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)	JART Response (June 2023)
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 kilometers 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 considered reliable for the Burlington Quarry facility.	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.	BCX examined the emission factors that were used to develop emission rate estimates which had marginal ratings. They stated that the contribution of the sources in which marginal emission factors were used accounted for 38% of the total modeled $PM_{2.5}$ concentration (maximum 24-hour average). An attached table shows their calculation in which they identified three sources for which marginal emission factors were used (PTOS_QA, PTOS_QE, and BH-HMA). The table shows the modeled maximum 24-hour $PM_{2.5}$ concentration at the maximum impacted receptor location. From their modeling files, I was able to determine that the modeled maximum 24-hour $PM_{2.5}$ concentration (3.63 µg/m^3) occurred at receptor (UTM: 590803.61, 4806333.49) on December 2, 2017 (using the variable hourly emissions modeling scenario for morning truck trip emissions from sources PTOS_QAV and PTOS_QEV, identified as Scenario 2 in the discussion of Issue No. 7, below). The table shows the maximum 24-hour $PM_{2.5}$ concentration and the data quality rating used for nine modeled sources, however it is noted that the maximum concentration for each source may not (and, in fact, does not) occur on the same day (nor at the same location) as the modeled maximum 24-hour average $PM_{2.5}$ concentration for all sources. The maximum 24-hour average $PM_{2.5}$ concentrations for the nine modeled sources do not match the provided modeling output file. The source PTOSHMAV was included in their list (with a non-zero $PM_{2.5}$ contribution) despite the fact that emissions for that source were modeled with zero emissions. In addition, three of the modeled POINT sources (GEN1_QEX, GEN2_QEX, and GEN_HMA), which had non-zero modeled emissions, were not included in their list of sources (and no information on the data quality for these sources is included). I recalculated the fractional contribution from the sources with marginally rated emission factors to the maximum 24-hour $PM_{2.5}$ concentration using the modeling results (from Scenario 2, as described in Issue No. 7, below), as

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 assessment.	Comment addressed.		

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 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.	Comment addressed.		

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 trucks per day in the traffic study.	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 concentrations remain below the criteria)	Examination of the AERMOD modeling input files shows the two different scenarios that were run by BCX to include the diurnal profile of trucking emissions: Scenario 1, using constant (maximum hourly) emissions during all morning hours, and Scenario 2, using expected “actual” emissions for each hour (as provided in Appendix B of the Traffic Study). In the latest BCX response, there is an attached table showing the factors (multipliers) that were used to scale the hourly emissions for Scenario 1 (which match the factors used in the AERMOD input control file for sources PTOS_QAV and PTOS_QEV). A factor of 1.0 was used for hours 6 through 12 representing 112 truck trips for each hour, and a factor of 0.082 was used for hour 13, which was obtained by dividing the 70 truck trips for that hour by 854 (total daily truck trips). The hour 13 multiplier appears to be incorrect; if the truck trips during that hour were 70, the hourly emissions scaling factor should be 70/112 = 0.625 (not 0.082). The 24 hourly emission scaling factors used in the

				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.		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	modeling for sources PTOS_QAV and PTOS_QEV were: **Scenario 1**: 0.0 0.0 0.0 0.0 0.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 0.082 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 **Scenario 2**: 0.0 0.0 0.0 0.0 0.0 0.0 0.4 0.6 0.98 1.0 0.96 0.88 0.85 0.94 0.9 0.67 0.35 0.33 0.02 0.0 0.02 0.0 0.0 0.0 There is also an attached table for Scenario 2, in which the hourly distribution of truck trips is shown assuming a daily maximum of 427 truck trips (according to Appendix B of the Traffic Study). The emission scaling factors, however, are computed based on the maximum hourly truck trips (during hour 10) being equal to 112 trips/hour. The daily (24 hour) totals of the modeled daily emissions scaling factors are **7.082** for Scenario 1 and **8.900** for Scenario 2. This implies that the modeled total daily truck trips for Scenario 2 is 1,073 truck trips (not 427). Other than the hourly emission factors, the model inputs were identical between Scenario 1 and Scenario 2: both had the same source parameters and emission rates for seven (non-zero) open pit sources and four point sources, identical building downwash parameters for the four point sources, identical wind speed emissions scaling for the two PTDR open pit sources (PTDR_HMA and PTD_QE), identical monthly emissions scaling (January through March had zero emissions for sources PTOS_HMA, BH_HMA, and GEN_HMA), the same five-year meteorological data (2014-2018), and the same

