

A&C Realty, LLC
Greystone Industrial Development
123 Old Colchester Road
Essex Jct., VT

Blasting Plan
January 2016

1.01 GENERAL REQUIREMENTS

- A. The goal of this Plan is to identify the requirements, processes and procedures to adequately and safely employ the use of explosives during the construction of this project.
- B. This Plan covers the transportation, storage, possession and use of explosives in drilling and blasting operations to fracture bedrock using conventional, industry accepted drilling and blasting techniques. Rock blasting will be used where necessary to acquire the designed grade, complete excavation for subsurface structures and utility trenches. All blasting shall conform to the requirements of all applicable laws, rules and regulations of the federal, state and local regulatory authorities and insurers that govern the licensing, transportation, storage, handling, use and disposition of explosives.

1.02 REFERENCES

- A. United States Bureau of Mines (USBM)
 - 1. Bureau of Mines Report of Investigation 8507, "Structure Response and Damage Produced by Ground Vibrations from Surface Blasting", 1980.

1.03 DEFINITIONS

- A. Peak Particle Velocity (ppv) – The maximum rate of change with respect to time of the particle displacement, measured on the ground, measured in the vertical, longitudinal, and transverse directions at the point of interest. Peak particle velocity is expressed in units of inches per second (ips).
- B. Airblast (or over-pressure) – The increase in ambient air pressure caused by blasting. Airblast, or over-pressure, is expressed in units of pounds per square inch (psi) or decibels (dB).
- C. Blast Area – The area including the blast site and the immediate adjacent area that is owned, leased or controlled by the blast operation.
- D. Blast Site – The area in which explosive materials are being or have been loaded and include all holes loaded or to be loaded for the same blast and for a distance of 50 feet in all directions.

1.04 SUBMITTALS

A. General Site Operations Information and Blaster Qualifications

1. Prior to performing any blasting, the Contractor shall submit information that includes a complete summary of proposed means of transportation, handling, storage, and use of explosives, and include the names of personnel who will supervise the blasting operations, copies of appropriate blaster's licenses, and a list of at least five similar type projects with a brief description of the Work conducted.
2. Prior to conducting any blasting, the Contractor shall review the overall factors affecting the operations. The review shall consider the following, but not be limited to: adjacent area structure(s); building(s); building foundation(s); potential impacts to surface and groundwater quality within 1,500 feet of the blast site.

B. Blast Design Plan

1. The Contractor shall prepare a Blast Design Plan. Precautions shall be undertaken by the blaster in the design of the blast plan to prevent damage and to minimize adverse effects including ground vibrations, air blast, flyrock, and degradation of surface water and groundwater quality.
 - a. Precautions shall include but not be limited to, review of each shot variable or dimension to ensure a blast design plan, which establishes sound relationships between current industry standards and the allowable limits of the effects of blasting.
 - b. At a minimum, the blast design plan shall describe the following: amount of material to be removed, benches and lifts, sketches of proposed drill patterns; number, spacing, location; amount, type diameter and distribution of explosive per hole; delay patterns, type of initiators and pounds of explosive for each delay; time of blast; total pounds of explosives in place at any one time; stemming; and the placement of seismographs.
 - c. All shots shall be designed using the most current industry standards, to prevent excessive air blast, ground vibration, and flyrock; and to maximize combustion of explosives during the blast.
 - d. Blasting mats shall be used at the discretion of the Contractor.
2. The Blast Design shall also address impacts to surface water and groundwater quality due to blasting operations. The Blasting Plan shall identify and implement steps to maximize the combustion of explosives for each blast and to mitigate impacts to surface water and groundwater quality on-and off-site that would result in violations of surface water and groundwater quality standards established by local, state and federal regulations. In particular, perchlorate-containing blasting agents will not be used on this project.

C. Preblast Survey

1. A minimum of two weeks prior to the start of Work, a copy of the preblast survey shall be submitted to the Owner or his representative.
2. See Section 3.01 for details on preblast survey requirements.

