Proposed Burlington Quarry Expansion JART COMMENT SUMMARY TABLE – Air Quality

Please accept the following as feedback from the Burlington 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 (February 2021)	Reference	Source of Comment	Applicant Response (July 2021)	JART Response January 2022	Applicant Response January 2022
Report/Date: Air Quality Study, March 2020			**Author: BCX Environmental Consulting**			
1.	Their analysis limited the computed air quality impacts by breaking the project up into smaller segments (phases) which were each evaluated separately. The BCX report should clearly indicate whether any of the phases will overlap.	General	Gray Sky Solutions	No, the phases will not overlap.	Comment addressed.	
2.	The dispersion model receptors were restricted to areas immediately surrounding the facility and did not include any receptors at distances further away from the facility, including areas of larger population (and exposure). Most of the larger computed impacts were fairly close to the sources, however it would be useful to also have estimated impacts in a larger geographical area. The modelled receptors should include a broader geographic area, extending to at least 5.0 kilometres from the facility.	General	Gray Sky Solutions	Typically the study area for an air quality study for an aggregate quarry is 1km because the highest concentrations fall close to the property line. For this study, BCX conservatively chose approximately a 3km study area to demonstrate to residents in the vicinity of the quarry that air quality criteria will be met. Within the 3km, the highest concentrations occur at the closer receptors to the quarry and are below the air quality criteria. At 5km the concentrations are lower and will still be below the air quality criteria. At 5km, the concentrations are close to background levels. (i.e. the quarry has little or no impact on air quality at 5km) The air quality study is not intended to be a risk assessment/population exposure study.	Comment addressed.	

3.	The analysis appears to include a fairly thorough inventory of all the various emission- generating activities in each phase, however they relied almost entirely on US EPA AP-42 emission factors, many of which have very low data quality ratings, and some of which are not directly applicable to the source in question at the proposed facility. The AP-42 document makes it very clear that these lower rated emission factors should only be used as a last resort, and it is highly recommended that source-specific emission factors should be sought, either from source testing at the facility, or from directly applicable source tests from similar nearby sources. Although there may not be are any better (textbook) or more recent data sources for some of these activities, many of the AP-42 emission factors were obtained from very old sources (over 40 years old) and are only marginally related to the activities at the proposed Burlington site. Using such low quality emission factors will likely result in significantly large uncertainties in the modeled air quality impacts. A range of potential emission levels (and exposures) should be developed based on lower and upper bound emissions factors (which generally exist in AP-42 and its supporting documents). A careful review of each of the emissions factors used in the BCX analysis should be conducted to determine those emission factors that are not representative of actual emission levels at the proposed site, and the potential errors (and possible underprediction) due to the use of the emission factors to estimate emission levels. Source testing of existing operations at the facility should also be conducted where applicable. The SO_2 emission factors that were used for diesel-fired engines are rated (in AP-42) as quality D (marginal), and the B(a)P emissions factors for diesel engines are rated E (marginal). The emission factors for Sand and Gravel processing were obtained from AP-42, Section 11.19.2 (mistakenly quoted in BCX Appendix B as Section 11.9.2), where it is stated that “The emission factors for industrial sand storage and screening presented in Table 11.19.1-1 are not recommended as surrogates for construction sand and gravel processing, because they are based on emissions from dried sand and may result in overestimates of emissions from those sources. Construction sand and gravel are processed at much higher moisture contents.” PM emission factors for controlled tertiary crushing and controlled and uncontrolled screening were taken from AP-42, Section 11.19.2, and are all rated E (marginal). As stated in AP-42 (Section 11.19.2.2), “Factors affecting emissions from either source category [stone quarrying or processing] include the stone size distribution and the surface moisture content of the stone processed, the process throughput rate, the type of equipment and operating practices used, and topographical and climatic factors.” PM emission factors for conveyor transfers and rock truck unloading were also taken from AP-42 (Section 11.19.2) and are all rated E (marginal). Estimates of emission rates using emission factors from AP-42 that are rated D or E cannot be	General	Gray Sky Solutions	US EPA AP-42 emission factors are standardly accepted by the Ontario Ministry of the Environment, Conservation and Parks (Ministry) for air quality studies and Environmental Compliance Approvals (ECAs) for aggregate sites. The key to using these emission factors is to ensure that the emission scenarios assessed are conservative (i.e. they represent maximum emissions scenarios). For this study, the following conservative assumptions were made: 1. All operations were assumed to occur simultaneously at their maximum rates unless specifically limited. In reality, this will not occur. 2. Truck volumes used were very conservative. 3. Assumed all NOx emissions are converted to NO2 (i.e. the ozone limiting methods (OLM) were not used). 4. Wet/dry depletion options were not used in modelling. 5. Met anomalies were not removed as is permitted by the Ministry. 6. Conservative background concentrations were added to the maximum concentrations at sensitive receptors. Based on this, emission estimates are expected to be conservative.	The US EPA AP-42 emissions factors may, in fact, be accepted by the Ontario Ministry of the Environment, Conservation and Parks (Ministry), however that doesn’t mean that the emission factors are applicable to this quarry, or even marginally accurate. Within the documentation (appendices) provided in AP-42 is important information regarding the sources of the data that were used to develop the emissions factors, including ranges of values that were obtained from source tests at various sources. These data could be used to evaluate the potential range of emission factors that may be appropriate for the quarry and could therefore be used to develop an analysis of the uncertainty of the emissions factors and the resulting uncertainty of the modeling results (which may be considerable) that were obtained using the AP-42 emissions factors. An uncertainty analysis would provide a range of potential air quality concentration impacts, rather than a single estimate of the impacts. AP-42 clearly states that those emissions factors that are rated as marginal in quality should only be used as a last resort, if no local or site-specific data are available. The quarry has been operating for a number of years, and site-specific source test data could have easily been obtained that would provide better emission factor estimates than those from AP-42. The list of reasons that were provided that purportedly provide evidence that the estimated air quality impacts were “conservative” do not include any consideration of the emission factors that are the most important component of the emissions estimates.	The emission factors used in the AQS contains a range of data quality ratings (above average, average, marginal) and not, as implied only marginal. BCX analysed the contribution of various data quality rated emission groups to the receptor with the maximum PM2.5 (24hr avg) concentration. The contribution of the marginal data quality group is approximately 38%. If the contribution of the marginal data quality group is conservatively doubled, the PM2.5 (24hr avg) modelling result is still predicted to be below the PM2.5 (24hr avg) criterion. Please see attached sheets for details. While it may be feasible to obtain source test data for some emission sources such as stacks, source testing of fugitive sources such as crushers is not a simple task as implied. Further, in Ontario, source testing that has not been Ministry approved is rated Marginal or Uncertain. Obtaining Ministry approved data is significant undertaking and the Ministry only uses their resources for regulatory compliance purposes (i.e. not for general Air Quality Studies). As previously stated, the emission estimates were conservatively developed and are consistent with normal practices for both general Air Quality Studies and regulatory compliance assessments in Ontario.

