

From: Brianna Schoen <briannaschoen1@gmail.com>
Sent: Sunday, January 27, 2019 4:32 PM
To: Donald H. Gerrish; Amanda L. Lessard; Donna Chapman; Rebecca Cummings; Tim E. Nangle; Jarrod Maxfield; David Nadeau; Bob Muir; Clayton Haskell
Cc: Ted North Cove; Janene Gorham; Paula Venti Curcio; Denise Tanguay; Tina LeBlanc; Brian French; Meg Eddy
Subject: Information for Planning Board and Town Council re: Presentation on New Mineral Extractions
Attachments: Impacts of New Mineral Extractions in Windham Maine.pdf; PowerPoint Research Documents.zip

Good Evening,

Attached please find a PowerPoint presentation and research documents regarding new mineral extractions in Windham.

We would like the Planning Board to have this information before making recommendations to the Town Council regarding new mineral extractions.

If you have any questions or problems opening the pdf or zip file please let us know.

Thank you for your time.

Sincerely,

The Forest Lake Association Civic Affairs Committee

Impacts of New Mineral Extractions in Windham, Maine



Westbrook, Maine - 100 acre quarry

Mineral Extractions are Allowed in Many Highly Populated Areas of Windham

- ▶ Mineral Extractions are **currently allowed** in: Commercial District 1 (C1), Farm District (F), Farm Residential District (FR), Industrial District (I) and Enterprise Development District (ED).
- ▶ Mineral Extractions are **currently not allowed** in: Light-Density Residential District (RL), Medium-Density Residential District (RM), Commercial District II (C2), Commercial District III (C3), Village Commercial District (VC), Aquifer Protection Overlay District Zone A (APA).

Mineral Extractions Don't Align with the Farm Zone's "Intent"

- ▶ In Section 406 of the Windham Land Use Ordinance the "Intent" of a Farm District is: "The Farm District is intended primarily for rural and residential land uses. Development is restricted to protect farmlands, woodlands, open space, wildlife habitat and scenic areas."
- ▶ New mineral extractions would impact woodlands, wildlife habitat and scenic areas, especially around watersheds and this goes directly against the farm zone's intent.

Is the intent for mineral extractions in farm zones to help farmers or for large industrial operations?

There was No Public Input at the Mineral Extraction Committee Meeting in Favor of Mineral Extractions

- ▶ At the September 28, 2018 public forum there were many concerns brought up that were not incorporated into the Mineral Extraction Committee's changes.
- ▶ The Council Chambers were packed with standing room only and 23 members of the public addressed the committee. Not one of the residents that spoke was defending mineral extraction operations, in fact, there were people there who currently live next to quarries or pits and stressed how much it has negatively impacted their quality of life.
- ▶ The public asked for zoning to be looked at more in depth to see what the impact of mineral extractions is on natural resources, particularly around waterbodies.
- ▶ The public asked to have developer's past violations to be considered from other towns, not just within the municipality. When a project is proposed near neighboring towns this impacts their quality of life and property values as well.
- ▶ Members of the public also asked for an Aquifer Overlay Zone, similar to the one around Chaffin Pond, to be considered around aquifers in Windham. An example of where this would be a great zone would be around Forest Lake's entire watershed to protect one of the largest drinking water aquifers in Southern Maine.

https://www.windhammaine.us/DocumentCenter/View/4314/Mineral-Extraction-Committee---Public-Meeting-Write-up_09-20-18

<https://www.youtube.com/watch?v=jTFapPN12xc&feature=youtu.be>

Do New Mineral Extractions Make Sense in a Town Currently Facing Growth Issues?

- ▶ Windham is currently facing growth issues, especially in the Farm and Farm Residential Zones. The Farm and Farm Residential Zoning Districts make up approximately 65% of Windham. Between 2001 and 2013, these areas hosted about 68% of Windham's growth.
- ▶ During the November 7, 2018 forum on farm zones in Windham, residents filled the middle school cafeteria expressing concerns over growth in the Farm and Farm Residential Zones.
- ▶ Top priorities to residents were: water quality, protecting natural resources, the environment, wildlife, traffic and schools.
- ▶ Many residents stated that the areas in farm zones that need the most protection are: lakes, rivers, streams, aquifers, recreational areas, forested areas and open spaces.

New Mineral Extractions Don't Align with Windham's Comprehensive Plan

- ▶ The plan details in bold type, the “4 Big Things” that are the highest priority for the town. Number 3 is “**Invest in rural Windham to keep it rural,**” this statement is also on the cover page.
- ▶ The Plan states that we need to, “**Protect critical and important natural resources.**”
- ▶ “**We need to get serious about open space and preserving land or there will be little left to preserve and protect**”.
- ▶ From the Future and Vision of Windham pages, “The community identifies the most important open space and undeveloped properties and works with owners to permanently protect these areas”.
- ▶ From the Future and Vision of Windham pages, there are Town Plan Goals that include, “Identify land for preservation, pursue opportunities to preserve open space and recreational lands and establish a program for preservation of land important to the people of Windham.”

* See plan details here: <http://www.windhammaine.us/225/Comprehensive-Plan>

New Mineral Extractions Don't Align with Windham's Comprehensive Plan



- ▶ There are no goals stated anywhere in the master plan to increase the number of mineral extraction sites in Windham nor to increase them in our forested lands, wildlife habitats, or near our lakes and other natural resources.
- ▶ Conservation, protection and/or acquisition of forested lands, open space, wildlife habitats, water and natural resources is mentioned over **200 times** in the Windham Comprehensive Plan.

Windham's Comprehensive Plan Contains a Detailed Survey of Residents

- ▶ On page 296 of the Comprehensive Plan, it discusses a survey from Windham residents and according to the results of the survey:
- ▶ Windham residents feel the amount of forested lands and open space in Windham is either about right or **not enough**.
- ▶ Windham residents agree that we must balance growth of the community while protecting rural character and natural resources.
- ▶ Most residents agree that protecting open spaces and forested lands should be a priority.
- ▶ Residents agree that loss of forested lands and open spaces is a **threat to our quality of life**.
- ▶ Residents are even willing to support a tax increase to finance efforts to acquire, preserve and/or protect undeveloped open space and forested lands.

Windham's Comprehensive Plan Discusses the Importance of Watersheds

- ▶ On Page 46 of the Comprehensive Plan, it states, “Many watersheds extend beyond municipal boundaries, so managing water quality efforts on a watershed model often requires regional cooperation to be truly effective. Windham values the quality of life its natural and water resources provide to its residents and visitors and appreciates the responsibility of all towns in the region to protect the water quality of watershed resources. Over the years Windham has actively participated in several regional planning efforts involving neighboring communities and regional entities related to these critical resources”.

Windham should be looking at the zones around its waterbodies and discussing what kinds of projects should and should not be allowed near them, especially bodies of water that impact multiple towns. **Forest Lake, Sebago Lake, Little Sebago Lake and Highland Lake all share frontage with other towns and have farm zones around them.**

Private Roads Are Already Having Issues in Windham - Should Industrial Operations Be Allowed on them?

- ▶ According to page 123 of the Windham Comprehensive Plan, “Private Roads make up a significant proportion of the miles in the Town’s road network. Private roads make up almost 50% of the miles in the network. Traditionally, when people thought of private roads in Windham, they were thinking of roads that provided access to the lakes and ponds, roads like Sandbar Road, Johnson Road, Anthoine Road, Brown Cove Road, and Anglers Road. In more recent years, people are probably just as likely to think of the relatively newer private roads that serve residential developments, both large (like James Way, Cross Ridge Road, Fall Ridge Road) and small (like Cajun Court, Delta Drive, Cardinal Lane and many others). Because the Town did not have Private Road standards in place for developers and property owners to use when constructing roads until **2009**, not all of these roads are capable of providing access for emergency vehicles during times when snow removal is an issue or during times of the year when the road is soft or wet. Further, some roads may be adequate for a small number of homes and lower traffic levels, but these roads may be subject to additional development in the future through extensions of the road or even along the existing length of road.”
- ▶ “As the number of private roads continues to grow, and more specifically, the number of homes that are located on private roads continues to grow, it will become more and more urgent over time to address what kind of upgrades to roads will be required as the number of homes on these roads exceeds the structural capacity of the road and the ability of homeowners’ associations to maintain them. Just as importantly, the Town must make some decisions about how and where this private road growth in the community is occurring.”

Groundwater Contamination Has Occurred from Gravel Pits and Quarries

- ▶ Groundwater contamination occurred in 1983 off of Blackstrap Road in Cumberland when a resident named Blanche Hutchins reported poor tasting drinking water and they found high levels of PCE in the water, which is a carcinogen. The list of potential sources was narrowed down to the Hutchins Gravel Pit, the Maine Department of Transportation Pit and former spraying of waste oil for dust control off of Goose Pond Road and Forest Lake Road.
- ▶ When the DEP spoke to the Mineral Extraction Committee, they stated that groundwater contamination occurred in 2007 in New Hampshire. This happened in Windham, New Hampshire from a pit where Meadowcroft used nitrogen-based explosives for rock blasting and the nitrates leached into the groundwater and contaminated resident's well water.
(https://www.eagletribune.com/news/local_news/windham-neighbors-say-blasting-work-is-damaging-homes-and-wells/article_d99a8196-aa5f-59c7-8a83-2d902cc57212.html and https://www.eagletribune.com/news/local_news/windham-residents-sue-ledge-road-developer-town/article_2e673c8c-85f4-52c7-ab1b-5841c8222f32.html)
- ▶ In 2002 in Westford Mass, Maine Drilling & Blasting paid \$1 million dollars to clean up the town's water supply due to contamination from blasting at the granite quarries in the town. (http://www.lowellsun.com/ci_14190053)

Forest Lake is the Recharge Zone for One of the Largest Drinking Water Aquifers in Southern Maine

- ▶ Forest Lake is the recharge zone for the West Cumberland Aquifer. Sevee and Maher Engineers did a report for Cumberland that stated, “The sand and gravel aquifer is largely exposed at the ground surface and receives direct precipitation which passes through the soils and enters the water table. Because the sand and gravel is exposed at the ground surface, any spills or chemicals or fuels will migrate quickly down to the water table and can pollute the groundwater, unfortunately, once the aquifer is polluted it may take decades or maybe even centuries to renovate the aquifer’s groundwater to a drinkable status.”
(<https://www.cumberlandmaine.com/sites/cumberlandme/files/uploads/12-165.pdf>)
- ▶ Windham’s Comprehensive Plan on page 59, discusses protecting aquifers and states, “Strategy 7.d Maintain, enact or amend public wellhead and aquifer recharge area protection mechanisms, as necessary.”

Why doesn’t Windham have an Aquifer Overlay Zone surrounding Forest Lake’s entire watershed? There is an Aquifer Overlay Zone around Chaffin Pond in Windham to protect that aquifer.

Windham Has Multiple Water Bodies on the Department of Environmental Protection's “Threatened” and “At Risk” List

- ▶ According to the Department of Environmental Protection, Highland Lake, Forest Lake and Little Sebago Lake are on the “Threatened Lake’s List.”
- ▶ The Department of Environmental Protection has created a list of “Lakes Most at Risk from New Development” in Maine. Windham has 6 water bodies on that list including, Forest Lake, Chaffin Pond, Highland Lake, Little Duck Pond, Little Sebago and Petingill’s Pond.

https://www.maine.gov/dep/land/watershed/nps_priority_list/NPS%20Priority%20List%2018-%20Lakes.pdf

Are Mineral Extractions and Neighborhoods Compatible?

“Mining and mineral-processing facilities generate more toxic and hazardous waste than any other industrial sector, according to the EPA. The federal agency says mining waste contaminates drinking water, rivers and streams.” (https://19january2017snapshot.epa.gov/enforcement/national-enforcement-initiative-reducing-pollution-mineral-processing-operations_.html)

- ▶ Westerly, Rhode Island has had issues related to blasting and silica dust being released into the air by quarries and causing health concerns for residents.
- ▶ “In August of 2012, the town issued a cease-and-desist order against Copar, claiming the company “willfully violated” local policies and created a nuisance to neighbors. A site inspection by the town found the company had failed to install measures to control stone dust.”
- ▶ “The Rhode Island Department of Environmental Management noted that the quarry failed to comply with a consent agreement that addressed water pollution.”
- ▶ “More than a dozen neighbors of the Bradford property — owned by the Comolli family’s Westerly Granite Co. Inc. — claimed their lives were disrupted by loud noises and wind-blown quarry dust that more than likely contained crystalline silica. Some filed lawsuits, others worried about their health, and some complained of problems caused by blasting at the site, including cracked foundations and compromised drinking water.”
- ▶ “Cherenzia Excavation Inc. also operates a quarry on White Rock Road. According to the EPA, the three operations, in 2011, produced 11.5 tons of silica-dust and diesel-soot emissions.”
- ▶ “The percentage of Westerly children ages 2-17 who had an asthma-related emergency-department visit from 2010-2012 was among the highest in Rhode Island, according to a 2014 study by Rhode Island Department of Health.”
- ▶ “In 2013, the American Lung Association sent a letter the Town Council and Zoning Board of Review noting how dangerous silica dust is to breathe. Among the organization’s noted concerns were:
 - ➡ The health risk posed by lung exposure to fine particulate matter such as crystalline silica is serious; and when the pollution source is nearby, the health risks increase. Children and people with asthma and chronic obstructive pulmonary disease are more vulnerable to the risk of being sickened by particles.
 - ➡ Often referred to as “stone dust” by mining interests, silica dust, like asbestos dust, scars and damages lungs. It can’t simply be wiped away with Pledge.” (https://www.ecori.org/public-safety/2017/4/15/quarry-dust-coats-westerly-in-concern?fbclid=IwAR1usGSdX9p6YQDXN9wE-oLbfULSMY-TfafpD-_4VWyiS2Vn1EQF5OCuhCg)

Silica can Cause Harmful Algal Blooms in Water

- ▶ If mineral extractions near bodies of water are releasing silica dust into the air it can contaminate water and cause harmful algal blooms.
- ▶ According the Friends of Sebago website, “It turns out that one key factor associated with harmful algal blooms is dissolved silica; intense red tides tend to occur in coastal waters where dissolved silica is low. We are all familiar with nitrogen and phosphorus as nutrients fueling algae growth, but silica is also an essential nutrient for one of the most abundant algae called diatoms. Without adequate dissolved silica, diatoms can’t grow and reproduce. Much of the dissolved silica found in our State’s coastal waters can be traced back to weathering processes of Maine rocks and soils. Silica, along with other minerals, slowly dissolves and is then carried from the watersheds by rivers to the ocean. With the continuous input of silica from rivers, along with other nutrients, diatoms grow in sufficient numbers and serve to suppress harmful algae that cause “red tides”. Healthy diatom populations in the Gulf of Maine also supply the nutrient foundation for one of the historically richest fisheries in the world.
- ▶ “Another, but more widely studied factor associated with harmful algal blooms is excess nutrients from such sources as crop fertilizers, sewage, industrial pollution, and poor land practices. Changing weather patterns, salinity and ocean currents also have relationships to harmful algal blooms.”

