EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Blast Impact Analysis
Ramara Quarry
Part of Lots 9 & 10, Concession C
Geographic Township of Rama, County of Simcoe

Submitted to:

Brand X Materials and Supply Inc.
15 Sarjeant Drive
Barrie, ON
L4N 4V9

LICENSED PROFESSIONAL ENGINEER
B. J. LAVOIE
100546996
PROVINCE OF ONTARIO

Prepared by

Explotech Engineering Ltd.
58 Antares Drive, Unit 5
Ottawa, Ontario
K2E 7W6

April 7, 2026

EXPLOTECH

EXECUTIVE SUMMARY

Explotech Engineering Ltd. (Explotech) was retained in April 2025 to provide a Blast Impact Analysis for the proposed Ramara Quarry located on 6059 Pearl Carrick’s Road Part of Lots 9 & 10, Concession C, Geographic Township of Rama, County of Simcoe.

Vibration levels assessed in this report are based on the Ministry of the Environment, Conservation, and Parks Model Municipal Noise Control By-law (NPC119) with regard to Guidelines for Blasting in Mines and Quarries. We have assessed the area surrounding the proposed Aggregate Resources Act licence with regard to potential damage from blasting operations and compliance with the aforementioned by-law document.

We have inspected the site and reviewed the available site plans. Explotech Engineering Ltd. is of the opinion that the planned aggregate extraction on the site can be carried out safely and within Ministry of the Environment, Conservation, and Parks guidelines as set out in NPC 119 of the By-Law.

Recommendations are included in this report to advocate for blasting operations which are carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, structures or residences surrounding the property.

EXPLOTECH

TABLE OF CONTENTS

INTRODUCTION

Brand X Materials and Supply Inc. has applied for a Class A Licence for the property legally described 6059 Pearl Carrick's Road Part of Lots 9 & 10, Concession C in the Geographic Township of Rama, County of Simcoe. This Blast Impact Analysis is based on the Ministry of the Environment, Conservation and Parks (MECP) Model Municipal Noise Control By-law (NPC 119) with regard to guidelines for blasting in mines and quarries. We have additionally assessed the area surrounding the proposed licence with regard to potential damage from blasting operations.

Recommendations are included in this report to advocate for blasting operations which are carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, structures or residences surrounding the property.

EXISTING CONDITIONS

The licenced area for the proposed Ramara Quarry is described as 6059 Pearl Carrick's Road Part of Lots 9 & 10, Concession C, Geographic Township of Rama, County of Simcoe. This property is bound by Donald Carrick's Lane followed by woodlots to the North, the existing James Dick Rama Quarry (Licence # 608542) to the East, Concession Road B/C to the South followed by woodlots and the existing Bot Aggregates Quarry (Licence #104616) and Pearl Carrick's Road followed by the existing Cut Above Natural Stone Quarry (Licence #3601) to the West.

The licenced area for the proposed Ramara Quarry encompasses a total area of 43.3HA. The associated extraction area is approximately 34.4HA when allowing for setbacks.

The lands surrounding the proposed licence area are mostly woodlots and existing quarries, with the areas of greatest development lying to the South/Southwest. The closest sensitive receptors surrounding the proposed Ramara Quarry extraction boundaries are listed in Table 1 below as well as in the Sensitive Receptor Overview contained in Appendix A:

Table 1: Closest Sensitive Receptors to the Proposed Ramara Quarry Licence Boundary			
Receptor Numbers	**Sensitive Receptor Address**	**Distance to Receptor (m)**	**Direction from Extraction Limits**
R1	7204 Concession Road B/C	845	West
R2	7181 Concession Road B/C	773	Southwest
R3	7111 Concession Road B/C	391	Southwest
R4	7006 Concession Road B/C	158	South
R5	6989 Concession Road B/C	240	South
R6	6290 Pearl Carrick's Road	842	Northwest
R7	6323 Pearl Carrick's Road	745	Northwest
R8	6478 Donald Carrick's Lane	1157	North
R9	6475 Donald Carrick's Lane	1223	North

PROPOSED AGGREGATE EXTRACTION

As per the April 2026 Operational Schematic (Refer to Appendix A), the proposed initial quarry operations will commence at the Northeastern corner of Phase 1 which is located just South of Donald Carrick's Lane. The initial blast will require a sinking cut, which will then allow extraction to proceed in a southern and western direction through Phase 1.

Phase 2 will be utilizing the face provided from Phase 1 eliminating the need for a sinking cut and will continue to progress in a southern and western direction.

