REPORT

Air Quality Impact Assessment - Revision 1

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario

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Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by R.W. Tomlinson Ltd. (Tomlinson) to complete an air quality impact assessment (AQIA) of the proposed hot mix asphalt (HMA) plant (the Plant) at 8205 County Road 2 in Greater Napanee, Ontario (the Subject Lands) to support a zoning amendment application.

The preparation of a detailed AQIA is not typically required for a zoning amendment application, however, an AQIA has been requested by the Town of Greater Napanee (the Town) following consultation with a third-party peer reviewer consultant and the Ontario Ministry of the Environment, Conservation and Parks (MECP).

In addition to this assessment, Tomlinson will be required to complete a separate air quality assessment as part of Emission Summary and Dispersion Modelling Report to support an Environmental Compliance Approval application under Section 9 of the Environmental Protection Act prior to the operation of the Plant.

This AQIA has been completed to achieve the following:

- characterize the existing air quality in the surrounding area;
- estimate the emissions from the proposed Plant;
- predict the impact of the Plant's operations on local air quality through dispersion modelling; and
- recommend best management practices to help mitigate the potential for fugitive dust and odour generation.

For the purpose of this report, the term "Facility" is used to describe the total area owned by Tomlinson which includes the existing Napanee Quarry and the area that is proposed for the Plant, as shown in Figure 1 – Facility Location Plan.

1.1 Description of Subject Lands

The lands subject to the proposed zoning application are 6.2 ha in size and are located on the north side of County Road 2, in the Town of Greater Napanee, County of Lennox and Addington, Ontario. The land immediately north, east and south of the Subject Lands is also owned by Tomlinson, including the Napanee Quarry, which is adjacent to the Subject Lands at Part of Lot 21 Concession VII, Town of Greater Napanee, County of Lennox and Addington, Ontario. The quarry will be a source of raw material (aggregate) for the Plant. Currently, the Subject Lands contain part of the entrance roadway for the Napanee Quarry.

Current operations at the quarry include extraction, processing and offsite transport of aggregate. Drilling and blasting are used to extract material. The extracted material is transported from the extraction face by haul trucks to a mobile crushing plant. Processed material is stored in various stockpiles before being shipped off-site.

1.1.1 Proposed Permanent Hot Mix Asphalt Plant

The Plant is a batch mix asphalt plant which will operate at a maximum production of 180 tonnes per hour when it is in operation at the Facility. Operations are expected to occur approximately 160 days a year, from April to the end of November. Asphalt production and shipping will generally occur during daytime hours. However, occasional projects may require the Plant to operate during night-time hours, such as overnight re-paving of the Highway 401.

Raw materials, typically various grades of aggregate and recycled asphalt pavement (RAP) are stored in on-site stockpiles. Liquid asphalt is stored in tanks heated by a natural gas fired heating system.

For each batch of HMA, specific amounts of aggregate and RAP are loaded into cold feed bins and fed onto conveyors to be screened and then fed into the dryer, which is heated by a natural gas burner. The dried aggregate and RAP are mixed with liquid asphalt in the batch tower and loaded into trucks or conveyed to asphalt storage silos.

Emissions from the dryer are controlled by a baghouse. Fines collected by the baghouse are stored in the mineral silo to be added back into subsequent batches of HMA or loaded into trucks to be shipped off-site.

1.2 Indicator Compounds

This assessment focuses on predicting changes in the concentrations of criteria air compounds (CACs). These compounds are indicative of air quality and have relevant air quality criteria. The indicator compounds for the quarry and Plant activities fall into three categories:

- **particulate matter**: suspended particulate matter (SPM), particles nominally smaller than 10 µm in diameter (PM_{10}), and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$);
- **crystalline silica**: as a fraction of PM_{10}; and
- **combustion gases**: nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and carbon monoxide (CO).

In addition to the compounds listed above, the following compounds were also assessed based on the MECP's priority list for asphalt plants:

- Benzene;
- Benzo(a)pyrene (as a surrogate for total polycyclic aromatic hydrocarbons [PAHs]);
- Metals (limited to arsenic, nickel and lead); and
- Naphthalene (as a surrogate for odorous compounds).

Ozone (O_3) was also quantified as it will be used to calculate NO_2 concentrations from the predicted nitrogen oxide (NO_X) concentrations. Ozone is not emitted directly into atmosphere but is associated with the reaction of NO_X (MECP 2021).

1.3 Applicable Guidelines

The relevant criteria used for assessing the air quality effects of the proposed Plant operating with the existing quarry include the Ontario criteria and federal standards and objectives where provincial guidelines are not available. The MECP has set guidelines related to ambient air concentrations which are summarized in *Ontario's Ambient Air Quality Criteria* (AAQC) document (MECP 2020). The Ontario AAQCs are characterized as desirable ambient air concentrations. They are not regulatory limits and are frequently exceeded at various locations across Ontario due to weather conditions and long-range transportation but represent an indicator of good air quality. The Ontario AAQCs are used for screening the air quality effects in environmental assessments, studies using ambient air monitoring data, and assessment of general air quality in a community or across the province (MECP 2017).

There are two sets of federal objectives and criteria: the National Ambient Air Quality Objectives (NAAQOs) and the Canadian Ambient Air Quality Standards (CAAQSs) (formerly National Ambient Air Quality Standards (NAAQS)). Similar to the Ontario AAQCs, the NAAQOs are benchmarks that can be used to facilitate air quality management on a regional scale and provide goals for outdoor air quality that protect public health, the environment, or aesthetic properties of the environment (CCME 1999). The federal government has established the following levels of NAAQOs (Health Canada 1994):

- the maximum ***Desirable*** level defines the long-term goal for air quality and provides a basis for an anti degradation policy for unpolluted parts of the country and for the continuing development of control technology; and
- the maximum ***Acceptable*** level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

The CAAQSs have been developed under the *Canadian Environmental Protection Act* (CEPA) and include standards for $PM_{2.5,}$ NO_2 and SO_2. Like the Ontario AAQCs, the CAAQSs are not regulatory limits and are used as national targets for $PM_{2.5}$ and NO_2, excluding Quebec (CCME 2019). The CAAQSs are based on the long-term averages of measurement data not a short-term measurement value.

A summary of the applicable Ontario and federal objectives and criteria as well as the criteria that will be used for this assessment are listed in Table 1.

Table 1: Ontario and Canadian Regulatory Air Quality Objectives and Criteria

Compound	Averaging Period	Ontario Ambient Air Quality Guidelines [a] (µg/m³)	Canadian Ambient Air Quality Standards[b] (µg/m³)	National Ambient Air Quality Standards and Objectives[c] (µg/m³)		Assessment Criteria
				Desirable	Acceptable	(µg/m³)
SPM[d]	24-Hour	120	—	—	120	120
	Annual	60[e]	—	60	70	60
PM_{10}	24-Hour	50[f]	—	—	—	50
$PM_{2.5}$	24-Hour	—	27[g][h]	—	—	27
	Annual	—	8.8[h]	—	—	8.8
Crystalline silica (<10 µm)	24-Hour	5	—	—	—	5
NO_2	1-Hour	400[i]	113 (60 ppb)[j]	—	400	113/400
	24-Hour	200[i]	—	—	200	200
	Annual	—	32 (17 ppb)[j]	60	100	22.6
SO_2	1-Hour	690	183 (70 ppb)[k]	450	900	183/690
	24-Hour	275	—	150	300	275/150
	Annual	55	13 (5 ppb)[k]	30	60	13/55
CO	1-Hour	36,200	—	15,000	35,000	36,200/15,000
	8-Hour	15,700	—	6,000	15,000	15,700/6,000
Benzene	24-hour	2.3	—	—	—	2.3
	Annual	0.45	—	—	—	0.45
Benzo(a)pyrene	24-hour	0.00005	—	—	—	0.00005
	Annual	0.00001	—	—	—	0.00001
Arsenic	24-hour	0.3	—	—	—	0.3
Nickel	24-hour	0.2[l]	—	—	—	0.2
	Annual	0.04[l]	—	—	—	0.04
Lead	24-hour	0.5	—	—	—	0.5
	30-day	0.2	—	—	—	0.2
Naphthalene	10-minute	50	—	—	—	50
	24-hour	22.5	—	—	—	22.5

(a) MECP (2020)
(b) CAAQS published in the Canada Gazette Volume 147, No. 21 - May 25, 2013
(c) CCME (1999)
(d) SPM in Ontario is defined as Suspended Particulate Matter (<44 µm diameter)
(e) Geometric mean
(f) Interim AAQC and is provided as a guide for decision making (MECP 2020)
(g) 2020 target. Compliance is based on the annual 98th percentile of the daily monitored data averaged over three years of measurements.
(h) Phase in date for standard is 2020.
(i) Standard is for nitrogen oxides (NO_X) but is based on the health effects of NO_2.
(j) Standards provided as parts per billion (ppb) were converted to µg/m³ using a reference temperature of 25°C and pressure of 1 atmosphere (atm). The 1-hour standard is based on the three-year average of the annual 98th percentile of the daily maximum 1-hour average concentration.
(k) The 1-hour standard is based on the three-year average of the annual 99th percentile of the daily maximum 1-hour average concentration.
(l) As a component of SPM.

2.0 EXISTING AIR QUALITY

The existing air quality in the area around the Facility can be described by considering publicly available monitoring data in the vicinity. The existing air quality includes the operation of the adjacent quarry prior to the operation of the Plant. Other existing sources include industrial facilities, emissions from vehicles on roadways and railways, long range transboundary air pollution, small regional sources and large industrial sources.

The publicly available data is used to complete a cumulative assessment of the air quality impacts by adding the existing air quality values to the predicted concentrations from the Plant. The results of the cumulative assessment were compared to the federal and provincial criteria (further discussed in section 5.0).

2.1 Monitoring Data

The existing air quality was characterized using observations from the Environment and Climate Change Canada (ECCC) National Air Pollution Surveillance Network (NAPS) air quality monitoring stations (ECCC 2018). Monitoring stations are typically sited in locations where there are potential concerns about local air quality or in population centres, therefore there are no locations in the immediate vicinity of the Facility and stations located some distance away were used. Stations were selected that have similar land use characteristics as the area surrounding the Facility. Monitoring data is not available for the metals (arsenic, nickel and lead) that were assessed as part of this study.

The relative locations of each of the air monitoring stations used to describe existing air quality are summarized in Table 2 and presented on Figure 2 - Ambient Air Quality Monitoring Stations. Table 2 also includes the monitoring data from each station that was used in the assessment for the 2014-2018 time period.

