal stance against development within an area not only applies to a quarry but is true of almost every proposed land use. Equally strong local opposition often occurs if the proposed development is a residential subdivision, church, or playground if that development is planned for an area where individuals have a different perspective on the best use of the property proposed for development.¹ The same is true of wind and solar farms, which are prized for their eco-friendly nature.²
4. The potential negative impact of quarry operations on property value is one of the top concerns raised in response to almost every proposed new mine or quarry expansion. Opponents to mining often claim the construction or expansion will reduce property values in the surrounding community. Although individuals and organizations issue statements and use social media networks to try and validate these concerns, they simply make claims without citing research. It is a common tactic, but repeating an unsupported statement often and loudly does not make it true.³
5. It is unclear why an industry required for the normal function of our society (the products of which constantly touch the lives of every individual, and contribute to the high quality of life) is so seemingly misunderstood, increasingly reviled, and opposed. The reality may be that where a quarry is passionately and emotionally challenged by a group of citizens, the concerns are raised as a smokescreen hiding the true personal reasons for the challenge. And yet, when all of the diversionary concerns are factually and technically addressed, the opposition does not wane, the deep-rooted reason remains – NIMBY.
6. There are no credible studies supporting claims of widespread and predictable property value declines associated with nonmetallic mining. This lack of credible evidence demonstrates how

¹ Rhonda Goodman, "Proposed Playground a Subject of Controversy. A Group Is Raising Money for a Tot Lot In Hillcrest Park. Some Nearby Residents Oppose It," Philly.com, April 16, 1995, http://articles.philly.com/1995-04-16/news/25686544_1_tot-lot-playground-hillcrest-park.

² Amanda Brodhagen, "Ontario Court Says Wind Turbines Reduce Property Values," April 24, 2013, Farm.com, <http://www.farms.com/ag-industry-news/ontario-court-says-wind-turbines-reduce-property-values-882.asp>. See also John Rodgers, "The Effect of Wind Turbines on Property Values: A New Study in Massachusetts Provides Some Answers," Union of Concerned Scientists, January 22, 2014, <http://blog.ucsusa.org/effect-of-wind-turbines-on-property-values-384>.

³ For more on this tactic, see Dr. L. Kip Wheeler, "Logical Fallacies Handlist," Carson-Newman University, no date, https://web.cn.edu/kwheeler/fallacies_list.html.

the concern, although legitimate and should be reviewed, is not supported by factual information that demonstrates it to be a reality.

7. Every mine is unique, and as is true of any development, there are circumstances where the value of adjacent properties may be affected. These are finite and unique circumstances at some, not all, quarries, and they can be addressed only on an individual basis. There are no documented circumstances of quarrying causing a community-wide reduction of property values.
8. There are also no documented circumstances where local property values are affected near the Material Sand Quarry, even by those that made the claims at the March 2025 meeting, as residential home sales along Pine Hill road, Pound Hill Road and Old Oxford Road near the Material Sand Quarry have occurred multiple times since the Quarry opened prior to 1970, more than 55 years ago.
9. Although the land sales records were not checked by GZA, based on the testimony of residents at the public hearings, it is unlikely more than 5 to 10 percent of the residents within ¼-mile of the Site were there more than 55 years prior to Quarry development.
10. Between 1981 and 2011, several studies, using technically sound methods, examined the relationship between nonmetallic mining and property values. Each of the studies concluded there was no consistent relationship between mines and property values. Although there were specific instances where mines or quarries may have reduced nearby property values, other homeowners realized an increase in property value because of the setbacks, open space, and wooded areas used to buffer mining operations. While it can be difficult to explain this seemingly counterintuitive finding during an emotionally charged public meeting, it is a demonstrable fact and logical when calmly considered or, better yet, witnessed.
11. Some studies report property values near mines were higher than similar properties farther from mines. This does not necessarily imply the mine itself increased the property value, but it does demonstrate a mine does not necessarily reduce the value of nearby properties. Many mines actually suffer from so much post-development encroachment by residential development they end up operating in a residential rather than rural environment, without complaint from, and more importantly, without harm to the neighbors or their properties.
12. Residential encroachment on existing nonmetallic mining operations has become a serious land-use issue that is gaining recognition from local officials who see a growing need for future planning.⁴ This planning is needed not specifically or only to protect residential land uses, but to protect the future availability of nonmetallic minerals as well. Without proper planning, for example, the most ideally situated local nonmetallic mineral resources may be buried by a subdivision, with the next available source of minerals needed to build the local development and infrastructure significantly farther away. This unnecessarily increases costs to consumers and municipalities. The Town of Hortonia should seriously consider stronger protections for the regionally unique limestone natural resource that is present in the community.
13. The earliest study we identified that addressed property values was completed in 1981, by the U.S. Bureau of Mines, which evaluated bedrock quarries in Illinois, Kentucky, Missouri, and