Similar concept to Phase 2, Phase 3 will utilize the existing face provided from Phase 2 eliminating the need for a sinking cut and will continue to progress in a southern and western direction.

Phase 1,2 and 3 are anticipated to be extracted in a single 15m lift but may be extracted in multiple lifts should the need arise. The maximum depth of extraction throughout the quarry extraction limits will be 15m terminating at the quarry floor elevation of 230MASL.

BLAST VIBRATION AND OVERPRESSURE LIMITS

The Ontario MECP guidelines for blasting in quarries are among the most stringent in North America.

Studies by the U.S. Bureau of Mines have shown that normal temperature and humidity changes can cause more damage to residences than blast vibrations and overpressure in the range permitted by the MECP. The limits suggested by the MECP are as follows.

Vibration___________ 12.5mm/sec Peak Particle Velocity (PPV)

Overpressure_______ 128 dB(L) Peak Sound Pressure Level (PSPL)

The above guidelines apply when blasts are being monitored. Cautionary levels are slightly lower and apply when blasts are not monitored on a routine basis. It is a recommendation of this report that all blasts at the operation be monitored to quantify and record ground vibration and overpressure levels employing a minimum of two (2) digital seismographs, one installed at the closest sensitive receptor in front of the blast and one installed at the closest sensitive receptor behind the blast.

BLAST MECHANICS AND DERIVATIVES

The detonation of explosives within a borehole results in the development of very high gas and shock pressures. This energy is transmitted to the surrounding rock mass, crushing the rock immediately surrounding the borehole (approximately 1 borehole radius) and permanently distorts the rock to several borehole diameters (5-25, depending on the rock type, prevalence of joint sets, etc).

The intensity of this stress wave decays quickly so that there is no further permanent deformation of the rock mass. The remaining energy from the detonation travels through the unbroken material in the form of a pressure wave or shock front which, although it causes no plastic deformation of the rock mass, is transmitted in the form of vibrations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. As such, for the purposes of this report, ground vibration units have been listed in mm/s.

In addition to the ground vibrations, overpressure, or air vibrations are generated through the direct action of the explosive venting through cracks in the rock or through the indirect action of the rock movement. In either case, the result is a pressure wave which travels through the air, measured in decibels (or dB(L)) for the purposes of this report.

VIBRATION AND OVERPRESSURE THEORY

Transmission and decay of vibrations and overpressure can be estimated by the development of attenuation relations. These relations utilize empirical data relating measured velocities at specific separation distances from the vibration source to predict particle velocities at variable distances from the source. While the resultant prediction equations are reliable, divergence of data occurs as a result of a wide variety of variables, most notably site-specific geological conditions and blast geometry and design for ground vibrations and local prevailing climatic conditions for overpressure.

In order to circumvent this scatter and improve confidence in forecast vibration levels, probabilistic and statistical modeling is employed to increase conservatism built into prediction models, usually by the application of 95% confidence lines to attenuation data.

The attenuation relations are not designed to conclusively predict vibrations levels at a specific location as a result of a specific blast design, application of this probabilistic model creates confidence that for any given scaled distance, 95% of the resultant velocities will fall below the calculated 95% regression line.

While the data still provides insight into probable vibration intensities, attenuation relations for overpressure tends to be less reliable and precise than results for ground vibrations. This is due primarily to wider variations in variables outside of the influence of the blast design which impact propagation of the vibrations. Atmospheric factors such as temperature gradients and prevailing winds (refer to Appendix B) as well as local topography can all serve to significantly alter overpressure attenuation characteristics.

Our experience and analysis demonstrates that blast overpressure is greatest when blasting toward receptors, and blast vibrations are greatest when retreating in the direction of the receptor.

GROUND VIBRATION LEVELS AT THE NEAREST SENSITIVE RECEPTOR

The most commonly used formula for predicting PPV is known as Bureau of Mines (BOM) prediction formula or Propagation Law. We have used this formula to predict the PPV's at the closest house for the initial operations.

$$PPV = k\left(\frac{d}{\sqrt{w}}\right)^{e}$$

Where, PPV = the calculated peak particle velocity (mm/s)

K, e = site factors

d = distance from receptor (m)

w = maximum explosive charge per delay (kg)

The value of K is variable and is influenced by many factors (i.e. rock type, geology, thickness of overburden, etc.). As such, these site factors are developed empirically through the measurement of vibration characteristics at the specific operations of interest.