<http://friendsofsebago.org/2016/09/29/silica-depletion-and-lake-regulation/>

Flyrock has Flown Through Abutter's Homes in Maine from Blasting



Courtesy of Bruce Rich

- ▶ On November 7, 2011 in Tremont, Maine flyrock, the size of a dinner tray, from a quarry flew through abutting neighbor's houses over **618 feet away**.
- ▶ Mark Stebbins from the Department of Environmental Protection stated that, "The department doesn't have the ability to order them to fix the [houses that were damaged]."
- ▶ Mark Stebbins also stated, "DEP requires owners of licensed quarries to contain rocks sent flying by blasts within the blast site, which he said is typically defined as the area within 50 feet of a drilled blasting hole. The rocks that soared over the nearby trees on Nov. 17 and crashed into homes owned by Bruce Rich and two of his neighbors flew **618 feet** through the air."

If flyrock from blasting can fly 618 feet through the air, is that kind of project safe to have in a heavily populated neighborhood with people and kids playing in their own yards?

http://bangordailynews.com/2011/12/02/news/hancock/dep-unable-to-order-tremonts-quarry-to-repair-damage-to-houses-after-blast/?fbclid=IwAR2V3eVLjiA8_vBwRKaiO4Z8NOC760wZi78W72ilpEZVzHhKbDQVZ0KCA

Quarry in Augusta, Maine Caused Cracks in Floors, Walls and Ceilings of Abutter's Homes

- ▶ In May of 2015, Maine Drilling and Blasting, blasted at a quarry in a pit off of West River Road and residents that lived roughly 2,000 feet away claimed that the blasting cracked their floors, walls and ceilings of their homes.
- ▶ Maine Drilling and Blasting stated that they were not responsible for it and this caused the city of Augusta to file a lawsuit, alleging that the blast exceeded allowable standards.
- ▶ The below article states, "The pit where the blast took place has been the subject of multiple disputes over the last several years between the operator and its neighbors, especially those in the nearby Grandview neighborhood, over issues including dust, noise and orders."

Who is held responsible for damage to an abutter's property?

https://www.pressherald.com/2015/09/21/augusta-quarry-pit-neighbors-say-blasting-damaged-homes/?fbclid=IwAR0J-XwSJzMRJa0_bz1z8xff4ITGVt6gP8ACfKQhMOaNmYqLyAG6kGzLFZw

Watershed and/or Aquifer Pollution is Expensive to Remediate

- ▶ Loss in property values will hurt Windham and tax payers if a watershed or aquifer becomes more polluted. This will be much costlier to the town and tax payers than what would be gained from a mineral extraction site. Once a lake tips it's extremely difficult and expensive to bring it back.
- ▶ Residents around Long Pond and Great Pond in the Belgrade Lakes Region have been trying to remediate their lakes from phosphorus contamination which can occur from storm water runoff.
- ▶ The below article states, "Phosphorus is the leading cause of bad water quality in the Belgrade watershed. The nutrient supports plant life and algae in lakes, but when there is an excess it acts like a fertilizer and can result in huge algal growths, or blooms. When the algae cells die, it depletes oxygen levels in the water, and can lead to anoxic, or zero oxygen, conditions that kill off fish and other organisms. A bloom can degrade water clarity to about two meters."
- ▶ The article also states, "A possible treatment is to add aluminum to anoxic areas of the lakes. The phosphorus bonds with the aluminum and won't release in anoxic conditions, which could reduce the internal load by up to 90 percent, according to King. The cost is estimated to be **\$1 million** for Long Pond and **double that** for Great Pond."
- ▶ "Another option is to pump oxygen into the lower levels of the lake, but it is barely cheaper. King estimates capital costs could cost **\$600,000** in Long Pond and **\$800,000** in Great Pond, with **annual** operating costs as much as **\$80,000**."

(<https://www.pressherald.com/2015/07/27/analysis-belgrade-lakes-water-quality-down/>)

Runoff from Farms is the Leading Source of Impairments to Surveyed River and Lakes

- ▶ The EPA's website states, "Farming operations can contribute to nutrient pollution when not properly managed. Fertilizers and animal manure, which are both rich in nitrogen and phosphorus, are the primary sources of nutrient pollution from agricultural sources. Excess nutrients can impact water quality when it rains or when water and soil containing nitrogen and phosphorus wash into nearby waters or leach into ground waters. This can cause algae blooms, remove oxygen from water which kill fish and put high concentrations of nitrates into drinking water, high nitrates can be fatal to infants which is called blue baby syndrome.

Should Farm or Farm Residential Zones surround Windham's watersheds?

<https://www.epa.gov/nps/nonpoint-source-agriculture>

Problems with the Mineral Extraction Committee's Proposed Changes

- ▶ The Mineral Extraction Committee did not look at each zone and whether mineral extractions should or should not be allowed in those zones.
 - ▶ Farm Zones are having growth issues in Windham, should new mineral extractions even be allowed in those zones that were intended to be rural?
- ▶ The proposed changes are great as far as making mineral extraction regulations more strict, but they do not address impacts to natural resources and heavily populated areas that are zoned to allow mineral extractions.
- ▶ There is an issue with the proposed change on “No Vote if Violation Exists. No site plan shall be approved by the Planning Board or Staff Review Committee as long as the applicant is in violation of the provisions of a previously approved site plan within the municipality.”
 - ▶ What if an applicant has a violation with the DEP or another town that did not occur within the municipality?
- ▶ There is another proposed change stating, “A violation for the purposes of this section includes any order, consent decree or consent agreement with which the applicant, owner or proposed operator of the facility is not currently in full compliance.”
 - ▶ What if the developer is in full compliance currently, but has a history of repeatedly violating environmental laws?
- ▶ Under the proposed change 10C. “No new mineral extraction operations shall be permitted to access a private road or private way that provides access to a public street to more than 100 dwelling units.”
 - ▶ Is 100 a fair number of dwelling units? What happens if there are 90 dwelling units on the private road? That is still a heavily populated area.
 - ▶ What happens if a developer has their own road that is adjacent to 100 dwellings, but the dwellings do not use that road? This is a potential loophole for the developer to still do their project in a heavily populated area.

Thank you for your time and efforts!
Please follow the Comprehensive Plan and
invest in rural Windham to keep it rural!



Presentation created by the Forest Lake Association Civic Affairs Committee.

AMERICAN LUNG ASSOCIATION® Fighting for Air

**American Lung Association
of the Northeast**

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260 West Exchange Street
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372 Hurricane Lane
Suite 101
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August 26, 2013

Dear Councilors and members of the Zoning Board of Review:

Neighbors of the COPAR quarries of Westerly, Rhode Island, have asked the American Lung Association to assist them in informing and educating local officials about the potential threats to lung health from quarry dust.

The neighbors state that environmental impact studies they commissioned show large amounts of crystalline silica are coming from the COPAR quarries. They state that silica air pollution has reached a point where nearby homes and cars are coated with silica dust. Of high concern is the fact that a school, Bradford Elementary School, is located within a few miles of the quarries, exposing children's immature lungs to high levels of fine particulate matter.

The health risk posed by lung exposure to fine particulate matter such as crystalline silica is serious; and when the pollution source is nearby, the health risks increase, and can include premature death, heart attacks, and asthma attacks. Children, teens, senior citizens, people with low incomes and people with chronic lung disease, such as asthma and chronic obstructive pulmonary disease (COPD), are more vulnerable to the risk of being sickened by particles. People with diabetes, heart disease, high blood pressure, coronary artery disease, and congestive heart failure also face higher risk from particle pollution.

Short-term exposure to particle pollution can kill. Peaks or spikes in particle pollution can last for hours to days. Deaths can occur on the very day that particle levels are high, or within one to two months afterward. Particle pollution does not just make people die a few days earlier than they might otherwise—these are deaths that would not have occurred if the air were cleaner.¹

Year-round exposure can kill and may cause cancer. Breathing high levels of particle pollution day in and day out also can be deadly, as landmark studies in the 1990s conclusively showed.² Chronic exposure to particle pollution can shorten life by one to three years.³ Other impacts range from premature births to serious respiratory disorders, even when the particle levels are very low.

¹ Zanobetti A, Schwartz J, Samoli E, Gryparis A, Tuoloumi G, Peacock J, Anderson RH, Le Tertre A, Bobros J, Celko M, Goren A, Forsberg B, Michelozzi P, Rabaczenko D, Perez Hoyos S, Wichmann HE, Katsouyanni K. The Temporal Pattern of Respiratory and Heart Disease Mortality in Response to Air Pollution. *Environ Health Perspect.* 2003; 111:1188-1193; Dominici F, McDermott A, Zeger SL, Samet JM. Airborne Particulate Matter and Mortality: Timescale Effects in Four US Cities. *Am J Epidemiol.* 2003; 157:1055-1065.

² Dockery DW, Pope CA III, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BG, Speizer FE. An Association Between Air Pollution and Mortality in Six U.S. Cities. *N Engl J Med.* 1993; 329:1753-1759. Pope CA, Thun MJ, Namboodiri MM, Dockery DW, Evans JS, Speizer FE, Heath CW. Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults. *Am J Respir Crit Care Med.* 1995; 151:669-674.

³ Pope CA III. Epidemiology of Fine Particulate Air Pollution and Human Health: biological mechanisms and who's at risk? *Environ Health Perspect.* 2000;108: 713-723.

Evidence shows that elevated exposure to silica dust in the workplace can lead to increased risk of developing silicosis, lung cancer, COPD, and kidney disease.⁴ Silicosis is a lung disease that is caused by inhaling tiny bits of silica. Silica is a common mineral that is part of sand, rock and mineral ores. People who work in jobs where they could breathe in these tiny silica bits—like sandblasting, mining, construction and many others—are at risk for silicosis. The silica dust can cause fluid buildup and scar tissue in the lungs that cuts down your ability to breathe. Silicosis cannot be cured, but steps can be taken to prevent it.

Generally, the silica dust affects the lungs' ability to work correctly. Each type of silicosis affects the body somewhat differently:

- In simple chronic silicosis, the silica dust causes areas of swelling in the lungs and chest lymph nodes, which causes breathing difficulty.
- In accelerated silicosis, swelling in the lungs and symptoms occur faster than in simple silicosis.
- In acute silicosis, the lungs become very inflamed and can fill with fluid, which causes severe shortness of breath and low blood oxygen levels.

Anyone with silicosis may suffer from several complications:

- Increased risk for lung infections and tuberculosis.
- Progressive massive fibrosis—severe scarring and stiffening of the lung, which makes it difficult to breathe. Progressive massive fibrosis can occur in either simple or accelerated silicosis, but is more common in the accelerated form.
- Respiratory failure.

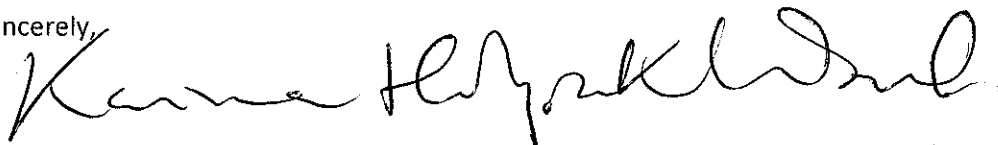
For further and more detailed information, please see the following resources on our website:

<http://www.stateoftheair.org/2013/health-risks/health-risks-particle.html>

<http://www.lung.org/lung-disease/silicosis>

In short, fine particulate matter from quarry dust is a dangerous pollutant posing serious risk to health even before silicosis develops.

Sincerely,



Karina Holyoak Wood

Director, Public Policy, Rhode Island
American Lung Association of the Northeast

⁴ Occupational Safety and Health Administration. Crystalline Silica Rulemaking. Accessed at <https://www.osha.gov/silica/>, Accessed August 26, 2013.

May 30, 2017

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20170420-ws

William Shane
Town of Cumberland
290 Tuttle Road
Cumberland, Maine 04021

Subject: Blackstrap Road Well Advisory Zone
Forest Lake Area, Cumberland

Dear Bill:

Following our recent discussions, at your request, Sevee & Maher Engineers, Inc. (SME) reviewed the history and status of the Well Advisory Zone established by the Maine Department of Environmental Protection (MEDEP) and the investigations and water quality monitoring program conducted by MEDEP between approximately 1983 and 2014. A brief history of the Well Advisory Zone and MEDEP's investigations and monitoring is provided below, followed by some summary thoughts and recommendations for your consideration.

ZONE DESCRIPTION & INVESTIGATION HISTORY

The subject area is located in West Cumberland in the area along Goose Pond Road, Upper Methodist Road, and Lower Methodist Road, generally between Blackstrap Road and Route 100. The subject area and surrounding vicinity is shown on Figure 1. The zoning in this area of Cumberland is primarily Rural Residential 2, with Industrial-zoned areas northwest of Blackstrap Road and northeast of Upper Methodist Road. The portion of the Well Advisory Zone northwest of Blackstrap Road has historically been used for industrial purposes, including gravel pit operations, a sawmill complex, auto salvage junkyard, and metal recycling. The area southeast of Blackstrap Road and southwest of Upper Methodist Road is primarily residential. Residences and businesses are served by private water supply wells and septic systems. No municipal water or sewer are currently or have historically been available to this region.

In 1983, MEDEP received a complaint of poor-tasting drinking water from Blanche Hutchins at 46 Blackstrap Road. MEDEP facilitated sampling of the Hutchins water supply well and other neighboring residential water supply wells. Through testing residential water supplies for the presence of volatile organic compounds (VOCs), the presence of tetrachloroethene (also known as perchloroethylene or PCE) was detected in wells in this vicinity. PCE was not detected above laboratory reporting limits in the Hutchins well during initial sampling, but was detected during the fifth round of sampling (January 1984) at a concentration of 67 micrograms per liter (ug/L), above the state Maximum Exposure Guideline (MEG) for drinking

water in effect at the time of 35 ug/L. MEDEP installed additional monitoring wells and conducted a water quality monitoring program of monitoring and residential water supply wells that continued (with varying coverage and frequency) until 2014. The approximate boundaries of the historical PCE plume and the region where PCE concentrations exceeded the MEG as of 1992 are shown on Figure 1. These boundaries were drawn by others (located in MEDEP files during a recent file review), and are based on data collected by MEDEP and Caswell, Echler, & Hill, Inc. (CEH), a consultant for MEDEP, prior to 1992. Based on water quality results, MEDEP installed carbon filters at six homes in the Blackstrap Road area between 1985 and 1987.

Results of MEDEP sampling confirmed PCE to be the only volatile organic contaminant of concern. Low concentrations of methyl-tert butyl ether (MTBE, associated with gasoline) were detected sporadically in residential wells, but MTBE was considered to be the result of localized minor spills, and not associated with the PCE plume.

Investigations were conducted to identify the source or sources of groundwater contamination and to characterize the plume. MEDEP identified several potential sources of PCE contamination. CEH conducted a Phase II Field Investigation according to a scope of work designed by MEDEP and CEH. According to the CEH final report¹, a single, discrete source of PCE contamination was not identified; however, the list of potential sources was narrowed to the Hutchins gravel pit (northwest of the Hutchins residence at 46 Blackstrap Road), operation of the MEDOT gravel pit (north-northwest of Hutchins residence), and former spraying of waste oil for dust control on Upper Methodist Road (aka Goose Pond Road, Forest Lake Road). No specific release is known to be attributed to any of these sources, and MEDEP assumes the PCE presence in groundwater to be caused by a one-time, low-level discharge of PCE.

In 1992, MEDEP established a Well Advisory Zone based on water quality in monitoring wells and residential water supply wells, as well as the location of streams along the southern edge of the zone². The purpose of the Well Advisory Zone was to alert new and potential residents to the potential for low-level groundwater contamination in the area. MEDEP advised the Town of Cumberland about the possibility of low-level VOC contamination in the bedrock and surficial aquifers, and intended that the Town of Cumberland control and/or advise the public regarding utilization of the aquifer as a resource via building permits and zoning ordinances.