Table 2: Location of Air Monitoring Stations

Station	Address	NAPS Station ID	Latitude and Longitude	Distance to Facility (km)	Predominant Wind Direction Relative to Facility	Monitoring Data Used
Belleville	2 Sidney Street, Belleville, On	65401	44.15053, -77.3955	39	West, generally upwind	SPM, PM_{10}, $PM_{2.5}$, NO_2 and O_3
Newmarket	Eagle St. & Mccaffrey Rd., Newmarket, On	65101	44.04431, -79.48325	205	West, generally upwind	VOCs (benzene and naphthalene)
Saint-Anicet	1128 De La Guerre, Saint-Anicet, Quebec	54401	45.120624, -74.2896	230	Northeast, generally downwind	CO and SO_2

[1] There are no monitoring data available for SPM and PM_{10}, however, an estimate of the SPM and PM_{10} concentrations can be calculated from the available $PM_{2.5}$ monitoring data. The mean levels of $PM_{2.5}$ in Canadian locations are found to be about 54% of the PM_{10} concentrations and about 30% of the SPM concentrations (Lall et al., 2004). By applying this ratio, it was possible to estimate the SPM and PM_{10} concentrations for the monitoring stations.

The air flow into the Facility is predominantly from the southwest for the majority of the time. Winds blowing from the northeast are also common in the area.

The closest air quality monitoring station is in Belleville, Ontario, 39 km west of the Facility. This station is generally upwind of the Facility and is likely the most representative monitoring station due to proximity, however only SPM, PM_{10}, $PM_{2.5}$, and NO_2 data is available at this station. The next closest air quality monitoring station is in Newmarket, Ontario, approximately 205 km west of the Facility and has VOC data (benzene and naphthalene) available. While Newmarket is further away from the Facility than the Belleville station, the land uses in the area are fairly similar to Napanee with low density residential, light industrial and agricultural. Therefore, the VOC data from Newmarket can be used to conservatively represent the VOC concentrations in the area surrounding the Facility since Napanee is a smaller community.

The next closest station is in Toronto West, located 218 km to the southwest and generally upwind of the Facility. While Toronto West has CO, SO_2 and PAH data available, it is in close proximity to the 400, 401, 409 series highways, a large number of industrial facilities and is also downwind of Toronto Pearson International Airport. Using the monitoring data from this NAPS station would not provide a realistic representation of the background air quality at the Facility and would potentially over-estimate the background concentrations for compounds in Napanee where these industrial and transportation sources are not present.

Based on the available data from the NAPS monitoring stations, the remaining stations monitoring PAH concentrations are located in similar urbanized areas with many industrial and transportation sources contributing to the background concentrations. The available PAH data would not be representative of the air quality at the Facility and has not been presented as part of this assessment.

Carbon monoxide and SO_2 data from the Saint-Anicet, Québec station, 230 km northeast of the Facility, was used as opposed to the data from Toronto West. Saint-Anicet is generally upwind of the Facility and is surrounded by mixed use agricultural rural land-use and is likely more representative of the background air quality in Napanee.

Table 3 summarizes monitoring data for the years 2014 through 2018 that were considered for this assessment. The 90th percentile of the 1-hour, 8-hour, and 24-hour measurements and the annual average are typically used to represent the existing air quality value when conducting an impact assessment (Alberta Environment 2013) and these are what is summarized in Table 3.

Table 3: Summary of Existing Air Quality Concentrations

Indicator	Averaging Period	Assessment Criteria (µg/m³)	Existing Air Quality Concentration (µg/m³)	NAPS Station
SPM	24-hour	120	37.22	Belleville
	Annual	60	19.59	Belleville
PM_{10}	24-hour	50	20.68	Belleville
$PM_{2.5}$*	24-hour	27	11.17	Belleville
	Annual	8.8	5.88	Belleville
Crystalline silica (<10 µm)**	24-Hour	5	2.23	Belleville
NO_2	1-Hour	113/400	18.81	Belleville

Indicator	Averaging Period	Assessment Criteria (µg/m³)	Existing Air Quality Concentration (µg/m³)	NAPS Station
	24-Hour	200	15.13	Belleville
	Annual	32	8.46	Belleville
SO_2	1-Hour	183.4/690	2.62	Saint-Anicet
	24-Hour	275/150	3.06	Saint-Anicet
	Annual	13.1/55	1.12	Saint-Anicet
CO	1-Hour	36.200/15,000	343.57	Saint-Anicet
	8-Hour	15,700/6,000	372.20	Saint-Anicet
O_3	1-Hour	—	102.29	Belleville
Benzene	24-hour	2.3	0.61	Newmarket
	Annual	0.45	0.38	Newmarket
Benzo(a)pyrene	24-hour	0.00005	Not available	—
	Annual	0.00001	Not available	—
Naphthalene	10-minute	50	0.22	Newmarket
	24-hour	22.5	0.05	Newmarket
Arsenic	24-hour	0.3	Not available	—
Nickel	24-hour	0.2	Not available	—
	Annual	0.04	Not available	—
Lead	24-hour	0.5	Not available	—
	30-day	0.2	Not available	—

* There are no monitoring data available for SPM and PM_{10}, however, an estimate of the SPM and PM_{10} concentrations can be calculated from the available $PM_{2.5}$ monitoring data. The mean levels of $PM_{2.5}$ in Canadian locations are found to be about 54% of the PM_{10} concentrations and about 30% of the SPM concentrations (Lall et al., 2004). By applying this ratio, it was possible to estimate the SPM and PM_{10} concentrations for the monitoring stations.

** Existing crystalline silica concentrations were estimated as 6% of the existing SPM concentration (US EPA, 1996).

2.2 Industrial Emissions Sources

There are two industrial facilities that reported to the National Pollutant Release Inventory (NPRI) within a 5 km radius of the Facility in 2019 (ECCC 2021): the Goodyear Canada Inc. tire plant and Maritime House Metals ULC. There is also an industrial park located south of Highway 401 and east of Centre Street North that appears to include numerous industrial and commercial sites. Of these facilities, only one reported CACs which are in common with the Facility. The 2019 reported data is the most recent data available at the time of this assessment. Reporting facilities and release totals are summarized in Table 4. These releases contribute to the local air quality and the consideration of cumulative effects. Overall, the data shows that there are not many industrial sources of air emissions located close to the Facility in comparison to the locations of some of the monitoring stations referenced above. Therefore, the monitoring data described above is likely a conservative representation of the existing air quality around the Facility.

Table 4: 2019 Air Releases for Industry within 5 km of the Facility

Company Name	Site Name	Distance to the Facility (km)	Direction from the Facility	Releases to Air (tonnes)					
				NO_X	SO_2	CO	SPM	PM_{10}	$PM_{2.5}$
Goodyear Canada Inc.	Napanee Plant	3.3	North northwest	560.033	—	—	—	180.905	51.471
Maritime House Metals ULC.*	Napanee Facility	3.5	North northwest	—	—	—	—	—	—
Total (Facilities within 5 km)				560.033	—	—	—	180.905	51.471
Ontario Total				61,814	108,299	64,354	29,612	16,227	8,366
Releases from Facilities within 5 km as a Percentage of Ontario Total				<1%	—	—	—	<1%	<1%

* This facility did not report pollutant releases, disposals or transfers for recycling of any CACs.

3.0 EMISSION RATE ESTIMATES

Emissions were estimated for the Facility which includes the existing Napanee Quarry and the proposed Plant. It will operate for approximately 160 days per year at a maximum anticipated production rate of 180 tonnes per hour, between April to the end of November, with infrequent projects requiring overnight or 24-hour operations at reduced production rates. The adjacent Napanee quarry can process up to 300 tonnes of material per hour through a mobile crushing plant, with blasts generally occurring once per week. The quarry can operate up to 24 hours per day, with reduced production rates during night-time hours. A loader transfers blasted aggregate from the working face into haul trucks which travel to the crushing plant in the quarry. Aggregate is processed first through the crushing plant and finished materials are stored in stockpiles. The finished materials are then hauled off-site for distribution or hauled to the Plant for use in HMA production. Quarry drilling and blasting activities do not occur during night-time hours. Figure 3 illustrates the layout of the Plant and quarry.

Table 5 summarizes the key inputs used for the emission calculations.

Table 5: Summary of Existing and Proposed Operations

Activity	Existing Operations	Proposed Operations
Crushing Plant	▪ Aggregate with 2% moisture content ▪ Primary crushing rate 300 tonnes/hr ▪ Primary screening rate 300 tonnes/hr ▪ Secondary crushing rate 550 tonnes/hr ▪ Secondary screening rate 550 tonnes/hr	▪ No change from existing
HMA Screens	—	▪ 171 tonnes/hr aggregate with 2% moisture content ▪ 54 tonnes/hr sand with 3% moisture content ▪ 36 tonnes/hr RAP with 3% moisture content
Wind Erosion of Stockpiles	▪ Quarry stockpiles with 3.9% silt content and each with an exposed area of 4,020 m^2	▪ No change to quarry stockpiles from existing ▪ Asphalt plant stockpiles with 3.9% silt content and each with an exposed area of 4,020 m^2
Paved Roads	—	▪ Asphalt plant access road with 3 g/m^2 silt loading
Unpaved Roads	▪ Quarry haul routes with 4.8% silt content	▪ No change to quarry haul routes from existing ▪ Asphalt plant interior area with 4.8% silt content
On Road Vehicles	▪ Vehicles meet Tier 3 emission standards	▪ No change to quarry vehicles from existing ▪ Asphalt plant shipping trucks meet Tier 3 emission standards

Activity	Existing Operations	Proposed Operations
Non-Road Vehicles/Engines	▪ Crusher engine meets Tier 2 emission standards ▪ Quarry haul trucks meet Tier 3 emission standards ▪ Quarry loaders meet Tier 4 emission standards	▪ No change to quarry equipment from existing ▪ Asphalt plant loaders meet Tier 4 emission standards
Material Handling	Quarry ▪ Stockpile 1 - 104 tonnes/hr ▪ Stockpile 2 - 95 tonnes/hr ▪ Stockpile 3 - 97 tonnes/hr ▪ Aggregate with 2% moisture content	▪ No change to quarry from existing ▪ Asphalt plant ▪ Aggregate Stockpile – 171 tonnes/hr ▪ Sand Stockpile – 54 tonnes/hr ▪ RAP Stockpile – 36 tonnes/hr ▪ Aggregate Cold Feed Bins onto conveyors – 171 tonnes/hr ▪ Sand Cold Feed Bins onto conveyors – 54 tonnes/hr ▪ RAP Bins onto conveyors – 36 tonnes/hr ▪ Aggregate with 2% moisture content ▪ Sand and RAP with 3% moisture content
Drilling	▪ Drilling rate 10 holes/hr	▪ No change from existing
Blasting	▪ 1 blast/day*	▪ No change from existing
Liquid Asphalt Tanks	—	▪ Maximum liquid temperature 338 °F (170 °C) ▪ Tanks are filled 160 times per year
HMA Dryer and Baghouse	—	▪ Production rate 180 tonnes/hr ▪ Natural gas fired burner
Dust Silo	—	▪ Load out 10 tonnes/day
Hot Oil System	—	▪ Maximum heat input 2,000,000 BTU/hr ▪ Natural gas fired burner
Asphalt Storage Silos	—	▪ Filling rate 180 tonnes/hr ▪ Product temperature 338 °F (170 °C)
Asphalt Load-Out	—	▪ Load out rate 180 tonnes/hr ▪ Product temperature 338 °F (170 °C)

* Although blasts generally occur once per week, blasts were conservatively assumed to occur once per day in the modelling assessment.