D. Blaster's Log

1. The Contractor shall submit a copy of the Blaster's Logs on a daily basis to the Owner or his representative.

1.05 QUALITY ASSURANCE

A. Test Blast

1. One test blast shall be required in areas where rock is to be excavated prior to the commencement of production blasting. The purpose of the test blast is to establish local ground-borne vibration and airborne over-pressure propagation characteristics and anomalies to aid in determination of efficient charges that will not cause the ground-borne vibration and airborne over-pressure limits to be exceeded. The test blast shall be located in areas selected by the Owner or his representative. Additional test blasts may be required based on the results of the initial test.

B. Acceptance of Submittals

1. No blasting shall be permitted until the Contractor's submittals have been accepted by the Owner or his representative, and other conditions as required by the Contract Documents have been met. No drilling for individual blasts shall be permitted until the Contractor's Blasting Design Plan has been accepted by the Town, as necessary.

1.06 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor is responsible for blasting in a safe manner, for producing smooth and sound rock surfaces at the lines of excavation, and for controlling damage, vibration, and over-pressure to nearby structures and building and mitigation impacts to surface water and groundwater quality consistent with local, state and federal regulations. Acceptance of the blasting plans, of any blasting operation, and of blasting products by the Owner or his representative, and compliance by the Contractor with provisions of the Contract Documents for protection of life and property, shall not relieve the Contractor of the Contractor's responsibility or liability for the safety of persons and property. Acceptance of the Contractor's submittals by the Owner or his representative does not constitute, nor shall be construed to be, a guarantee by the Owner or his representative that the desired results will be achieved. Acceptance of the Contractor's submittals by the Owner or his representative shall not relieve the Contractor from the Contractor's responsibilities of complying with requirements of the specifications.

1.07 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall comply with federal, state, and local regulations, including noise ordinances, applying to the purchase, transportation, storage, handling, and use of explosives, blasting agents, primers, initiators, and ancillary equipment and materials. Blasting materials including explosives, blasting agents, primers, initiators and other materials will not be stored overnight on-site. Only materials sufficient to perform the day's Work will be stored on-site.
- B. No trucks or other site related vehicles shall use Old Colchester Road, except for the portion from Route 2A to the project entrance, or Pinecrest Drive for any activity related to the extraction project.

PART 2 - PRODUCTS

2.01 EXPLOSIVE MATERIALS

- A. Use only products, blasting techniques, and monitoring equipment as recommended by the manufacturer, and which are acceptable to the Owner and his representative. Only explosives that can withstand exposure to water and pressure during maximum exposure time, without loss of performance, shall be used for blasting. Explosives, blasting agents, primers, initiators, and ancillary blasting materials shall be kept in original packaging. All explosives and initiating devices used shall be less than one year old. No perchlorate-containing blasting materials will be used on this project. The contractor shall provide manufacturer's documentation, including MSDS sheets that documents that non perchlorate-containing blasting materials are being used.

2.02 BLAST MONITORING EQUIPMENT

- A. Equipment for on-site and off-site particle velocity and air over-pressure monitoring shall be 4-channel units (1 over-pressure and 3 seismic channels) capable of digitally storing collected data. Equipment must be capable of printing ground motion time histories and summaries of peak motion intensities, frequencies and USBM RI8507 ppv-frequency plots. Printed report records must also include date, time of recording, operator name, instrument number and date of last calibration.
- B. Equipment shall meet the following minimum specifications for seismographs:
 - 1. Seismic Frequency Range: 2 to 200 Hz (+/- 3 dB)
 - 2. Acoustic Frequency Range: 2 to 200 Hz (+/- 1 dB)
 - 3. Sound Range: 90 to 140 dB Linear
 - 4. Transducers: Three mutually perpendicular axes (radical, transverse and vertical).
 - 5. Recording: Provide time-history of waveform.

- C. The monitoring equipment shall have digital storage capacity.