	considered reliable for the Burlington Quarry facility.					
4.	Although the estimated (modeled) levels of particulate matter (PM) were below acceptable “air quality criteria”, there are still potential health effects (mortality and morbidity risk) associated with the emitted PM and these additional risks should be evaluated.	General	Gray Sky Solutions	This air quality study (AQS) relies on air quality standards set by the province or Environment Canada where provincial standards are not available. This AQS considers the health effects of PM by comparing PM2.5 modelled concentrations against the Canadian Ambient Air Quality Standards (CAAQS). The PM2.5 standards have been set by the Canadian Council of Ministers of the Environment (CCME) to be protective of health. The assessment very conservatively compares the maximum 24-hour and annual concentrations to the CAAQS which are in fact based on a 3- year average of the annual 98th percentile of the daily 24-hour average concentrations and 3-year average of the annual average of the daily 24- hour average concentrations, respectively. The maximum concentrations of PM2.5 at the property line and at all sensitive receptors are below the CAAQS. The AQS is not intended to be a risk	Comment addressed.	

				assessment.		
5.	The background level for B(a)P was obtained from monitoring data collected at Newmarket and Simcoe (Barrie), which are located 78.0 kilometres and 109.0 kilometres, respectively, from the Nelson quarry, and are likely not representative of the air quality in the vicinity of the quarry. Further analysis of these data needs to be performed to justify their use in establishing background B(a)P levels, including potentially collecting local B(a)P data to determine background B(a)P levels.	General	Gray Sky Solutions	The background level for B(a)P was obtained from the Simcoe National Air Pollution Surveillance (NAPS) ambient monitoring station located in the township of Simcoe (not Barrie) approximately 65km southwest of the Nelson Quarry. This station is located in a reasonably similar rural/suburban location to the site. Air quality studies (AQS) in Ontario rely on background data from ambient stations and this AQS follows the accepted approach in Ontario. B(a)P data is also available from one closer ambient monitoring station, the Toronto West MECP ambient monitoring station (approximately 50km away). This station is within the City of Toronto	Comment addressed.	

				adjacent to a major highway. A comparison of the B(a)P data from both stations shows that the background levels are similar. The background chosen is, therefore, considered representative and fairly consistent across Ontario.		
6.	The meteorological preprocessor for the AERMOD model (AERMET) has been updated (in 2011) to include a separate processing tool (AERMINUTE) that is recommended to be used to account for calm wind speeds when using hourly wind data from nearby airports. The BCX report should indicate where the meteorological data were obtained (and assess whether it is close enough to reliably represent conditions at the Burlington site), and whether one-minute (ASOS) wind data were used to reduce the number of calm winds (using AERMINUTE). The AERMOD computer files that were received do not include the AERMET processing files.	General	Gray Sky Solutions	The regulatory body, Ontario Ministry of the Environment, Conservation and Parks (Ministry) processed the surface and upper meteorological data using AERMET to develop an AERMOD ready site-specific met set to be used for this site. The Ministry has their own procedure to treat calm hours from the met data set. The Ministry does not include the AERMET processing files when they provide the AERMOD ready site- specific met set.	Comment addressed.	
7.	The BCX modeling report indicates that the traffic was represented in the modeling using a “typical shipping” assumption. However the traffic report for the proposed quarry extension (Paradigm Transportation Solutions Limited, report dated February 2020) indicates that “the site’s the weekday AM peak hour truck generation is forecast to be 111 truck trips…”, which is significantly greater than the average daily truck traffic and would therefore generate much higher emissions during morning hours. The modeling therefore needs to include a non-uniform diurnal distribution of traffic emissions that includes the peak AM traffic density.	General	Gray Sky Solutions	Per the Traffic Study (Feb 2020), 111 truck trips means 56 inbound and 55 outbound trips (i.e. one-way trips). Trucks/day or trucks/hr in the Air Quality Study (AQS) means a two-way round trip of those trucks for the purposes of emission estimates. 111 truck trips will be equivalent to 56 trucks/hr in the AQS. Using a 24-hr average emission rate is an acceptable method per the Ministry guidance documents for contaminants with 24-hr average standards such as PM2.5. For this AQS, the daily truck emission rate (daily truck traffic emissions over 24 hrs is assumed to occur equally over 24 hrs. Since, dispersion is typically poor at night and truck traffic will be minimal at night, this approach will result in a similar or more conservative 24-hr average concentration than if a non-uniform diurnal distribution of traffic emissions was assumed. Furthermore, daily trucks entering the site assumed in the air quality study was 469 to 681(trucks/day depending on the month), which is very conservative compared to the approximate equivalent of 400	It is a fairly simple task to include a diurnal profile of emissions in the AERMOD model to address the non-uniform distributions of hourly truck traffic. Although (as the MHBC response states) dispersion is typically poor at night (resulting in higher concentration impacts per truck trip for those hours), dispersion is also often poor in the early morning hours which would potentially increase the impacts significantly during those hours when peak traffic densities are expected to occur. The modeling needs to be revised to account for the peak hourly truck traffic (111 trips per hour).	As requested, the maximum hourly trucking of 112 truck trips per hour were updated in the calculation sheets. BCX confirmed with the Traffic Study consultant that the AM Peak hour does not mean maximum trucks entering the quarry at that specific hour. The AM Peak Hour per the traffic study means the maximum car and trucks on the public road. (e.g. rush hour traffic) The maximum hourly trucking distribution is attached. Maximum hourly trucks actually occur in the 8am to 3pm time range. Notwithstanding, BCX tested the sensitivity of trucking variable emissions for PM2.5 (24hr) in AERMOD for two scenarios: 1. Peak hourly traffic was very conservatively concentrated into morning hours as requested. 2. Actual expected truck distribution per hour as provided in Appendix B of the Traffic Study. Modelling results PM2.5 (24hr) shows that there would be negligible change and that the AQS conclusions remain unchanged (i.e. PM2.5 24-hr avg