Descriptions of how the emission rates were estimated for this assessment are provided below and summarized in Table A1 of Appendix A.

3.1 Crushing Plant and HMA Screens

The mobile crushing plant processes blasted material in the quarry. Aggregate, sand and RAP are also screened before being transferred to the batch mix dryer. Emission factors for SPM, PM_{10} and $PM_{2.5}$ were obtained from US EPA AP-42 Chapter 11.19.2 – Crushed Stone Processing, Table 11.19.2-1 (U.S. EPA, 2004). Controlled emission factors were applied for due to the high moisture content in the material (2% to 3%).

The following equation was used to estimate the hourly emission rates for particulates:

$$\text{Hourly Emission Rate}\left[\frac{\text{g}}{\text{s}}\right] = \text{Emission Factor}\left[\frac{\text{kg}}{\text{Mg}}\right] \times \text{Hourly Throughput}\left[\frac{\text{tonnes}}{\text{hour}}\right] \times \text{Conversion Factors}$$

The following is a sample calculation for the maximum hourly SPM emission rate from haul trucks unloading at the grizzly feeder:

$$\text{Hourly SPM Emission Rate} = 0.000008\frac{\text{kg}}{\text{Mg}} \times 300\frac{\text{tonnes}}{\text{hour}} \times \frac{1000\text{ g}}{1\text{ kg}} \times \frac{1\text{ day}}{3600\text{ s}}$$

$$\text{ER} = 6.67\text{E} - 04\text{ g/ s}$$

Crystalline silica emissions were estimated as a percentage of the PM_{10} emission rates. The assumed percentages of crystalline silica vary depending on the source activity, summarized in Table 6. These percentages were derived from emission factors for silica and PM_4 (particulate matter with a diameter of less than 4 microns) that were obtained from source testing conducted at three aggregate sites in the U.S. (Richards et. al. 2012).

In this air quality assessment, the silica contents estimated based on PM_4 were conservatively applied to PM_{10}.

A sample calculation below illustrates how the crystalline silica content for PM_{10} from conveyor transfers was derived.

$$\text{Crystalline silica content [\%]} = \left[\frac{0.000048\frac{\text{lb}}{\text{t}}\, silica\ in\ PM4}{0.00035\frac{\text{lb}}{\text{t}}\, PM4\ from\ conveyor\ transfer}\right] = 14\%$$

The next sample calculation below illustrates how a crystalline silica emission rate in grams per second was estimated from the PM_{10} emission rate.

$$\text{Hourly Crystalline Silica Emission Rate} = 6.67\text{E} - 04\frac{\text{g}}{\text{s}}\text{PM}_{10} \times 14\%\text{ silica}$$

$$\text{Hourly Crystalline Silica Emission Rate} = 9.14\text{E} - 05\text{ g/ s}$$

Table 6: Assumed Crystalline Silica Content of PM_{10}

Parameter	Source Activity		
	Crusher	Screen	Conveyor Transfer
PM_4 emission factor (EF) [lb/t]	0.00088	0.00044	0.00035
PM_4 Silica (EF) [lb/t]	0.000097	0.000044	0.000048
Crystalline silica content (%, applied to PM_{10} ER)	11%	10%	14%

3.2 Wind Erosion of Stockpiles

Material is stored in stockpiles at the quarry and the Plant and is therefore subject to wind erosion. The emission factors from U.S. EPA Control of Open Fugitive Dust Source (EPA 45/3 88 008), September 1988, Page 4-17 were used to calculate the fugitive dust emissions associated with wind erosion from the storage piles. The following predictive emissions equation was used in determining the emission factors for wind erosion:

$$\mathrm{EF} = 1.9 \times \left(\frac{\mathrm{s}}{1.5}\right) \times \left(\frac{\mathrm{f}}{15}\right) \times scaling\ factor \times (1 - control\ efficiency)$$

Where:

EF = particulate emission factor (kg/ha/day),

s = silt loading (%),

f = percent of time the wind speed is greater than 5.4 m/s (%),

Scaling factor = a particle size multiplier for particulate matter, and

Control efficiency = reduction of fugitive dust emissions due to implementation of a BMP for fugitive dust.

The emission rate is a function of wind speed, and the equation assumes that there are no emissions generated when the wind speed is lower than 5.4 m/s (19.3 km/h). The percent of time the wind speed is greater than 5.4 m/s (17.51%) was obtained from the MECP pre-processed meteorological data (1996 to 2000) used for the dispersion modelling assessment.

The following is a sample calculation for the SPM emission factor for emissions that will occur from one of the stockpiles. The silt content for limestone products of 3.9% from Table 13.2.4-1 of the U.S. EPA AP-42 Section 13.2.4 was used.

$$\mathrm{EF} = 1.9 \times \left(\frac{3.9}{1.5}\right) \times \left(\frac{17.51}{15}\right)$$

$$\mathrm{EF} = 5.766\ \frac{kg}{\mathrm{ha - day}}$$

The following is a sample calculation for the SPM emission rate for one of the stockpiles. A control efficiency of 75% (obtained from the Western Regional Air Partnership Fugitive Dust Handbook, Table 9-4) (WRAP, 2006) was selected to represent the implementation of a fugitive dust best management practices plan (BMPP).

$$\mathrm{ER} = \mathrm{EF} \times \mathrm{A} \times \frac{1\ \mathrm{ha}}{10{,}000\ \mathrm{m}^2} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}} \times \frac{1\ \mathrm{day}}{24\ \mathrm{hr}}\ \mathrm{x}\ (1 - \mathrm{control\ efficiency})$$

Where:

EF = particulate emission factor (kg/ha/day)

A = exposed area (m²)

Control efficiency = reduction of fugitive dust emissions due to implementation of a BMPP

$$\mathrm{ER} = 5.766 \frac{\mathrm{kg}}{\mathrm{ha - day}}\ \mathrm{x}\ 4{,}020\ \mathrm{m}^2 \times \frac{1\ \mathrm{ha}}{10{,}000\ \mathrm{m}^2} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}} \times \frac{1\ \mathrm{day}}{24\ \mathrm{hr}} \times (1 - 75\%)$$

$$\mathrm{ER} = 6.71\mathrm{E} - 03\ \mathrm{g/\ s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above based on scaling factors provided in AP-42 Chapter 13.2.5 Industrial Wind Erosion as summarized in Table 7. Crystalline silica emissions were estimated as 14% of the PM_{10} emission rates (refer to s.3.1 for details on assumptions and methodology).

Table 7: Particle Size Multipliers for Wind Erosion

Size Range	k
SPM	1
PM_{10}	0.5
$PM_{2.5}$	0.075

3.3 Vehicles – Paved Road Dust

The routes travelled by off-site highway trucks to enter the Plant, as well truck routes around and through the Plant, will be paved. The U.S. EPA AP-42 emission factors from Chapter 13.2.1 – Paved Roads (January 2011) were used to calculate the fugitive dust emissions from paved roadways. The following predictive emissions equation was used to estimate the fugitive dust emission factor for paved roads:

$$\mathrm{EF} = \left(\mathrm{k}(\mathrm{sL})^{0.91} \times (\mathrm{W})^{1.02}\right)(1 - \text{control efficiency})$$

Where:

EF = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see Table 8),
sL = road surface silt loading (g/m^2) assumed to be 3.0 (as per U.S. EPA, 2000),
W = prorated mean weight (tons) of the vehicles traveling the road, and
control efficiency = reduction of fugitive dust emissions due to implementation of a BMPP for fugitive dust.

Table 8: Particle Size Assumptions for Paved Road Dust

Size Range	k (g/VKT)
SPM	3.23
PM_{10}	0.62
$PM_{2.5}$	0.15

The following is a sample calculation for SPM for the predictive emission factor for the highway trucks transporting finished asphalt product from the Plant. It was estimated that the mean vehicle weight on the road is 22.94 tons. A control efficiency of 80% was selected to represent the implementation of a fugitive dust control measures as per the Western Regional Air Partnership Fugitive Dust Handbook, Table 9-4 (WRAP, 2006).

$$\mathrm{EF} = \left(3.23 \times (3)^{0.91} \times (22.94)^{1.02}\right)(1 - 80\%)$$

$$\mathrm{EF} = 42.89\ \mathrm{g/VKT}$$

The following is a sample calculation for the hourly SPM emission rate for vehicles travelling along the same paved road segment:

$$\mathrm{ER} = \frac{42.89\ \mathrm{g}}{\mathrm{VKT}} \times \frac{14.3\ \mathrm{VKT}}{\mathrm{hour}} \times \frac{1\ \mathrm{hr}}{3600\ \mathrm{s}}$$

$$\mathrm{ER} = 1.70\mathrm{E}-01\ \mathrm{g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above. Crystalline silica emissions were estimated as 14% of the PM_{10} emission rates (refer to s.3.1 for details on assumptions and methodology).

3.4 Vehicles – Unpaved Road Dust

Roads within the quarry and at the Plant are unpaved. The predictive equation in U.S. EPA AP 42 Chapter 13.2.2 – Unpaved Roads (November 2006) was used to calculate the fugitive dust emissions from unpaved roadways. The equation accounts for a control efficiency for the implementation of dust control measures. The equation is as follows:

$$\mathrm{EF} = \left(\mathrm{k}\left(\frac{\mathrm{s}}{12}\right)^{\mathrm{a}} \times \left(\frac{\mathrm{W}}{3}\right)^{\mathrm{b}} \times 281.9\right)(1 - \text{control efficiency})$$

Where:

EF = particulate emission factor (g/VKT)

k = empirical constant for particle size range (pounds (lbs) per vehicle mile travelled (VMT)) (see Table 8)

s = road surface silt content (%) assumed to be 4.8% (as per U.S. EPA AP 42 Section 13.2.2 for Sand and Gravel Processing Plant Roads)

W = average weight (tons) of the vehicles traveling the road,

a = empirical constant for particle size range (dimensionless) (see Table 9)

b = empirical constant for particle size range (dimensionless) (see Table 9)

281.9 = conversion from pounds per vehicle miles travelled to grams per vehicle kilometres travelled

control efficiency = reduction of fugitive dust emissions of 80% as per the Western Regional Air Partnership Fugitive Dust Handbook, Table 9-4 (WRAP, 2006).