The portion of the BOM prediction formula contained within the parentheses is referred to as the *Scaled Distance* and represents another important PPV relation. It correlates the separation distance between a blast and receptor to the energy (usually expressed as explosive weight) released at any given instant in time. The two most popular approaches are square root scaling and cube root scaling:

$$(SDSR = \frac{R}{\sqrt{W}}) \qquad (SDCR = \frac{R}{\sqrt[3]{W}})$$

Where, SDSR = Scaled distance square root method

SDCR = Scaled distance cube root method

R = Separation distance between receptor site and blast (m)

W = Maximum explosive load per delay period (kg)

Historically, square root scaling is employed in situations whereby the explosive load is distributed in a long column (i.e. blasthole) while cube root scaling is employed for point charges. In accordance with industry standard, square root scaling was adopted for ground vibration analysis for the purposes of this report.

For a distance of 1160m (i.e. the standoff distance to the closest sensitive receptor for the initial blasting operations, namely 7006 Concession B/C) and a maximum explosive load per delay of 122kg (102mm diameter hole, 15m deep, 2.5m surface collar, and 1 hole per delay), we can calculate the maximum PPV at the closest building using the following formulae:

Imperial Equations:

Oriard 50% bound (2002)	$v = 160\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$
Oriard 90% Bound (2002)	$v = 242\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$
Quarry Production Blast (Bulletin 656 – 1971)	$v = 182\left(\frac{D}{\sqrt{W}}\right)^{-1.82}$
Typical limestone Quarry (Pader report – 1995)	$v = 52.2\left(\frac{D}{\sqrt{W}}\right)^{-1.38}$
Typical Coal Mine (RI8507 1980)	$v = 133\left(\frac{D}{\sqrt{W}}\right)^{-1.5}$

Metric Equations:

General Blasting (Dupont) $$v = 1140\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$$

Construction Blasting (Dowding 1998) $$v = 1326\left(\frac{D}{\sqrt{W}}\right)^{-1.38}$$

Agg. Quarry Blasting (Explotech 2005) $$v = 5175\left(\frac{D}{\sqrt{W}}\right)^{-1.76}$$

Agg. Quarry blasting (Explotech 2003) $$v = 7025\left(\frac{D}{\sqrt{W}}\right)^{-1.85}$$

The equations described above accommodate for a range of geological conditions. The proposed parameters were applied to the formulae to estimate a range of the potential vibrations to be imparted on the closest sensitive receptor behind the blast. As discussed in previous sections, the MECP guideline for blast-induced vibration is 12.5 mm/s (0.5 in/s). Appendix C demonstrates that the maximum (i.e. worst case) calculated value for the vibration intensities imparted on the closest sensitive receptor based on all equations is 2.15mm/s for the initial blasting, below the MECP guideline limit. All blasts will be monitored for overpressure and ground vibrations with blast designs adjusted in response to readings on site in order to ensure consistent compliance with established limits.

Utilizing the formula providing the worst-case scenario for all geological conditions (Construction Blasting (Dowding 1998)), the table below states the maximum explosive loading based on MECP guideline limits. The following table will form a guideline for blasting operations until a site specific equation is developed.

Table 2: Maximum Explosive Load at Set Offset Distances to Maintain 12.5 mm/sec	
Distance to Receptor (m)	**Allowable Explosives Per Period** (kg)
100	11.6
150	26.0
200	46.4
300	104
400	185
500	289
600	417
700	568
800	742
900	939
1000	1159

As the separation distance between the blast and closest receptor decreases, it will be necessary to adjust blast parameters to ensure continued compliance with the guideline limit. Fortunately, a variety of blast design alternatives are available to accomplish this including but not limited to reductions in blast hole diameter, change in explosive types, adjustment in bench heights and decking of holes. Given the planned phasing of the proposed quarry, vibration data will be continually collected and analyzed as the adjacent receptors are approached in order to confirm the requirement for any design modifications.

OVERPRESSURE LEVELS AT THE NEAREST SENSITIVE RECEPTOR

It is unusual for overpressure to reach damaging levels, and when it does, the evidence is immediate and obvious in the form of broken windows in the area. However, overpressure remains of interest due to its ability to travel further distances as well as cause audible sounds and excitation in windows and walls.

Air overpressure decays in a known manner in a uniform atmosphere, however, a uniform atmosphere is not a normal condition. As such, air overpressure attenuation is far more variable due to its intimate relationship with environmental influences. Air vibrations decay slower than ground vibrations with an average decay rate of 6dB(L) for every doubling of distance.

Air overpressure levels are analyzed using cube root scaling based on the following equation:

$$P = k\left(\frac{d}{\sqrt[3]{w}}\right)^{e}$$

Where, P = the peak overpressure level (dB(L))
K, e = site factors
d = distance from receptor (m)
w = maximum explosive charge per delay (kg)

The value of K and e are variable and are influenced by many factors (i.e. rock type, geology, thickness of overburden, etc.). As such, these site factors are developed empirically through the measurement of overpressure characteristics at the specific operations of interest.