PART 3 - EXECUTION

3.01 PREBLAST SURVEY

- A. The Contractor shall perform a preblast survey.
- B. At least two weeks prior to performing any blasting on the site, a preblast survey shall be made of residences and other public or private structures existing within a minimum of 1,500 feet of the blast area. Sensitive structures located beyond 1,500 feet shall also be surveyed if necessary. The preblast survey shall be performed by a third party firm using qualified specialists approved by the Owner or his representative who are familiar with construction methods and materials, and familiar with blasting procedures.
- C. The scope of Work for the Preblast Survey shall meet the following:
 - 1. The Preblast Survey shall document the existing visual conditions of the interior and exterior of the structure including improvements to the property and other physical factors that could reasonably be affected by the blasting.
 - 2. The Preblast Survey shall accurately record deficiencies by means of videotape or any other format or combination that sufficiently depicts the pre-existing conditions prior to the blasting.
 - 3. Three attempts shall be made to contact the owner to offer the Preblast Survey. If no response is made after the second attempt, or the owner refuses to sign a survey waiver, a notice offering the survey shall be sent via any carrier capable of providing a receipt of delivery. A receipt of delivery shall satisfy this requirement.
 - 4. A Preblast Survey Summary Report shall be provided to the Owner or his representative documenting in writing the results of the survey, including but not limited to a list of properties notified/surveyed and any special conditions noted.

3.02 BLAST MONITORING

- A. The Contractor shall perform vibration and air over-pressure monitoring during blasting operations using at least two seismographs at the nearest structures not controlled by the project or at the Owner's or his representative's direction. The contents and form of monitoring reports shall be consistent with guidance provided by the USBM. The Contractor may employ additional seismographs as he may choose at his own cost. Printed reports of all monitoring results including ground motion and over-pressure time-histories shall be provided to the Owner or his representative before subsequent blasting occurs.
- B. The Contractor shall promptly inform the Owner or his representative of any complaints received from the public regarding noise or vibration; Contractor shall describe the action

proposed and the schedule for implementation to address the complaint; and, shall subsequently inform the Owner or his representative of the result of the action.

- D. The Owner's or his representative's presence does not include supervision or direction of the actual Work by the Contractor, his employees, or agents. Neither the presence of the Owner or his representative nor any observations and/or testing performed by them shall excuse the Contractor from defects discovered in his Work or damage to third parties.

3.03 BLASTER'S LOGS

- A. The Contractor shall submit to the Owner or his representative a copy of the blaster's log on a daily basis.
- B. The blaster's logs shall be maintained and completed by the blaster on a log form approved by the Owner or His representative and a copy of the logs shall be maintained on-site for the duration of the project.
- C. Blaster's logs shall include the following:
 - 1. Name, signature, and Certificate of Competency Number of the Blaster-in-Charge.
 - 2. Blast location, address and description.
 - 3. Date and time of blast.
 - 4. Distance in feet, to the nearest in habited building or structure, not under control of the project.
 - 5. Type of matting or cover over blast, if applicable.
 - 6. Weather conditions, including temperature, cloud cover, and wind direction.
 - 7. Blast plan and sketch showing blast hole diameter, delay, delay pattern, and number of holes.
 - 8. Explosive material type, size, total weight of each explosive by hole.
 - 9. Type of initiation system (methods of firing and type of circuit).
 - 10. Depth and type of stemming.
 - 11. Maximum weight of explosives detonated within any eight millisecond period.
 - 12. The seismograph(s) location(s) including distance and direction from the seismograph to the closest borehole and from the seismograph to the closest structure.
 - 13. Seismograph readings including peak particle velocity, frequency, and airblast.

14. Type of seismograph, instrument make, model serial number, calibration date and sensitivity settings.
15. Name of person taking the seismograph reading. The name and firm analyzing the seismograph record if applicable.
16. List of complaints or comments following the blast including the name, company (if applicable) address and telephone number of the individual making the complaint.

3.04 BLASTING OVER-PRESSURE AND VIBRATION CONTROL

- A. Blasting operations shall be performed in a manner to minimize noise and vibration. Controlled blasting procedures shall be used to provide effective suppression of noise, vibration and flyrock. Other abatement measures shall be employed as necessary for protection of both employees and the public.
- B. Working hours shall be restricted and operations scheduled in a manner that will minimize to the extent practical the disturbance to the public in areas adjacent to the Work and to occupants of buildings in the vicinity of the Work. Hours of blasting shall be limited to daytime between 8:30 AM and 4:00 PM on Monday through Friday, or in accordance with the Blasting Permit.