Table 9: Particle Size Assumptions for Unpaved Road Dust

Size Range	k (lb/VMT)	a	b
SPM	4.9	0.7	0.45
PM_{10}	1.5	0.9	0.45
$PM_{2.5}$	0.15	0.9	0.45

The following is a sample calculation for SPM for the emission factor for loaders that will travel along unpaved roads within the quarry. It was estimated that the loaders will have an average weight of 46.05 tons. A control efficiency of 80% was selected to represent the implementation of fugitive dust control measures will include road watering and use of a calcium-based dust suppressant.

$$\mathrm{EF} = \left(4.9\left(\frac{4.8}{12}\right)^{0.7} \times \left(\frac{46.05}{3}\right)^{0.45} \times 281.9\right)(1 - 80\%)$$

$$\mathrm{EF} = 497.19\ \mathrm{g/VKT}$$

The following is a sample calculation for the hourly SPM emission rate for loaders travelling along the same unpaved road segment within the quarry:

$$\mathrm{ER} = \frac{497.19\ \mathrm{g}}{\mathrm{VKT}} \times \frac{2.3\ \mathrm{VKT}}{\mathrm{hr}} \times \frac{1\ \mathrm{hr}}{3600\ \mathrm{s}}$$

$$\mathrm{ER} = 3.18\mathrm{E}-01\ \mathrm{g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above. Crystalline silica emissions were estimated as 14% of the PM_{10} emission rates (refer to s.3.1 for details on assumptions and methodology).

3.5 On Road Vehicles – Exhaust Emissions

Sand and RAP material is delivered to the Plant via off-site highway trucks. Processed aggregate material and HMA product are shipped off-site using highway trucks. Emission rates for the vehicle exhaust from these highway trucks were estimated using the U.S. EPA exhaust emission standards for Heavy-Duty Highway Compression-Ignition Engines and Urban Buses (U.S. EPA 2016).

It is assumed the vehicles at the Facility meet Tier 3 emission standards at minimum. Emission standards are not provided for PM_{10} and $PM_{2.5}$, therefore it was assumed that SPM emissions from vehicle exhaust consist of PM_{10} and that $PM_{2.5}$ emissions are 97% of PM_{10} emissions per U.S. EPA 2010a.

The following predictive emissions equation was used to estimate the combustion emission rates for the off-site highway trucks:

$$\mathrm{ER} = \mathrm{EF}\ \times \text{engine brake horsepower rating} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}}$$

Where:

- ER = emission rate (g/s)
- EF = emission factor (g/bhp hr).

The following is a sample calculation for the NOx emissions for a highway truck:

$$\mathrm{ER} = \frac{2.00\mathrm{E}-01\ \mathrm{g}}{\mathrm{bhp}-\mathrm{hr}} \times 310.69\ \mathrm{bhp}\ \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}}$$

$$\mathrm{ER} = 1.73\mathrm{E}-02\ \mathrm{g/s}$$

The emission rates for SPM, PM_{10} and $PM_{2.5}$, SO_2, and CO were calculated using the same general equation.

3.6 Non-Road Engines – Exhaust Emissions

Emission rates for heavy-duty off-road equipment, including the on-site haul trucks, loaders and the diesel-fired generator at the crushing plant, were estimated using the U.S. EPA NON-ROAD model. NON-ROAD uses the emission factors provided in documents published by U.S. EPA (2010a, 2010b). Emission factors are not provided for PM_{10} and $PM_{2.5}$, therefore it was assumed that SPM emissions from vehicle exhaust consist of PM_{10} and that $PM_{2.5}$ emissions are 97% of PM_{10} emissions per U.S. EPA 2010a.

The following predictive emissions equation was used to estimate the combustion emission rates for on-site non-road vehicles:

$$\mathrm{ER} = \mathrm{EF}\ \times \text{engine horsepower rating}\ \times \text{load factor}\ \times \text{Number of equipment} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}}$$

Where:

ER = emission rate (g/s)

EF = emission factor (g/hp hr).

The calculation method follows that of the U.S. EPA NON-ROAD model for selecting the appropriate emission factor and load factors for heavy-duty equipment. Non-road vehicles and diesel engines at the Facility meet Tier 3 emission standards at minimum. It is assumed the loaders operating at the face of the extraction area and the loader at the HMA plant meet Tier 4 emission standards. Emission factors vary depending on the sulphur content of the fuel, the emission type, the equipment type, and the equipment make, model and year. The emission factors are found using the methods in Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling – Compression Ignition – Report No. NR 009d (U.S. EPA 2010a). The load factor is determined by the type of equipment defined in Median Life, Annual Activity, and Load Factor Values for Non-road Engine Emissions Modelling – Report No. NR-005d (U.S. EPA 2010b).

The following is a sample calculation for the SPM emissions for one of the loaders:

$$\mathrm{ER} = \frac{1.36\mathrm{E}-02\ \mathrm{g}}{\mathrm{hp}-\mathrm{hr}} \times 404\ \mathrm{hp}\ \times 0.59\ \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}}$$

$$\mathrm{ER} = 8.97\mathrm{E}-04\ \mathrm{g/s}$$

The emission rates for PM_{10} and $PM_{2.5}$, NOx, SO_2, and CO were calculated using the same general equation.

3.7 Material Handling

At the extraction face, loaders are used to load blasted material into haul trucks, which transport the aggregate to the crushing plant. Loaders are also used to load processed aggregate from the crushing plant into shipping trucks. Similar drop operations occur at the Plant where processed aggregate and RAP are stockpiled and then loaded into cold feed bins and RAP bins, respectively. Potential emissions from these drop operations include particulate matter because of the disturbance of material during handling.

Predictive emission factors for particulate emissions were developed using the drop operation equation from the U.S. EPA AP 42 Section 13.2.4 Aggregate Handling and Storage Piles (November 2006), which is dependent on wind speed. The following predictive emissions equation was used in determining the emission factors for material handling:

$$\mathrm{EF} = \mathrm{k} \times 0.0016\ \times \frac{\left(\frac{\mathrm{U}}{2.2}\right)^{1.3}}{\left(\frac{\mathrm{M}}{2}\right)^{1.4}}$$

Where:

EF = particulate emission factor (kg/Mg)

k = particle size multiplier for particle size range (see Table 10)

U = mean wind speed (m/s)

M = moisture content of material (percent) (%).

Table 10: Particle Size Multiplier for Material Handling

Size Range	k
SPM	0.8
PM_{10}	0.35
$PM_{2.5}$	0.053

The following is a sample calculation for the SPM emission factor from aggregate stockpile loading. An hourly wind speed of 4.6 m/s obtained from the MECP pre-processed meteorological data (1996-2000) was used for this sample calculation. A moisture content of 2% for aggregate (stone) was provided by Tomlinson.

$$\mathrm{EF} = 0.80 \times 0.0016 \times \frac{\left(\frac{4.6}{2.2}\right)^{1.3}}{\left(\frac{2}{2}\right)^{1.4}}$$

$$\mathrm{EF} = 3.34\mathrm{E}-03\,\frac{\mathrm{kg}}{\mathrm{Mg}}$$

The following is a sample calculation for the 1-hour SPM emission rate for a material handling rate of 171 tonnes/hour and based on a wind speed of 4.6 m/s.

$$\mathrm{ER} = \frac{3.34\mathrm{E}-03\ \mathrm{kg}}{\mathrm{Mg}} \times \frac{171\ \mathrm{Mg}}{\mathrm{hour}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}}$$

$$\mathrm{ER} = 1.59\mathrm{E}-01\,\frac{\mathrm{g}}{\mathrm{s}}$$

The emission rates of PM_{10} and $PM_{2.5}$ were also estimated as presented above. Crystalline silica emissions were estimated as 14% of the PM_{10} emission rates (refer to s.3.1 for details on assumptions and methodology).

3.8 Drilling

Rock and stone are loosened by drilling and blasting the quarry face. Drilling is expected to result in emissions of fugitive dust, consisting of SPM, PM_{10} and $PM_{2.5}$. Emission rates of SPM and PM_{10} from drilling are based on emission factors obtained from Table 2 of the Australian National Pollutant Inventory Emission Estimation Technique Manual for Mining (Version 3.1, January 2012). The equation used to estimate the emission rates is as follows:

$$\mathrm{ER} = \mathrm{EF} \times \frac{\mathrm{Holes}}{\mathrm{hr}} \times \left(1 - \frac{\mathrm{C}}{100}\right) \times \frac{1000\ \mathrm{g}}{\mathrm{kg}} \times \text{Conversion to g/s}$$

Where:

- ER = emission rate of particulate matter (g/s)
- EF = emission factor (kg/hole)
- Holes = number of holes drilled (holes/hour)
- C = emission reduction factor of the control technology

The following is a sample calculation for the 1-hour SPM emission rate.

$$\mathrm{ER} = \frac{0.59\ \mathrm{kg}}{\mathrm{hole}} \times \frac{10\ \mathrm{holes}}{\mathrm{hr}} \times \frac{1\ \mathrm{hr}}{3600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}} \times (1 - 0.99)$$

$$\mathrm{ER} = 1.64\mathrm{E} - 02\,\frac{\mathrm{g}}{\mathrm{s}}$$

In this equation, drilling emission factors are only available for SPM and PM_{10}. For the purpose of the assessment, an emission factor for $PM_{2.5}$ was estimated from SPM based on the ratio between the SPM and $PM_{2.5}$ emission factors for tertiary crushing (controlled) from U.S. EPA (2004).

A maximum drilling rate of 10 holes/hr was used in estimate the emissions from drilling activities. Emissions are controlled by a vacuum bag dust collector equipped with a fabric filter, therefore a 99% control factor was applied to the calculations, as per the Australian National Pollutant Inventory Emission Estimation Technique Manual for Mining, Version 3.1, January 2012.

Crystalline silica emissions were estimated as 14% of the PM_{10} emission rate (refer to s.3.1 for details on assumptions and methodology).

