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 (December 2022)	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	**Explotech Engineering Ltd.** The vibration and overpressure analysis utilized a blast design based on parameters used in the past at the adjacent Milton Quarry, and a design that was feasible at that specific offset distance. Bench height could be adjusted while maintaining recommended load per delay limits by adjusting hole diameters, including decking, etc. The maximum bench height of 25m does not apply if an engineer certifies in writing that no worker would be endangered if the vertical height of the working face is more than twenty-five meters (Occupational Health and Safety Act and Regulation for Mines and Mining Plants, Section 89. 2.) The existing Milton quarry has used this clause in the past to have vertical heights of working faces greater than 25m. To address this comment, Explotech recommends the following note be added to the ARA site plans blasting notes: "The Licensee shall adhere to the Occupational Health and Safety Act and Regulation for Mines and Mining Plants."	

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	**Explotech Engineering Ltd.** Fish and Fauna are not defined as sensitive receptors as per the Ministry of Environment, Conservation, and Parks (MECP). Sensitive receptors are specifically defined by the MECP as 'a property of a person that accommodates a dwelling and includes a legal non-conforming residential use, a property of a person that accommodates a building used for a noise sensitive commercial purpose, and/or a property of a person that accommodates a building used for a noise sensitive institutional purpose.' As herpetofauna do not fall within this definition, the ground vibration and air overpressure limits defined by NPC 119 would not apply to these species. **Goodban Ecological Consulting Inc. (GEC)** GEC is not aware of any scientific literature dealing with the effects of quarry blasting of bedrock upon amphibians (either adults, eggs or larvae). The fact that there appears to be no literature on the effects of blasting on amphibians is a good indication that they are not affected much or at all. If blasting caused tadpole or adult frog mortality, surely someone somewhere would have observed this and reported it. In more than 25 years of ecological field work at/around the Milton Quarry, GEC has not observed any signs of unusual amphibian mortality or injuries in pools located in proximity to blasting areas. The wetlands that are supported by the Water Management System (WMS) all continue to support amphibian breeding functions and those with permanent or semi-permanent standing water support resident populations of amphibians such as Red-spotted Newt and Green Frog.	

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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	. **Goodban Ecological Consulting Inc. (GEC)** DFO reviewed relevant information related to the proposed Milton Quarry East Extension (MQEE) and they concluded in their March 23, 2022, letter that: “Based on the information provided, we have found that the proposed works are not in fish habitat and will not likely affect fish or fish habitat. No further review pursuant to the *Fisheries Act* or the *Species at Risk Act*, as listed above, is required.”	

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4.	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.	General	Matrix Solutions	**Explotech Engineering Ltd.** As noted above in point 2, breeding ponds do not fall under the MECP definition of a 'sensitive receptor'. The DFO has prepared guidelines for the protection of adult fish and incubating fish eggs. No similar guideline is available pertaining to Herpetofauna and accordingly, no associated guidance is provided on appropriate limitations to ground vibration, air overpressure and water overpressure. **Goodban Ecological Consulting Inc. (GEC)** Matrix Solutions has provided no evidence that "… the confirmed Jefferson Salamander and Unisexual Ambystoma breeding ponds U1 and V2 were sensitive receptors." Extraction has already occurred within 20 m of Wetland W7 and 30 m of Wetland V2 and they both continue to support populations of breeding Jefferson Salamander, Unisexual Ambystoma, Spotted Salamander, Spring Peeper, Wood Frog, Gray Treefrog, etc. Extraction has already occurred as close as 20 m to Wetland W8, which is a permanent pond that continues to support resident Red-spotted Newt and Green Frog populations. As extraction progressed closer to Wetlands W7, W8 and V2, no evidence of amphibian mortality or injury was observed by GEC or GHD. Ecological monitoring of Wetlands W7, W8 and V2 from 2004 to 2022 has not detected any negative amphibian population trends. Amphibian breeding activity increased in Wetland V2, following commencement of surface water mitigation in 2009. GEC reviewed a series of drone photos and extraction mapping of the East Cell from 2016 to 2022. Extraction approached Wetland V2 first, starting in 2016 and reaching the extraction limit on the southwest, west and northwest sides by 2017. Extraction of the upper bench around Wetland V2 was completed in 2019. Extraction of the lower bench near V2 commenced in 2018 and was completed in 2019. Upper bench extraction approached within approximately 50 m of Wetland W7 by late 2019 and was within 50 m or less around most of W7 by late 2020. Upper and lower bench extraction approached close to Wetland W8 in 2020. Extraction in proximity to Wetlands W7 and W8 was largely complete by 2022. GEC reviewed amphibian call count data and salamander egg mass survey data across the	