				trucks per day in the traffic study. The AQS assumed for contaminants with 1-hr average standards (e.g. Nitrogen Dioxide (NO2)), an hourly truck rate of 67 to 84 trucks/hour (depending on month). The AQS 67 to 84 trucks/hour is equivalent to 67x2=134 to 84x2=168 truck trips in the Traffic Study. The hourly truck number used for the AQS is much higher than the 111 truck trips (peak hour) in the Traffic Study. The AQS did not use a "typical shipping" assumption and used a very conservative worst case shipping assumption. BCX worked in collaboration with Paradigm Transportation Solutions Limited and was aware of the conservative AQS truck assumptions compared to the traffic study. BCX purposely kept the theoretical worst case assumptions to be conservative.		concentrations remain below the criteria) Please see attached sheets and modelling file for details. As explained in the previous BCX response, contaminants with 1-hr average standards (e.g. Nitrogen Dioxide (NO2)) have already been modelled conservatively using more than the peak hourly traffic trips (>111) and assuming the peak hour can occur any hour in the 24 hour day. Per the Traffic Study, peak traffic counts are expected in the time range of 8am to 3pm and would not be occurring every single hour of the day.
8.	Does Nelson track or have any data on emissions or undertake monitoring related to air quality from their current operation?	General	Halton Region	Nelson has a detailed Dust Management Plan. Nelson completes monitoring checklists from their Dust Management Plan. With the DMP in place, dust from the site is expected to be minimized.	How do we know this is the case if no active monitoring is provided? (Point observation checklists only.) How does the proposal contribute to the overall improvement of air quality in Halton Region? Dust clouds were observed on the site visit (November 24, 2021), and a delegation raised dust as an issue at the Region's statutory public meeting. Dust is to be mitigated on site (Provincial Standards, Category 2, section 3.1). This standard does not appear to be met by the current operation today. The application needs to demonstrate on the site plan the improvements to be made to contain dust on site.	An effective BMP that requires documentation to show that measures are being implemented, recorded and where necessary improved upon is highly effective. Relying on periodic ambient monitoring at a few locations is a less effective tool than having a robust dust management plan. The dust management plan is a living document that requires regular review to confirm that fugitive dust is being properly managed. Originally, Nelson used informal dust management procedures. This has now been replaced with a formal dust management plan which will be required under the site plan. It may be possible to observe dust on site. However, the purpose of the dust management plan is to prevent fugitive dust impacts off-site. On a regional level no change in air quality is expected from the proposed

						extension. Concentrations from the quarry drop off rapidly with distance since emission sources are low in height.

AERMOD Modelling Source Emission Rates (Scenario A)

Source Type	Modelling Source ID	Scenario	Modelling Source Description	Maximum Daily Emission Rate (g/s)		Maximum Annual Emission Rate (g/s)		Maximum Hourly Emission Rate (g/s)	
				PM	PM2.5	PM	PM2.5	PM	PM2.5
				24 hr	24 hr	Annual	Annual	1 hr	1 hr
OPEN_PIT	PTDR_HMA	HMA	Existing Pit Drop Points HMA	7.80E-01	5.17E-02	9.08E-02	6.02E-03	0.00E+00	0.00E+00
OPEN_PIT	PTOS_HMA	HMA	Existing Pit Other Sources HMA	2.57E-01	4.43E-02	8.52E-02	6.87E-03	0.00E+00	0.00E+00
OPEN_PIT	PTDR_QE	SA	Existing Pit Drop Points - Quarry	1.25E+00	8.26E-02	7.59E-01	5.03E-02	0.00E+00	0.00E+00
OPEN_PIT	PTOS_QE	SA	Existing Pit Other Sources - Quarry	1.05E+00	4.09E-02	1.65E+00	6.29E-02	0.00E+00	0.00E+00
OPEN_PIT	PTOS_QEV	SA	Existing Pit Other Sources - Quarry - Trucks Hourly Variable	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.58E+00	1.79E-01
OPEN_PIT	PTOS_QA	SA	ScA quarry other sources	7.37E-01	3.35E-02	6.17E-01	2.49E-02	0.00E+00	0.00E+00
OPEN_PIT	PTOS_QAV	SA	ScA quarry other sources - Hourly Variable	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.17E-01	1.04E-02
POINT	BH_HMA	HMA	Existing HMA dryer baghouse	4.86E-01	2.94E-01	9.32E-02	5.64E-02	0.00E+00	0.00E+00
POINT	GEN_HMA	HMA	Existing Pit HMA RAP crusher generator	9.47E-03	9.47E-03	7.10E-03	7.10E-03	0.00E+00	0.00E+00
POINT	GEN1_QEX	SA	ScA/B/C/D Crushing Plant 1 Generator	2.87E-02	2.87E-02	2.15E-02	2.15E-02	0.00E+00	0.00E+00
POINT	GEN2_QEX	SA	ScA/B/C/D Crushing Plant 2 Generator	2.87E-02	2.87E-02	2.15E-02	2.15E-02	0.00E+00	0.00E+00

Note:

1 Emissions for material drop points (highlighted in blue) have been calculated for the six AERMOD wind categories. Emission rates for Category F are presented in this table.