The Maine Department of Health and Human Services (Center for Disease Control and Prevention) is responsible for establishing MEGs. As guidance has changed over time and

¹ CEH, Inc., March 1992. Final Phase II Field Investigation Report, blackstrap Road Area, West Cumberland, Maine.

² Maine Department of Environmental Protection, July 2, 1992. Status Report and Recommendations, Blackstrap Road Site, Cumberland, Maine.

as new toxicological data have become available, the MEGs have been updated to reflect new data and understanding. At the start of investigations and testing in the Blackstrap Road area, the MEG for PCE was 35 ug/L. In 1988, the MEG was lowered to 3 ug/L, and MEDEP observed an action level of 1.5 ug/L, or half the MEG. Several updates to the PCE MEG were instituted following this period. The PCE MEG was updated most recently in 2012, to 40 ug/L (with an action level of 20 ug/L).

The highest concentrations of PCE in the Blackstrap Road monitoring program were detected in samples from the Hutchins residential water supply well (Lot 58, 46 Blackstrap Road). Concentrations over time from this well are shown on Figure 2. The prevailing MEG and MEDEP action levels over time are also shown on Figure 2. Concentrations in other residential water supply wells show a similar decline in concentrations over time, with lower overall detected concentrations of PCE.

MEDEP observed steadily declining concentrations of PCE in residential and monitoring wells. They reduced the sampling frequency in 1997, and removed carbon filters from three of the six homes where filtration systems had been installed in the 1980s. In 2014, MEDEP conducted a final sampling round and based on further-reduced concentrations of PCE, terminated the residential well treatment and monitoring program for the area. In the absence of an identified source of contamination and resulting responsible party, MEDEP's Uncontrolled Sites Program maintained oversight of the Blackstrap Road area. This program issued a "No Further Action" (NFA) Decision Document effectively terminating the MEDEP oversight and interest of the area following 2014 sampling³.

The most recent data from each well in the monitoring program is shown on Figure 3, based on electronic data available from the MEDEP EGAD database. This dataset generally includes monitoring well data collected post-2000, and residential water supply data collected post-2007. Concentrations have declined significantly since the 1980s, and in most locations, PCE is not detected above laboratory reporting limits. In this most-recent dataset, PCE was not detected within an order of magnitude of the current MEG anywhere in the monitoring program.

SUMMARY AND RECOMMENDATIONS

The NFA status determination made by MEDEP reflects a dramatic improvement in groundwater quality beneath the areas of Blackstrap Road and Upper Methodist Road, to the point where treatment and monitoring were no longer considered necessary. This is excellent news for current residents of this area, and for potential future development; however, the NFA status pertains to existing residential water supply wells and the level of groundwater

³ MEDEP, July 24, 2014. No Further Action (NFA) Decision Document, Blackstrap Road, Cumberland.

withdrawal currently in place in this region. The NFA status does not provide guidance for development of new water supplies, and MEDEP's findings do not guarantee that VOCs including PCE will not be detected in existing or future water supply wells in the vicinity. Changes to the groundwater hydrogeology of the area could affect groundwater flow patterns, as well as the transport of any residual VOC contamination remaining in the aquifer.

Recent water quality showed no detections of any parameters tested above or near the relevant water quality standards. While significant improvements to water quality in the surficial aquifer have been observed over the course of about 30 years of monitoring, it would be prudent for the Town of Cumberland to maintain the Well Advisory Zone and to request that new water supply wells within the zone be tested for the presence of VOCs. Requiring baseline VOC testing as part of the Town's site plan review process would provide the Town with the opportunity to stay updated with new water quality information, and would also provide the Town with a vehicle to communicate the history of low-level contamination to potential homeowners and/or developers.

In the absence of new water quality data (from e.g., new water supply wells), or simply to maintain a current understanding of groundwater quality in this region, the Town of Cumberland may want to consider water quality sampling in the Blackstrap Road area. Annual sampling of a limited number of residential and monitoring wells from which the highest concentrations of PCE had historically been detected would provide continued visibility into groundwater quality conditions, including any further decline in concentrations and/or any water quality changes or changes in groundwater flow that may be attributable to changes in land use in the area.

Water quality has been monitored by MEDEP in residential wells in a limited area, and conclusions about water quality improvements have been made based on this available data set. Water quality is not understood in as much detail at varying depths in the aquifer, or over a wider area. If significant development in this region of Cumberland is proposed, and/or if the Town of Cumberland wants to explore using the groundwater resource protected in this area, you may want to consider conducting a hydrogeologic investigation and possibly some three-dimensional groundwater modeling to simulate changes to hydrogeology with increased groundwater extraction. A more robust monitoring well network would be needed to be able to ground truth model simulations, if modeling is an option the Town would like to explore.

We appreciate the opportunity to serve the Town of Cumberland. Please contact us with any questions, or to discuss our recommendations.

Very truly yours,

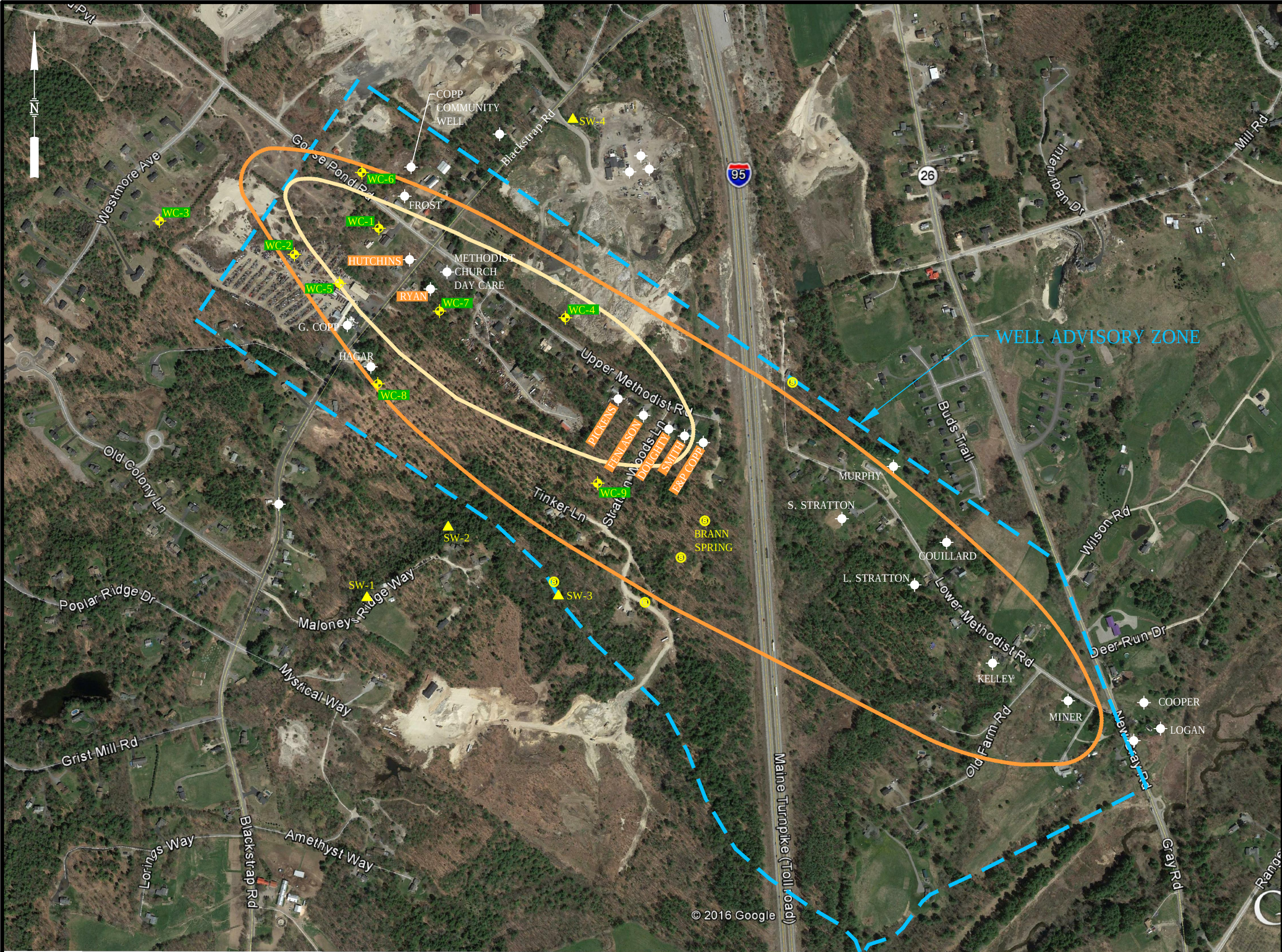
SEVEE & MAHER ENGINEERS, INC.

 for John Sevee

John E. Sevee, C.G.
Principal

Enclosures: Figures

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LEGEND

- WC-7 MONITORING WELL
- RYAN DOMESTIC WELL
- SURFACE WATER MONITORING LOCATION
- SPRING
- FILTERS
- HISTORICAL ESTIMATED PCE PLUME BOUNDARY (CEH, MEDEP, 1992)
- HISTORICAL ESTIMATED AREA OF PCE > MEG

NOTES:

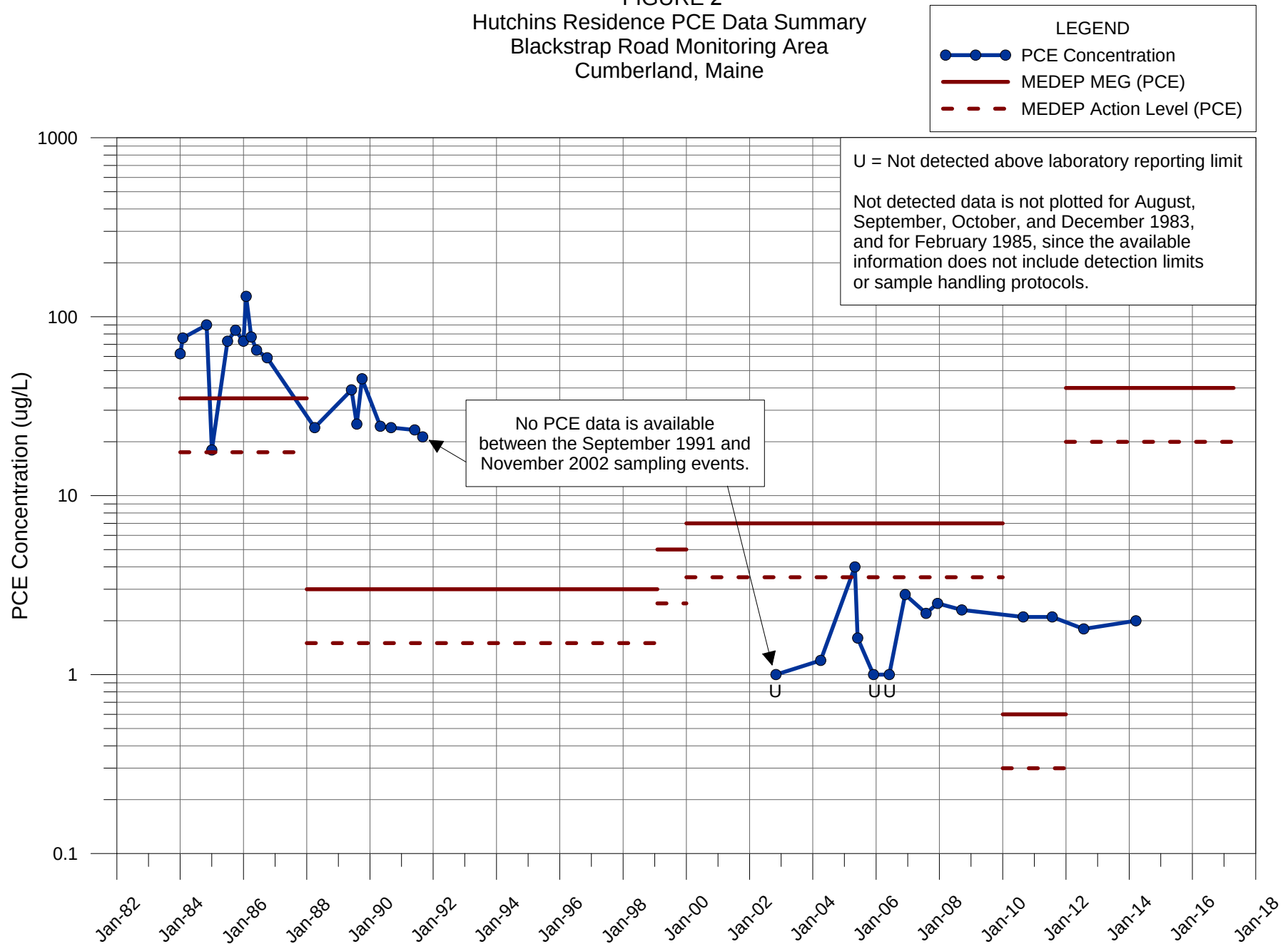
- BASEMAP DERIVED FROM "FIGURE 1-2 SITE LAYOUT" BY CASWELL, ECHLER & HILL INC., DATED JANUARY 27, 1992.
- AERIAL IMAGE FROM GOOGLE EARTH, DATED MAY 9, 2016.
- LOCATION OF THE SITE FEATURES IS APPROXIMATE.