⁴ John Henriksen, Mark Krumenacher, Zak Lesemi, and Mathew Hensel, "Planning for Sustainable Aggregate Production," presentation to the National Planning Conference of the American Planning Association, Chicago, Illinois, April 16, 2013.

Pennsylvania.⁵ The analyses found no consistent relationship between quarries and property values.

14. In 1987, the Department of Real Estate at Georgia State University conducted a study to measure adverse impacts on the value of existing homes or homes to be built near a proposed quarry in Bolingbroke, Georgia. The study considered quarries in DeKalb, Newton, and Monroe Counties in Georgia, utilizing two comparative analyses.⁶ The study concluded the following:
 - a. Properly developed quarries had no effect on the value of housing adjacent to the operation
 - b. In one of three Counties, property values in the non-quarry area increased more slowly than values in the quarry-influenced area
 - c. Some homeowners said they benefited from being near a quarry because of the open space and wooded areas used to buffer operations.
 - d. The overall study of changes in the value of homes located both nearby and away from properly operated rock quarries indicates quarries have no significant adverse impact on the value of homes.
15. A 1995 analysis of a proposed sand and gravel quarry in Granite Falls, Washington conducted by Schueler, McKown & Keenan, Inc., a real estate appraisal firm, considered four case studies in Washington.⁷ The analysis concluded properties adjacent to quarry operations buffered by 100 or more feet showed no difference in value compared to properties removed from the operation, and in some instances, the values near a quarry were found to be higher.
16. A study by the Department of Economics at Ohio Wesleyan University in 1996, evaluated previous studies by the U.S. Bureau of Mines (1981) and Rabianski and Carn (1987), who focused on residential appreciation rates near a Delaware County, Ohio quarry and a quarry located in Franklin County, Ohio.⁸ The Ohio Wesleyan researchers also used the repeat sales method to study values near the Marble Cliff Quarry and Shawnee Quarry. They found values of properties located adjacent to an existing quarry were not reduced. The researchers concluded an expansion of the Shawnee Quarry would not reduce the values of adjacent and nearby residential properties.
17. The land-use consulting company Banks and Gesso, LLC, conducted a study in 1998, examining property values near three quarries in Jefferson County, Colorado that sold before and after quarry development. The analysts found no basis for suggesting quarries devalue residential properties.⁹
18. In 2002, Banks and Gesso evaluated 10 subdivisions in the vicinity of three sand and gravel operations in the Fort Collins, Colorado area.¹⁰ The analysts found no significant statistical

⁵ M. Radnor, D. Hoffer, C. Aimone, *et al.*, *Social, Economic and Legal Consequences of Blasting in Strip Mines and Quarries*, U.S. Bureau of Mines, May 1981, <http://www.cdc.gov/niosh/nioshtic-2/10006499.html>.

⁶ Joseph Rabianski and Neil Carn, "Impact of Rock Quarry Operations on Value of Nearby Housing," Department of Real Estate, Georgia State University, August 1987.

⁷ Richard McKown, "Analysis of Proposed Sand & Gravel Quarry, Granite Falls, Washington," Schueler, McKown & Keenan Inc., September 1995.