3.9 Blasting – Particulate

Blasting activities will generate fugitive dust emissions, including SPM, PM_{10} and $PM_{2.5}$. At the quarry, blasting will only occur during a three-hour period each day, between the hours of 11 am and 2 pm. A maximum of two blasts would occur each week. An equation from U.S. EPA AP-42 Chapter 11.9 Western Surface Coal Mining (U.S. EPA 1998a) was used to calculate the fugitive dust emissions associated with blasting activities. The equation is as follows:

$$E = 0.00022 \times \mathrm{A}^{1.5} \times \mathrm{SF}$$

Where:

- E = emission factor (kg/blast)
- A = horizontal area (m^2)
- SF = scaling factor for PM_{10} and $PM_{2.5}$ only

The following is a sample calculation for the 1-hour SPM emission rate.

$$\mathrm{ER} = \frac{16.11\ \mathrm{kg}}{\mathrm{blast}} \times \frac{1\ \mathrm{blast}}{\mathrm{hr}} \times \frac{1\ \mathrm{day}}{3\ \mathrm{hrs}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}}$$

$$\mathrm{ER} = 1.49\,\frac{\mathrm{g}}{\mathrm{s}}$$

As the blasting emission factor was only available for SPM, PM_{10} and $PM_{2.5}$ emission factors were estimated using scaling factors ratios obtained from the US EPA Chapter 11.9 (US EPA 1998a) summarized in Table 11. Crystalline silica emissions were estimated as 14% of the PM_{10} emission rate (refer to s.3.1 for details on assumptions and methodology).

Table 11: Blasting Fugitive Emissions Scaling Factors for Particulate Matter

Size Range	Scaling Factor
SPM	1
PM_{10}	0.52
$PM_{2.5}$	0.03

There will be at most one blast per day. There are no emission control measures for blasting considered in the assessment.

3.10 Blasting – Combustion Gases

Blasting will result in emissions of combustion gases (CO, NO_X, SO_2) from the detonation of emulsion explosives. Emission factors from Table 7 of the Australian National Pollutant Inventory document “Explosives Detonation and Firing Ranges 3.1, August 2016” were applied. The maximum diameter of the drilled holes at the quarry will be no larger than 88.9 mm. Therefore, the emulsion emission factors for holes <150 mm were applied. The equation is as follows:

$$\mathrm{ER} = \mathrm{EF} \times \text{Explosives Throughput} \times \frac{1000\ \mathrm{g}}{\mathrm{kg}} \times \text{Time Conversions}$$

Where:

ER = emission rate (g/s)

EF = emission factor (kg/tonne explosive)

The following is a sample calculation for the hourly NOx emission rate.

$$\mathrm{ER} = \frac{0.2\ \mathrm{kg}}{\text{tonne explosive}} \times \frac{7140\ \text{kg explosive}}{\text{blast}} \times \frac{1\ \text{tonnes explosive}}{1000\ \mathrm{kg}} \times \frac{1\ \text{blast}}{\text{hour}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}}$$

$$1 - \text{hour ER} = 3.97\mathrm{E} - 01\frac{\mathrm{g}}{\mathrm{s}}$$

The 1-hour and 24-hour emission rates of NOx, SO_2 and CO were calculated using the same general equation.

3.11 Liquid Asphalt Tanks

The Plant operates three vertical liquid asphalt storage tanks. Emissions from the storage tanks result from the volatilization of liquid asphalt. Vapour is discharged through the vents when the tanks are being filled (working losses) and changes in the thermal concentration gradient (breathing losses). Filling losses are estimated assuming the headspace in the empty tank is saturated with liquid asphalt vapours, and that air from the vapour space is emitted during filling.

The vapour pressure of asphalt was calculated using methods outlined in Trumbore, 1999. The constants (A and B) for paving asphalt provided in Table 2 of Trumbore, 1999 were used in the calculation.

$$\log P_v = A \log T + B$$

Where:

P_v = pure vapour pressure of asphalt (mmHg)
T = maximum temperature of liquid asphalt (°F)
A = 7.8771
B = -19.06

A sample calculation is provided below.

$$\log P_v = 7.8871 \times \log\,(338°\mathrm{F}) - 19.06$$

$$P_v = 10^{(7.8871 \times (\log(338°\mathrm{F})) - 19.06)}$$

$$P_v = 7.69\ \mathrm{mmHg} \times \frac{0.01934\ \mathrm{psi}}{\mathrm{mmHg}} = 1.49\mathrm{E}-01\ \mathrm{psi}$$

The methodology for calculating routine losses from fixed roof tanks in U.S. EPA Chapter 7.1 Organic Liquid Storage Tanks (U.S. EPA 2020) was used to calculate total annual losses (working and breathing losses) of asphalt from the liquid asphalt tanks.

Sample calculations are provided below for the conversion of total annual losses to an annual emission rate of asphalt in grams per second.

$$\text{Annual breathing losses } ER_{\text{Asphalt}} = \frac{3.75\ \text{lbs of losses}}{\text{year}} \times \frac{453.39\ \text{g}}{\text{lb}} \times \frac{1\ \text{year}}{160\ \text{operating days}} \times \frac{1\ \text{day}}{86400\ \text{s}}$$

$$\text{Annual breathing losses } ER_{\text{Asphalt}} = 1.23\mathrm{E}-04\ \frac{\mathrm{g}}{\mathrm{s}}$$

An annual emission rate of working losses was calculated using the same methodology. The emission rates of breathing and working losses were summed to calculate the total annual emission rate of asphalt (in grams per second) from each tank.

Since breathing losses occur continuously, the calculated annual emission rate of breathing losses is assumed to be equivalent to the 1-hour emission rate.

One-hour and 24-hour working losses of asphalt from the liquid asphalt storage tanks were calculated using a formula for short term losses from tanks. The vapour molecular weight (84 lb/lbmol, equivalent to 84 g/gmol), liquid molecular weight (1000 lb/lbmol), and liquid density (1 lb/gal) were taken from Trumbore, 1999.

$$\mathrm{ER_{Asphalt}} = \frac{\mathrm{M_{wt}} \times \mathrm{P_v} \times \mathrm{F} \times \mathrm{V}}{\mathrm{R} \times \mathrm{T}} \times \frac{101.3\ \mathrm{kPa}}{760\ \mathrm{mmHg}}$$

Where:

- ER = emission rate (g/s)
- M_{wt} = molecular weight of asphalt (g/mol)
- P_v = pure vapour pressure of asphalt (mmHg)
- F = liquid mole fraction of asphalt (= 1 as tank is 100% asphalt)
- V = volumetric filling rate of asphalt (L/s)
- R = gas constant (kPa-L/mol-K)
- T = temperature of liquid asphalt (K)

A sample calculation is provided below for 1-hour working losses.

$$\text{Working losses } 1-\text{hour } \mathrm{ER_{Asphalt}} = \frac{84\ \mathrm{g}}{\mathrm{gmol}} \times \frac{7.69\ \mathrm{mmHg \cdot mol \cdot K}}{8.314\ \mathrm{kPa \cdot L}} \times 1 \times \frac{19\ \mathrm{L/s}}{443\ \mathrm{K}} \times \frac{101.3\ \mathrm{kPa}}{760\ \mathrm{mmHg}}$$

$$\text{Working losses } 1-\text{hour } \mathrm{ER_{Asphalt}} = 4.42\mathrm{E}-01\ \frac{\mathrm{g}}{\mathrm{s}}$$

Total 1-hour losses from each tank were calculated by summing the 1-hour working and breathing losses.

Total 24-hour losses were calculated as follows:

$$24-\text{hour } \mathrm{ER_{Asphalt}} = \frac{(\text{Working losses} \times \text{Hours of tank filling/day}) + (\text{Breathing losses} \times \text{Hours breathing/day})}{24 \text{ hours}}$$

$$24-\text{hour } \mathrm{ER_{Asphalt}} = \frac{\left(4.42\mathrm{E}-01\frac{\mathrm{g}}{\mathrm{s}} \times 1.39\frac{\mathrm{hrs}}{\mathrm{day}}\right) + \left(1.23\mathrm{E}-04\frac{\mathrm{g}}{\mathrm{s}} \times 22.6\frac{\mathrm{hrs}}{\mathrm{day}}\right)}{24 \text{ hours}}$$

$$24-\text{hour } \mathrm{ER_{Asphalt}} = 2.57\mathrm{E}-02\frac{\mathrm{g}}{\mathrm{s}}$$

In the absence of emission factors for specific contaminants from liquid asphalt storage tanks, the breakdown of asphalt fume emissions provided in Trumbore, 1999 was used. The article states that asphalt fumes can be broken down to 78% volatile organic compounds (VOC) and 22% particulate matter (PM). Therefore, the emission rate of SPM was calculated as 22% of the asphalt emission rate. PM_{10} and $PM_{2.5}$ emission rates were conservatively assumed to be equal to SPM.

Emission rates of benzene were calculated as a percentage of the VOC content of asphalt, as follows:

$$\mathrm{ER_{benzene}} = \mathrm{ER_{Asphalt}} \times 78\%\ \mathrm{VOC} \times \%\text{benzene in VOC}$$

Emission rates of benzo(a)pyrene and naphthalene were calculated as a percentage of the PM component of asphalt, as follows:

$$\mathrm{ER} \quad = \mathrm{ER_{Asphalt}} \times 22\%\ \mathrm{PM} \times \%\text{contaminant in PM}$$

The speciation profiles for silo filling and asphalt storage from Tables 11.1-15 and 11.1-16 of U.S. EPA (2004d) were used for benzene, benzo(a)pyrene and naphthalene. If no data was available for silo filling and asphalt storage, the profile for load-out was used.

Emission rates for metals released from liquid asphalt tank filling were calculated using emission factors from Table 11.1-11 (Batch mix hot mix asphalt plants) of U.S. EPA (2004d) and the maximum tank filling rate.

3.12 HMA Plant Batch Hot-Mix Dryer and Baghouse

The Plant operates a natural gas fired batch hot-mix dryer. Emissions associated with the dryer, hot screens, and mixer are controlled by a baghouse system.

Emission factors for SPM, PM_{10} and $PM_{2.5}$ from the dryer were obtained from Tables 11.1-1 (batch mix hot mix asphalt plant, dryer with a fabric filter) and Table 11.1-2 (Summary of Particle Size Distribution for Batch Mix Dryers, Hot Screens and Mixers) of U.S. EPA (2004d).

Emission factors for CO, NOx and SO_2 from the burner were obtained from Table 11.1-5 (natural gas fired dryer) of U.S. EPA (2004d).