As discussed in previous sections, the MECP guideline for blast-induced overpressure is 128dB(L). For a distance of 1213m (i.e. the standoff distance to the closest sensitive receptor in front of the initial blast, namely 6478 Donald Carrick's Lane), and a maximum explosive load of 122kg (102mm diameter hole, 15m deep, 2.5m surface collar and 1 hole per delay), we can calculate the maximum overpressure at the nearest receptor in front of the blast using the following equations:

Imperial Equations:

USBM RI8485 (Behind Blast) $$P = 0.056\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.515}$$

USBM RI8485 (Front of Blast) $$P = 1.317\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.966}$$

USBM RI8485 (Full Confined) $$P = 0.061\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.96}$$

Construction Average (Oriard 2005) $$P = 1\left(\frac{D}{\sqrt[3]{W}}\right)^{-1.1}$$

Metric Equations:

Ontario Quarry - dB (Explotech) $$P = 159\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.0456}$$

Limestone - dB (Explotech) $$P = 206\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.1}$$

Ontario Quarry - Pa (Explotech) $$P = 1222\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.669}$$

Appendix C demonstrates that the maximum calculated value for the overpressure intensities imparted on the closest sensitive receptor in front of the blast based on all equations is 123.8 dB(L) for the initial blasting operations. Based on this calculation and the applied blast parameters, blasting from the initial operations will remain compliant with the MECP NPC 119 guideline limit of 128dB(L).

Utilizing the formula providing the worst case scenario for all geological conditions (Ontario Quarry– Pa (Explotech), Table 3 below can be used as an initial guide showing maximum loads per delay based on various separation distances for receptors in front of the blast face. The following maximum loads per delay are derived from the air overpressure equation above and are based on a peak overpressure level of 128dB(L):

Table 3: Maximum Explosive Load at Set Offset Distances to Receptors <u>in Front of</u> the Blast to Maintain 128 dB(L)	
Distance to Receptor (m)	**Allowable Explosives Per Period** (kg)
100	0.6
200	4.8
300	16.4
400	39
500	76
600	131
700	209
800	312
900	445
1000	610
1100	810
1200	1050

We note that the above values are typically conservative and are intended as a guideline only as the air overpressure attenuation equation is based on a calculated 95% regression line. Actual loads employed shall be based on the results of the monitoring program in place.

It is a recommendation of this report that all blasts be monitored for overpressure and ground vibrations with blast designs adjusted in response to readings on site in order to ensure consistent compliance with established limits.

We reiterate that air overpressure attenuation is far more variable due to its intimate relationship with environmental influences and as such, the equation employed is less reliable than that developed for ground vibration. Overpressure monitoring performed on site shall be used to guide blast design as it pertains to the control of blast overpressures.

RECOMMENDATIONS

It is recommended that the following conditions be added to the Aggregate Resources Act Site Plans for all blasting operations at the proposed Ramara Quarry:

1. An attenuation study shall be undertaken by an independent blasting consultant during the first 4 blasts that are representative of typical production blasts occurring over the life of the quarry in order to obtain sufficient quarry data for the development of site-specific attenuation relations. This study will be used to confirm the applicability of the initial guideline parameters and assist in developing future blast designs.

2. All blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) digital seismographs – one installed in front of the blast and one installed behind the blast. Monitoring shall be performed by an independent third party engineering firm with specialization in blasting and monitoring.

3. The guideline limits for vibration and overpressure shall adhere to standards as outlined in the MECP Model Municipal Noise Control By-law publication NPC 119 (1978) or any such document, regulation or guideline which supersedes this standard.

4. In the event of an exceedance of NPC 119 limits or any such document, regulation or guideline which supersedes this standard, blast designs and protocols shall be reviewed prior to any subsequent blasts and revised accordingly in order to return the operations to compliant levels.

5. Orientation of the aggregate extraction operation shall be designed and maintained so that the direction of the overpressure propagation will be away from structures as much as possible.

6. Blast designs shall be continually reviewed with respect to fragmentation, ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with current applicable guidelines and regulations.

7. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.

8. Detailed blast records shall be maintained in accordance with current industry best practices.

CONCLUSION

Blasting operations required at the proposed Ramara Quarry can be carried out safely and within governing guidelines set by the Ministry of the Environment, Conservation and Parks.