⁸ Anne Dorrian and Clifford Cook, "Do Rock Quarry Operations Affect Appreciation Rates of Residential Real Estate," Department of Economics, Ohio Wesleyan University, April 1996.

⁹ "Impacts of Rock Quarries on Residential Property Values, Jefferson County, Colorado," Banks and Gesso LLC, May 1998.

¹⁰ "A Property Valuation Report: Affect of Sand and Gravel Mines on Property Values," Banks and Gesso LLC, October 2002.

difference in the data suggesting locations near sand and gravel mines suffered lower property values. For two of the mines, the subdivisions nearest the operations had higher rates of appreciation for home values than subdivisions farther away.

19. Two studies addressed expansion of existing industrial sand mines. A 2005 study by William A. McCann & Associates, Inc., a real estate appraisal company, evaluated real estate values near two aggregate quarries in Naperville and Bolingbrook, Illinois and compared them to properties near a proposed industrial sand mine expansion in Ottawa, Illinois.¹¹ The empirical data indicated the proposed mining expansion would not have a measurable adverse effect on nearby property values.
20. In 2011, two Wisconsin-certified appraisers, William Richardson and Brian Ducklow, analyzed sales in the Town and Village of Maiden Rock and comparable markets along the Great River Road in Pierce County, Wisconsin to determine the effect on the local real estate market of an underground industrial sand mine.¹² They found no historical data to suggest the mine had affected the real estate market in the Maiden Rock and surrounding area.
21. Also in 2011, the Winona County, Minnesota, Planning Department prepared a memo to address questions submitted by the County board, planning commission, and the public regarding three proposed industrial sand mines in Saratoga Township.¹³ The Planning Department concluded property values around existing quarries and sand pits in the County - 54 mine sites identified - were not noticeably reduced due to proximity to existing mining operations.
22. Property values depend on a variety of local factors, with each property having specific characteristics, making it difficult to draw broad generalizations about how a particular property will be affected by development of any form. Because property values are affected by such specific factors, modeling exercises that try to isolate the influence of a specific factor, such as proximity to a proposed mine, rarely succeed in accurately assessing property values.
23. A search for information that demonstrates mining has a negative impact on property values yields essentially no credible and scientifically valid studies and reports. Because we are aware that the claim of decreased property values has been made in response to the Material Sand property at the March 2025 public hearing, we discuss the limitations of a report commonly cited without validation as allegedly demonstrating nonmetallic mines decrease nearby property values.
24. The most widely cited information claiming nonmetallic mining operations have a consistent, negative effect on property values is based on a report by George Erickcek of the W. E. Upjohn Institute for Economic Research, "An Assessment of the Economic Impact of the Proposed Stoneco Gravel Mine Operation on Richland Township."¹⁴ Commonly, but erroneously referred to as the "Erickcek study" or "Hite study," this information is in fact not a study, but a theoretical

¹¹ "Property Value Impact Study, Proposed Mining Expansion, Ottawa, Illinois," William A. McCann & Associates, Inc., April 2005.

¹² William Richardson and Brian Ducklow, "Comparative Study of the Maiden Rock Real Estate Markets to Surrounding Markets," 2011.

¹³ Winona County (Minnesota) Planning & Environmental Services, "Memo to Winona County Board Planning Commission RE: Frac Sand Questions," November 10, 2011, <http://www.red-wing.org/media/files/planning/silicansand/winonacountyregulatoryframework.pdf>.

¹⁴ George Erickcek, "An Assessment of the Economic Impact of the Proposed Stoneco Gravel Mine Operation on Richland Township," August 15, 2006, <https://www.heartland.org/policy-documents/assessment-economic-impact-proposed-stoneco-gravel-mine-operation-richland-township>.

model based on an unpublished, non-peer-reviewed working paper by Diane Hite, an associate professor at Auburn University.