Source I.D.	Scenario	Scenario	Source ID	Calculation Sheet	Description	Material	Modelled Source	Contaminant	CAS #	Averaging Period	Maximum Emission Rate (g/s)	Emission Estimating Technique	Emissions Data Quality	% of Overall Emissions
Q2Ru	SE	SE	Q2Ru	11A	Road dust emissions from processed limestone shipping trucks travelling on onsite unpaved road	-	PTOS_QEV	PM	PM	1 hr	9.71E-01	EF	AA	14.9%
		SE	Q2Ru	11A			PTOS_QEV	PM2.5	PM2.5	1 hr	2.76E-02	EF	AA	10.5%
Q1Rp	SE	SE	Q1Rp	11B	Road dust emissions from processed limestone shipping trucks travelling on onsite paved road	-	PTOS_QEV	PM	PM	1 hr	3.02E-01	EF	AA	4.6%
		SE	Q1Rp	11B			PTOS_QEV	PM2.5	PM2.5	1 hr	1.44E-02	EF	M	5.5%
Q1Tt	SE	SE	Q1Tt	11C	Tailpipe emissions from processed limestone shipping trucks travelling on onsite road	-	PTOS_QEV	PM	PM	1 hr	1.84E-02	EF	AA	0.3%
		SE	Q1Tt	11C			PTOS_QEV	PM2.5	PM2.5	1 hr	5.95E-03	EF	AA	2.3%
Q1Ti	SE	SE	Q1Ti	11D	Tailpipe emissions from processed limestone shipping trucks idling during loading	-	PTOS_QEV	PM	PM	1 hr	7.24E-03	EF	AA	0.1%
		SE	Q1Ti	11D			PTOS_QEV	PM2.5	PM2.5	1 hr	3.58E-03	EF	AA	1.4%
QRp-FILL	SE	SE	QRp-FILL	11B	Road dust emissions from rehab delivery trucks travelling on onsite paved road	-	PTOS_QEV	PM	PM	1 hr	2.84E-01	EF	AA	4.4%
		SE	QRp-FILL	11B			PTOS_QEV	PM2.5	PM2.5	1 hr	1.36E-02	EF	AA	5.1%
QTt-FILL	SE	SE	QTt-FILL	11C	Tailpipe emissions from rehab delivery trucks travelling on onsite road	-	PTOS_QEV	PM	PM	1 hr	2.53E-02	EF	AA	0.4%
		SE	QTt-FILL	11C			PTOS_QEV	PM2.5	PM2.5	1 hr	8.22E-03	EF	AA	3.1%
QTi-FILL	SE	SE	QTi-FILL	11D	Tailpipe emissions from rehab delivery trucks idling during unloading	-	PTOS_QEV	PM	PM	1 hr	3.69E-03	EF	AA	0.1%
		SE	QTi-FILL	11D			PTOS_QEV	PM2.5	PM2.5	1 hr	1.83E-03	EF	AA	0.7%
P1-Q4Ru	SA	SA	P1-Q4Ru	11A	Road dust emissions from processed limestone shipping trucks travelling on onsite unpaved road	-	PTOS_QEV	PM	PM	1 hr	2.91E+00	EF	M	44.8%
		SA	P1-Q4Ru	11A			PTOS_QEV	PM2.5	PM2.5	1 hr	8.29E-02	EF	M	31.4%
P1-Q1Rp	SA	SA	P1-Q1Rp	11B	Road dust emissions from processed limestone shipping trucks travelling on onsite paved road	-	PTOS_QEV	PM	PM	1 hr	9.05E-01	EF	AA	13.9%
		SA	P1-Q1Rp	11B			PTOS_QEV	PM2.5	PM2.5	1 hr	4.32E-02	EF	AA	16.4%
P1-Q1Tt	SA	SA	P1-Q1Tt	11C	Tailpipe emissions from processed limestone shipping trucks travelling on onsite road	-	PTOS_QEV	PM	PM	1 hr	5.51E-02	EF	AA	0.8%
		SA	P1-Q1Tt	11C			PTOS_QEV	PM2.5	PM2.5	1 hr	1.79E-02	EF	AA	6.8%
P1-Q1Ti	SA	SA	P1-Q1Ti	11D	Tailpipe emissions from processed limestone shipping trucks idling during loading	-	PTOS_QEV	PM	PM	1 hr	2.17E-02	EF	AA	0.3%
		SA	P1-Q1Ti	11D			PTOS_QEV	PM2.5	PM2.5	1 hr	1.07E-02	EF	AA	4.1%
P1-Q1Ru-FILL	SA	SA	P1-Q1Ru-FILL	11A	Road dust emissions from rehab delivery trucks travelling on onsite unpaved road (existing quarry road)	-	PTOS_QEV	PM	PM	1 hr	5.74E-01	EF	AA	8.8%
		SA	P1-Q1Ru-FILL	11A			PTOS_QEV	PM2.5	PM2.5	1 hr	1.63E-02	EF	M	6.2%
P1-Q2Ru-FILL	SA	SA	P1-Q2Ru-FILL	11A	Road dust emissions from rehab delivery trucks travelling on onsite unpaved road (extension quarry road)	-	PTOS_QAV	PM	PM	1 hr	3.14E-01	EF	AA	4.8%
		SA	P1-Q2Ru-FILL	11A			PTOS_QAV	PM2.5	PM2.5	1 hr	8.92E-03	EF	AA	3.4%
P1-QRp-FILL	SA	SA	P1-QRp-FILL	11B	Road dust emissions from rehab delivery trucks travelling on onsite paved road	-	PTOS_QEV	PM	PM	1 hr	1.00E-01	EF	AA	1.5%
		SA	P1-QRp-FILL	11B			PTOS_QEV	PM2.5	PM2.5	1 hr	4.79E-03	EF	AA	1.8%
P1-Q1Tt-FILL	SA	SA	P1-Q1Tt-FILL	11C	Tailpipe emissions from rehab delivery trucks travelling on onsite road (existing quarry road)	-	PTOS_QEV	PM	PM	1 hr	8.52E-03	EF	AA	0.1%
		SA	P1-Q1Tt-FILL	11C			PTOS_QEV	PM2.5	PM2.5	1 hr	2.76E-03	EF	AA	1.0%
P1-Q2Tt-FILL	SA	SA	P1-Q2Tt-FILL	11C	Tailpipe emissions from rehab delivery trucks travelling on onsite road (extension quarry road)	-	PTOS_QAV	PM	PM	1 hr	2.53E-03	EF	AA	0.0%
		SA	P1-Q2Tt-FILL	11C			PTOS_QAV	PM2.5	PM2.5	1 hr	8.19E-04	EF	AA	0.3%
P1-QTi-FILL	SA	SA	P1-QTi-FILL	11D	Tailpipe emissions from rehab delivery trucks idling during unloading	-	PTOS_QAV	PM	PM	1 hr	1.30E-03	EF	AA	0.0%
		SA	P1-QTi-FILL	11D			PTOS_QAV	PM2.5	PM2.5	1 hr	6.45E-04	EF	AA	0.2%