Modern blasting techniques will permit blasting to take place with explosives charges below allowable charge weights ensuring that blast vibrations and overpressure will remain minimal at the nearest receptors and compliant with applicable guideline limits.

Appendix A

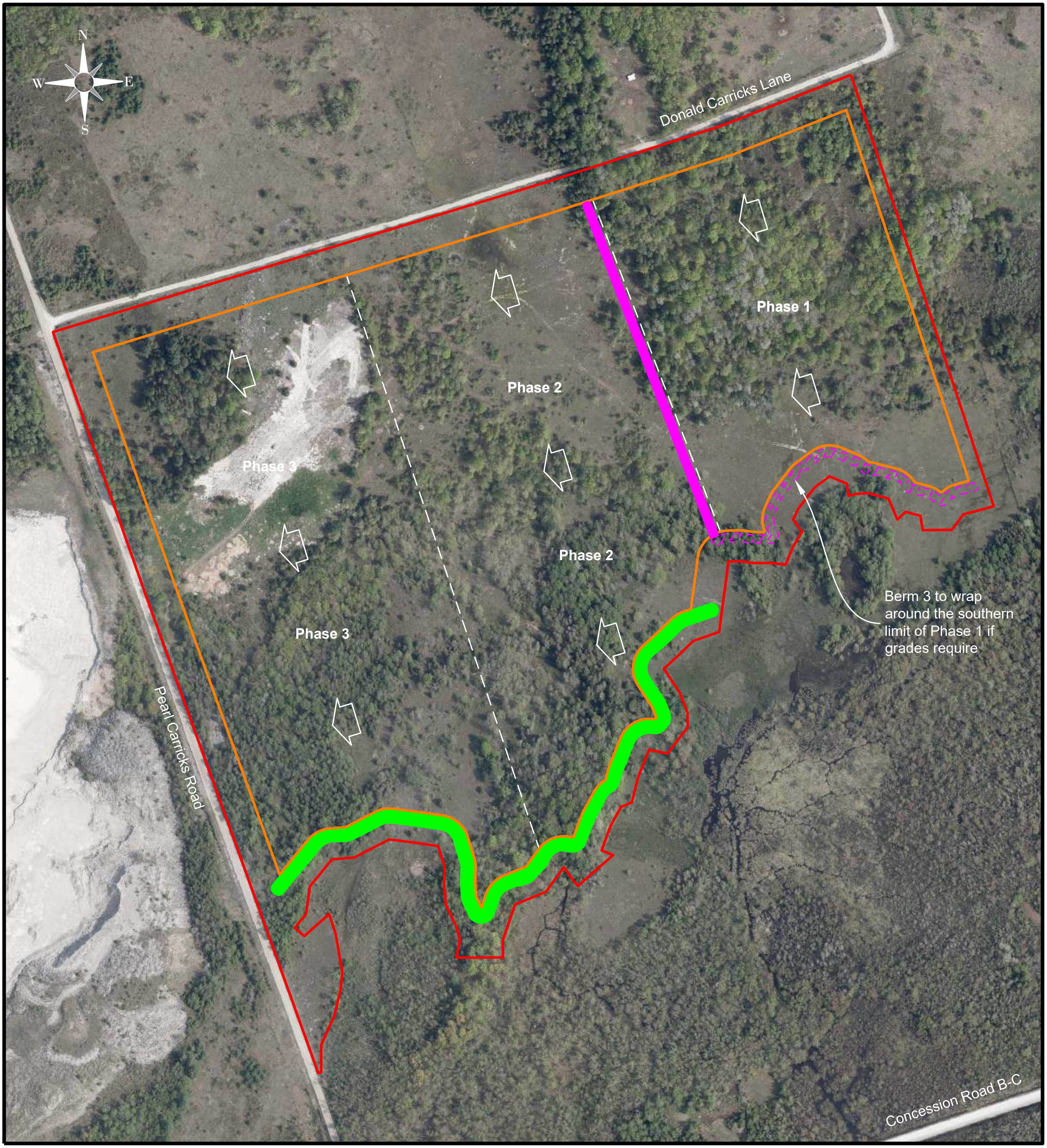

Figure # 5
Operational Schematic

Ramara Quarry
Part of Lots 9 and 10, Concession C
Geographic Township of Rama
Township of Ramara
County of Simcoe

Legend

- Proposed Licence Boundary - 43.3 ha
- Proposed Limit of Extraction - 34.4 ha
- Phase Boundary
- Proposed Impermeable Berm (Required Before Operations in Phase 1)
- Proposed Noise Attenuation Berm (Required Before Operations in Phase 2)