25. Although Erickcek presented Hite's model as credible evidence for decreased property values, and he calls Hite's analysis "the only rigorous study to date of gravel mine impacts on property values," research by Mr. Krumenacher which included a personal conversation with Hite and others, concluded Hite's work was never more than a working paper that was neither peer-reviewed nor published and was grossly misrepresented by Erickcek and subsequently by several others.
26. Other analysts have drawn conclusions similar to GZA's about Erickcek's work. The Great Lakes Appraisal Company (GLAC) exposed Erickcek's misuse of Hite's information as "unprofessional at best and likely misleading and reckless." GLAC stated, "If the author(s) of the Upjohn report were subject to the same rules and regulations governing our profession, they would be in violation of a number of basic tenets, particularly those regarding unsubstantiated conclusion and the requirement to produce credible results."¹⁵
27. The major shortcomings of Erickcek's paper include:
 - a. His use of studies that investigated the impact of trash landfills on property values as a proxy for sand and gravel mines
 - b. His refusal to acknowledge his own findings that appreciation rates for property values near sand and gravel mines are the same as for properties distant from these operations; and
 - c. His demonstrated lack of understanding of the inputs of the conceptual model used by Hite, which severely limit the usefulness of Erickcek's modeling.
28. Most of the studies presented by Erickcek as evidence that environmental disamenities (environmental features some parties may consider undesirable) can reduce property values actually assessed the potential impact of landfills on property values. The environmental impacts of landfills and nonmetallic mining operations are vastly different, rendering these comparisons invalid and inappropriate. For example, among the primary concerns regarding landfills are objectionable odors and fears of an influx of undesirable animals such as rats and seagulls.¹⁶ Nonmetallic mines do not emit objectionable odors or attract vermin.
29. If the two Superfund sites near the Material Sand Site did not have an impact on property values or otherwise convince current property owners not to buy, the Quarry operation can also be expected to have no impact.
30. Erickcek found appreciation rates (the rates at which property increases in value) to be similar for property located next to a mining operation and property located farther away. These findings suggest proximity to sand and gravel mines does not substantially influence the value of a given property. Despite that finding, and without data to support his claim, Erickcek developed an unsubstantiated theory suggesting sand and gravel mines create a one-time, immediate loss of property value that is then priced into the value from that point forward, essentially lowering the value all at once and hitting a "reset button" allowing the property to appreciate at the same rate

¹⁵ Memorandum to Alamo Township Michigan Planning Commission Regarding Aggregate Industries Application and Matters and Information Brought Before the Township, Great Lakes Appraisal Company, February 2007.

¹⁶ See, for example, Ariel Barkhurst and Lisa J. Huriash, "Mount Trashmore smell prompts resident complaints," *Sun Sentinel*, July 15, 2013, http://articles.sun-sentinel.com/2013-07-15/news/fl-trashmore-odor-violations-20130711_1_monarch-hill-landfill-operator-waste-management-inc; New York Department of Health, "Important Things to Know About Landfill Gas," New York State, August 2012, https://www.health.ny.gov/environmental/outdoors/air/landfill_gas.htm.

as other properties. Research conducted by GLAC to assess the validity of this theory found it to be unsupported by the data. Looking back in time to before the mining operations opened, GLAC determined there was no evidence to support the hypothesis of an immediate, one-time decline in property value. Based on the comments from at least one resident near the Material Sand Quarry, there are attempts to hit the reset button again. This claim and approach are not unique to the North Smithfield.