set of receptor locations. The locations of the 11 modeled sources and 323 modeled receptors are shown in Figure 1, below. The spatial distribution of receptor locations appears to adequately capture peak concentration impacts.

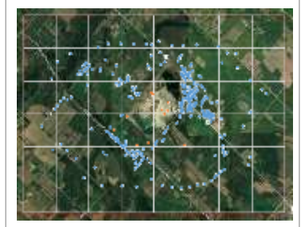

Figure 1. Modeled source locations (red) and receptor locations (blue)

The maximum modeled hourly total $PM_{2.5}$ emissions (for all sources) for both modeled scenarios is 4.19 lb/hour.[1] Considering (1) the hourly wind speeds during the peak modeled day (December 2, 2017) for sources PTDR_HMA and PTDR_QE, and (2) the diurnal scaling factors for sources PTOS_QAV and PTOS_QEV, the modeled average hourly $PM_{2.5}$ emission rate during the peak modeled day was 3.52 lb/hour for Scenario 1, and 3.56 lb/hour for Scenario 2. The modeled maximum 24-hour average $PM_{2.5}$ concentration for Scenario 1 (constant hourly morning emissions) was 4.33 µg/m^3. The modeled maximum 24-hour average $PM_{2.5}$ concentration for Scenario 2 ("actual" emissions across 14 hours each day) was 3.63 µg/m^3. Scenario 2 had higher overall daily emissions than Scenario 1, however the modeled

[1] The maximum hourly emissions rate assumes the highest wind speed category. Emission rates for two of the modeled sources (PTDR_HMA and PTDR_QE) were adjusted downward within AERMOD based on the hourly wind speed. The emissions scaling factors were 0.04 for wind speeds between 0.0 and 1.54 m/s, 0.10 for wind speeds between 1.55 and 3.09 m/s, .019 between 3.10 and 5.14 m/s, 0.35 between 5.15 and 8.23 m/s, 0.50 between 8.24 and 10.80 m/s, and 1.00 for wind speeds above 10.80 m/s.

							maximum 24-hour average $PM_{2.5}$ concentration for Scenario 1 was 19% higher than for Scenario 2. This is due to the higher emissions for Scenario 1 that occur during the early morning hours when dispersion tends to be lower (causing higher downwind concentrations). The background 24-hour $PM_{2.5}$ concentration used by BCX was 12.04 µg/m^3 which brings the total $PM_{2.5}$ concentration to 16.37 µg/m^3 for Scenario 1 and 15.67 µg/m^3 for Scenario 2, which are both under the criteria (standard) of 27 µg/m^3. I re-ran the AERMOD model for Scenario 1, with the hour 13 scaling factor adjusted to account for the apparent error, as described above (the hour 13 multiplier was changed from 0.082 to 0.625). As expected, adjusting the minor error barely changed the modeling results, increasing the modeled maximum 24-hour average $PM_{2.5}$ concentration from 4.332 µg/m^3 to 4.339 µg/m^3. The modeled maximum 24-hour average PM concentration was 56.5 µg/m^3 for Scenario 1 and 45.4 µg/m^3 for Scenario 2. When added to the assumed background concentration (48.17), the total PM was 104.7 µg/m^3 for Scenario 1 and 93.57 for Scenario 2. Although these modeled total PM concentrations are both under the criteria (standard), the Scenario 1 results are 87% of the standard level, which represents a significant modeled impact