AERMOD Variable Emissions - Trucking - Theoretical All Morning

			max receptor	background	criteria	% of criteria
AM Peak Hour 7:30 to 8:30 per Traffic Study		PM2.5 ScA (Original AQS Result) ug/m3	4.098	12.04	27	60%
Hourly: 56 physical trucks (111 truck trips)						
Daily: 427 physical trucks (854 truck trips)	112 trips/hr	PM2.5 ScA (Truck Traffic Hourly Var) ug/m3	4.330	12.04	27	61%

AM Peak hour does not mean maximum trucks entering the quarry at that specific hour, AM Peak hour per the traffic study means the maximum car and trucks on the public road. (e.g. rush hour traffic)

Factor of 1 means assuming emissions from max hourly trips of 112 occuring in that hour

Ending Hour	Factor	Hourly Truck Trips Distribution Assumpt	Daily Total Max = 854 trips (i.e. sum of hourly will not exceed this)
1	0		
2	0		
3	0		
4	0		
5	0		
6	1	112	854
7	1	112	
8	1	112	
9	1	112	
10	1	112	
11	1	112	
12	1	112	
13	0.0820	70	Factor = 70/854
14	0		
15	0		
16	0		
17	0		
18	0		
19	0		
20	0		
21	0		
22	0		
23	0		
24	0		

AERMOD Variable Emissions - Trucking - Realistic Distribution

		max receptor	background	criteria	% of criteria
	PM2.5 ScA (Original AQS Result) ug/m3	4.10	12.04	27	60%
112 trips/hr	PM2.5 ScA (Truck Traffic Hourly Var - Morning Theoretical) ug/m3	4.33	12.04	27	61%
112 trips/hr	PM2.5 ScA (Truck Traffic Hourly Var - Realistic Distribution) ug/m3	3.63	12.04	27	58%
	PM ScA (Original AQS Result) ug/m3	54.18	48.17	120	85%
112 trips/hr	PM ScA (Truck Traffic Hourly Var - Morning Theoretical) ug/m3	56.50	48.17	120	87%
112 trips/hr	PM ScA (Truck Traffic Hourly Var - Realistic Distribution) ug/m3	45.40	48.17	120	78%

Factor of 1 means assuming emissions from max hourly trips of 112 occuring in that hour

Ending Hour	Factor	Hourly Truck Distribution Assumption (Appendix B of Traffic Report)
1	0.00	0
2	0.00	0
3	0.00	0
4	0.00	0
5	0.00	0
6	0.00	0
7	0.40	19
8	0.60	29
9	0.98	47
10	1.00	48
11	0.96	46
12	0.88	42
13	0.85	41
14	0.94	45
15	0.90	43
16	0.67	32
17	0.35	17
18	0.33	16
19	0.02	1
20	0.00	0
21	0.02	1
22	0.00	0
23	0.00	0
24	0.00	0

Daily Total Max = 427 trucks (i.e. sum of hourly will not exceed this)

427 Total Physical Truck Measured By Traffic Study (Appendix B)

Data Quality Grouping - Sensitivity Test

	max receptor	background	criteria	% of criteria
PM2.5 ScA (Truck Traffic Hourly Var - Realistic Distribution) ug/m3	3.630	12.04	27	58%
PM2.5 ScA (Truck Traffic Hourly Var) ug/m3 (New Theoretical)	5.010	12.04	27	63%

	Max conc. may not occur on same day ug/m3 at max receptor	% of total	Data Quality (PM2.5)
PTOS_QA	0.43	8.7%	Marginal
PTOS_QAV	0.06	1.2%	Above Average
PTOS_QE	0.81	16.5%	Marginal
PTOS_QEV	1.35	27.4%	Above Average
PTOSHMAV	0.53	10.8%	Above Average
BH_HMA	0.63	12.8%	Marginal
PTDR_HMA	0.09	1.8%	Above Average
PTDR_QE	0.14	2.8%	Above Average
PTOS_HMA	0.88	17.9%	Average
Total Conc (not same day, will not be exactly the same as 3.63)	4.92		
Approx. Marginal Data Quality (Contribution to % Conc. At Max Receptor)		38.0%	

PM2.5 ScA (Truck Traffic Hourly Var) ug/m3	3.630	Total
	1.380	Marginal Portion
	2.250	Non-marginal Portion
PM2.5 ScA (Truck Traffic Hourly Var) ug/m3 (New Theoretical)	2.759	Marginal Portion x2 (Theoretically Doubled)
	2.250	Non-marginal Portion
	5.010	Total

Calculation Sheet 9A
Unpaved Road Dust Emissions

Unpaved Road Dust Emission Rate [g/s] = Unpaved Road Emission Factor [g/VKT] x Trip Distance [km] x (1-Control Efficiency [%]) / Averaging Period Converted to seconds [years to seconds/days to seconds/hours to seconds])

Unpaved Road Emission Factor E (lb/VMT) = k * ((s/12)^a * (W/3)^b) [Note 1]