C. Ground Vibration Due to Blasting

1. General

- a. Conduct blasting operations to avoid damage to structures or buildings.
- b. Ground vibrations shall not exceed the maximum allowable particle velocities for the blast vibration frequencies set forth in the graphic plot of maximum allowable particle velocity versus frequency in USBM Report of Investigation 8507, "Structure Response and Damage Produced by Ground Vibration From Surface Mining Blasting" (see attached Figure 1), or in accordance with the Blasting Permit. These ground vibration limits can be approximated by the following values; a maximum peak particle velocity of 2.0 inches per second (isp) for blasts having a frequency above 40 Hertz (Hz), 1.5 ips for blasts having a frequency between 20 and 30 Hz, and 0.5 ips for blasts having a frequency below 20Hz. However, the actual graphic plot of maximum allowable particle velocity versus frequency in USBM shall be the ground vibration limits which shall not be exceeded at the nearest structure not under control of the project.

D. Airblast (Over-Pressure) Due to Blasting

1. General

- a. Conduct blasting operations to avoid damage to structures or buildings.

- b. The maximum allowable levels for airblast in decibels at occupied structures shall not exceed 132 decibels, or in accordance with the Blasting Permit.

3.05 PREPARATION AND PROTECTION

- A. Compliance with the requirements of this Section shall not offer any relief from responsibility for compliance with local ordinances, regulations, and other Sections. The Contractor shall obtain all necessary permits required prior to blasting Work, including but not limited to, all permits required by the Town of Essex Jct. and the State of Vermont.
- B. The following warning systems, procedures and protection devices shall be established prior to blasting in accordance with industry standards, and the following requirements:
 1. A system of audible signals to warn of impending blasts. The railway shall be notified of all blasting sessions.
 2. Signboards indicating areas where blasting operations are occurring. These signs shall be clearly visible and legible from all points of access to the area. The signs shall clearly describe the audible signal system for warning of impending blasts. Blast area signs shall clearly indicate the length and nature of audible blast warning and all clear signals. All warning systems shall comply with the most stringent requirements of regulating local, state and federal agencies.
 3. The blaster-in-charge shall determine when to sound the initial warning signal. Blasting shall be performed only after ensuring that all people and equipment have been removed to a safe location.

3.06 BLASTING

- A. The Contractor shall perform blasting operations in accordance with all regulatory authorities.
- B. Blasting work shall be performed only with necessary permits from all regulatory authorities and after completion of the preblast survey. Blasting work shall take place only after persons in the vicinity have been notified and have reached positions of safety. Take appropriate precautions to prevent all persons from entering the blasting area. Use methods and programs that will prevent damage to, but not limited to, adjacent dwellings, structures, public domain, natural resources, habitat, existing wells and landscape features and that will minimize that scattering of rock, stumps or other debris.
- C. Take all precautions necessary to warn and/or protect any individuals exposed to his operations prior to any blasting. Blasting mats or other approved flyrock protection may be employed as necessary and at the blaster-in-charge's discretion, to protect areas adjacent to blasting.
- D. Perform blasting operations in a manner to minimize airblast and ground motion near private structures and critical on-site structures. If blast-induced air over-pressure or peak particle velocity exceeds the performance requirements specified herein, suspend

blasting in the affected excavations(s) until a redesigned blasting plan is submitted to and accepted by the Owner or his representative.

- E. The Contractor may need to employ special measures to meet the specified airblast and ground motion limits. Use controls to limit air over-pressure limits and for protection of employees, the public, and property.

3.07 LIMITATIONS ON BLASTING

- A. Blasting shall not be permitted when, in the opinion of the Owner or his representative, it may be detrimental to existing installations. The Owner's or his representative's decision shall be final.
- B. Controlled blasting techniques shall be used to prevent over break and minimize rock damage in all excavations. Blast patterns shall be designed so that the explosive energy is not directed into the back and sidewalls of the excavation but, instead, towards the developed free face. Over break below the bottom of blasting areas shall be limited to a maximum of two feet.
- C. Whenever, in the opinion of the Owner or his representative, proposed blasting may cause harm to persons, cause damage to structures, or create unacceptable rock instability, cease blasting immediately and review the blast design. The Contractor can resume excavation of the rock with an approved re-designed blast plan or by mechanical means.
- D. Blasting and crushing shall not occur from December 15th to March 15th.