31. Finally, research conducted by GLAC found the supposed sand and gravel mine that was the basis of Hite's work and the Erickcek report was, in fact, not a gravel mine, but a limestone mine in Ohio. Hite did not collect the data she used in her working paper. Neither Hite nor Erickcek visited the subject mine and they did not collect sufficient information to construct a model capable of accurately predicting the impact of sand and gravel mines on property value.
32. Despite the documented inaccuracy of Erickcek's representation of Hite's working paper, others have repackaged Erickcek's work as fact in subsequent reports, blogs, and articles relaying his manipulation of Hite's initial working paper. Erickcek's deeply flawed work is still being used to oppose mines in Canada¹⁷ and the United States, with the initial concept getting twisted a little more with every subsequent report. This is especially true of a seemingly simple curve initially created by Erickcek showing a reduction in property value plotted against distance from a mine. This now convenient curve is cited frequently as fact and even "irrefutable" without an understanding of its genesis. Inconceivably, even Diane Hite now cites Erickcek's 2006 report and his use of "the Hite (2006) study" in a recent report prepared in opposition to an aggregate operation in Colorado.¹⁸ Despite her telling this author that her work was not a "Study". It is this ridiculously flawed plot that has led residents to comment at the recent public hearings of 25% property value decline near the Quarry.
33. Hite's draft working model – a hedonic pricing model that assumes the price of property is determined both by its own characteristics and external factors – requires credible inputs, but, property value is influenced by a complex mixture of variables that are difficult to control for and separate from one another for analysis. Erickcek's work fails to take the complexity of property value into account and lacks credible inputs, rendering the outputs of the model useless for predicting the impact of sand and gravel mines on property values.
34. It is vitally important that local decision makers and residents understand the limitations of such reports alleging to be scientific studies. Public opinion is too often influenced by unsubstantiated claims or modeling exercises that appear to be sophisticated but produce results that do not match real-world observations. When people in positions of assumed high esteem and respect, such as University Professors and consultants at 90-year-old independent research organizations, make statements they are too often accepted and not vetted or otherwise challenged.
35. It is important to note that, although the damage is done and the Erickcek flawed plot has gone viral, Erickcek does not include that 2006 report in his 2016 curriculum vitae (CV) posted on the W. E. Upjohn website. Erickcek's CV lists 72 publications and 8 working papers between 2001 and

¹⁷ "The Potential Financial Impacts of the Proposed Rockfort Quarry," The Centre for Spatial Economics, February 26, 2009, http://www.wcwrpc.org/FinancialImpacts_RockfortQuarryCanada.pdf.

¹⁸ Chuck Wallace, "Property Values Decrease Around a Quarry," *StopTheQuarryCascadeTownship*, November 25, 2014, <https://stopthequarrycascadetownship.wordpress.com/2014/11/25/property-values-decrease-around-a-quarry/>; Ellen E. Kisker and Diane Hite, "Response to Weld County 34 Value Diminution Study by Michael Smith, Foster Valuation Company LLC," August 5, 2015, <http://www.clr-34.org/images/Real%20Estate%20value%20impacts.pdf>.

2016. This can be viewed as a positive recognition that the 2006 report is not a document to be proudly advertised.

36. Property values can be affected by the mere *perception* of possible harm from a given source, such as a cell phone tower, electric transmission lines, school, church, day care, playground, residential subdivision, big-box retail, wind turbines, solar farm, or nonmetallic mine. The ways in which people perceive risks can influence how they view themselves, their surroundings, properties, and society at large.¹⁹ People exposed to new ideas tend to give more weight to negative information, even if their initial fears are not based on a rational view of the available evidence.
37. Unscientific, anecdotal claims that inaccurately quantify potential risks and those erroneously reported as fact by influential groups feed the irrational perception of harm. Such claims do nothing to quantify the potential impacts of mining, instead causing unnecessary consternation among local residents. Such claims may very well have a greater negative impact on property values near mines than the mining operations themselves. Residents in opposition to the Material Sands Quarry may be making matters worse for themselves and their neighbors with such unsubstantiated allegations and painting an unreal picture of the quality of life in the area. As one resident pointed out at the March 2025 public hearing, the area is getting a lot of publicity and negative press that will only hurt those that are making the claims.
38. Perceptions of harm that have no basis in fact are likely to be temporary and so, too, is any property value decrease based on those perceptions. Research shows the irrational perception of harm can be addressed by scientific, evidence-based information.

¹⁹ Alex Geisinger, "Nothing but Fear Itself: A Social-Psychological Model of Stigma Harm and Its Legal Implications," *Nebraska Law Review* 76 (3), <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1513&context=nlr>.