Source I.D.	Scenario	Operation	Activity	Contaminant	CAS No.	Trip ID	Trip Distance (km) [Note 2]	Number of Trucks per Hour (roundtrip 56x2=112 trips/hr)	Empty Vehicle Weight (tonne) [Note 3]	Load Weight (tonne)	Loaded Vehicle Weight (tonne)	Vehicle Weight (ton) [Note 3]	Silt Content of Unpaved Road, s (%) [Note 1]	k [Note 1]	a [Note 1]	b [Note 1]	Emission Factor (g/VKT) [Note 4]	Uncontrolled Emissions (g/s)	Control Efficiency (%) [Note 5]	Controlled Emissions (g/s)	Averaging Period [Note 6]	US EPA AP42 Data Quality	Estimation Technique
Quarry Operations - Scenario A (Phase 1a/1b & Phase 2)																							
P1-Q4Ru	SA	SA-Quarry Operations	Road dust emissions from processed limestone shipping trucks travelling on onsite unpaved road	PM	PM	Q-SHIPP	1.4	50	12.0	30	42	29.8	8.3	4.9	0.7	0.45	2996.850	5.83E+01	95%	2.91E+00	1 hr	B	EF
P1-Q4Ru	SA	SA-Quarry Operations	Road dust emissions from processed limestone shipping trucks travelling on onsite unpaved road	PM2.5	PM2.5	Q-SHIPP	1.4	50	12.0	30	42	29.8	8.3	0.15	0.9	0.45	85.220	1.66E+00	95%	8.29E-02	1 hr	B	EF
P1-Q1Ru-FILL	SA	SA-Quarry Operations	Road dust emissions from rehab delivery trucks travelling on onsite unpaved road (existing quarry road)	PM	PM	Q-FILL-E	2.38	6	14.0	22	36	27.6	8.3	4.9	0.7	0.45	2894.838	1.15E+01	95%	5.74E-01	1 hr	B	EF
P1-Q1Ru-FILL	SA	SA-Quarry Operations	Road dust emissions from rehab delivery trucks travelling on onsite unpaved road (existing quarry road)	PM2.5	PM2.5	Q-FILL-E	2.38	6	14.0	22	36	27.6	8.3	0.15	0.9	0.45	82.319	3.27E-01	95%	1.63E-02	1 hr	B	EF
P1-Q2Ru-FILL	SA	SA-Quarry Operations	Road dust emissions from rehab delivery trucks travelling on onsite unpaved road (extension quarry road)	PM	PM	Q-FILL	1.3	6	14.0	22	36	27.6	8.3	4.9	0.7	0.45	2894.838	6.27E+00	95%	3.14E-01	1 hr	B	EF
P1-Q2Ru-FILL	SA	SA-Quarry Operations	Road dust emissions from rehab delivery trucks travelling on onsite unpaved road (extension quarry road)	PM2.5	PM2.5	Q-FILL	1.3	6	14.0	22	36	27.6	8.3	0.15	0.9	0.45	82.319	1.78E-01	95%	8.92E-03	1 hr	B	EF

Calculation Sheet 9B
Paved Road Dust Emissions

Road Dust Emission Rate [g/s] = E [g/VMT] x Number of Vehicles x Distance Travelled [miles] / Averaging Period Converted to seconds [years to seconds/days to seconds/hours to seconds]

Paved Road Emission Factor E (g/VMT) = k * ((sL)^0.91 * (W)^1.02) [Note 1]

E = the particulate emission factor [g/VMT]
k = particulate size multiplier [g/VMT]
sL = silt loading [g/m^2]
W = average weight of vehicle [tons]

Roadway Average Daily Traffic (ADT)	sL
<500	0.6
50-5000	0.2
5000-10000	0.06
>10000	0.03

Source ID	Scenario	Operation	Source Description	Contaminant	CAS Number	Trip ID	Averaging Period [Note 2]	k (g/VMT) [Note 1]	ADT	Number of Trucks per Hour (roundtrip 56x2=112 trips/hr)	Distance Travelled (miles) [Note 4]	sL (g/m^2) [Note 1]	W (tons) [Note 1]	E (g/VMT) [Note 1]	Control Efficiency (%) [Note 5]	Emission Rate (g/s)	US EPA AP42 Data Quality	Estimation Technique
Quarry Operations - Scenario A (Phase 1a/1b & Phase 2)																		
P1-Q1Rp	SA	SA-Quarry Operations	Road dust emissions from processed limestone shipping trucks travelling on onsite paved road	PM	PM	Q-SHIPP	1 hr	5.24	<500	50	1.243	0.6	29.76	1.05E+02	50%	9.05E-01	A	EF
P1-Q1Rp	SA	SA-Quarry Operations	Road dust emissions from processed limestone shipping trucks travelling on onsite paved road	PM2.5	PM2.5	Q-SHIPP	1 hr	0.25	<500	50	1.243	0.6	29.76	5.00E+00	50%	4.32E-02	D	EF
P1-QRp-FILL	SA	SA-Quarry Operations	Road dust emissions from rehab delivery trucks travelling on onsite paved road	PM	PM	Q-FILL-E	1 hr	5.24	<500	6	1.243	0.6	27.56	9.69E+01	50%	1.00E-01	A	EF
P1-QRp-FILL	SA	SA-Quarry Operations	Road dust emissions from rehab delivery trucks travelling on onsite paved road	PM2.5	PM2.5	Q-FILL-E	1 hr	0.25	<500	6	1.243	0.6	27.56	4.62E+00	50%	4.79E-03	D	EF

Calculation Sheet 9C
Tailpipe Travelling Emissions

Tailpipe Travelling Emission Rate [g/s] = Number of Vehicles x Distance Travelled per Vehicles [km] x 0.621 [miles/ km] x Travelling Emission Factor [g/VMT] / Averaging Period Converted to Seconds [years to seconds/days to seconds/hours to seconds]