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				period 2016 to 2022 and no patterns of decline in amphibian breeding activity at Wetlands W7, W8 and V2 were observed. In late May 2022, Dufferin voluntarily requested that GEC rescue Red-spotted Newts from a shallow drainage ditch between two sump pools on the floor of Phase 2 of the Acton Quarry. Dufferin was blasting on the quarry floor. Blasting had already occurred to within 10 m of the drainage ditch (distance varied from 10 to 50 m, average distance was approximately 20 m), in the days prior to GEC's rescue actions. Using dip-nets and minnow traps, GEC captured 32 Red-spotted Newts and 10 Green Frog tadpoles on May 28 and 29. All of the newts and tadpoles appeared to be in good condition. No dead or injured amphibians were observed in the shallow ditch or the sump pools. Representative photographs are provided in Attachment A. The proposed Milton Quarry East Extension (MQEE) is not a unique situation within the Niagara Escarpment, because Wetlands W7 and V2 are salamander breeding pools that are adjacent to extracted portions of the East Cell of the Milton Quarry. There is no evidence of negative effects of blasting upon amphibian populations in these wetlands.	

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<tr><th></th><th>JART Comments (December 2022)</th><th>Reference</th><th>Source of Comment</th><th>Applicant Response (December 2022)</th><th>JART Response</th></tr>
<tr><td colspan="2">Report/Date: Blast Impact Analysis November 25, 2021</td><td colspan="2">Author: Explotech Engineering Ltd.</td><td colspan="2"></td></tr>
<tr><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><td>General</td><td>Matrix Solutions</td><td>Goodban Ecological Consulting Inc. (GEC)

In GEC’s opinion, Matrix Solutions has not demonstrated the potential for salamander breeding pools to be impacted by blasting activities and only conjectured that this is the case. With 30+ years of experience working at quarry sites in southern Ontario, GEC is not aware of situations where quarry blasting in general proximity to a wetland or breeding pool has resulted in negative effects on amphibians (adults, eggs or larvae). GEC is not aware of any scientific literature that supports the speculation by Matrix Solutions. GEC is aware of many examples of ponds and wetlands in proximity to quarry faces that continue to support amphibian populations. Also see GEC’s response to Comment #4.</td><td></td></tr>
<tr><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></table>(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 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.</td><td>General</td><td>Matrix Solutions</td><td>Goodban Ecological Consulting Inc. (GEC)

The DFO guidelines were established “…to protect fish populations from the impacts of blasting.” There are no guidelines related to amphibians.

DFO reviewed relevant information related to the proposed Milton Quarry East Extension (MQEE) and they concluded in their March 23, 2022, letter that:

“Based on the information provided, we have found that the proposed works are not in fish habitat and will not likely affect fish or fish habitat. No further review pursuant to the Fisheries Act or the Species at Risk Act, as listed above, is required.”

Furthermore, please see GEC’s response to Comments #4 & 5.</td><td></td></tr>
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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 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	General	Matrix Solutions	**Explotech Engineering Ltd.** Neither the MECP sensitive receptor limits or DFO guidelines are applicable to Herpetofauna. Any suggestion to introduce such a limit would be inappropriate. **Goodban Ecological Consulting Inc. (GEC)** See GEC response to Comments #4 & 5.	

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.