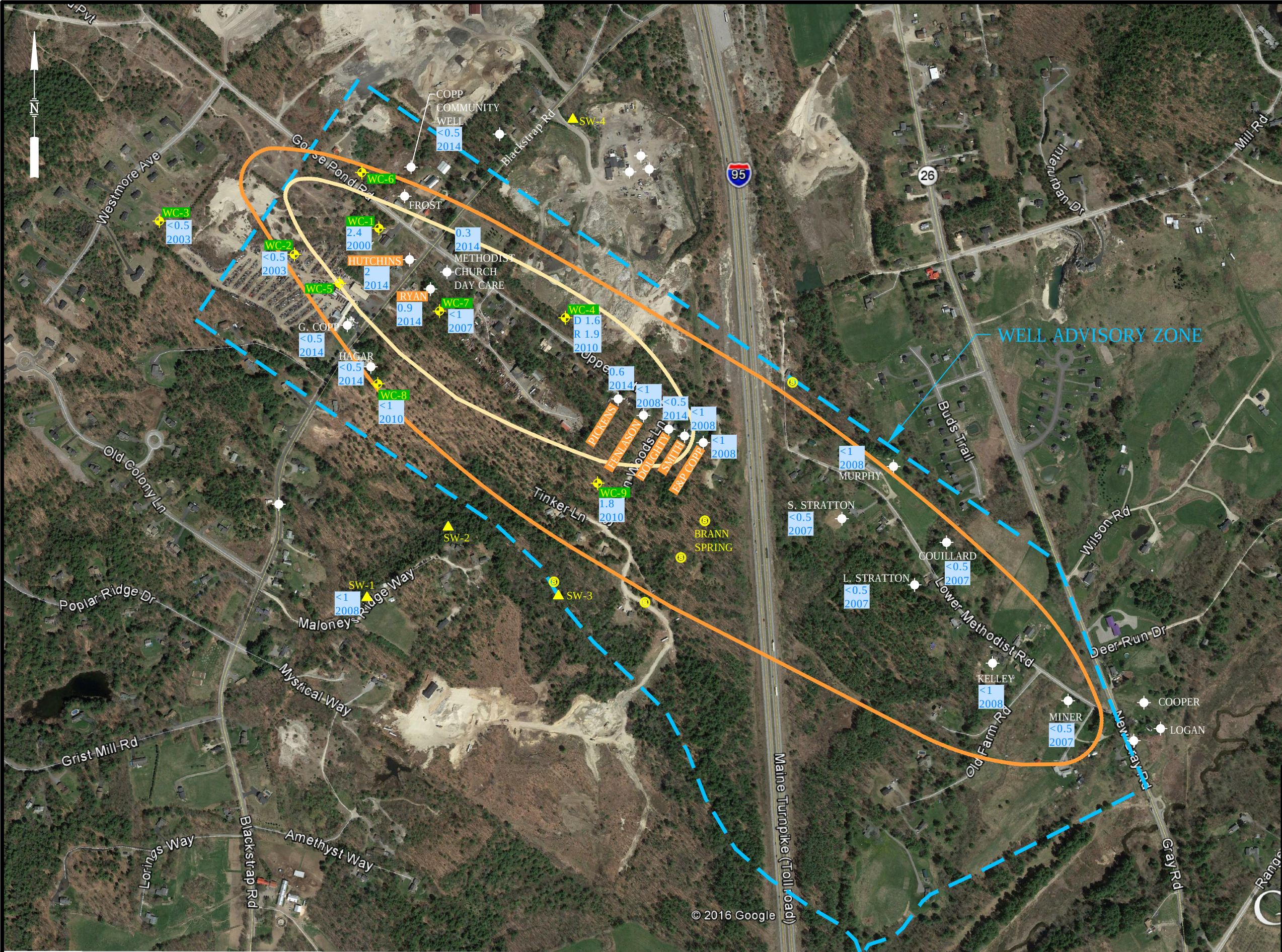
FIGURE 1
SITE PLAN
BLACKSTRAP ROAD
MONITORING AREA
CUMBERLAND, MAINE

SME
Sevee & Maher Engineers, Inc.
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE

FIGURE 2
Hutchins Residence PCE Data Summary
Blackstrap Road Monitoring Area
Cumberland, Maine



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Email: eleshar@sjcme.edu

Synopsis of Current and Most Recent Activities

Assistant Professor, Natural Sciences Department, Saint Joseph's College of Maine

Teaching

Principles of Chemistry I Lecture and Lab (CH103), Principles of Chemistry II Lecture (CH104), Analytical Chemistry Lecture and Lab (CH202), Environmental Chemistry Lecture and Lab (CH/ES 205), Research Science on Sebago Lake (CH/ES 107), Senior Research (CH406). Spearheaded innovative programs including Peer Focused Tutoring Program with TAC in CH103-104, and "Enriched" CH103.

Implementation of curricula fueled by grant-funded activities in ES/CH205, CH103, ES/CH107.

Scholarship: Research, Advocacy, and Outreach

Development of standard operating protocol for EPA method 200.5 for SJC Trace Element Lab ICP-OES

Use of method to conduct water testing in public schools and private childcare facilities; discovery of lead and assistance in remediation of contamination in three public schools. Advocacy and education at the state level encouraging funding for lead testing.

Monitoring of Sebago Lake CO₂ concentrations over Summer 2016

Research activities at the Katahdin Ironworks (KIW) field site and creation of an educational module for Environmental Science Semester from KIW work.

Research presentations at Biennial Conference on Chemical Education, American Chemical Society National Meeting and University of New Hampshire seminar series.

Ongoing Service to the Saint Joseph's College Community

Current: Academic Athletic Committee, Faculty Senate, Mercy Week Planning Committee, Civic Engagement group.

Recent: Search committee for Assistant Communications Director ('17), Veteran's Committee ('15-'17), Natural Sciences subcommittee on infrastructure planning ('16), Search committees for 3 faculty positions ('14-'16), Chair of Faculty Development Committee ('14-'16), Ad Hoc institutional learning outcomes committee ('14-'15), Online undergraduate educational policies committee ('13-'15), Selection Committee for Maine Space Consortium Student Research Grant ('14).

Education

2011

Colorado School of Mines

Ph.D., Environmental Science and Engineering

Dissertation title: *Development and Application of Flow Field-Flow Fractionation - Inductively Coupled Plasma - Mass Spectrometry for Analysis of Uranium Speciation and Transport in the Presence of Nanoparticulate Ligands*

Developed and applied online FFF-ICP-MS method for determination of uranium speciation to better understand U fate and transport in the subsurface. Advisors: Dr. Jim Ranville and Dr. Bruce Honeyman (CSM)

2008

Colorado School of Mines

M.S., Environmental Science and Engineering

2002

Dartmouth College

B.A., Earth Sciences with High Honors

Academic Positions

2013-present

Assistant Professor, Natural Sciences Department, Saint Joseph's College of Maine

2014

Visiting Professor, Colorado School of Mines (May field session course)

2011-2013

Instructor and Research Associate, Colorado School of Mines

2009

Affiliate Faculty, Metropolitan State College of Denver

2006-2011

Research Assistant and Teaching Assistant, Colorado School of Mines

2003-2006

Teacher, Miller School of Albemarle, Charlottesville, VA (high school level)

Courses Taught

Saint Joseph's College: See "Teaching" under "Current and Most Recent Activities" above.

Colorado School of Mines: Environmental Field Session (EGGN335), Environmental Stewardship of Nuclear Resources (ESGN 511), Introductory Chemistry (CHGN 111), Principles of Environmental Chemistry Lab Teaching Assistant (ESGN 500), Environmental Engineering Lab (EGGN 355, curriculum preparation only)

Metropolitan State College of Denver: General Chemistry I

Miller School of Albemarle: AP Environmental Science, Chemistry, Honors Chemistry, Earth Science.

Research Activities at SJC

Please see Publications for additional information on past and ongoing work.

Summer 2016-present: Lead in Public Drinking Water Supplies by ICP-OES

Summer 2015-present: Carbon Cycling on Sebago Lake

Summer 2014: Field research at Katahdin Ironworks.

Research Advising at SJC

2018-present Marissa Hoffman '21

2018-present Alyssa Charette '20

2018 Jarrett Beaulier '20

2018-present Natalie Juris '19

2017 Tyler Allen '18 – Research Internship funded by Connections on comparison of phosphorous response by developed and undeveloped lakes to storm and calm conditions.

2017 Adrienne Dolley '20 – Research Internship funded by Burnham Trust grant assisting with outreach to childcare centers for education and testing on lead in drinking water.

2017 Haley Batchelder '18 – Research Internship funded by the Maine Space Grant Consortium (\$3000) on sediment controls on Sebago Lake phosphorous concentrations.

2016-2017 Samantha Lavallee '17 – Senior Research on Diversity Oriented Synthesis of Beta Lactams. Co-advised by Yi Jin Gorske.

2016-2017 Micaela Mitchell '17 and Michelle Rocker '17 – assistance on their Senior Research Projects with ICP-OES training and methods development.

2016 Sarah MacLeod '18 – Research Internship assisting with Lead in Public Drinking Water and Sebago Lake Carbon Cycling (grant funded)

2015 Jessica Selva '17 and Alana Dougherty '17 – Research Internships assisting with Research Science on Sebago Lake course (grant funded)

2014-2015 Yuping Hu '15 – Senior Research on the synthesis, properties, and occurrence of silver nanoparticles in consumer products.

2014 Yuping Hu '15 – Research Internship funded by the Maine Space Grant Consortium (\$3000) on the effects of relative humidity on synthesis of iron sulfates. Resulted in poster presentations at NURDS conference (UNE, Spring 2015) and SJC Research Fair (Spring 2015), and a final report delivered to MSGC.

2014 Mikaela Rowell '17 – Research Internship assisting in Katahdin Ironworks field activities.

Grant Proposals Prepared

2018. "Chemistry for the Community." Submitted to NSF by Emily Leshner, Yi Jin Gorske, and Chris Bauer (UNH) 1/18. **\$183,000 awarded.**

2017. "Building Capacity at St. Joseph's College for Secondary Science Teacher Training." Submitted to NSF by Emily Leshner, Patricia Waters, and Dan Moore (SMCC) 8/17. **\$103,000 awarded.**

2017. "Transdisciplinary Approaches to Improving Detection and Exposure Assessment and Controlling Lead in Drinking Water." Submitted to EPA by Susan Masten (MSU) and 15 additional investigators at 6 institutions 8/17. \$1,981,500, requested including subcontract to SJC for \$79,800. Declined

2016. "Lead Testing in Maine Schools: A Collaborative Project With Schools and Municipalities Benefiting Childhood Health and STEM Training." Submitted to the Burnham Trust by Emily Leshner and Liz Schran on 9/30/16. **\$5,000 awarded.**

2016. "Real Time Data For Sebago Lake To Support Sustainable Water Resource Management, Lake Research, Undergraduate Research Training, And Community Engagement." Submitted to Maine Water Resources Research Institute at the Senator George J. Mitchell Center for Sustainability Solutions FY17 Water Resources Sustainability Research Grants (USGS 104b) Program by Emily Leshner, Brie Holme (Portland Water District) and Ryan Dorland on 9/16/16. **\$28,200 awarded** contingent on availability of federal funding.

2016. "Analytical Chemistry Curriculum Development." Submitted to SJC Faculty Development Committee by Emily Leshner. Result: **\$1200 awarded.**

2015. "Integrating a Community Based Learning Laboratory Project in Environmental Chemistry." Submitted to SJC Faculty Development Committee by Emily Leshar. Result: **\$1200 awarded**, CBL project implemented in CH/ES205.
2014. "Development of "Research Science at Sebago Lake": a course to improve retention of early Natural Science Majors at Saint Joseph's College". Submitted to Maine Space Grant Consortium by Emily Leshar and Johan Erikson. Result: **\$10,000 awarded**, planning and delivery of Research Science on Sebago Lake in Fall 2015.
2014. "Field Research and Course Project Development at Katahdin Ironworks." Submitted to SJC Faculty Development Committee by Emily Leshar. Result: **\$1200 awarded**, June 2014 research activities conducted.
2014. "Incorporating Research-Based and Inquiry Learning into the Principles of Chemistry (CH103-104) Laboratory" Submitted to SJC Faculty Development Committee by Emily Leshar. Result: **\$1200 awarded**, June 2014 participation in CCwCS Chicago workshop entitled "Chemical Education: Supporting Student Laboratory Learning" and overhaul of CH103 lab curriculum.
2014. "Protecting the Sebago Lake Watershed—Greater Portland's Water Supply While Contributing to New Freshwater Research And Training Early STEM Majors". Submitted to Burnham Trust by Liz Schran, Emily Leshar, and Johan Erikson, \$2900 requested. Result: not funded.

Publications

- Smith, K., Ranville, J., Leshar, E.K., McKnight, D., Diedrich, D.J., Sofield, R. (2014) Fractionation of Fulvic Acid by Iron and Aluminum Oxides—Influence on Copper Toxicity to *Ceriodaphnia dubia*. *Environmental Science & Technology*, 48(20), 11934-11943, [available through ACS](#).
- Leshar, E.K., Ranville, J.F., and Honeyman, B.D. (2013) Detection and Characterization of Uranium-Humic Complexes During 1D Transport Studies. *Geochimica et Cosmochimica Acta*, 109, 127-142, [available at ScienceDirect](#).
- Leshar, E. K., Bednar, A., Poda, A., Ranville, J.F. (2012) Field-flow fractionation coupled to inductively coupled plasma-mass spectrometry (FFF-ICP-MS): Methodologies and applications to environmental nanoparticle research. Chapter in *Field-Flow Fractionation in Biopolymer Analysis*, editors: Karin D. Caldwell and Kim R. Williams, publisher: Springer.
- Leshar, E.K. (2011) Development and application of flow field-flow fractionation-inductively coupled plasma-mass spectrometry for analysis of uranium speciation and transport in the presence of nanoparticulate ligands. Colorado School of Mines PhD thesis, [available for download](#).
- Leshar, E.K., Ranville, J.F., and Honeyman, B.D. (2009) Analysis of pH dependent uranium (VI) sorption to nanoparticulate hematite by flow field-flow fractionation - inductively coupled plasma mass spectrometry. *Environmental Science & Technology*, 43(14), 5403-5409, [available through ACS](#).
- Campbell, K., Kukkadapu, R., Qafoku, N., Peacock, A., Leshar, E., Williams, K., Bargar, J., Wilkins, M., Icenhower, J., Figueroa, L., Ranville, J., Davis, J., and Long, P.E. (2012) Microbiological, mineralogical and geochemical characteristics of a naturally reduced zone in a uranium-contaminated aquifer. *Applied Geochemistry*, 27(1), 1499-1511, [available at ScienceDirect](#).
- Mitrano, D., Leshar, E.K., Bednar, A.J., Monserud, J., Higgins, C., and Ranville, J.F. (2011) Detection of nano-Ag using single particle inductively coupled plasma mass spectrometry. *Environmental Toxicology & Chemistry*, 31(1), 115-121, [available from Wiley](#).
- Trenfield, M., McDonald, S., Kovacs, K., Leshar, E.K., Pringle, J., Markich, S., Ng, J., Noller, B., Brown, P., van Dam, R. (2011) Dissolved organic carbon reduces uranium bioavailability and toxicity. 1. Characterisation of aquatic fulvic acid and its complexation with uranium. *Environmental Science & Technology*, 45(7), 3075-3081, [available through ACS](#).
- Pace, H., Leshar, E., and Ranville, J.F. (2010) Influence of stability on the acute toxicity of CdSe/ZnS nanocrystals to *Daphnia Magna*. *Environmental Toxicology & Chemistry*, 29(6), 1338-1344, [available from Wiley](#).
- Leshar, E.K., Bednar, A.J., Newman, M., Honeyman, B.D, and Ranville, J.F. Hyphenated separation techniques for investigation of uranium-organic matter complexation at a military testing ground. In preparation for *Journal of Chromatography A*.

Invited Presentations and Panels

- Leshar, E. Current Knowledge on Children & Drinking Water Lead: Sources, Effects, Exposure. Intermed Pediatrics, South Portland, ME, October 2017.
- Leshar, E. School Drinking Water: Is Lead an Issue? Educational Plant Maintenance Association Annual Meeting. Augusta, ME, July 2017.
- Leshar, E. SENCER Success Stories. Invited panelist at SENCER (Science Education for New Civic Engagements and Responsibilities) New England Spring Regional Gathering, Portland, ME, April, 2017
- Leshar, E. Katahdin Ironworks: Field Environmental Chemistry in Maine. Invited presentation at University of New Hampshire Chemistry Department Seminar Series, Durham, NH, September, 2014.
- Leshar, E. Environmental Colloids and Metal Transport: An Analytical Perspective. Invited presentation at St. Joseph's College of Maine, Standish, ME, January, 2013.

- Leshner, E., D. Mitrano, R. Reed, E. Gray, C. Higgins, J. Ranville, H. Pace. Single Particle (SP)-ICP-MS Methodologies and Application to Tracking Silver Nanoparticle Transformations. Invited presentation at Perkin Elmer Inspiring Innovation Tour, Golden, CO, September 2012.
- Leshner, E. Research opportunities relating to uranium on Navajo lands. Panel discussion at Navajo Technical College, Crownpoint, NM, September 2012.
- Leshner, E. Acid Mine Drainage: Impacts on Stream Chemistry and Metal Toxicity. Invited presentation at Carroll College, Helena, MT, March 2012.
- Leshner, E. Redox Biogeochemistry in a Uranium-Contaminated Aquifer. Invited presentation at University of Colorado Baker Residential Academic Program, Boulder, CO, December 2011.
- Leshner, E. Detecting and Characterizing Nanomaterials in the Environment: Why, How, and What Do We Learn? Invited presentation in the ESE Seminar Series, Golden, CO, February 2011.
- Leshner, E., J. Ranville, D. Mitrano, J. Monserud, B. Honeyman. ICP-MS Analysis of Nanomaterials. Invited presentation at Perkin Elmer Inorganic Users Workshop, Golden, CO, May 2010.