Date: April 2026

Sources: 2023 aerial photography from the County of Simcoe GIS

Scale - 1:5000
0 75 150 Metres

B:\Brian\21511C - Sarjeants - 6059 Pearl Carricks Road Ramara\Drawings\Figures\Planning Report\CAD\21511C - Operational and Rehabilitation Schematic.dwg

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE


Sensitive Receptor Map
Legend
6475 Donald Carricks Lane
6478 Donald Carricks Lane
6290 Pearl Carricks Road
6323 Pearl Carricks Road
Sweetwater Farm Nature Reserve, protected by...
Donald Carricks Lane
Proposed Entrance/Exit Location
7204 Concession Road B/C
7006 Concession Road B/C
6989 Concession Road B/C
7181 Concession Road B/C
7111 Concession Road B/C
Bot Aggregates
Google Earth
Image © 2025 Airbus
Image © 2025 CNES / Airbus
900 m
N

Appendix B

Ramara Quarry

PREVAILING METEOROLOGICAL CONDITIONS

Medians provided by Environment Canada
Canadian Climate Normals 1991-2020
Lagoon City, ON

Date	Wind Direction	Wind Velocity Km/h	Temperature (Deg Celsius)
January	N	17.4	-8.2
February	NW	16.4	-7.5
March	N	15.9	-2.5
April	NW	16.4	4.7
May	NW	14.7	12.3
June	NW	13.8	17.8
July	NW	14.1	20.4
August	W	14.0	19.7
September	N	14.7	15.8
October	N	17.9	9.2
November	N	19.5	2.7
December	W	19.4	-3.6

Appendix C

Ground Vibrations

Imperial Equations

Equation 1	Equation 2	Equation 3	Equation 4	Equation 5
Oriard 50% Bound (2002)	Oriard 90% Bound (2002)	Typical Production Blast (Bulletin 656 – 1971)	Typical limestone Quarry (Pader report – 1995)	Typical Coal Mine (RI8507 1980)
$v = 160\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$	$v = 242\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$	$v = 182\left(\frac{D}{\sqrt{W}}\right)^{-1.82}$	$v = 52.2\left(\frac{D}{\sqrt{W}}\right)^{-1.38}$	$v = 133\left(\frac{D}{\sqrt{W}}\right)^{-1.5}$

Metric Equations

Equation 1	Equation 2	Equation 3	Equation 4
DuPont General (1968)	Construction Blasting (Dowding 1998)	Agg. Quarry Blasting (Explotech 2005)	Agg. Quarry blasting (Explotech 2003)
$v = 1140\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$	$v = 1326\left(\frac{D}{\sqrt{W}}\right)^{-1.38}$	$v = 5175\left(\frac{D}{\sqrt{W}}\right)^{-1.76}$	$v = 7025\left(\frac{D}{\sqrt{W}}\right)^{-1.85}$

D (m)	W (Kg)	PPV1 (mm/s)	PPV2 (mm/s)	PPV3 (mm/s)	PPV4 (mm/s)	PPV5 (mm/s)	PPV1 (mm/s)	PPV2 (mm/s)	PPV3 (mm/s)	PPV4 (mm/s)
1160	122	**0.67**	**1.01**	**0.23**	**0.72**	**0.96**	**0.67**	**2.15**	**1.43**	**1.28**

Air Overpressure

Imperial Equations

Equation 1	Equation 2	Equation 3	Equation 4
USBM RI8485 (Behind Blast)	USBM RI8485 (Front of Blast)	USBM RI8485 (Full Confined)	Construction Average
$P = 0.056\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.515}$	$P = 1.317\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.966}$	$P = 0.061\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.96}$	$P = 1\left(\frac{D}{\sqrt[3]{W}}\right)^{-1.1}$

Metric Equations

Equation 1	Equation 2	Equation 3
Ontario Quarry (Explotech 2013)	Limestone (Explotech 2011)	Ontario Quarry (Explotech 2012)
$P = 159\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.0456}$	$P = 206\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.1}$	$P = 1222\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.669}$

D (m)	W (Kg)	OP1 (dB)	OP2 (dB)	OP3 (dB)	OP4 (dB)	OP1 (dB)	OP2 (dB)	OP3 (dB)
1213	122	**117.0**	**119.2**	**92.9**	**109.4**	**123.7**	**118.9**	**123.8**

Appendix D

Robert J. Cyr, P. Eng.

