Proposed Milton Quarry East Extension
JART COMMENT SUMMARY TABLE – Blast Impact Analysis (BIA)

Please accept the following as feedback from the Milton Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (December 2022)	Reference	Source of Comment	Applicant Response	JART Response
Report/Date: Blast Impact Analysis November 25, 2021			**Author: Explotech Engineering Ltd.**		
1.	The BIA report under the heading "RECOMMENDATIONS" provides seven (7) recommendations as the condition of blasting in the proposed Milton Quarry East Extension extraction area. Englobe concurs with these recommendations and suggests the following: - Critical conditions outlined in note C, sheet 2 of 4 of the site plan drawing be judiciously implemented to maintain compliance with the MECP guidelines and regulations - Based on Explotech's vibration and overpressure prediction analysis, the recommended blast-hole depth must be limited to 18.6 m. The maximum single bench height shall not exceed 25m in accordance with the requirements of the Occupational Health and Safety Act and Regulation for Mines and Mining Plants, Section 89. (a)	General	Englobe		
2.	Consultation with Subject Matter Experts familiar with blasting guidelines in relation to pits and quarries reveal that impacts from blasting are based upon human-related receptor impacts and not ecological receptor impacts (with the exception of fish habitat). It is the opinion of Subject Matter Experts that there is a general a lack of research on blasting impacts to fauna other than fish. Herpetofauna such as Jefferson Salamander which may occur near quarry operations may not be defined as sensitive receptors to blasting operations due to lack of information and research.	General	Matrix Solutions		
3.	The Blast Impact Analysis Report refers to potential impact to fish habitat in proximity to the MQEE. The types of impacts presented in the report include potential for vibration and overpressure limits exceedances due to the use of explosives within the vicinity of fish habitat. Page 23 of the Blast Impact Analysis acknowledges that the "detonation of explosives in or near water can produce compressive shock waves which initiate damage to internal organs of fish in close proximity, and ultimately resulting in the death of the organism" (Explotech Engineering 2021). To alleviate adverse impacts to fish populations, the Department of Fisheries and Oceans (DFO) developed Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998). This publication establishes limits for water overpressure and ground vibrations which are intended to mitigate impacts on aquatic organisms, while providing flexibility for blasting operations to proceed. The Blast Impact Analysis further states that fish habitat impacts are not likely to occur as they are "approximately 1.3 km removed from the proposed extraction area." The report concludes that based on the far distance to the closest known fish habitat, water overpressures and ground vibration generated by the blasting will be well below the DFO 100kPa and 13 mm/s guideline limit and will have no impact on the fish populations present. Review of current mapping of fish habitat in relation to the licensed area supports the conclusion that fish habitat are not likely to occur.	General	Matrix Solutions		

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<td>4.</td>
<td>The Blast Impact Analysis Report suggests that design modifications to the preliminary blasting design will be required once blasting operations encroach to within 289.5 m of sensitive receptors. Since the Blast Impact Analysis only considers human residences as sensitive receptors and there is an excess of 1 km separation distance between blasting activities, Page 13 of the Blast Impact Analysis states that the blasting design could be adjusted to even higher blasting loads per delay in comparison to current designs used in existing licenses. The blasting report stated that typical load per delay is between 50 kg and 210 kg per blasting period.

Although higher blasting loads can be accommodated due to the distance to human residences, this conclusion is unlikely to be applicable if the confirmed Jefferson Salamander and Unisexual Ambystoma breeding ponds U1 and V2 were sensitive receptors, as the distance to the confirmed breeding ponds would be very close to the blasting zone. Due to the lack of available information, the applicant should include a discussion of how the potential impacts from blasting can be mitigated, and this should be supported by monitoring information. It is possible that the MQEE is a unique situation within the Niagara Escarpment, where Jefferson Salamander habitat may occur in close proximity to active quarry sites.</td>
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<td>5.</td>
<td>Although fish and salamanders have differences in anatomy, there are general similarities in their basic body anatomy and eggs which would leave them vulnerable to the same type of impacts as fish. Further, Jefferson Salamander populations are reliant on the use of breeding ponds during the breeding period of their life cycle, their breeding activities have many similarities to fish spawning.

As mentioned in #5, the detonation of explosives can result in compressive shock waves that can damage internal organs of fish in close proximity. In addition, ground vibrations imparted on active spawning beds can adversely impact incubating eggs and spawning activity to fish.

Depending on the weight of the explosive charges used in the vicinity of the Jefferson Salamander breeding ponds, there is potential for explosive charges to affect the salamander population during the time that the ponds are being occupied for mating and larval incubation and development periods.</td>
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<td>6.</td>
<td>The DFO has established guidelines of 100 kpa for water overpressure limits and ground vibrations of 13 mm/sec to protect fish populations from the impacts of blasting. These guidelines are based on setbacks from the centre of detonation based on the weight of explosives charges and substrate types. The DFO Guidelines for fish and fish habitat are provided in Tables 1 and 2 as follows:

TABLE 1 Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPA guideline criteria for various substrates.
<table>
<tr><th rowspan="2">Substrate Type</th><th colspan="8">Weight of Explosive Charge (kg)</th></tr>
<tr><th>0.5</th><th>1</th><th>2</th><th>5</th><th>10</th><th>25</th><th>50</th><th>100</th></tr>
<tr><td>Rock</td><td>3.6</td><td>5.0</td><td>7.1</td><td>11.0</td><td>15.9</td><td>25.0</td><td>35.6</td><td>50.3</td></tr>
<tr><td>Frozen Soil</td><td>3.3</td><td>4.7</td><td>6.5</td><td>10.4</td><td>14.7</td><td>23.2</td><td>32.9</td><td>46.5</td></tr>
<tr><td>Ice</td><td>3.0</td><td>4.2</td><td>5.9</td><td>9.3</td><td>3.2</td><td>20.9</td><td>29.5</td><td>41.8</td></tr>
<tr><td>Saturated Soil</td><td>3.0</td><td>4.2</td><td>5.9</td><td>9.3</td><td>13.2</td><td>20.9</td><td>29.5</td><td>41.8</td></tr>
<tr><td>Unsaturated Soil</td><td>2.0</td><td>2.9</td><td>4.1</td><td>6.5</td><td>9.2</td><td>14.5</td><td>20.5</td><td>29.0</td></tr>
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(Wright and Hopky 1998)
Based on Table 1, the 100kpa for water overpressure limit is reached within the setback limit of 50.3 m in rock substrate when the weight of explosive charge is 100 kg. Since the edge of the extraction limit and the confirmed salamander breeding pond in</td>
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	U1 is within the range of 50 m, the applicant should provide an explanation of how this situation is unlikely to occur within the wetland U1.				
7.	The Blast Impact Analysis Report states that the current practice at Milton Quarry employs between 89 mm and 114 mm diameter blast holes with a typical load per delay of between 50 kg and 210 kg per period. Calculations contained within this report suggest blast designs currently being used at the Milton Quarry will remain compliant at the closest adjacent sensitive receptors. Through consultations with JART's blasting consultants, we understand that assuming the current minimum weight of 50 kg explosive charge per delay is used, levels experienced within 50 m of the blast zone will exceed limits from the Ontario Ministry of the Environment, Conservation and Parks (MECP) and DFO Guidelines. This is particularly relevant to Wetlands U1 and V2 which are currently not considered to be sensitive receptors. Using the PPV equation depicted as: $$PPV = k\left(\frac{d}{\sqrt{w}}\right)^{e}$$ 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) We understand that the calculated PPV would be approximately 65.61 mm/sec if the distance from the salamander habitat (receptor) is 50 m and the maximum explosive charge per delay is 50 kg. The site factors ("e" and "K") were kept at -1.523 and 1290.4 as per the Blast Impact Analysis. This calculation exceeds the MECP Guideline for blast induced vibration of 12.5 mm/sec, and the DFO Guideline of 13 mm/sec. Using the Air Overpressure equation depicted as: $$P = k\left(\frac{d}{\sqrt[3]{w}}\right)^{e}$$ Where, P = the peak overpressure level (dB) K, e = site factors d = distance from receptor (m) w = maximum explosive charge per delay (kg) We understand that peak overpressure level would be approximately 161.3 dB(L) if the distance from the salamander habitat is 50 m, the maximum explosive charge per	General	Matrix Solutions		

	delay is 50 kg and the site factors are e = -0.123 and K = 222.3 as per the Blast Impact Analysis. This calculation exceeds the MECP Guideline for blast induced overpressure of 128 dB(L). Based on these levels and our discussion with JART Blasting experts, it is suggested that either setback limits would need to be increased and weights of explosive charges would have to be greatly reduced to avoid impacting salamander breeding habitat in wetland U1 and V2 when blasting. Setback distances from DFO Guidelines, particularly in Table 2 would be expected to be in the range of 106.7 m, considering a weight of 50 kg (i.e., the minimum explosive charge per delay) to achieve a 13 mm/sec guideline for spawning habitat. TABLE 2 Setback distance (m) from centre of detonation of a confined explosive to spawning habitat to achieve 13 mm/s-1 guideline criteria for all types of substrate. (Wright and Hopky 1998)				
8.	The Blast Impact Analysis Report states that detonation of explosives may result in energy transmission within the rock, with distortion of the rock interface having varying levels of impact. The applicant should provide an explanation of how blasting can be controlled such that rock materials around wetland U1 are not fragmented by blasting to less than the 50 m from the blasting zone (i.e., underlying rock substrate between the wetland and edge of the extraction limit should not be fragmented), and that flyrock generated by blasting does not impact the wetland U1 habitat. With the short distance of the excavation limit to wetland U1 and V2, the applicant should provide assurance to ensure that the underlying bedrock is not fragmented such that leakage of subsurface flows from these wetlands to the edge of the extraction limit does not result. How is blasting controlled such that the extent of fracturing of the rock face does not extend closer to the salamander breeding ponds? The discussion should also include any by-products from the detonation of explosives that may also cause physical and/or chemical alteration to the salamander breeding habitat.	General	Matrix Solutions		
9.	In light of the potential for salamander habitat to be impacted by blasting activities, the applicant should provide additional explanation to the following: • Given that herpetofauna are not considered sensitive receptors, are there monitors in place to ensure that blasting levels do not cause adverse effects to their habitat? • Are the setbacks to the edge of the wetlands currently used by salamanders and other amphibians adequate to maintain under a broad range of blasting loads currently envisioned for the MQEE? • Is it possible to reduce the risk of blasting impacts by staging the blasting during times when the ponds are not used for breeding and larval development of salamanders?	General	Matrix Solutions		

	Weight of Explosive Charge (kg)						
	0.5	1	5	10	25	50	100
Setback Distance (m)	10.7	15.1	33.7	47.8	75.5	106.7	150.9