Published Proceedings and Abstracts

- Leshner, E., Ranville, J., Honeyman, B. (2009) Uranium partitioning to nanoparticulate phases: Measurements with FI FFF-ICP-MS. Oral presentation at Goldschmidt Conference, Davos, Switzerland, June 2009. *Geochimica et Cosmochimica Acta* 73(13), A745-A745.
- Ranville, J.F., Pace, H.E., Leshner, E.K., and Lee, B.T. (2009) Advanced methods to characterize nanomaterials for environmental toxicity studies. Oral presentation by E. Leshner at Goldschmidt Conference, Davos, Switzerland, June 2009. *Geochimica et Cosmochimica Acta* 73(13), A1072-A1072.
- Leshner, E., Lee, S.Y., Ranville, J.. Detection and Characterization of Inorganic Nanoparticles Using Inductively Coupled Plasma-Mass Spectrometry in Hyphenated and Real Time Single Particle Modes. Poster presentation at International Environmental Nanotechnology Conference: Applications and Implications, Chicago, IL, October, 2008. Publication of conference proceedings (extended papers).
- Campbell, K., Qafoku, N., Kukkadapu, R., Williams, K., Leshner, E., Figueroa, L., Peacock, A., Wilkins, M., Davis, J., and Icenhower, J. (2008) Characterizing the extent and role of natural subsurface bioreduction in a uranium-contaminated aquifer. *Geochimica et Cosmochimica Acta*, 72, 12.
- Campbell, K M, Williams, K H, Leshner, E., Figueroa, L, Davis, J A, Long, P E (2007), A Comparison of Naturally-Occurring and Artificially Stimulated Uranium(VI) Bioreduction in Sediment from a Field-scale Experiment in Rifle, CO, *Eos Trans. AGU.* 88(52), Fall Meet. Suppl., Abstract B32A-05

Selected Conference Presentations (full list available upon request)

- Leshner, E., Holme, B., Dorland, R., Eduljee, N. Leveraging Real Time Data from a Water Quality Monitoring Buoy in Sebago Lake for Community Engagement: Preliminary Plans. Poster presentation at Maine Sustainability & Water Conference, Augusta, ME, March, 2017.
- Leshner, E. Trading Quantity for Quality in Introductory Chemistry Lab with Inquiry Based Learning. Oral presentation at the Biennial Conference on Chemical Education, Greeley, CO, August, 2016.
- Leshner, E. Community-based learning in environmental chemistry: Arsenic testing in rural Maine. Oral presentation at American Chemical Society, National meeting, Boston, MA, August, 2015.
- Leshner, E., Ranville, J., Honeyman, B. FFF-ICP-MS Analysis of Uranium-Organic Matter Complexation. Oral presentation at Society for Environmental Chemistry and Toxicology, National meeting, Portland, OR, November, 2010.
- Leshner, E., Lee, S.Y., Ranville, J. Flow field-flow-fractionation-inductively coupled plasma-mass spectrometry: A tool for characterizing size dependent elemental concentrations in metal-bearing engineered nanoparticles. Oral Presentation at American Chemical Society National Conference, Salt Lake City, UT, March 2009.
- Leshner, E., Ranville, J., Honeyman, B. Hyphenation of field flow fractionation with ICP-MS to Determine Pore-Scale Uranium (VI) Speciation. Oral Presentation (presented by Ranville) at the 5th Congress Society for Environmental Toxicology and Chemistry World Congress, Sydney, Australia, August 2008.
- Leshner, E., Ranville, J., Honeyman, B. Optimization of Flow-Field Flow Fractionation-Inductively Coupled Plasma Mass Spectrometry for U(VI) Characterization. Poster presentation at the 2008 Graduate Students Association Research Fair, Golden, CO, April 2008. Second place prize for best poster.
- Leshner, E., Ranville, J., Honeyman, B. Optimization of Flow-Field Flow Fractionation-Inductively Coupled Plasma Mass Spectrometry for U(VI) Characterization. Poster presentation at Environmental Remediation Sciences Program (ERSP) PI's meeting, Lansdowne, VA, April 2008.
- Leshner, E., Pace, H., Forth, J., Ranville, J. Detection and Characterization of Natural and Engineered Nanoparticles in the Environment. Oral Presentation at the 2008 American Geophysical Union's Hydrology Days, Fort Collins, CO, March 2008.
- Leshner, E., Figueroa, L., Ranville, J. Characterization of Dissolved Organic Carbon in a Biostimulated Aquifer. Oral Presentation at the 2007 Geological Society of America Denver Annual Meeting, Denver, CO, October 2007.

Curriculum Development, Assessment, Professional Development, and Special Projects Beneficial to Students and the College

- 2017-present. Development and implementation of new major: Physical Sciences and Secondary Education (ongoing).
- 2017-present. Modernization of Chemistry curriculum (ongoing).
- 2016-present. Ongoing work with McAllister and Quinn related to grant writing
2016. Spearheaded Enriched CH103, a third section of Principles of Chemistry designed to give the top students more of a challenge. This course was delivered Fall '16 by Gorske, Benfaremo, and Erikson.
2016. Participated in NSF Days, a full day workshop in Bangor on best practices for writing NSF grants.
2016. Re-designed and delivered three day module for Environmental Science Semester at Katahdin Ironworks.
2016. Designed and delivered a demonstration for groups Windham Middle School students as part of a half day visit to campus coordinated by Ryan Dorland. Assisted Sarah MacLeod '17 in designing and delivering her own demo.
2016. Designed and delivered a "Science Night" demonstration to support the SJC Pre-Professional Club.
2015. Invited and scheduled external speaker, Gonghu Li from UNH, to SJC to give a seminar on Nov. 18. Facilitated the placement of Samantha Lavalley '17 in a summer research internship with Dr. Li during summer '16.
2015. Developed and delivered CH/ES107 Research Science on Sebago Lake for 1st/2nd year Natural Science majors. Curriculum is project based with a goal of improving retention of science majors. Grant supported.
2015. Improved the ability of the Sciences Department to communicate with students by creating the "sjc-sciences" Google group listserv.
2015. Organized (with Nick Benfaremo) and found funding for chemistry majors to attend ACS national meeting in Boston.
- 2014-2015. Developed Peer Focused Tutoring program with Shanna Webster of the Academic Center.
2014. Advocated for the "Science Commons" – a common space in Mercy Hall for science students.
2014. Participant in NSF/CCWCS workshop "Chemical Education: Supporting Student Laboratory Learning" in Chicago. Workshop resulted in redesign of CH103 labs to inquiry-based formats with a focus on writing and communication of results.
2014. Designed and delivered one day module for Environmental Science Semester at Katahdin Ironworks.
2014. Participant in "Safe Zone Training" at Saint Joseph's College.
- 2012-2013. Coordinated effort in accrediting two new degrees at Colorado School of Mines: BS Environmental Engineering and BS Civil Engineering. Installed and enacted department-wide assessment plan for degree learning outcomes (at CSM).
2012. Designed labs and assessments for Environmental Engineering Laboratory course (at CSM).

Analytical and Computing Skills

- Analytical:** ICP-MS, Field flow fractionation, ICP-AES, DOC fractionation and analysis, solid phase TOC, UV-Vis spectroscopy, Dynamic light scattering, X-ray diffraction, Liquid scintillation counting, Fluorescence spectroscopy and PARAFAC modeling of fluorophores, FTIR, Raman Spectroscopy
- Computing:** Educational (Brightspace, Angel, Blackboard, Sapling, Connect, educational video production – Screenflow/Youtube), Chemical Speciation (Visual MINTEQ, Hydraql, Biotic Ligand Model), Transport (Chain, MPNE), ArcView (GIS), JMP, Lyx (LaTeX based document processing), Microsoft Office and competing office suites.

Awards

- | | |
|------|--|
| 2017 | Nominated for (did not win) Maine Campus Compact Donald Harward Faculty Award for Service-Learning Excellence |
| 2016 | NCAA Division III Week Faculty Recognition, nominated and presented by Elyse Caiazzo '18 |
| 2012 | CH2M-Hill/CEE Outstanding Graduate Student Award in recognition of outstanding academic performance, leadership, and service |
| 2012 | Best student paper award in Civil and Environmental Engineering |
| 2010 | 2nd place Presentation Award, Rocky Mountain SETAC |
| 2009 | Best student paper award in Environmental Science and Engineering Division |
| 2009 | GSA travel grant for Goldschmidt Conference, Davos, Switzerland |
| 2009 | Recognized by the International Association of Geoanalysts for outstanding contribution to the field of analytical geochemistry by a young scientist |
| 2009 | 2nd place student presentation, Rocky Mountain SETAC Conference |
| 2008 | GSA travel grant for International Environmental Nanotechnology Conference, Chicago |
| 2008 | 2nd place, Graduate Students Association Research Fair (poster presentation) |
| 2008 | Student Presentation Award, Rocky Mountain SETAC (oral and poster presentation) |
| 2008 | DOE ERSD Student Travel Fellowship |
| 2007 | Colorado Lake and Reservoir Management Association Scholarship |

2007	Edna Bailey Sussman Research Internship Grant (advised by Phil Long, PNNL, and Linda Figueroa, CSM)
2006	Golden Apple – Albemarle County award for excellence in teaching

Professional Service and Affiliations

2018	Reviewer for <i>Environ. Science and Technology</i>
2017	Reviewer for <i>The Chemical Educator</i>
2016	Reviewer for <i>Journal of Chromatography-A</i>
2015	Reviewer for Maine Aerospace Workforce Development Program Student Internship Program
2014-present	Maine Geological Society
2009, 2010	Reviewer for <i>Analytical Chemistry</i> , <i>Environ. Science and Technology</i> , and <i>Environ. Chemistry</i>
2010	Organized first Career Panel for ESE division
2009-2010	Seminar Committee member within ESE division
2009-present	American Chemical Society
2008-present	Society for Environmental Toxicology and Chemistry
2006-2007	Student Committee of the Environmental Science and Engineering Division
2007-2012	Society of Women Environmental Professionals
2003-present	National Science Teachers Association

Additional Community Activities

Annual activities	Participant in SJC Faculty-Staff Day of Service, work with Pre-Professional Sciences club to plan and deliver “Science Night”
2017-	Outreach activities at area schools including Gorham HS, Westbrook HS
2016	Developed and taught “Science for Curious Kids,” an early elementary after-school science enrichment class
2016-present	Volunteer activities at Longfellow Elementary School, Portland
2016-present	Soccer coach, Portland Area Youth Soccer Association
2016	Volunteer campaigning for Democratic Party
2013	Faculty advisor and coach, CSM Women’s Ultimate Frisbee team
2010-2012	Outreach to high school science classrooms
2003-present	Alumni Interviewer for Dartmouth College



September 18, 2018

Dr. Emily Leshar
Assistant Professor, Sciences
St. Joseph's College of Maine
278 Whites Bridge Road
Standish, Maine 04084

Windham Town Council
Windham, Maine

Dear Town Council Members,

I am writing with some comments regarding the proposed mineral extraction near Forest Lake. I am an assistant professor of chemistry at Saint Joseph's College and was asked by some concerned residents of the Forest Lake Association for help in better understanding some of the environmental and health risks associated with the proposed project.

A bit more on my background for context – I have a long history of studying and involvement with issues of water quality, mining impacts on water systems, and engaging with the community on these issues. My PhD is in Environmental Science and Engineering (Colorado School of Mines). Please find my CV attached for further details.

I met with members of the Forest Lake Association on August 30 2018 to hear more about their concerns and give them my thoughts on the level of risk associated with the project. I share many of the concerns of the group and I encourage the City Council and its committees to be cautious with regards to the development for a number of reasons.

1. Moving water and sediment transport – water needs to leave the proposed site one way or another, and every mineral extraction operation results in increased surface area of rock that was previously very geochemically stable. That increased surface area is then interacts with air and water which can result in mobilization of trace metals, as well as the generation of large amounts of particles and rubble of all sizes (from very fine dust to cobbles and boulders). This presents a few potential risks to Forest Lake and Cumberland aquifer.
 - a. Storms and drainage patterns may result in overland flow transporting fine material to the lake. I was informed the developers have said the site is “internally drained” – so this might be a smaller issue – but I am concerned that

the site is seeking a waiver from the stormwater management plan. Given the proximity to the lake I think it is imperative to have a robust stormwater management plan to prevent movement of turbid waters into the lake. The suspended particles can transport nutrients like phosphorus to the lake, and increases in turbidity are harmful to aquatic life. A waiver should not be considered.

- b. An “internally drained” site means water that moves through the site continues to groundwater aquifers. I have not seen any hydrogeology reports on the site, but my assumption, given the proximity of the site to Forest Lake which feeds the Cumberland aquifer, would be that any internally drained water would be entering the aquifer, and quite possibly impacting the Forest Lake residents’ wells. Has there been any analysis of trace metals in rock units that are proposed to be quarried? I would very much want to know about the possibility of the quarrying mobilizing trace metals, particularly arsenic and uranium given that the aquifer is a drinking water source for so many people.
 - c. I am unsure how the aquifer protection boundary has been defined. Since Forest Lake feeds Cumberland aquifer, it illogical for the aquifer protection boundary to only extend some small distance from the lakeshore – it would make much more sense from a hydrologic point of view to include Forest Lake’s watershed since the watershed, lake, and aquifer appear to be hydrologically continuous.
- 2. Infrastructure degradation – moving massive amounts of rock off the site requires quite a bit of trucking, and the road servicing the site is quite narrow and not in great shape. I worry that heavy usage of the road by heavy trucks will result in degradation of the road and further runoff issues to the lake. I’m aware there was also a waiver requested for traffic management. I think this is an issue that must be dealt with, not circumvented.
 - 3. Dust and noise pollution – although this is outside of my area of expertise, I would be concerned about the health impacts of dust and noise if I lived around Forest Lake.