Principal, Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Civil Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Association of Professional Engineers and Geoscientists of BC (APEG)
Association of Professional Engineers, Geologists and Geophysicists of Alberta
Association of Professional Engineers and Geoscientists of New Brunswick
Association of Professional Engineers of Nova Scotia
Association of Professional Engineers and Geoscientists Manitoba
Professional Engineers and Geoscientists Newfoundland and Labrador
Northwest Territories and Nunavut Association of Professional Engineers (NAPEG)
International Society of Explosives Engineers (ISEE)
Ontario Stone Sand & Gravel Association (OSSGA)
Surface Blaster Ontario Licence 450109

SUMMARY OF EXPERIENCE

Over thirty five years experience in many facets of the construction and mining industry has provided the expertise and experience required to efficiently and accurately address a comprehensive range of engineering and construction conditions. Sound technical training is reinforced by formidable practical experience providing the tools necessary for accurate, comprehensive analysis and application of feasible solutions. Recent focus on vibration analysis, blast monitoring, blast design, damage complaint investigation for explosives consumers and specialized consulting to various consulting engineering firms.

PROFESSIONAL RECORD

2001 – Present	-Principal, Explotech Engineering Ltd.
1996 – 2001	-Leo Alarie & Sons Limited - Project Engineer/Manager
1993 – 1996	-Rideau Oxford Developments Inc. – Project Manager
1982 – 1993:	-Alphe Cyr Ltd. – Project Coordinator/Manager

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Mitch Malcomson, P.Eng.

Consulting Engineer, Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Civil Engineering with Concentration in Business Management,
Carleton University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Engineers and Geoscientists British Columbia (EGBC)
International Society of Explosives Engineers (ISEE)
Ontario Stone Sand and Gravel Association (OSSGA)

SUMMARY OF EXPERIENCE

A Consulting Engineer and Project Manager for Explotech Engineering Ltd., Mitch holds a Bachelor of Engineering degree from Carleton University in Civil Engineering with a Concentration in Business Management. Mitch has strong analytical, technical, business and leadership skills. As a Project Manager, Mitch is responsible for operational strategies, scheduling and contract procurement. As a Consulting Engineer, the technical responsibilities include detailed blast designs, blast investigations and reviews, implementation of vibration monitoring programs, development of monitoring equipment/ technologies and building assessments for construction and the drilling and blasting portions of mining, quarrying and construction projects across Canada.

PROFESSIONAL RECORD

2008 – Present - Consulting Engineer / Project Manager, Explotech Engineering Ltd.

Michael Tobin, P.Eng.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Geological Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Engineers and Geoscientists British Columbia (EGBC)
International Society of Explosives Engineers (ISEE)

SUMMARY OF EXPERIENCE

An engineer working for Explotech Engineering Ltd., Michael holds a Bachelor of Applied Science degree from Queen's University in Geological Engineering. Michael has strong analytical, technical, and interpersonal skills. Recent projects have focused on blast monitoring, vibration analysis, job estimation, damage complaint investigation and blast design.

PROFESSIONAL RECORD

2021 – Present - Engineer, Explotech Engineering Ltd.

2017 – 2021 - Technician, Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Bradley Lavoie, P.Eng.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Mechanical Engineering, Laurentian University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)

SUMMARY OF EXPERIENCE

An Engineer working for Explotech Engineering Ltd., Bradley holds a Bachelor of Engineering degree from Laurentian University in Mechanical Engineering. Bradley has strong analytical, technical, project management and interpersonal skills. Recent projects have focused on blast monitoring, vibration analysis, job estimation, blast design and damage complaint investigations.

PROFESSIONAL RECORD

2023 – Present	- Engineer, Explotech Engineering Ltd.
2018 – 2023	- Technician, Explotech Engineering Ltd.

Appendix E

EXPLOTECH

Blasting Terminology

ANFO:	Ammonium Nitrate and Fuel Oil – explosive product
ANFO WR:	Water resistant ANFO
Blast Pattern:	Array of blast holes
Body hole:	Those blast holes behind the first row of holes (Face Holes)
Burden:	Distance between the blast hole and a free face
Column:	That portion of the blast hole above the required grade
Column Load:	The portion of the explosive loaded above grade
Collar:	That portion of the blast hole above the explosive column, filled with inert material, preferably clean crushed stone
Face Hole:	The blast holes nearest the free face
Overpressure:	A compressional wave in air caused by the direct action of the unconfined explosive or the direct action of confining material subjected to explosive loading.
Peak Particle Velocity*:*	The rate of change of amplitude, usually measured in mm/s or in/s. This is the velocity or excitation of the particles in the ground resulting from vibratory motion.
Scaled distance:	An equation relating separation distance between a blast and receptor to the energy (usually expressed as explosive weight) released at any given instant in time.
Sensitive Receptor:	Sensitive land use may include recreational uses which are deemed by the municipality or provincial agency to be sensitive; and/or any building or associated amenity area (i.e. may be indoor or outdoor space) which is not directly associated with the industrial use, where humans or the natural environment may be adversely affected by emissions generated by the operation of a nearby industrial facility. For example, the building or amenity area may be associated with residences, senior citizen homes, schools,

EXPLOTECH

day care facilities, hospitals, churches and other similar institutional uses, or campgrounds.