Speciation profiles for benzene, benzo(a)pyrene and naphthalene were obtained from Table 11.1-9 (natural gas fired dryer), and emission factors for metals were obtained from Table 11.1-11 (batch mix hot mix asphalt plants natural gas with fabric filter) (U.S. EPA 2004d).

The following is a sample calculation for the 1-hour emission rate of benzene:

$$\mathrm{ER} \quad = \mathrm{Processing\ capacity}\left(\frac{\mathrm{Mg}}{\mathrm{hr}}\right) \times \mathrm{Emission\ factor}\left(\frac{\mathrm{kg}}{\mathrm{Mg}}\right) \times \mathrm{Conversion\ factors}$$

$$\mathrm{ER_{benzene}} = \frac{180\ \mathrm{Mg}}{\mathrm{hr}} \times \frac{0.0001\ \mathrm{kg}}{\mathrm{Mg}} \times \frac{1000\ \mathrm{g}}{\mathrm{kg}} \times \frac{1\ \mathrm{hr}}{3600\ \mathrm{s}}$$

$$\mathrm{ER_{benzene}} = 7.00\mathrm{E}-03\,\frac{\mathrm{g}}{\mathrm{s}}$$

Emission rates for all other contaminants were calculated in a similar manner.

3.13 Dust Silo Load-Out

Dust from the baghouse is collected in a silo and unloaded once per day. The silo exhaust discharges to the baghouse. The only emission point is when the silo is unloaded. The unloading point is controlled via a covered truck and sock. The dust silo may be operational up to 24 hours per day.

It is assumed that the load out rate is occurring at maximum capacity. In the absence of process-specific emissions factors, similar emission factors were assumed from Table 11.12-1 of U.S. EPA (2006) for truck loading (truck mix). An emission factor for $PM_{2.5}$ was not available, therefore the ratio of "k" (particle size multiplier) for $PM_{2.5}$ over PM_{10} from Table 11.12-3 was used as a multiplier to calculate a $PM_{2.5}$ emission factor from the PM_{10} emission factor. Sample calculations are provided below.

$$PM_{2.5}\ EF = \frac{k_{controlled\ PM_{2.5}}}{k_{controlled\ PM_{10}}} \times PM_{10}EF$$

Where:

$k_{controlled\ PM2.5}$ = 0.048

$k_{controlled\ PM10}$ = 0.32

$PM_{2.5}$ EF = 0.002 (kg/tonne)

$$ER \quad = \text{Processing capacity}\left(\frac{\text{tonnes}}{\text{day}}\right) \times \text{Emission factor}\left(\frac{\text{kg}}{\text{tonne}}\right) \times \text{Conversion factors}$$

$$ER_{PM2.5} = \frac{10\ \text{tonnes}}{\text{day}} \times \frac{0.002\ \text{kg}}{\text{tonne}} \times \frac{1000\ \text{g}}{\text{kg}} \times \frac{1\ \text{day}}{86400\ \text{s}}$$

$$ER_{PM2.5} = 2.27E-04\,\frac{g}{s}$$

The emission rates of SPM and PM_{10} were calculated in a similar manner.

3.14 Hot Oil System

A natural gas fired hot oil heater is used to maintain the tank temperature of the liquid asphalt tanks. The heater has a maximum thermal heat input of 2,000,000 BTU/hr. Emissions were calculated using emission factors from Table 1.4-1 and Table 1.4-2 of the U.S. EPA AP-42 Chapter 1.4 Natural Gas Combustion (07/98). It is conservatively assumed that the heater is operating at maximum capacity.

A sample calculation for the emission rate of NOx is provided below.

$$ER = \text{Maximum thermal heat input}\left(\frac{\text{BTU}}{\text{hr}}\right) \times \text{Emission factor}\left(\frac{\text{lbs}}{10^6\ \text{scf}}\right) \times \text{Higher heating value}\left(\frac{\text{scf}}{\text{BTU}}\right) \times \text{Conversion factors}$$

Where:

BTU = British Thermal Unit

scf = standard cubic foot

$$ER_{NOx} = \frac{2{,}000{,}000\ \text{BTU}}{\text{hr}} \times \frac{100\ \text{lbs}}{1{,}000{,}000\ \text{scf}} \times \frac{1\ \text{scf}}{1020\ \text{BTU}} \times \frac{1\ \text{hr}}{3600\ \text{s}} \times \frac{454\ \text{g}}{\text{lb}}$$

$$ER_{NOx} = 2.47E-02\,\frac{g}{s}$$

Emission rates of CO, SO_2, SPM, PM_{10} and $PM_{2.5}$ were calculated in a similar manner. The PM emission factor was used to estimate PM_{10} and $PM_{2.5}$ since all particulate matter is assumed to be less than 1 micrometer in diameter, as per U.S. EPA 1998b. The SO_2 emission factor assumes the sulphur content in natural gas is 2,000 grains/10^6 scf.

3.15 Asphalt Storage Silos

Finished HMA product is stored in silos prior to loading in trucks for delivery to customers. The silos are kept at a temperature of 338°F. Emissions occur during silo filling operations.

The predictive equations from Table 11.1-14 of U.S. EPA (2004d) were used to calculate emissions from asphalt silo filling.

$$\text{Total PM EF} = 0.5\left(0.000332 + 0.00105(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

$$\text{Organic PM (OPM) EF} = 0.5\left(0.00105(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

$$\text{Total Organic Carbon (TOC) EF} = 0.5\left(0.0504(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

$$\text{CO EF} = 0.5\left(0.00488(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

Where:

V = -0.5, default value as per footnote (a) to Table 11.1-14 (U.S. EPA 2004d)
T = maximum temperature of asphalt (°F)

Sample calculations for the Total PM EF and maximum 21-hour SPM emission rate follow, below.

$$\text{Total PM EF} = 0.5\left(0.000332 + 0.00105(0.5)e^{((0.0251)(338+460)-20.43)}\right)$$

$$\text{Total PM EF} = 3.42\text{E}-04\,\frac{\text{kg PM}}{\text{tonne HMA produced}}$$

$$1-\text{hour ER}_{\text{PM}} = \frac{3.42\text{E}-04\text{ kg}}{\text{tonne}} \times \frac{180\text{ tonnes HMA}}{\text{hr}} \times \frac{1000\text{ g}}{\text{kg}} \times \frac{1\text{ hr}}{3600\text{ s}}$$

$$1-\text{hour ER}_{\text{PM}} = 1.71\text{E}-02\,\frac{\text{g}}{\text{s}}$$

Emission factors for OPM and TOC, and an emission rate in grams per second for CO were also calculated as described above.

Speciation profiles for benzene, benzo(a)pyrene and naphthalene were obtained from Tables 11.1-15 and 11.1-16 (U.S. EPA 2004d). In the absence of a profile for benzo(a)pyrene from silo loading, the profile for load-out was assumed.

It was assumed that 100% of TOCs are considered VOCs, as outlined in Table 11.1-16 of U.S. EPA (2004d). Therefore, 24-hour emissions of benzene were speciated from the calculated TOC emissions as follows:

$$\text{ER}_{\text{benzene}} = \text{HMA Production Rate}\left(\frac{\text{tonnes}}{\text{day}}\right) \times \text{TOC EF}\left(\frac{\text{kg}}{\text{tonne HMA}}\right) \times \%\text{benzene in TOC} \times \text{Conversion factors}$$

$$\text{ER}_{\text{benzene}} = \frac{2760\text{ tonnes HMA}}{\text{day}} \times \frac{8.44\text{E}-03\text{ kg TOC}}{\text{tonne HMA}} \times \frac{1000\text{ g}}{\text{kg}} \times \frac{1\text{ day}}{86400\text{ s}} \times 0.032\%\text{ benzene in TOC}$$

$$24-\text{hour ER}_{\text{benzene}} = 8.63\text{E}-05\,\frac{\text{g}}{\text{s}}$$

Emission rates for benzo(a)pyrene and naphthalene were calculated in a similar manner using the OPM emission factor and percentages of benzo(a)pyrene and naphthalene from the speciation profiles.

In the absence of data on metal emissions from silo filling, emission factors for metals were taken from Table 11.1-11 (batch mix hot mix asphalt plants) of U.S. EPA (2004d). This is a conservative assumption since Table 1 of U.S. EPA (2000) does not list asphalt silo filling as a significant source of metals. The 24-hour emission rates of metals were calculated following a similar methodology as described above for the 24-hour emission rate of PM.

3.16 Asphalt Load-Out

HMA product is loaded into trucks at 338°F, for transport to customers. Emissions occur when the product is dropped from openings in the asphalt silos onto the truck beds. The predictive equations from Table 11.1-14 of U.S. EPA (2004d) were used to calculate emissions from asphalt load-out.

$$\text{Total PM EF} = 0.5\left(0.000181 + 0.00141(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

$$\text{OPM EF} = 0.5\left(0.00141(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

$$\text{TOC EF} = 0.5\left(0.0172(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

$$\text{CO EF} = 0.5\left(0.00558(-V)e^{((0.0251)(\text{T}+460)-20.43)}\right)$$

Where:

V = -0.5, default value as per footnote (a) to Table 11.1-14 (U.S. EPA 2004d)
T = load-out temperature of asphalt (°F)

Sample calculations for the Total PM EF and maximum 1-hour SPM emission rate follow, below.

$$\text{Total PM EF} = 0.5\left(0.000181 + 0.00141(0.5)\text{e}^{((0.0251)(338+460)-20.43)}\right)$$

$$\text{Total PM EF} = 3.27\text{E}-04\,\frac{\text{kg PM}}{\text{tonne HMA produced}}$$

$$1-\text{hour ER}_{\text{PM}} = \frac{3.27\text{E}-04\text{ kg}}{\text{tonne}} \times \frac{180\text{ tonnes HMA}}{\text{hr}} \times \frac{1000\text{ g}}{\text{kg}} \times \frac{1\text{ hr}}{3600\text{ s}}$$

$$1-\text{hour ER}_{\text{PM}} = 1.63\text{E}-02\,\frac{\text{g}}{\text{s}}$$

Emission factors for OPM and TOC, and an emission rate in grams per second for CO were also calculated as described above.

Speciation profiles for benzene, benzo(a)pyrene and naphthalene were obtained from Tables 11.1-15 and 11.1-16 (U.S. EPA 2004d). It was assumed that 100% of TOCs are considered VOCs, as outlined in Table 11.1-16 of U.S. EPA (2004d). Therefore, emissions of benzene were speciated from the calculated TOC emissions.