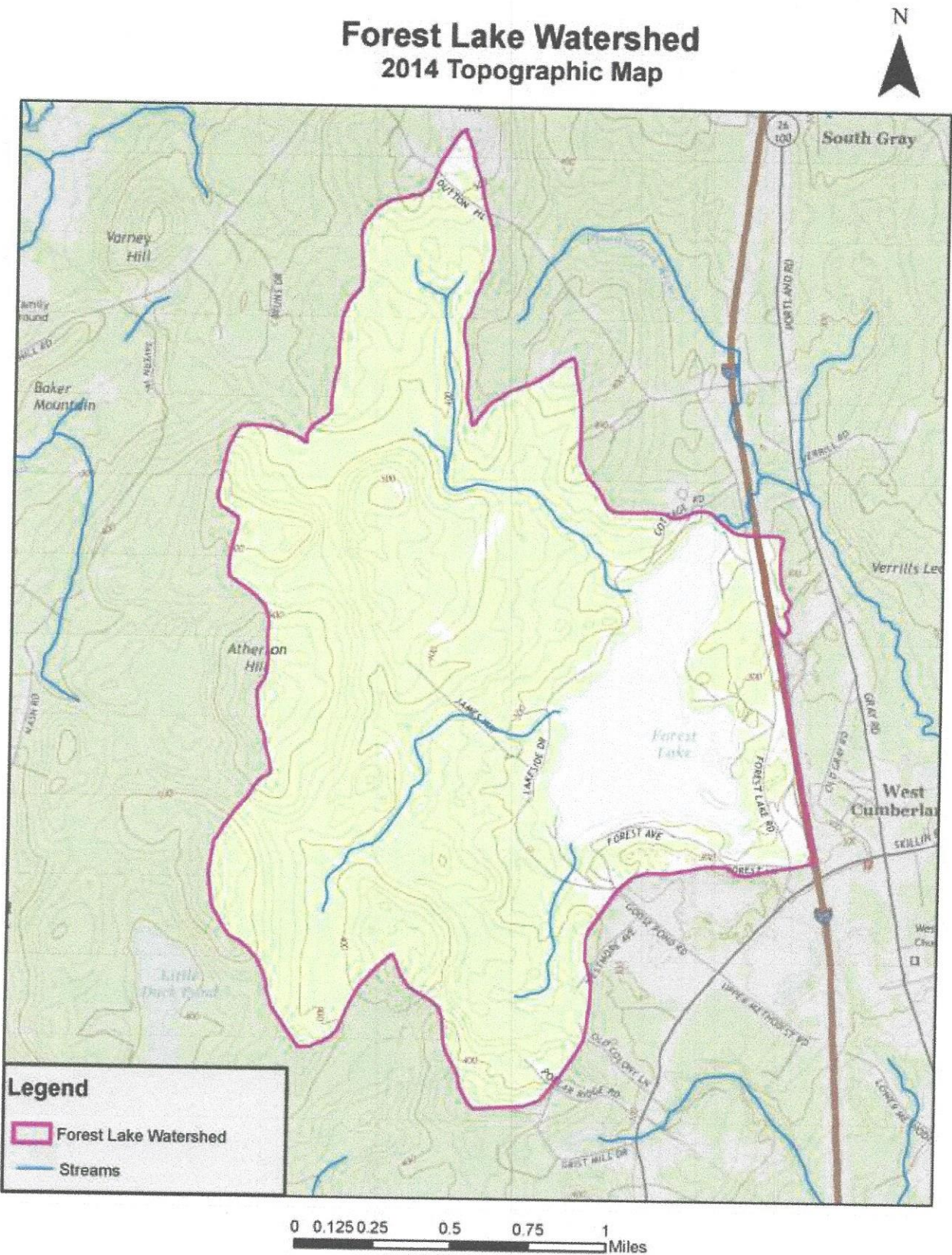
I hope my comments are helpful and please do let me know if I can be of further assistance.

Sincerely,



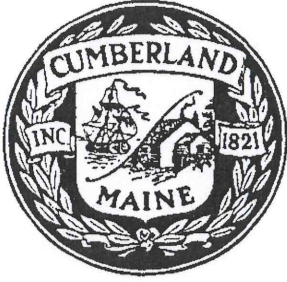
Dr. Emily Lesher

FIGURE 1: FOREST LAKE TOPOGRAPHIC WATERSHED MAP



ITEM 12-165

To hear a report from the Town Manager re: updating the Aquifer
Protection Ordinance as recommended by John Sevee of
Sevee & Maher Engineers



M E M O R A N D U M

TOWN OF CUMBERLAND, MAINE
290 TUTTLE ROAD
CUMBERLAND, MAINE 04021
TEL: 207-829-2205 FAX: 829-2224

To: Town Council
From: William R. Shane, Town Manager
Date: September 19, 2012
Re: Aquifer Protection Updates

In light of the recent junkyard application, the Ordinance Committee asked me to do some preliminary leg work with John Sevee of Sevee & Maher Engineers to re-evaluate the impact our current zoning may have on the 5 billion gallon aquifer in West Cumberland.

Johns report is attached. I am recommending the following as next steps in the process:

1. Direct the Town Manager to review and develop new ordinances consistent with the report and return to the Ordinance Committee by **the end of October** with a draft Ordinance update.
2. Direct the Ordinance Committee to review and hold at least one public informational meeting on the proposed ordinance changes and return to the Town Council with a final **Draft by November 26, 2012** at which time the Town Council will decide if it is ready to be sent to the Planning Board for a Public Hearing and a recommendation.

I believe this is a critical policy issue and will have significant environmental impacts on our community for generations to come. I am not recommending a Moratorium at this time, but I do believe by holding this meeting and discussing the purpose and plan for a revised ordinance we have announced our intentions to change the Aquifer Protection language and therefor lock out the potential onslaught of applications that may try to come under the older set of zoning regulations.

September 11, 2012

12102

20120911ws.doc

William Shane
Town of Cumberland
290 Tuttle Road
Cumberland, ME 04021

Subject: Town of Cumberland Aquifer Protection Review

Dear Bill:

At the request of the Town of Cumberland (Town), Sevee & Maher Engineers, Inc (SME) has completed a review of the Town's zoning ordinance with regard to currently allowed uses in those portions of Town that overlie sand and gravel aquifers. Our review focuses on those allowed uses and their potential impacts to the water quality of the aquifers. In a general sense, our review applies anywhere in Town where groundwater is being used to supply drinking (potable) water. However, this letter specifically addresses the sand and gravel aquifers because of their ability to provide significant volumes of potable water for community supply wells and because they are particularly susceptible to pollution. We begin by discussing the importance of the sand and gravel aquifers in Town, followed by a discussion of the currently permissible uses and the risks to the aquifers created by some of the permissible uses, and conclude with recommendations about how to upgrade your ordinances to better protect the aquifers now and in the future.

IMPORTANCE OF GROUNDWATER AQUIFER

Recent permitting applications for two businesses atop the West Cumberland sand and gravel aquifer have raised issues relative to potential pollution threats of this important groundwater resource. The West Cumberland sand and gravel aquifer is one of the three sand and gravel aquifer deposits located within the Town of Cumberland boundaries. The other two are located in the vicinity of the fairgrounds and east of Main Street in the center of Town. These aquifers have the potential of providing potable water for the entire Town into the foreseeable future. SME has previously estimated approximately four to five billions of gallons of water from precipitation recharges these three aquifers throughout a single year. This quantity of water is sufficient to satisfy a population in the order of over 100,000 people.

The West Cumberland aquifer is the most regionally extensive of the three aquifers and, therefore, deserves special consideration. A good portion of the sand and gravel aquifer located east of Main Street in Cumberland Center is covered with clay deposits and is, thereby, naturally protected from surficial pollution. This is not the case for the aquifers in the

vicinity of the fairgrounds and in West Cumberland. The sand and gravel is largely exposed at the ground surface and receives direct precipitation which passes through the soils and enters the water table. Because the sand and gravel is exposed at the ground surface, any spills of chemicals or fuels will migrate quickly down to the water table and can pollute the groundwater. Spills in the order of one to two gallons typically will not reach the water table if it is 20 to 30 feet deep; larger spills will quickly reach the water table under these conditions. If the water table lies within ten feet of the ground surface, even smaller spills, depending of the chemicals involved, can be detrimental to the aquifer's potability.

The West Cumberland aquifer is also currently used to supply individual residential wells. Groundwater movement is typically in the order of 100 to 1,000 feet per year in Maine's sand and gravel deposits so pollution of the aquifer can quickly affect existing groundwater users over large distances. Unfortunately, once the aquifer is polluted it may take decades or maybe even centuries to renovate the aquifer's groundwater to a potable or drinkable status. The last fifty years or so, with the emphasis on groundwater issues and pollution, have demonstrated the societal costs and extended time frame for cleaning up contaminated groundwater.

REVIEW OF CURRENT TOWN ZONING OVER WEST CUMBERLAND AQUIFER

Our review of zoning focuses on the West Cumberland Aquifer, the largest of the Town's three aquifers, and the potential impacts from future development. Portions of the West Cumberland aquifer are currently zoned for Commercial (VCC), Industrial (I), and Rural Residential (RR) development. Below is a review of the permitted uses in each zone that potentially put the aquifer at risk. The risks are associated with the typical use or storage of fuels, oils, or chemicals that, if spilled or discharged via leachfields, would result in pollution of portions of the aquifer.

Industrial zone (I)

- Motor vehicle repair (fuel, oil solvents);
- Warehousing and storage(storage of chemicals);
- Construction operations (storage of fuels, oils, solvents, chemicals);
- Heliports depending (fuel storage and engine servicing); and
- Agriculture and animal husbandry (manure storage and pesticides).
- Junkyards are allowed under special exception (various oils, liquids, heavy metals, PCBs, and solvents).

Village Center Commercial Zone (VCC)

- Auto repair and gasoline stations (bulk storage of fuels and oils, and solvents);
- Restaurants (type of waste water entering leachfields);
- Grocery stores (type of wastewater entering leachfields);

- Landscaping services (storage of chemicals, fertilizers, pesticides, equipment repair and refueling, stock pile storage);
- Motor vehicle sales (servicing the vehicles and fuel storage);
- Warehousing and distribution(storage of chemicals); and
- Aggregate processing, (storage of large piles of soils).

Many of the uses, both within the VCC and the I Zones also potentially involve large leachfield systems. For instance, hotels and inns are allowed in the VCC district and, depending on the size of the hotel and the volume of wastewater, may create a potential threat to surrounding groundwater users. While such large volumes of wastewater could be treated, treatment is not currently required in the zoning ordinance for the Town's sand and gravel aquifers.

Rural Residential (RR)

- Agricultural and animal husbandry (manure storage and pesticides),
- Airports and heliports (fuel storage and engine servicing);,
- Riding stables (manure storage);
- Kennels(manure storage); and,
- Cemeteries (leaching).

The above-mentioned allowed uses in the various zones over the West Cumberland aquifer may require modification in the ordinance to better protect the aquifer from pollution. The other two major sand and gravel aquifers in Town are largely associated with RR zones and are currently at less at risk under the Town's zoning ordinance. However, as with the RR zone for the West Cumberland aquifer, it may be beneficial to revisit appropriate zoning in the RR zones in the other two aquifers as well.

Aquifer Overlay District

This district has been put in place to protect the quality of the Town's sand and gravel aquifers. However, the zone allows the following uses with a demonstration with a positive finding that they will not create an adverse effect on groundwater quality:

- Disposable solid waste (unknown chemicals);
- Road salt and deicing salt storage (leaching);
- Animal feed lots (manure storage);
- Manure piles (leaching which may contain chemicals given to animals);
- Petroleum storage (spillage); and
- Disposable leachable materials (unknown chemicals)

All of these items represent a potential threat to water quality of the underlying aquifers. We believe that some of these uses allowed in the current Aquifer Overlay District should be prohibited from the Town's aquifers because of the pollution threat they represent to the aquifer.

EXAMPLES OF POTENTIAL RISK OF ALLOWED USES

One of the recently proposed uses over the West Cumberland sand and gravel aquifer is a metals recycling facility. This facility is similar to a junkyard but has more controls of materials stockpiled for sorting and reshipment. However, simply refueling equipment on-site creates a potential risk to the aquifer. Even if such a facility were to begin without the intention of bringing in hazardous materials, without clear definition of what chemicals are allowed, such materials could be brought in later and threaten the quality of the aquifer. Beyond the aquifer itself, any risk to the aquifer threatens existing residential water supply wells. The threat on the water supply wells also raises the question that if those wells are contaminated, who is responsible for providing them with potable, safe water. A water line would have to be installed to service the affected residents.

The West Cumberland application just mentioned, therefore, represented an example of a currently permissible activity within one of the Town's sand and gravel aquifers that also is a pollution risk to the aquifer. Even though the applicant can demonstrate adequate safeguards against pollution, accidents can still occur resulting in aquifer pollution.

RECOMMENDATIONS

Many towns have strengthened their ordinance in regards to protection of groundwater. Even though the Town of Cumberland currently has some controls in place, we believe that now is a good time for the Town to upgrade aquifer protection in their zoning ordinance. This will be important in the future as southern Maine grows, so now is a good time to be proactive. Aquifer protection ordinances look at zoning from the perspective of maintaining the quality and quantity of groundwater within the Town's groundwater aquifers. Activities that can result in degradation of the quantity of water recharging the aquifer, or the quality of water in the aquifer, would not be permitted in the sand and gravel aquifers and may require better planning in other areas in Town. Examples of prohibited uses currently not included in the Town's aquifer protection ordinance are power plants, chemical facilities, bulk storage, fuel facilities, large septic systems, and junkyards. Allowable activities over a sand and gravel could include low-density residential housing with individual leachfields or small leachfield systems, certain agricultural facilities that do not involve use of chemicals such as fertilizers and pesticides and/or bulk storage of animal waste, and limited-size office complexes that do not involve manufacturing or chemical storage. Historically there has been an interest in developing spring water in Maine. Commercial mining of groundwater should be clarified in the ordinance as this protects the future quantity of available water in the aquifers. In addition, the ordinance would address special considerations for permissible activities. For instance, drainage plans and spill prevention plans should be required for applications over sand and

gravel aquifer. There should also be the ability to monitor and enforce prohibition of hazardous materials in the aquifer protection zone.

We have attached in Appendix A for your consideration, as an example, typical aquifer protection ordinance language. This represents a composite of several ordinances from around the United States. Various elements may or may not be applicable to Cumberland, but the ordinance provides you with a general sense for the type of language, structure, and prohibited uses. We would recommend that you begin your aquifer protection by verifying that the current aquifer map is consistent with all recently available data. The Maine Geological Survey, who publishes the significant sand and gravel aquifer maps for Maine, is continually updating these maps with new information from borings, excavations, and studies. Consideration should also be given to a buffer (e.g., 200 feet or so) around these mapped aquifers that may provide for mapping uncertainty as well as recharge contributions within the aquifer. These adjacent areas may be as important to protect as the aquifer itself. Also, existing lot lines are often a useful means for delineating the aquifer boundaries. This eliminates questions of interpretation of boundaries drawn across a large-scale map.

As part of your request for Sevee & Maher Engineers, Inc. (SME) to review the potential uses of the sand and gravel aquifers in the Town of Cumberland, we also made an inspection of the Town gravel pit located in West Cumberland. Attached as Appendix B is a brief summary of our observations and findings. In general, none of the current operations or stored materials in the Town's pit or the adjacent pits represents an immediate threat to the quality of the West Cumberland sand and gravel aquifer.

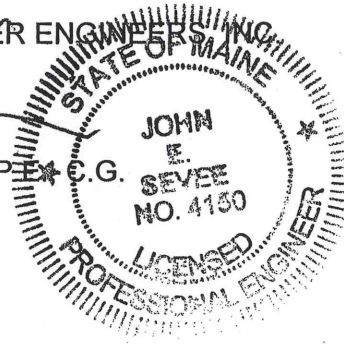
Once you have had an opportunity to review this letter, please do not hesitate to give us a call and we would be happy to go over in more detail the steps necessary to develop a comprehensive aquifer protection ordinance. Our experience with other ordinance development is that the aquifer overlay zone is the first element and usually takes one or two months to collect the sufficient information and compile it into a map. Once that is done, the ordinance language is relatively straightforward to develop and requires only a few weeks to complete a first draft.

Once again, please review this information and do not hesitate to give us a call if you have any questions.

Very truly yours,

SEVEE & MAHER ENGINEERS, INC.