Spacing: Distance between blast holes

Stemming: Inert material, preferably clean crushed stone applied into the blast hole from the surface of the rock to the surface of the explosive in the blast hole.

Sub-grade: That portion of the blast hole drilled band loaded below the required grade

Toe Load: The portion of explosive loaded below grade

EXPLOTECH

References

Building Research Establishment, (1990), *"Damage to Structures From Ground-Borne Vibration",* BRE Digest 353, Gaston, Watford, U.K.

Crum S. V., Siskind D. E., Pierce W. E., Radcliffe K. S., (1995) *"Ground Vibrations and Airblasts Monitored in Swedesburg, Pennsylvania, From Blasting at McCoy Quarry",* Contract Research Rept. By the United States Bureau of Mines for the Pennsylvania Department of Environmental Resources, 120 pp.

Dowding C.H., (1985), *"Blast Vibration, Monitoring and Control"*, Prentice-Hall Canada Inc., 297 pp.

Dowding C.H., (1996), *"Construction Vibrations"*, Prentice-Hall, Upper Saddle, N.J., USA, 610 pp.

Du Pont Company, (1980), *"Blaster's Handbook"* Wilmington, Delaware, United States of America

Fletcher L.R., D'Andrea D.V., (1986) *"Control of Flyrock in Blasting"*, Proceedings of the Twelfth Annual Conference on Explosives and Blasting Technique, International Society of Explosives Engineers

Froedge D. T., (1983) *"Blasting Effects on Water Wells",* Proceedings of the Ninth Annual Conference on Explosives and Blasting Technique, International Society of Explosives Engineers

Kopp J.W., (1994) *"Observation of Flyrock at Several Mines and Quarries"*, Proceedings of the Twentieth Annual Conference on Explosives and Blasting Technique, International Society of Explosives Engineers

Matheson G. M., Miller D. K., (1997) *"Blasting Vibration Damage to Water Supply, Well Water Quality and Quantity",* Proceedings of the Twenty-Third Conference on Explosives and Blasting Technique, International Society of Explosive Engineers

Moore A.J., Richards A.B., (2005), *"Golden Pike Cut-Back Flyrock Control and Calibration of a Predictive Model"*, Terrock Consulting Engineers, Eltham, Victoria, Australia.

EXPLOTECH

Nicholls H., Johnson C., Duvall W., (1970), "*Blasting Vibrations and their Effects on Structures",* United States Department of the Interior, Bureau of Mines, Bulletin 656

Oriard L.L., (1989) *"The Scale of Effects in Evaluating Vibration Damage Potential"* Fifteenth Conference on Explosives and Blasting Technique, International Society of Explosive Engineers

Oriard L.L., (2002) *"Explosives Engineering, Construction Vibrations and Geology"* International Society of Explosive Engineers, Clevland, Ohio, United States of America

Robertson D. A., Gould J. A., Straw J. A., Dayton M. A., (1980) *"Survey of Blasting Effects on Ground Water Supplies in Appalachia",* United States Department of the Interior, Bureau of Mines, Contract No. J-0285029

Rose R., Bowles B., Bender W. L., (1991) *"Results of Blasting in Close Proximity to Water Wells at the Sleeper Mine",* Proceedings of the Seventeenth Annual Conference on Explosives and Blasting Technique, International Society of Explosive Engineers

Roth J., (1979) *"A Model for Determination of Flyrock Range as a Function of Shot Conditions"*, United States Department of the Interior, Bureau of Mines, Report OFR 77-81

Siskind D.E., Stagg M.S., Kopp J.W., Dowding C.H., (1980), *"Structural Response and Damage Produced by Ground Vibration from Surface Mine Blasting",* United States Bureau of Mines RI 8507.

White,T.J., Farnfield,R.A., Kelly,M., (1993), "*The Effect of Low Level Blast Vibrations and the Environment on a Domestic Building"*, Proceedings of the Ninth Annual Symposium on Explosives and Blasting Research, International Society of Explosives Engineers.

Wright D.G., Hopky G. E., (1998) *"Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters",* Canadian Technical Report of Fisheries and Aquatic Sciences 2107