Emission rates for benzo(a)pyrene and naphthalene were speciated from the calculated OPM emissions using the percentages of benzo(a)pyrene and naphthalene from the speciation profiles.

In the absence of data on metal emissions from load out, emission factors for metals were taken from Table 11.1-11 (batch mix hot mix asphalt plants) of U.S. EPA (2004d). This is a conservative assumption since Table 1 of U.S. EPA (2000) does not list load out as a significant source of metals. The 1-hour emission rates of metals were calculated following a similar methodology as described above for the 1-hour emission rate of PM.

4.0 DISPERSION MODELLING

The potential air quality effects based on the indicator compounds were evaluated using the AERMOD air dispersion model developed by the United States Environmental Protection Agency (U.S. EPA). AERMOD is recognized by federal and Ontario regulators as one of the accepted dispersion models and is suitable to model quarry and asphalt plant activities.

The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor, the AERMAP terrain pre-processor and the BPIP building downwash pre-processor. The AERMET pre-processor was not used in this assessment as the most current version of the appropriate pre-processed Ministry meteorological dataset was used.

The following is a list of the model and pre-processors which were used in this assessment, along with the version numbers of each:

- AERMOD dispersion model (v. 19191)
- AERMAP terrain pre-processor (v. 18081); and
- BPIP building downwash pre-processor (v.04274).

Dispersion modelling was completed considering guidance from the MECP Guide "*Air Dispersion Modelling Guideline for Ontario*" (ADMGO) dated February 2017 (MECP, 2017).

4.1 Model Inputs

To predict ambient air concentrations using AERMOD, a series of inputs are required that parameterize the sources of emissions as well as their transport. These inputs can be grouped into the categories listed below:

- Meteorological data;
- Terrain and receptors;
- Building downwash; and
- Model source configurations.

Each of these input categories are discussed separately in the following sections.

4.1.1 Meteorological Data

The MECP, as well as other agencies, recommends that five years of hourly data be used in the model to cover a wide range of potential meteorological conditions (MECP, 2017). In this assessment, the AERMOD model was run using a MECP pre-processed five-year dispersion meteorological dataset (i.e., surface and profile files), last processed in 2020, in accordance with paragraph 1 of s.13(1) of O.Reg.419/05. As the Facility is in the Eastern MECP Region – Ottawa, Cornwall, Kingston, Belleville, Peterborough, the meteorological dataset for East ("Ottawa") Crops is used (MECP 2020). The data set covers the period of January 1996 to December 2000. This is the most recent data set made available by the MECP.

4.1.2 Terrain and Modelling Receptors

Terrain elevations have the potential to influence air quality concentrations at individual receptors, therefore surrounding terrain data is required when using regulatory dispersion models in both simple and complex terrain situations (U.S. EPA 2004a). Digital terrain data is used in the AERMAP pre-processor to determine the base elevations of receptors, sources and buildings. AERMAP then searches the terrain height and location that has the greatest influence on dispersion for each receptor (U.S. EPA 2004a). This is referred to as the hill height scale. The base elevation and hill height scale produced by AERMAP are directly inserted into the AERMOD input file.

Digital terrain data was obtained from the MECP (NED GeoTIFF format) (MECP 2020). The GeoTIFF file used in this assessment was cdem_dem_031C.tif. The terrain data is used to provide base elevations and hill height for model sources and receptors.

Sensitive receptors were identified in the vicinity of the Facility based on the Draft Acoustic Assesement Report for the Zoning of a Hot Mix Asphalt Plant, prepared by Freefield Ltd. and dated April 26, 2021. A discrete receptor was placed directly at the nearest sensitive location (residential private dwellings) at ground level. In addition, receptors were placed to cover the main residential and commercial areas of the Town of Napanee. The area of modeling coverage and location of the sensitive receptors are illustrated in Figure 4 – Air Quality Dispersion Modelling Receptors.

4.1.3 Building Downwash

Building wake effects were considered in this assessment using the U.S. EPA BPIP building downwash pre-processor. The input data was based on preliminary building and structure dimension data provided by Tomlinson. The output data from BPIP is used in the AERMOD building wake effect calculations.

4.1.4 Model Source Configurations

The emissions summarized in Table A1 were distributed into various model sources as described below and summarized in Table A2.

4.1.4.1 Point Sources

Vertical point sources were used to model emissions from the liquid asphalt tank vents, HMA baghouse and the crushing plant diesel engine. The stack gas exit velocities and stack inner diameters for the liquid asphalt tank vents were assigned following guidance in Table 4-4 of the ADMGO. The vent heights above grade were assigned as the stack release heights. The stack exit gas temperatures were provided by Tomlinson.

Parameters for the baghouse exhaust stack were obtained from manufacturer’s data. Parameters for the crushing plant diesel engine were provided by Tomlinson.

4.1.4.2 Volume Sources

Volume sources are used to model emissions from a variety of industrial sources that cannot be classified as releases from a dedicated stack or that occur from a large, fixed area, such as a stockpile. The MECP has suggested that emissions from roads should be modelled as a series of individual volume sources creating a line that follows the road (MECP 2017). The emissions from on-site roads were modelled using this volume source approach. The roads were divided into contiguous volume sources with release heights assumed to be half the plume height (plume height is calculated as 1.7 x vehicle height as per US EPA, 2012)). Road widths varied depending on the route. The emission rate for the entire road segment was divided amongst the total volume sources for the entire segment. There are four unpaved road routes and five paved road routes considered in this assessment.

Line volume sources were also used to represent emissions from operations of loaders moving around the quarry and the Plant since these activities are not stationary. This approach accounts for the effects of turbulence from the loader movements on the loader exhaust and dust emissions. The volume source parameters for roads and moving loaders are summarized in Table A2 in Appendix A.

The emissions from the crushing plant, material handling activities, cold feed/RAP bin loading, truck loading and all other Plant sources not detailed above were modelled as individual volume sources. The source parameters for these individual volumes are also summarized in Table A2.

4.1.4.3 Area Sources

Area sources are used to model low level or ground releases of emissions to the atmosphere that are distributed over a fixed area. Emissions from wind erosion of stockpiles located in and around the crushing plant and stockpiles of aggregate and RAP at the Plant were modelled as separate rectangular area sources as per guidance from the National Stone, Sand & Gravel Association (NSSGA, 2004). Emissions from drilling and blasting were also modelled as a rectangular area source. The effective height and initial vertical dimension used for each source are provided in Table A2 in Appendix A.

Locations of the model sources for each scenario are presented in Figure 3.

4.2 Summary of Model Options

The options used in the AERMOD model are summarized in Table 12.

Table 12: Options Used in the AERMOD Model

Modelling Parameter	Description	Used in Concentration Modelling?
DFAULT	Specifies that regulatory default options will be used.	Yes
CONC	Specifies that concentration values will be calculated.	Yes
OLM	Specifies that the non-default Ozone Limiting Method for NO_2 conversion will be used.	No - NO_2 is converted during post processing, as described in Section 4.7.2
DDEP (DRYDPLT)	Specifies that dry deposition will be calculated.	Yes – for particulates, silica
WDEP	Specifies that wet deposition will be calculated.	No - assessment is more conservative if this option is not selected
FLAT	Specifies that the non-default option of assuming flat terrain will be used.	No - the model will use elevated terrain as detailed in the AERMAP output.
NOSTD	Specifies that the non-default option of no stack-tip downwash will be used.	No
AVERTIME	Time averaging periods calculated.	1-hr, 24-hr, annual
URBANOPT	Allows the model to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions.	No
URBANROUGHNESS	Specifies the urban roughness length (m).	No
FLAGPOLE	Specifies that receptor heights above local ground level are allowed on the receptors.	No

4.2.1 Dry Deposition/Depletion

For modelling of SPM, PM_{10}, crystalline silica and $PM_{2.5}$ the dry deposition option was selected. Particle deposition is the naturally occurring process of removing suspended particles from the air, this process occurs through ‘dry deposition’ and ‘wet deposition’. Dry deposition refers to the gravitational settling of particles, and wet deposition refers to removal from the atmosphere by precipitation. Wet deposition was conservatively not accounted for since the meteorological datasets provided by the MECP did not contain precipitation data.

Use of the AERMOD dry depletion option requires an estimate of the mass fraction of each particle size for each emission source. This was determined using the emission rates of SPM, PM_{10} and $PM_{2.5}$. Mass fractions for PM_{10} were also used for crystalline silica emissions as they are estimated as a fraction of PM_{10} emissions. The following is an example calculation for deposition parameters for modelling SPM from wind erosion of the stockpiles at the crusher (source ID QSP1_W), and the results are summarized in Table 13.

$$\text{mass fraction of PM}_{2.5} = \frac{\text{ER}_{2.5}}{\text{ER}_{\text{SPM}}} = \frac{4.19\text{E}-07\,\frac{\text{g}}{\text{s}}}{5.59\text{E}-06\,\frac{\text{g}}{\text{s}}} = 0.075$$

$$\text{mass fraction of PM}_{10} = \frac{\text{ER}_{\text{PM10}} - \text{ER}_{\text{PM2.5}}}{\text{ER}_{\text{SPM}}} = \frac{2.79\text{E}-06 - 4.19\text{E}-07\,\frac{\text{g}}{\text{s}}}{5.59\text{E}-06\,\frac{\text{g}}{\text{s}}} = 0.425$$

$$\text{mass fraction of SPM} = 1 - \text{mass fraction of PM}_{10} - \text{mass fraction of PM}_{2.5} = 1 - 0.425 - 0.075 = 0.5$$

Table 13: Particle Size Parameters for Model Source QSP1_W

Compound	Emission Rate from Source QSP1_W (g/s)	Mass Fraction
PM	5.59E-06	0.5
PM_{10}	2.79E-06	0.425
$PM_{2.5}$	4.19E-07	0.075

A particle density of 2.7 g/cm^3, which is the typical maximum density of soil, was assigned to model sources representing handling/processing of raw/uncrushed material. A particle density of 1.7 g/cm^3, which is the maximum density for loose sand or gravel from the US EPA (1985), was assigned to sources releasing crushed or finer particulate matter. Table 14 below presents the particle densities assigned to the model sources.