	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

(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	**Explotech Engineering Ltd.** As noted on page 9 of our Blast Impact Analysis, '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.). As the quarry typically employs 114.3mm (4 ½") borehole diameters, we would expect permanent rock deformation to a maximum of 2.9m. Even if the hole diameter were to be increased to 203mm (8"), the permanent rock deformation would extend to a maximum of 5.1m, well beyond the 50m offset distance to wetland U1 and effectively eliminating any possibility of bedrock fracturing at the U1 and V2 locations. With respect to flyrock, blasts are designed to control flyrock to whatever extent required. Emulsion explosive products currently used on site are designed to resist dissolution for up to several months. Given that loading of explosives is typically performed on the day of detonation and the explosive product is completely consumed in the explosive process, there is little opportunity for chemical alteration to the surrounding area. Notwithstanding, it is our understanding that groundwater monitoring programs will be in place to assess water quality and potential impacts from not only the blasting but all aspects of the quarry operation. **Goodban Ecological Consulting Inc. (GEC)** GEC routinely spends time in the East Cell excavation during periods when Wetlands W7, W8 and V2 are subject to surface water augmentation via the WMS. GEC has not observed signs of significant leakage of water on adjacent quarry faces. GHD Contractors operate the WMS and are able to maintain target water levels in Wetlands W7, W8 and V2, which have approved buffer widths of 15 to 25 m, with the quarry face being approximately 20 to 30 m from the adjacent wetlands. Any water leaking from a wetland in proximity to a dewatered quarry face will have a gradient that leads from the wetland towards the quarry face. GEC is not aware of any pathway for the "by-products from the detonation of explosives" to enter the water column in an adjacent wetland. Wetland W7, W8 and V2 are hydrologically isolated features.	

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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	**Explotech Engineering Ltd.** As noted, neither the MECP sensitive receptor limits or DFO guidelines are applicable to Herpetofauna. Any suggestion to introduce a limit would be inappropriate. **Goodban Ecological Consulting Inc. (GEC)** In GEC's opinion, Matrix Solutions has not demonstrated the potential for salamander breeding pools to be impacted by blasting activities and only conjectured that this is the case. With 30+ years of experience working at quarry sites in southern Ontario, GEC is not aware of situations where quarry blasting in general proximity to a wetland or breeding pool has resulted in negative effects on amphibians (adults, eggs or larvae). GEC is not aware of any scientific literature that supports the speculation by Matrix Solutions. GEC is aware of many examples of ponds and wetlands in proximity to quarry faces continuing to support amphibian populations The proposed buffer width for Wetland U1 is 50 m. The future quarry face will actually be more than 50 m away from Wetland U1, because the overburden material must be sloped down to the top of bedrock. The approved buffer widths for Wetlands W7, W8 and V2 are considerably smaller and no negative effects have been observed during routine monitoring. Regarding timing restrictions for blasts in proximity to Wetland U1, Matrix Solutions has provided no evidence to support such a restriction. Additionally, please see GEC's response to Comments #4 & 5.	

Attachment A:

Acton Quarry Phase 2
May 28-29, 2022, Amphibian Rescue

Representative photographs taken by GEC

Goodban Ecological Consulting Inc. (GEC)

December 16, 2022

Photo 1: In late May 2022, Dufferin Aggregates voluntarily retained GEC to complete an amphibian rescue from the floor of Phase 2 of the Acton Quarry. The blasting crew had observed salamanders swimming in a shallow drainage ditch between two sump pools and reported this to Dufferin Aggregates. Dufferin was in the process of blasting the quarry floor to remove additional aggregate material.
GEC 2022-05-19

Photo 2: Blasting was temporarily ceased. GEC then confirmed that the salamanders were in fact Red-spotted Newts. Until a few years earlier, Phase 2 was partially flooded; water was gradually pumped out to allow for extraction of some reduced setbacks and the quarry floor. As the water receded, the Red-spotted Newts present must have found refuge in the sump pools and connecting ditch. GEC 2022-05-29

Photo 3: Blasting had already occurred to as close as 10 m of the drainage ditch (distance varied from 10 to 50 m, average distance was approximately 20 m), in the days prior to GEC's rescue actions. GEC 2022-05-29