3.08 MISFIRES AND DANGEROUS CONDITIONS

- A. After a blast has been fired, the blaster-in-charge shall make a careful inspection of the blast area. The inspection shall determine whether there is any indication that a misfires might have occurred or whether the blast created any other imminent dangers such as unstable ground conditions. If misfires or other dangerous conditions are found, the blaster-in-charge shall secure the area and properly correct all hazards before any other Work is allowed in the affected area. The all clear signal, allowing other Work to resume in the area, shall not be given until affected blast sites are clear of all hazards.

3.09 SUSPENSION OF BLASTING

- A. Blasting operations may be suspended by the Owner or his representative if the Contractor's safety precautions are inadequate, or if airblast and/or ground motion levels exceed specified limits.

3.10 DAMAGE COMPLAINTS

- A. The Contractor shall inform the Owner or his representative immediately upon receiving a complaint from any person or firm alleging damage as a result of blasting operations.

- B. The Contractor shall direct the person or firm alleging damage to file a complaint on a “Blasting Damage Complaint” form to be obtained from the Contractor or the Town’s Fire Department.
- C. After-blasting inspections shall be required for property where written damage complaints were filed by property owners.

3.11 DAMAGE REPAIR

- A. When blasting operations damage off-site properties or a portion of the Work, or material surrounding or supporting the Work, the Contractor shall promptly repair damaged items to the condition that existed prior to the damage, to the satisfaction of the Owner or his representative.
- B. Nothing contained herein shall relieve the Contractor of his responsibility for claims arising from his operations. Failure to inspect any structure required by these Contract Documents, or inadequacy of the inspections shall not relieve the Contractor of his responsibility. The Contractor shall indemnify the Owner from such claims.