Source ID	Scenario		Source Description	Contaminant	CAS No.	Trip ID	Vehicle Type	Trip Distance (km) [Note 1]	Number of Trucks per Hour (roundtrip 56x2=112 trips/hr	Travelling Emission Factor (g/VMT) [Note 2]	Emission Rate (g/s)	Averaging Period [Note 3]	Data Quality	Estimation Technique
Quarry Operations - Scenario A (Phase 1a/1b & Phase 2)														
P1-Q1Tt	SA	SA-Quarry Operations	Tailpipe emissions from processed limestone shipping trucks travelling on onsite road	PM	PM	Q-SHIPP	Aggregate/Limestone/RAP truck	3.4	50	1.88E+00	5.51E-02	1 hr	Above Average	MOVES EF
P1-Q1Tt-FILL	SA	SA-Quarry Operations	Tailpipe emissions from rehab delivery trucks travelling on onsite road (existing quarry road)	PM	PM	Q-FILL-E	Aggregate/Limestone/RAP truck	4.38	6	1.88E+00	8.52E-03	1 hr	Above Average	MOVES EF
P1-Q2Tt-FILL	SA	SA-Quarry Operations	Tailpipe emissions from rehab delivery trucks travelling on onsite road (extension quarry	PM	PM	Q-FILL	Aggregate/Limestone/RAP truck	1.3	6	1.88E+00	2.53E-03	1 hr	Above Average	MOVES EF
P1-Q1Tt	SA	SA-Quarry Operations	Tailpipe emissions from processed limestone shipping trucks travelling on onsite road	PM2.5	PM2.5	Q-SHIPP	Aggregate/Limestone/RAP truck	3.4	50	6.09E-01	1.79E-02	1 hr	Above Average	MOVES EF
P1-Q1Tt-FILL	SA	SA-Quarry Operations	Tailpipe emissions from rehab delivery trucks travelling on onsite road (existing quarry road)	PM2.5	PM2.5	Q-FILL-E	Aggregate/Limestone/RAP truck	4.38	6	6.09E-01	2.76E-03	1 hr	Above Average	MOVES EF
P1-Q2Tt-FILL	SA	SA-Quarry Operations	Tailpipe emissions from rehab delivery trucks travelling on onsite road (extension quarry	PM2.5	PM2.5	Q-FILL	Aggregate/Limestone/RAP truck	1.3	6	6.09E-01	8.19E-04	1 hr	Above Average	MOVES EF

Calculation Sheet 9D
Tailpipe Idling Emissions

Tailpipe Idling Emission Rate [g/s] = Number of Vehicles x Distance Travelled per Vehicle [km] x 0.621 [miles/ km] Speed [miles/h] x Idling Emission Factor [g/VMT] x Idling Time [h] / Averaging Period Converted to Seconds [years to seconds/days to seconds/hours to seconds]

Source ID	Scenario	Operation	Source Description	Contaminant	CAS No.	Trip ID	Vehicle Type	Number of Trucks per Hour (roundtrip 56x2=112 trips/hr) [Note 1]	Idling "Speed" (miles/h) [Note 2]	Idling Time (h) [Note 1]	Idling Emission Factor (g/VMT) [Note 3]	Emission Rate (g/s)	Averaging Period [Note 4]	Data Quality	Estimation Technique
Quarry Operations - Scenario A (Phase 1a/1b & Phase 2)															
P1-Q1Ti	SA	SA-Quarry Operations	Tailpipe emissions from processed limestone shipping trucks idling during loading	PM	PM	Q-SHIPP	Aggregate/Limestone/RAP truck	50	2.5	0.17	3.75E+00	2.17E-02	1 hr	Above Average	MOVES EF
P1-QTi-FILL	SA	SA-Quarry Operations	Tailpipe emissions from rehab delivery trucks idling during unloading	PM	PM	Q-FILL	Aggregate/Limestone/RAP truck	6	2.5	0.08	3.75E+00	1.30E-03	1 hr	Above Average	MOVES EF
P1-Q1Ti	SA	SA-Quarry Operations	Tailpipe emissions from processed limestone shipping trucks idling during loading	PM2.5	PM2.5	Q-SHIPP	Aggregate/Limestone/RAP truck	50	2.5	0.17	1.86E+00	1.07E-02	1 hr	Above Average	MOVES EF
P1-QTi-FILL	SA	SA-Quarry Operations	Tailpipe emissions from rehab delivery trucks idling during unloading	PM2.5	PM2.5	Q-FILL	Aggregate/Limestone/RAP truck	6	2.5	0.08	1.86E+00	6.45E-04	1 hr	Above Average	MOVES EF

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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519-896-3163 cbowness@ptsl.com

Count Name: Gravel Pit - Number 2 Sideroad east of Guelph Line
Site Code:
Start Date: 10/08/2019

Turning Movement Data

Start Time	Number 2 Sideroad Eastbound					Number 2 Sideroad Westbound					Gravel Pit Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
4:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Hourly Total	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
5:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 AM	0	4	0	0	4	2	1	0	0	3	0	0	0	0	0	7
5:30 AM	2	3	0	0	5	1	1	0	0	2	0	0	0	0	0	7
5:45 AM	2	1	0	0	3	1	6	0	0	7	0	0	0	0	0	10
Hourly Total	4	8	0	0	12	4	8	0	0	12	0	0	0	0	0	24
6:00 AM	0	5	0	0	5	1	8	0	0	9	1	0	0	0	1	15
6:15 AM	1	2	0	0	3	1	9	0	0	10	2	0	0	0	2	15
6:30 AM	0	10	0	0	10	0	8	0	0	8	9	0	0	0	9	27
6:45 AM	0	11	0	0	11	4	8	0	0	12	7	0	0	0	7	30
Hourly Total	1	28	0	0	29	6	33	0	0	39	19	0	0	0	19	87
7:00 AM	1	8	0	0	9	6	8	0	0	14	9	0	0	0	9	32
7:15 AM	0	22	0	0	22	0	8	0	0	8	6	0	0	0	6	36
7:30 AM	0	22	0	0	22	11	11	0	0	22	5	0	0	0	5	49
7:45 AM	0	21	0	0	21	6	14	0	0	20	9	0	0	0	9	50
Hourly Total	1	73	0	0	74	23	41	0	0	64	29	0	0	0	29	167
8:00 AM	0	24	0	0	24	10	10	0	0	20	16	0	0	0	16	60
8:15 AM	0	18	0	0	18	7	8	0	0	15	11	0	0	0	11	44
8:30 AM	1	11	0	0	12	6	9	0	0	15	9	1	0	0	10	37
8:45 AM	0	11	0	0	11	7	5	0	0	12	8	2	0	0	10	33
Hourly Total	1	64	0	0	65	30	32	0	0	62	44	3	0	0	47	174
9:00 AM	0	6	0	0	6	4	19	0	0	23	10	0	0	0	10	39
9:15 AM	0	6	0	0	6	8	15	0	0	23	12	0	0	0	12	41
9:30 AM	0	6	0	0	6	6	12	0	0	18	16	0	0	0	16	40
9:45 AM	0	8	0	0	8	3	9	0	0	12	10	0	0	0	10	30
Hourly Total	0	26	0	0	26	21	55	0	0	76	48	0	0	0	48	150
10:00 AM	1	2	0	0	3	1	11	0	0	12	9	0	0	0	9	24
10:15 AM	0	6	0	0	6	8	15	0	0	23	9	1	0	0	10	39
10:30 AM	0	6	0	0	6	1	13	0	0	14	6	0	0	0	6	26
10:45 AM	0	3	0	0	3	3	15	0	0	18	20	1	0	0	21	42
Hourly Total	1	17	0	0	18	13	54	0	0	67	44	2	0	0	46	131
11:00 AM	0	9	0	0	9	3	9	0	0	12	14	1	0	0	15	36