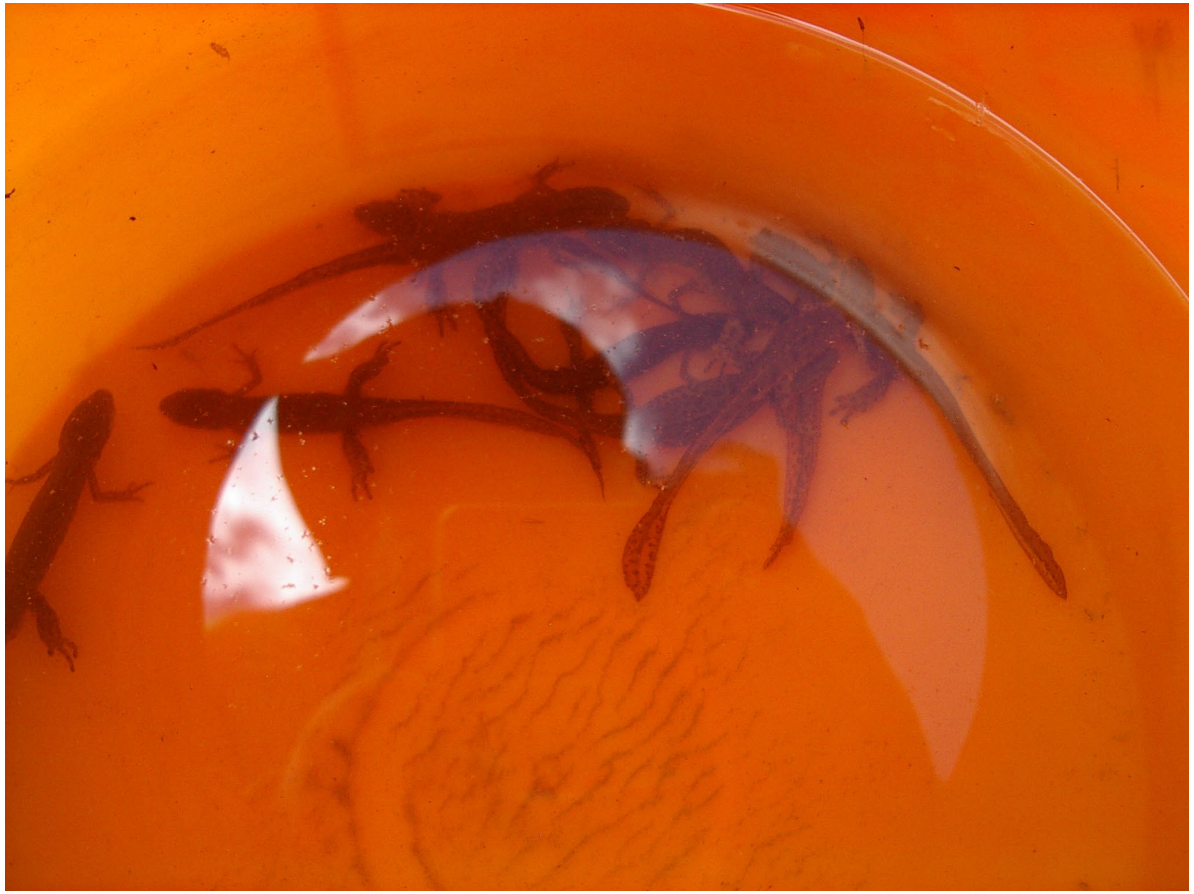

Photo 4: On May 28th GEC captured 9 Red-spotted Newts using a dip-net. Ten (10) minnow traps were set at the same time. All of the newts appeared vigorous and in good condition. GEC 2022-05-28

Photo 5: Using a combination of dip-nets and minnow traps, GEC captured another 23 Red-spotted Newts and 10 large Green Frog tadpoles. GEC 2022-05-29

Photo 6: All of the newts and tadpoles were vigorous and appeared in good condition. Some of the newts were exhibiting mating/courtship behaviour. GEC 2022-05-29