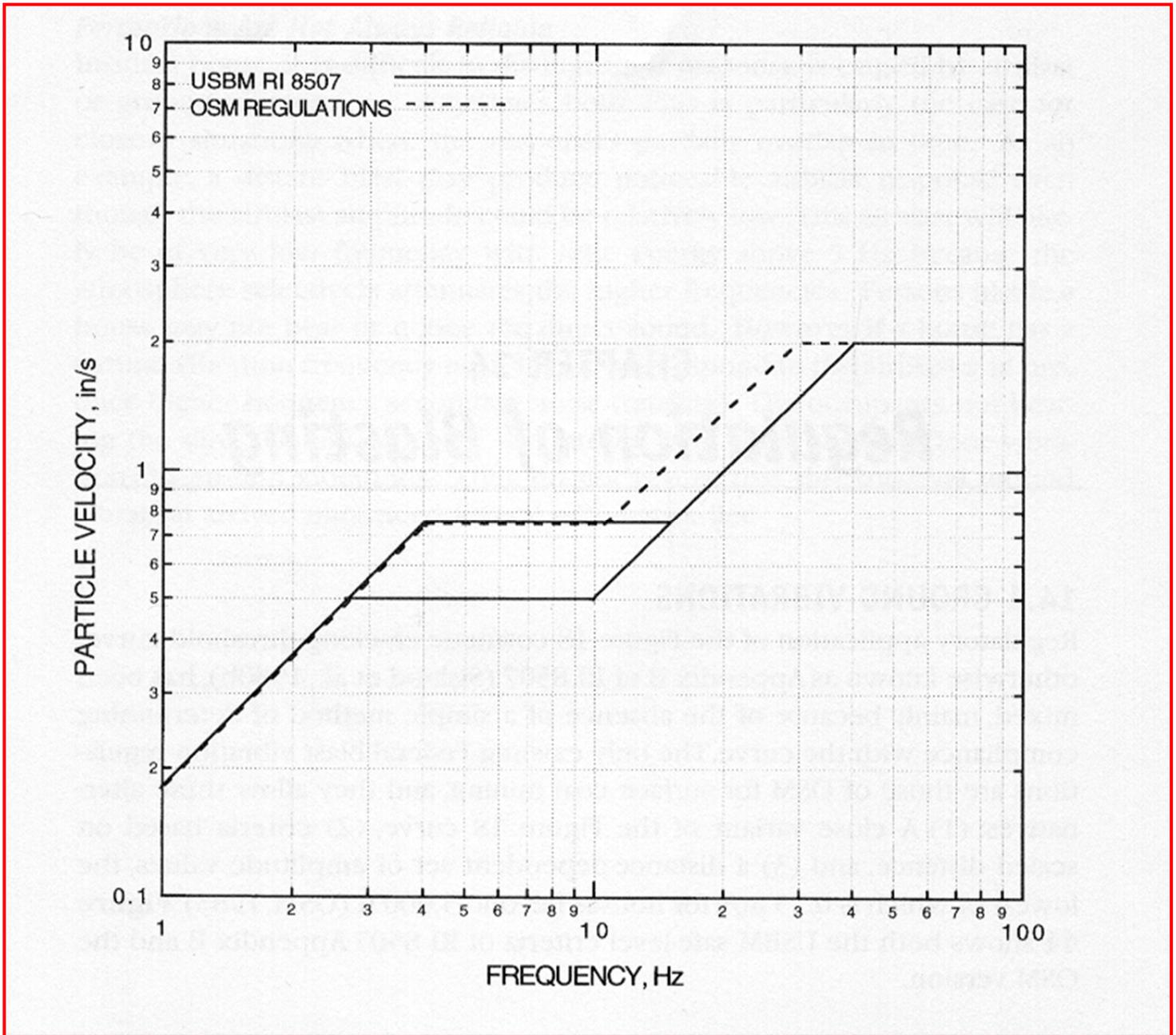


FIGURE 1

BRENT J. TARDIF, PG, PRESIDENT/SENIOR GEOLOGIST

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AREAS OF EXPERTISE

Blasting Consulting and Vibration Control: Mr. Tardif has provided expert expertise in blast consultation and vibration control services for major highway construction and related projects. A sample of some of the more unique projects completed by Mr. Tardif include a vent shaft raise for an underground mine and several projects that included blasting adjacent to a fully charged natural gas transmission line.

Additionally, Mr. Tardif has provided blasting consultation for a taking at a six million ton per year quarry. Tasks included blast design within 150 feet of inhabited dwellings and multi-deck blasting for faces 140 feet in height.

Throughout his career Mr. Tardif has conducted several hundred pre-blast surveys and post-blast inspections throughout New England and the northeast.

Reserves Valuations: Many acquisitions require that a valuation be made of the business to be purchased. Mr. Tardif has conducted many valuations on properties throughout the U.S. of several large aggregate material producers in New England, the Mid-Atlantic States and the Midwest. Responsibilities included certification of reserves, market analyses, environmental assessments and net present value/discounted cash flow calculations. Tardif has also performed numerous sand and gravel evaluations throughout New England and the northeast.



Prepared a study for the New England Governor's Conference on the Supply and Demand for Construction Aggregates throughout New England.

Permit Preparation and Regulatory Compliance: Mr. Tardif has prepared numerous federal, state and local permits for aggregate quarry projects including comprehensive Title V, Clean Air Act Amendment compliance review inventories and testing throughout New England and the northeast. Other permits for such clients have included stormwater permits, spill prevention plans and wetland permits. Mr. Tardif has designed reclamation plans for secondary uses to maximize profit and concurrent reclamation schemes to lessen restoration costs.

Exploration and Development: For over 30 years Tardif has been involved in the search for, evaluation and development of sand, gravel and bedrock deposits. These projects have been throughout the eastern and New England portions of the United States. Such projects involve expertise not only in geology but also involve an assessment of the business economics, marketing strategies, permitting and processing. Mr. Tardif has conducted

numerous core-drilling programs to quantify reserves; he has developed material testing programs and planned sequencing and mine layouts. These projects have been done for large international corporations as well as individuals on scopes that have varied from regional programs to site specific.

Education	BA – Geology, State University of New York at Buffalo
Years Experience	31
Professional Registrations	New Hampshire PG #431
Professional Membership	International Society of Explosive Engineers New England Society of Explosive Engineers NHDOT Approved Seismologist Associated General Contractors- Committee Chair (past), Director (past)
Employment History	Continental Placer Inc., President/Senior Geologist Dunn Geoscience Corp. (New England), Dir. of Mining Division/Sr. Geologist Pike Industries, Inc., Field Technician

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- Environmental Permitting
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- Groundwater Resources
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- Web-based Site Compliance and Data Management Services