11:15 AM	0	8	0	0	8	6	4	0	0	10	15	0	0	0	15	33
11:30 AM	0	7	0	0	7	3	9	0	0	12	6	0	0	0	6	25
11:45 AM	0	7	0	0	7	7	12	0	0	19	6	0	0	0	6	32
Hourly Total	0	31	0	0	31	19	34	0	0	53	41	1	0	0	42	126
12:00 PM	0	8	0	0	8	5	10	0	0	15	10	0	0	0	10	33
12:15 PM	0	3	0	0	3	4	13	0	0	17	11	0	0	0	11	31
12:30 PM	0	2	0	0	2	6	12	0	0	18	10	0	0	0	10	30
12:45 PM	0	7	0	0	7	1	12	0	0	13	10	0	0	0	10	30
Hourly Total	0	20	0	0	20	16	47	0	0	63	41	0	0	0	41	124
1:00 PM	0	10	0	0	10	5	11	0	0	16	18	0	0	0	18	44
1:15 PM	0	11	0	0	11	6	7	0	0	13	12	0	0	0	12	36
1:30 PM	0	5	0	0	5	12	12	0	0	24	5	0	0	0	5	34
1:45 PM	0	7	0	0	7	4	7	0	0	11	10	0	0	0	10	28
Hourly Total	0	33	0	0	33	27	37	0	0	64	45	0	0	0	45	142
2:00 PM	0	9	0	0	9	5	14	0	0	19	10	0	0	0	10	38
2:15 PM	0	6	0	0	6	9	13	0	0	22	10	0	0	0	10	38
2:30 PM	0	11	0	0	11	9	14	0	0	23	10	0	0	0	10	44
2:45 PM	0	2	0	0	2	8	8	0	0	16	13	0	0	0	13	31
Hourly Total	0	28	0	0	28	31	49	0	0	80	43	0	0	0	43	151
3:00 PM	0	5	0	0	5	10	2	0	0	12	16	1	0	0	17	34
3:15 PM	1	4	0	0	5	10	10	0	0	20	4	0	0	0	4	29
3:30 PM	0	8	0	0	8	15	2	0	0	17	8	0	0	0	8	33
3:45 PM	0	9	0	0	9	15	5	0	0	20	3	0	0	0	3	32
Hourly Total	1	26	0	0	27	50	19	0	0	69	31	1	0	0	32	128
4:00 PM	0	15	0	0	15	21	4	0	0	25	4	0	0	0	4	44
4:15 PM	0	14	0	0	14	19	3	0	0	22	3	1	0	0	4	40
4:30 PM	1	12	0	0	13	28	1	0	0	29	3	0	0	0	3	45
4:45 PM	1	16	0	0	17	22	1	0	0	23	6	0	0	0	6	46
Hourly Total	2	57	0	0	59	90	9	0	0	99	16	1	0	0	17	175
5:00 PM	0	6	0	0	6	24	0	0	0	24	5	2	0	0	7	37
5:15 PM	0	16	0	0	16	32	0	0	0	32	2	1	0	0	3	51
5:30 PM	0	11	0	0	11	38	0	0	0	38	1	0	0	0	1	50
5:45 PM	0	12	0	0	12	26	1	0	0	27	4	1	0	0	5	44
Hourly Total	0	45	0	0	45	120	1	0	0	121	12	4	0	0	16	182
6:00 PM	0	13	0	0	13	13	0	0	0	13	0	0	0	0	0	26
6:15 PM	0	6	0	0	6	21	0	0	0	21	1	0	0	0	1	28
6:30 PM	0	4	0	0	4	12	0	0	0	12	0	0	0	0	0	16
6:45 PM	0	5	0	0	5	11	0	0	0	11	0	0	0	0	0	16
Hourly Total	0	28	0	0	28	57	0	0	0	57	1	0	0	0	1	86
7:00 PM	0	9	0	0	9	6	0	0	0	6	0	0	0	0	0	15
7:15 PM	0	3	0	0	3	2	0	0	0	2	0	0	0	0	0	5
7:30 PM	0	4	0	0	4	4	0	0	0	4	0	0	0	0	0	8
7:45 PM	0	1	0	0	1	6	0	0	0	6	0	0	0	0	0	7
Hourly Total	0	17	0	0	17	18	0	0	0	18	0	0	0	0	0	35
8:00 PM	0	1	0	0	1	2	0	0	0	2	1	0	0	0	1	4
8:15 PM	0	3	0	0	3	4	0	0	0	4	0	0	0	0	0	7
8:30 PM	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	2
8:45 PM	0	3	0	0	3	2	0	0	0	2	0	0	0	0	0	5
Hourly Total	0	7	0	0	7	10	0	0	0	10	1	0	0	0	1	18
Grand Total	11	509	0	0	520	535	419	0	0	954	415	12	0	0	427	1901
Approach %	2.1	97.9	0.0	-	-	56.1	43.9	0.0	-	-	97.2	2.8	0.0	-	-	-
Total %	0.6	26.8	0.0	-	27.4	28.1	22.0	0.0	-	50.2	21.8	0.6	0.0	-	22.5	-