John E. Sevee
John E. Sevee, P.E. & C.G.
Principal



APPENDIX A

EXAMPLE ORDINANCE LANGUAGE

ARTICLE X

X.1 AQUIFER PROTECTION ORDINANCE TOWN OF _____

X.2 PURPOSE: Pursuant to RSA 674:16 674:21, the Town of _____ adopts an Aquifer Protection Ordinance and accompanying regulations to help insure the future quality and quantity of groundwater in the Town's sand and gravel aquifers. The Town believes that an adequate water supply is indispensable to the future well being, health, welfare, and safety of its citizens. Such an adequate supply of quality water is also essential to the maintenance of the existing natural environment of the Town, an environment the Town wishes to protect as essential to its overall goals and objectives. Since the water resources are under a constantly increasing demand for new and/or competing uses, and since the resources are under an ever-increasing potential for contamination, the Town declares such water resources invaluable. These resources should be protected, conserved, and managed in the interests of present and future generations. Therefore, the purposes of this Aquifer Protection Ordinance are:

X.2.1 To protect the public health and general welfare of the citizens of _____.

X.2.2 To protect, preserve, and maintain the existing and potential groundwater supplies from adverse development and unwise land use practices.

X.2.3 To promote future growth and development of _____ by insuring the future availability of clean water for all domestic and public uses.

X.2.4 To encourage uses that can appropriately and safely be located within the direct and indirect recharge areas of the sand and gravel aquifers in the Town of _____.

EX. LOCATION: The Aquifer Protection Zone is identified herein on Figure 1 of this Article. It is based on the 19_____ study by Caswell, Eichler and Hill entitled "_____."

X.3 RECHARGE AREAS: For the purpose of this Ordinance, the Direct Recharge area for the identified sand and gravel aquifers are considered to be excessively well-drained soils directly over the aquifer. No Indirect Recharge areas have been identified at the time of enactment and are not considered a part of this ordinance.

X.4 DEFINITIONS

SAND AND GRAVEL AQUIFER: A geologic formation, group of formations, or part of a formation primarily consisting of sands and gravels that is capable of yielding quantities of potable groundwater sufficient for public or private water supplies.

BULK SALE: Removal and sale of groundwater.

GROUNDWATER CONTAMINATION: Exceeding the current drinking water standards in groundwater of the aquifer.

GROUNDWATER: All the water below the land surface in sediments of sand, gravel and mixtures, or in rock fractures, capable of yielding water to a well.

GROUNDWATER MINING: Water being withdrawn at a rate exceeding the rate of recharge.

GROUNDWATER RECHARGE AREAS: Those primary, direct and indirect areas from which water is added to the aquifers by the natural processes of infiltration and precipitation.

LEACHABLE WASTES: Waste materials, including solid wastes, sludge and agricultural wastes that are capable of releasing contaminants to the surrounding environment.

MINING: The removal of geologic materials such as topsoil, sand and gravel, metallic ores, or bedrock to be crushed or used as building stone.

NON-CONFORMING USES: Any lawful use of building, structures, premises, land or parts thereof existing as of the effective date of this Ordinance, or amendment thereto, and not in conformance with the provisions of this Ordinance, shall be considered to be a non-conforming use.

RECHARGE AREAS: Any land surface from which groundwater recharge occurs.

SOLID WASTE: Any discarded or abandoned material including refuse, putrescible materials, septage, or sludge, as defined by Maine _____. Solid waste includes solids, liquids, semi-solids, or waste containing gaseous material resulting from residential, industrial, commercial, mining, or agricultural operations, or waste from community activity or waste from educational institutions.

IMPERVIOUS: Not readily permitting infiltration of water.

IMPERVIOUS SURFACE: Not permitting infiltration of regulated substances when spilled.

TOXIC OR HAZARDOUS MATERIALS: Any substance or mixture of such physical, chemical, or infectious characteristics as to pose a significant, actual or potential hazard to water supplies, or other hazard to human health, if such substance or mixture were discharged to land or waters of this Town. Toxic or hazardous materials include, without limitation, volatile organic chemicals, petroleum products, heavy metals, radioactive or infectious wastes, acids and alkalies, asphalt and roofing tars, and include products such as pesticides, herbicides, solvents and thinners, and such other substances as defined in Maine _____.

Wastes generated by the following commercial activities are presumed to be toxic or hazardous, unless and except to the extent that anyone engaging in such an activity can demonstrate the contrary to the satisfaction of the Planning Board:

- Chemical and bacteriological. laboratory operation, including laboratory operations in educational institutions.

- Dry cleaning and laundries.
- Electronic circuit manufacturing. Metal plating, finishing and polishing.
- Painting, wood preserving and furniture stripping.
- Pesticide and herbicide application.
- Photographic and printing processes.

JUNKYARD: An establishment or place of business which is maintained, operated, or used for storing, keeping, buying, or selling junk, or for the maintenance or operation of an automotive recycling yard.

X.5 APPEALS: Where bounds of the identified aquifer areas, as delineated, are in doubt or in dispute, any landowner aggrieved by such delineation may appeal the boundary location to the Planning Board. Upon receipt of such appeal, the Planning Board shall suspend further action on development plans related to the area under appeal and shall engage, at the landowner's expense, a qualified hydrogeologist to prepare a report determining the revised location and extent of the aquifer area(s) relative to the property in question. The aquifer map may be modified, if need be, by such determination subject to review and approval by the Planning Board.

At a minimum, the hydrogeologic investigation shall determine the continuity or lack thereof of aquifer soils, saturated thickness of aquifer soils, groundwater elevation mapping and continuity with aquifer, groundwater flow paths from landowners' properties.

X.6 USE REGULATIONS

X.6.1 For minimum lot size refer to lot sizes for Residential, Rural Agricultural, Commercial and Industrial.

X.6.2 MAXIMUM LOT COVERAGE: Within the Aquifer Protection Zone, no more than 10% of a single lot, including the portion of any new street abutting the lot, may be rendered impervious to infiltration. Maximum lot coverage may be increased if upon site plan review, drainage requirements are properly engineered.

X.7 PROHIBITED USES: The following uses are prohibited in the Aquifer Protection Zone except where permitted to continue as a non-conforming use.

X.7.1 Floor drains or subslab drainage piping.

X.7.2 Drainage of sinks and floor washings into wetwells or direct discharge to soils.

X.7.3 Disposal or storage of solid waste other than brush.

X.7.4 Disposal or storage of hazardous waste.

X.7.5 Subsurface storage of petroleum and other refined petroleum products.

X.7.6 Industrial uses which discharge wastewaters.

X.7.7 Storage of road salt or other de-icing chemicals.

X.7.8 Dumping of snow containing de-icing chemicals.

X.7.9 Storage of unregistered junk, automobiles, and salvage yards.

X.7.10 Waste injection wells.

X.7.11 Wastewater, sewage, and septage lagoon.

X.7.12 Compost facilities or compost storage.

X.7.13 Fuel or hazardous chemical pipelines.

X.7.14 Bulk storage of petroleum and fuels, including tanks, tank cars or vehicles, that contain more than 300 gallons excluding residential fuel storage.

X.7.15 Gasoline or service stations, paint shops, or paint spray business.

X.8 PERMITTED USES: The following activities may be permitted provided they are conducted in accordance with the purpose and intent of this Ordinance:

X.8.1 Single- and two-family residential development.

X.8.2 Outdoor recreation, nature study, boating, fishing and hunting and other activities directly associated with the conservation of wildlife.

X.8.3 Foot, bicycle, horse paths, ski trails and bridges.

X.8.4 Farming, gardening, nursery, forestry, harvesting and grazing provided that fertilizers, herbicides, pesticides, manure and other leachables are used appropriately at levels that will not cause groundwater contamination. Materials will be stored under shelter and on an impervious _____ plastic/concrete pad, with spill containment.

X.9 EXEMPTIONS: The following uses are exempt from the specified provisions of this Ordinance as long as they are in compliance with all applicable local, state, and federal requirements:

X.9.1 Any private residence is exempt from all Performance Standards.

X.9.2 Any business or facility where regulated substances are stored in containers with a capacity of less than five gallons.

X.9.2 Storage of heating fuels for on-site use or fuels for emergency electric generation, provided that storage tanks are indoors on a concrete floor or have corrosion control, leak detection, and secondary containment in place.

X.9.3 Storage of motor fuel in tanks attached to vehicles and fitted with permanent fuel lines to enable the fuel to be used by that vehicle.

X.9.4 Storage and use of office supplies.

X.9.5 Temporary storage of construction materials on a site where they are to be used is exempt from Performance Standards _____ through _____ if incorporated within the site development project within six months of their deposit on the site.

X.9.6 Household hazardous waste collection projects regulated under Maine Code of _____ are exempt from Performance Standards _____ through _____.

X.10 SPECIAL EXCEPTIONS: The Zoning Board of Adjustment may grant a Special Exception for those uses otherwise permitted in the underlying zoning district only if written findings of fact are made that all of the following are true:

X.10.1 The proposed use will not detrimentally affect the quality of the groundwater contained in any aquifer by directly contributing to pollution or by increasing the long-term susceptibility of any aquifer to potential pollutants.

X.10.2 The proposed use will not cause a significant reduction in the long-term volume of water contained in any aquifer or in the storage capacity of any aquifer.

X.10.3 The proposed use will discharge no wastewater on site other than that typically discharged by domestic wastewater disposal system and will not involve onsite disposal of toxic or hazardous wastes as herein defined.

X.10.4 The proposed use complies with all other applicable sections of this Ordinance.

X.10.5 The Zoning Board of Adjustment may require that the applicant provide data or reports prepared by a registered professional engineer or qualified groundwater consultant to assess any potential damage to the aquifer that may result from the proposed use. The Zoning Board of Adjustment shall engage such professional assistance as it requires to adequately evaluate such reports and to evaluate, in general, the proposed use in light of the above criteria

X.11 CONDITIONAL USES

X.11.1 The excavation of earth products providing such excavation does not go lower than five (5) feet above the wet-season water table, as determined by a qualified Maine Registered Professional Engineer or hydrogeologic professional.

X.11.2 Construction of ponds subject to site plan review.

X.12 SEPTIC SYSTEM DESIGN AND INSTALLATION: In addition to meeting all local and state septic system siting requirements, all new wastewater disposal systems installed in the Aquifer Zone shall be designed by a registered professional engineer licensed in Maine and approved by the Planning Board. The Zoning Board of Adjustment may require that the applicant provide data or reports prepared by a registered professional engineer or qualified groundwater consultant to assess any potential damage to the aquifer that may result from the proposed use. The Zoning Board of Adjustment shall engage such professional assistance as it requires to adequately evaluate such reports and to evaluate, in general, the proposed use in light of the above criteria

X.12 EXISTING NONCONFORMING USES: Existing nonconforming uses may continue without expanding or changing to another nonconforming use, but must be in compliance with all applicable state and federal requirements, including _____.

X.13 ADDITIONAL GUIDELINES: Except for single family and two-family dwellings, the following guidelines shall be observed within the Aquifer Protection Zones:

X.13.1 Safeguards: Provision shall be made to protect against toxic or hazardous materials discharge or loss resulting from corrosion, accidental damage, spillage, or vandalism through measures such as spill control provisions in the vicinity of chemical or fuel delivery points, secured storage areas for toxic or hazardous materials, and indoor storage provisions for corrodible or dissolvable materials. For operations which allow the evaporation of toxic or hazardous materials into the interiors of any structure, a closed vapor recovery system shall be provided for each such structure to prevent discharge of contaminated condensate into the groundwater. A Spill Prevention Countermeasures and Control Plan (SPCC) shall be prepared for materials stored in the Zone.

X.13.2 Location: Where the premises are partially outside the Aquifer Protection Overlay Zone, potential pollution sources such as on-site waste disposal systems shall be located outside the Zone.

X.13.3 All regulated substances stored in containers with a capacity of five gallons or more must be stored in product-tight containers on an impervious surface designed and maintained to prevent flow to exposed soils, floor drains, and outside drains.

X.13.4 Drainage: Runoff from impervious surfaces shall be recharged on the site, and diverted toward areas covered with vegetation for surface infiltration to the extent possible. Dry wells

shall be used only where other methods are not feasible, and shall be preceded by oil, grease, and sediment traps to facilitate removal of contaminants. Development of a Stormwater Pollution Prevention Plan (SWPPP) is required.

X.13.5 Inspection: All uses granted under Section X.10 may be subject to annual inspections by the Building Inspector or if another agent, that agent must be approved by both the Board of Selectmen and the Planning Board. The purpose of these inspections is to ensure continued compliance with the conditions under which approvals were granted. A fee for inspection shall be charged to the owner according to a fee schedule determined by the Selectmen.

X.13.6 Facilities where regulated substances are stored must be secured against unauthorized entry by means of a door and/or gate that is locked when authorized personnel are not present and must be inspected weekly by the facility owner.

X.13.7 Outdoor storage areas for regulated substances, associated material or waste must be protected from exposure to precipitation and must be located at least 50 feet from surface water or storm drains, at least 75 feet from private wells, and outside the sanitary protective radius of wells used by public water systems.

X.13.8 Secondary containment must be provided for outdoor storage of regulated substances in regulated containers and the containment structure must include a cover to minimize accumulation of water in the containment area and contact between precipitation and storage container(s).

X.13.9 Containers in which regulated substances are stored must be clearly and visibly labeled and must be kept closed and sealed when material is not being transferred from one container to another.

X.13.10 Prior to any land disturbing activities, all inactive wells on the property, not in use or properly maintained at the time the plan is submitted, shall be considered abandoned and must be sealed in accordance with _____ of the _____.

X.13.11 All transfers of petroleum from delivery trucks and storage containers over five gallons in capacity shall be conducted over an impervious surface having a positive limiting barrier at its perimeter.

X.14 ENFORCEMENT PROCEDURES AND PENALTIES: Any violation of the requirements of this Ordinance shall be subject to the enforcement procedures and penalties detailed in _____.

X.15 SAVING CLAUSE: If any provision of this Ordinance is found to be unenforceable, such provision shall be considered separable and shall not be construed to invalidate the remainder of the Ordinance.

X.16 EFFECTIVE DATE: This Ordinance shall be effective upon adoption by the legislative body.

APPENDIX B

SITE WALK

SME visited the gravel pits on Thursday, July 12, 2012 to perform a site walk to observe current conditions and pit operations. The site walk included observations for all of the pits mentioned above. SME observed three access roads to the Town's gravel pit; two access roads along Goose Pond Road that were gated and locked, and one access road along Blackstrap Road that was gated and lockable, but open for operation. SME observed stockpiled areas of sand and gravel, waste asphalt/reclaimed asphalt, as well as piles of stumps, mulch, trees, and loam at various locations in the pits. There were no permanent structures; however, a small trailer and outhouse were observed on the Storey Brothers Inc. property. An area on the Storey Brothers Inc. property is used for storage of plastic and concrete culverts, stone slabs, and portable mechanical equipment. A locked monitoring well was also found in this area. Operations observed during the site walk included several active equipment vehicles (e.g., dump truck, bulldozer, loader). A small material separator/screener was observed in the Town's pit. A larger portable material separator/screener was observed near the common property boundary between Storey Brother's Inc. and RJT Properties, Inc.

SME observed several small stains that appeared to be oil stains (e.g., 1- to 2-foot diameter) in the lower area of the Town's gravel pit; none of these locations appeared to be substantial enough to be a significant threat to the aquifer. A small shooting range was also observed on one of the parcels owned by the State of Maine (Tax Map R07, Lot 48). No bullets or ammunition shells were found, so the type of ammunition used is not known. Ammunition containing lead could potentially contribute to contamination of the soil and underlying groundwater.

Mr. Bolduc indicated that the Town generally does not leave equipment vehicles on-site, but that Storey Brothers Inc. generally leaves equipment vehicles on-site. He also indicated that the vehicles are generally fueled offsite, but were occasionally fueled on-site from tanks on other vehicles. Mr. Bolduc indicated that he knew of no fueling stations on any of the gravel pits, and none were seen by SME during our site walk. SME recommends that best management practices be incorporated when fueling vehicles on-site, such as the use of absorbent pads when fueling.

Based on the observations made during the site walk, current operations as observed do not appear to represent significant threats to the sand and gravel aquifer; although the actual groundwater quality is not known. The current risks at the Town's pit that would be the most likely to threaten the aquifer are: (1) spilling of fuel and/or oil from vehicles, equipment, and machinery; and (2) vandalism via unlocked gates.



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner



November 28, 2007

CERTIFIED RETURN RECEIPT
7099-3400-0018-1290-9192

Bruce J. Marshall, P.E.
Getman, Stacey, Schulthess & Steere, P.A.
3 Executive Park Drive, Suite 9
Bedford, NH 03110

SUBJECT: **Windham** - Ledge Road Area Site, Town of Windham Tax Map 11, Block A, Lot 50, DES Site # 200711031, Project RSN # 17681

Summary of Analytical Data, Ledge Road Area, Windham, NH, prepared by
StoneHill Environmental, Inc., received November 23, 2007

Dear Mr. Marshall:

The New Hampshire Department of Environmental Services (Department) has completed its review of the above Summary of Analytical Data Report (Report), prepared by StoneHill Environmental, Inc. (StoneHill) regarding the discharge of regulated contaminants to groundwater at the subject site. Based on our review, the Department has determined that a discharge of a regulated contaminant, as defined in New Hampshire Code of Administrative Rules Env-Or 600 Contaminated Site Management, has occurred at the subject site and impacted the groundwater.

The discharge of a regulated contaminant to the groundwater was confirmed by the presence of nitrate at concentrations exceeding Ambient Groundwater Quality Standards (AGQS) in samples collected by StoneHill on October 4, 2007 from the on-site bedrock boring and on-site supply well on October 4, 2007.

Based on the information presented in the Report, the Department has concluded that there may be an association between the blasting operation conducted at the site and the elevated concentration of nitrate observed in residential wells sampled by StoneHill. This conclusion is based on groundwater sampling results for residences located at: 55 Haverhill Road (StoneHill sample collected on October 26, 2007), 57 Haverhill Road (StoneHill sample collected on October 27, 2007), 59 Haverhill Road (StoneHill sample collected on October 27, 2007), 61 Haverhill Road (StoneHill collected on October 27, 2007), and 64 Haverhill Road (StoneHill sample collected on October 26, 2007)

Request for Site Investigation

The Department has determined that Meadowcroft Development, LLC may be a potential responsible party in regard to this discharge and requires that Meadowcroft Development, LLC complete a **Site Investigation** in accordance with Env-Or 606. At this time, the Department

understands that Getman, Stacey, Schulthess & Steere, P.A. represents Meadowcroft Development, LLC. Accordingly, this letter is addressed to you.

The **Site Investigation** is required to assess the full extent of groundwater contamination, identify potential public and environmental receptors, and develop an appropriate remedial action for the site. A copy of this rule can be downloaded at: <http://www.des.state.nh.us/rules/Env-Or600.pdf>.

The **Site Investigation Report** is due within 120-days of receipt of this letter. The Department will provide guidance on the need for further investigation, remediation or closure of this project after we have completed our review of the **Site Investigation Report**.

Provision of Potable Water Source to Affected Residential Properties

Consistent with Env-Or 605, the presence of Nitrate in the residential supply wells at concentrations exceeding AGQS requires that a potable water source (bottled water) be provided by the potential responsible party to the affected properties. Potable water must be provided to the affected properties immediately upon receipt of this letter. Documentation of confirming provision of bottled water to all affected properties shall be provided to the Department by December 7, 2007.

Work Scope

Please use the Department's requirements for Work Scope for a Site Investigation and Report as contained in Env-Or 600. Please submit a detailed work scope for our review and approval. The work scope is due on or before January 3, 2008.

Future Notification and Response Action Requirements

During the work, the Department requires that you continue to meet the requirements of Env-Or 604 for Notification and Env-Or 605 for Preliminary Response Actions. This is necessary to prevent further risk to public health and the environment from this discharge or any new discharge(s). Steps may include, but are not limited to, sampling drinking water supply wells at risk of contamination and providing potable water to any properties with newly confirmed at risk drinking water supply wells. All notifications and response actions should be coordinated with the Department's Project Manager listed below. Please include a Potential Receptors Map, prepared in accordance with Env-Or 606.07(d), with any notification.

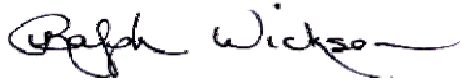
Electronic Submittals

The Waste Management Division strongly encourages the electronic submittal of reports and data via the Department's One Stop upload process, although e-mail attachments and CDs sent to the file library are still permissible. Submittal of documents in an electronic format is voluntary but the electronic submittal must meet certain guidelines to be accepted by the Department. You can obtain complete guidelines at the following web site link: http://des.nh.gov/orcb/doclist/Electronic_Submittal_Guidelines.pdf.

Bruce J. Marshall, P.E.
DES Site # 200711031
November 28, 2007
Page 3 of 3

If you have questions, please contact me immediately.

Sincerely,

A handwritten signature in black ink that reads "Ralph Wickson". The signature is fluid and cursive, with a long horizontal stroke at the end.

Ralph Wickson, P.G.
Hazardous Waste Remediation Bureau
Tel: (603) 271-6572
Fax: (603) 271-2181
Email: ralph.wickson@des.nh.gov

cc: John Regan, P.G., WMD, DES (via e-mail)
Keith H. DuBois, P.G., WMD, DES (via e-mail)
Brandon Kernen, P.G., WD, DES
Evan Mulholland, Esq., NHDOJ
Alfred F. Turner, Jr., Town of Windham
Tim Stone, P.G., StoneHill Environmental, Inc.

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 BEDFORD NH 03110

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 DEPT OF ENVIRONMENTAL SERVICES
 WASTE MANAGEMENT DIVISION
 29 HAZEN DRIVE PO BOX 95
 CONCORD NH 03302 0095

DES Site # 200711031

E. Modesitt

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BRUCE J MARSHALL PE
 GETMAN STACEY SCHULTHESS & STEERE
 3 EXECUTIVE PARK DRIVE SUITE 9
 BEDFORD NH 03110

2. Article Number
 (Transfer from service label)

7099-3400-0018-1290-9192

COMPLETE THIS SECTION ON DELIVERY

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- B. Received by (Printed Name) C. Date of Delivery
- D. Is delivery address different from item 1? ☐ Yes ☒ No
- If YES, enter delivery address below:

3. Service Type
- ☒ Certified Mail ☐ Express Mail
- ☐ Registered ☐ Return Receipt for Merchandise
- ☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

December 4, 2008

CERTIFIED RETURN RECEIPT
7005-1160-0004-7470-0637

Bruce Marshall, P.E.
D'Amante Couser Steiner Pellerin, P.A.
Nine Triangle Park Drive
PO Box 2650
Concord, NH 03302-2650

SUBJECT: **Windham** – Ledge Road Area Site, Windham Tax Map 11, Block A, Lot 50
DES Site # 200711031, Project RSN # 17681

Environmental Site Investigation Report (report) prepared by Nobis Engineering, Inc. (Nobis) and dated August 18, 2008

Dear Mr. Marshall:

The New Hampshire Department of Environmental Services (Department) has reviewed the referenced report received August 19, 2008. The report was prepared on behalf of Meadowcroft Development LLC (Meadowcroft) for the property located at 62 Haverhill Road in Windham, NH (Site). The Department has also reviewed supplemental correspondence dated September 26, 2008 from Nobis that presents clarification for the proposed sampling program.

The Department has also reviewed a September 25, 2008 letter prepared by StoneHill Environmental, Inc. (StoneHill), presenting their respective comments concerning the report. The Department understands that the September 25, 2008 letter was prepared at the request of the Town of Windham.

The report responds to the Department's November 28, 2007 request for site investigation issued to Getman, Stacey, Schulthess and Steere, P.A. That request identified Meadowcroft as a potentially responsible party in regard to the discharge of nitrogen-based explosives to the environment. In a letter dated January 7, 2008 to Getman, Stacey, Schulthess and Steere, P.A., the Department required that blasting at the Site cease and desist in accordance with RSA 485-C:16 until such time that: 1) a remedy to address existing contamination is implemented; and 2) procedures are implemented to ensure future blasting activities will not cause violations of ambient groundwater quality standards (AGQS). The Department issued comments on a February 15, 2008 work scope for the environmental site investigation in correspondence dated April 2, 2008.

The report concludes that nitrogen-based explosives used at the Site for rock blasting operations are the likely source of the documented AGQS violations of nitrate confirmed in the Site vicinity. The report further concludes that in the absence of a continuing source of nitrogen to the environment, natural attenuation processes would likely be effective in reducing on-Site

nitrate concentrations to below AGQS during an estimated 1 to 2 year timeframe without active remediation. Off-Site nitrate concentrations are estimated to be reduced to below AGQS within 6 months to 1 year through natural attenuation processes.

Comments

The Department finds the report to be complete with respect to meeting the requirements of Env-Or 606.03, *Site Investigation Report*. However, the Department believes that additional information and/or refinement of the existing information is required to move forward within the corrective action program. The Department provides the following comments:

1. The report presents sufficient information for the Department to conclude that on-Site rock blasting operations utilizing nitrogen-based explosives have resulted in the discharge of nitrates to groundwater and that discharge has resulted in a violation of AGQS.
2. The existing information demonstrates a strong hydraulic connection between the blasting site and nearby residential drinking water supply wells.
3. The confirmed violation of AGQS in a number of nearby residential drinking water supply wells has resulted in a public health risk due to direct exposure of groundwater via ingestion.
4. The Department has determined that Meadowcroft is a responsible party with respect to this discharge as defined in Env-Or 602.26.
5. As a responsible party, Meadowcroft is required to apply for, and maintain, a groundwater management permit to address the violations of AGQS and to develop a remedy in accordance with Env-Or 600.
6. The groundwater management permit application must present a proposed GMZ and a detailed water quality monitoring program that includes a monitoring schedule, parameter list, monitoring locations, and supporting information justifying the locations, frequency, and parameters selected.
7. The water quality monitoring program presented in the report must be expanded to include the following residential properties: 2 Meetinghouse Road (Map 11, Block A, Lot 2), 4 Meetinghouse Road (Map 11, Block A, Lot 3), 6 Meetinghouse Road (Map 11, Block A, Lot 4), 8 Meetinghouse Road (Map 11, Block A, Lot 5), 67 Blossom Drive (Map 11, Block A, Lot 1634), 68 Blossom Drive (Map 11, Block A, Lot 1638), and 71 Blossom Drive (Map 11, Block A, Lot 1635).
8. The parameter list for the existing on-Site monitoring wells and bedrock supply well must be expanded to include volatile organic compound (VOC) analysis. The VOC analysis will be required until it has been consistently demonstrated that no on-Site VOC impacts exist.

9. The proposed GMZ must be revised to define the eastern extent of the nitrate contaminant plume and must include the property located at 55 Haverhill Road. Samples collected by the Department from the 55 Haverhill Road property on May 28, 2008 and September 3, 2008 have shown that the combined concentrations of nitrate and nitrite exceed the established health-based standard. The Department has therefore recommended that the drinking water well serving this property not be utilized for potable purposes.
10. As noted in the April 2, 2008 letter to Getman, Stacey, Schulthess and Steere, P.A., the Department reserves the right to require installation of additional bedrock monitoring wells if the information obtained under the groundwater management permit indicates the need for additional groundwater data points.
11. Monitoring well points SW-2 and SW-3 are positioned side gradient (east) of the inferred strike of the nitrate contaminant plume (refer to Figure 8, *Nitrate Distribution*), indicating these locations may not be representative of the extreme southern boundary of the GMZ. To meet the requirements of Env-Or 607, *Establishing the GMZ*, additional monitoring points must be established downgradient of the nitrate plume. The Department recommends the installation of additional monitoring points within the northern bank of the unnamed stream at the southern portion of the 59 and 61 Haverhill Road properties.
12. The results of the Synthetic Precipitation Leaching Procedure analysis of the former crushed rock piles, conducted by StoneHill on behalf of the Town of Windham, do not indicate the piles were an active source of groundwater contamination at the time the sampling occurred. Future testing of runoff water from crushed rock piles staged on-Site will be required to confirm that they do not represent an active source of nitrate.
13. The Department has determined that "monitored natural attenuation" (MNA) is the presumptive remedy for the Site. This determination is based on the criteria of Env-Or 606.11 and the observed nitrate concentration trends in groundwater subsequent to the January 7, 2008 cessation of blasting order.
14. In order for the Department to consider the "accelerated natural attenuation" alternative (periodic pumping of the Site bedrock supply well) an engineering analysis, consistent with Env-Or 606.10, will be required. The analysis must include the methodology for evaluating the performance of this alternative.
15. The "enhanced bioremediation" process, as proposed, is not appropriate as it may alter local groundwater chemistry and potentially stress the existing residential water treatment systems active in the Site vicinity.
16. Meadowcroft must continue to provide potable water to the affected properties. Potable water must be provided to these properties until notified otherwise.

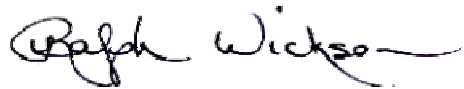
17. If monitoring conducted under the groundwater management permit does not exhibit a consistent downward trend in nitrate concentration and ultimate AGQS compliance in the affected drinking water supply wells, contingency provisions in accordance with Env-Or 607.06 will be required. These contingency provisions may require the installation of water treatment equipment and/or repair or maintenance of an existing water treatment system as directed by the Department.

The next step in the corrective action process is the preparation of the groundwater management permit application in accordance with Env-Or 607.02, *Groundwater Management Permit Procedures*. The Department requires submittal of the permit application within 60 days of receipt of this letter.

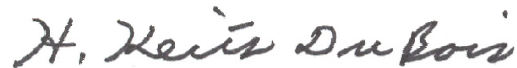
This letter must not be construed as an approval for resumption of blasting at the Site. The Department is in receipt of the document titled "Blasting Pilot Test Work Plan" (work plan), prepared by Nobis on behalf of Meadowcroft, and dated October 2008. Comments regarding the work plan will be provided by the Department under separate cover.

Should you have any questions, please contact the undersigned below.

Sincerely,



Ralph Wickson, P.G.
Hazardous Waste Remediation Bureau
Tel: (603) 271-6572
Fax: (603) 271-2181
Email: Ralph.Wickson@des.nh.gov



H. Keith DuBois, Supervisor
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cc: Brandon Kernen, DES
David Gordon, DES
Evan Mulholland, NHDOJ
Town of Windham Board of Selectmen
Town of Windham Planning Board
Alfred Turner, Town of Windham
Thomas Bobowski, Nobis Engineering, Inc.
Sylvain Noiseux, Meadowcroft Development
Timothy Stone, StoneHill Environmental, Inc.
Amy Clark, DES
Pamela Monroe, DES