Table 14: Particle Densities for Model Sources

Model Source ID	Description	Particle Density [g/cm^3]
BLAST	Blasting fugitive dust emissions	2.7
UNLOAD	Truck unloading at crushing plant	2.7
SCRN1, SCRN2, SCRN_HMA	Screening	2.7
CONV3, CONV8	Conveyor transfers	2.7
CRSH2	Crushing	2.7
QSP1, QSP2, QSP3, AGG_MH, RAP_MH	Material handling at quarry and HMA plant stockpiles	2.7
CFB, RAP	Cold feed and RAP bin transfers onto conveyors, RAP screening	2.7
LAT1, LAT2, LAT3	Liquid asphalt tanks	1.7
BGH	HMA plant baghouse	1.7
QSP1_W, QSP2_W, QSP3_W	Crusher stockpiles wind erosion	1.7
AGG_W, RAP_W	HMA stockpiles wind erosion	1.7
DG, HOS	Crushing plant generator and HMA plant hot oil system	1.7
DUST_SILO	Load-out from dust silo	1.7
SILOS, HMA_LO	Asphalt storage silos and load out from asphalt storage silos	1.7
ASP_LO	Road dust and tailpipe emissions from HMA shipping trucks	1.7
LOADER1, LOADER2	Road dust and tailpipe emissions from loader movements	1.7
H_TRUCK1, H_TRUCK2, HTRK2_PR, W_TRUCK	Road dust and tailpipe emissions from haul truck movements and water truck movements on paved and unpaved routes	1.7
CRUSH_OFF, CROFF_PR	Road dust and tailpipe emissions from crushed aggregate shipping trucks travelling on paved and unpaved routes	1.7
ASP_RAW, ASP_LA	Road dust and tailpipe emissions from shipping trucks delivering sand/RAP and liquid asphalt	1.7
DRILL	Blast hole drilling emissions	1.7

4.3 Special Modelling Considerations

4.3.1 Variable Emissions by Month and Hour of Day

Emissions from the majority of the activities at the Facility will vary depending on the month and hour of day. These sources were modelled using the emission factor card for variable month, day of week and hour of day of operation (EMISFACT MHRDOW) as summarized in Table 15 below. To consider the full range of meteorological conditions, the Facility activities were assumed to operate seven days per week during the April through end of November operating period.

The factors in Table 15 were based on information provided by Tomlinson regarding anticipated production levels and truck traffic when the Facility is in operation.

Table 15: Variable Emissions by Month and Hour of Day

Modelling ID	Source ID(s)	Source Description	Variable Emission Factor	Month(s)	Hour (Ending of Hour Period)	Factor Applied to Emission Rates During the Specified Period
CONV3	CONV3	Conveyor	Month, Hour-of-Day, Seven Days/Week	Dec through Mar	7 am - 7 pm	0
CONV8	CONV8	Conveyor			7 pm - 7 am	0
CRSH2	CRSH2	Crushing				
DG	DG	Crushing Plant Generator				
DRILL	DRILL	Blast hole drilling				
SCRN1	SCRN1	Screening				
SCRN2	SCRN2	Screening				
UNLOAD	UNLOAD, CRSH1	Truck unloading, Crushing		Apr through Nov	7 am - 7 pm	1
ASP_LA	ASP_LA	Shipping Trucks (Liquid asphalt delivery to plant)			7 pm - 7 am	0
CROFF_PR	CROFF_PR	Shipping Trucks (aggregate shipped offsite from crusher on PR)				
CRUSH_OFF	CRUSH_OFF	Shipping Trucks (processed aggregate shipped offsite from crushing plant)				
H_TRUCK1	H_TRUCK1	Haul Trucks (Quarry to Crushing plant)				
ASP_RAW	ASP_RAW	Shipping Trucks (Sand and RAP delivery to HMA plant)	Month, Hour-of-Day, Seven Days/Week	Dec through Mar	7 am - 7 pm	0
H_TRUCK2	H_TRUCK2	Haul Trucks (Crushing plant to HMA plant)			7 pm - 7 am	0
HTRK2_PR	HTRK2_PR	Haul Trucks (Crushing plant to HMA plant on paved roads)		Apr through Nov	7 am - 7 pm	1
					7 pm - 7 am	0.25
ASP_LO	ASP_LO	Shipping Trucks (Asphalt load out from HMA plant)	Month, Hour-of-Day, Seven Days/Week	Dec through Mar	7 am - 7 pm	0
BGH	BGH	HMA Plant Baghouse			7 pm - 7 am	0
HMA_LO	HMA_LO	Asphalt Load Out				
SCRN_HMA	SCRN_AGG, SCRN_SAND	Cold Feed Screen - Aggregate, Cold Feed Screen - Sand		Apr through Nov	7 am - 7 pm	1
SILOS	SILOS	Asphalt Silos			7 pm - 7 am	0.44
W_TRUCK	W_TRUCK	Water truck				

Table 15: Variable Emissions by Month and Hour of Day (continued)

Modelling ID	Source ID(s)	Source Description	Variable Emission Factor	Month(s)	Hour (Ending of Hour Period)	Factor Applied to Emission Rates During the Specified Period
BLAST	BLAST	Blast hole drilling, Blasting Explosives, Blasting Fugitives	Month, Hour-of-Day, Seven Days/Week	Dec through Mar	7 am - 7 pm	0
					7 pm - 7 am	0
				Apr through Nov	11 am - 2 pm	1
					2 pm -11 am	0
LOADER1	LOADER1	4 Loaders (at Quarry)	Month, Hour-of-Day, Seven Days/Week	Dec through Mar	7 am - 7 pm	0
					7 pm - 7 am	0
				Apr through Nov	7 am - 7 pm	1
					7 pm - 7 am	0.5
LOADER2	LOADER2	Loader (at HMA plant)	Month, Hour-of-Day, Seven Days/Week	Dec through Mar	7 am - 7 pm	0
					7 pm - 7 am	0
				Apr through Nov	7 am - 7 pm	1
					7 pm - 7 am	0.53

4.3.2 Variable Emissions by Month

The Facility can operate from April through to the end of November, seven days a week. The sources that do not have hourly variable emission rates were modelled using the emission factor card for variable month (EMISFACT MONTH), with emissions set to 0 from December through March, as summarized in Table 16 below.

Table 16: Summary of Variable Emissions by Month

Modelling ID	Source ID(s)	Source Description	Variable Emission Factor	Month(s)	Factor Applied to Emission Rates During the Specified Period
QSP1_W	QSP1_W	Crusher Stockpiles Wind Erosion	Month	Dec through Mar	0
QSP2_W	QSP2_W	Crusher Stockpiles Wind Erosion		Apr through Nov	1
QSP3_W	QSP3_W	Crusher Stockpiles Wind Erosion			
AGG_W	AGG_W	HMA-Aggregate and Sand Stockpile Wind Erosion			
RAP_W	RAP_W	HMA-RAP Stockpile Wind Erosion			
DUST_SILO	DUST_SILO	Dust Silo			
HOS	HOS	Hot Oil Heater			
LAT1	LAT1	Hot Oil Heater			
LAT2	LAT2	Hot Oil Heater			
LAT3	LAT3	Hot Oil Heater			

4.4 Post Processing

Most air quality concentration predictions are output directly from the model, however there are certain parameters, including averaging periods less than 1 hour and conversion of NO_2 using existing regional ozone concentrations that require post processing. These post processing methods are described in the following sections.

4.4.1 Time Average Conversions

The smallest time scale that AERMOD predicts is a 1-hour average value. There are instances when criteria are based on different averaging times, and in these cases the following conversion factor, recommended by the MECP for conversion from a 1 hour averaging period to the applicable averaging period less than 1 hour could be used (MECP 2017). An example is given below for converting from a 1 hour averaging period to a 1/2-hour averaging period:

$$F = \left(\frac{t_1}{t_0}\right)^n$$

$$= \left(\frac{60}{30}\right)^{0.28}$$

$$= 1.21$$

Where:

F = the factor to convert from the averaging period t1 output from the model (MECP assumes AERMOD predicts true 60 minute averages) to the desired averaging period t0 (assumed to be 30 minutes in the example above), and

N = the exponent variable; in this case the MECP value of n = 0.28 is used for conversion.

For averaging periods greater than 1 hour, the AERMOD output was used directly.

4.4.2 Conversions of NO_x to NO_2

Emissions of oxides of nitrogen (NO_x) were used as inputs to the AERMOD model. Predictions of nitrogen dioxide (NO_2) concentrations can be calculated from modelled NO_x values using the Ozone Limiting Method (OLM). The OLM compares the maximum modelled NOx concentration to the background ozone concentration to assess the limiting factor to NO_2 (Cole et al. 1979). The following equations present the methodology:

If background $[O_3]$ >0.90 [NOx], total conversion: $[NO_2] = [NO_x]$

If background $[O_3]$ <0.90 [NOx], NO_2 is limited by O_3: $[NO_2] = [O_3] + 0.10\ [NO_x]$

The background concentrations of O_3 used in the OLM are presented in Table 17. The 1-hour background concentration presented in Table 5 was converted to a 24-hour and annual concentration using the method detailed above in section 4.4.1.

Table 17: Ozone Concentrations Used in OLM

Averaging Period	Concentration of O_3 [µg/m^3]
1-hour	90.27
24-hour	81.45
Annual	58.87

4.5 Conservative Assumptions in Modelling Approach

Table 18 outlines the conservative assumptions in the modelling approach which results in an assessment that is not likely to under-predict the air quality associated with the Facility.

Table 18: Conservative Assumptions in Modelling Approach

Area	Conservative Assumption
Operations were modelled to be occurring simultaneously	The modelling assessment includes all operations occurring simultaneously at the anticipated maximum capacity. This is unlikely to occur in practice.
At grade source elevations	All sources were modelled at grade. In reality, the quarry operations occur below grade, which reduces the amount of particulate matter and silica escaping off-site.
Blasting frequency	Although blasts will generally occur once per week, blasts were conservatively assumed to occur once per day in the modelling assessment. This allows for the consideration of as many different meteorological conditions as possible for compounds with 1 hour averaging periods. This also results in conservative results for compounds with 24 hour and annual averaging periods.
Explosive usage	It was assumed that the same amount of explosive would be used in each blast. In reality, explosive usage varies and would likely be decreased as the extraction face approaches the Facility property line and sensitive receptors. The termination point for the blasting operations will be governed by the results of the on-site blasting monitoring program.
Particle deposition/removal processes	Wet deposition was not used in the assessment. This modelling option calculates the removal of particles from the atmosphere by precipitation and when used, can result in lower predicted concentrations.
	Metals were modelled without considering particle deposition and therefore, the predicted concentrations are conservative.

It is assumed that the conservative emission rates, when combined with the conservative operating conditions and conservative dispersion modelling assumptions description herein, are not likely to under predict the modelled concentrations at each of the sensitive receptors.

5.0 AIR QUALITY PREDICTIONS

To assess the overall local air quality effects a given facility, the existing air quality must be combined with the maximum predicted concentrations from the proposed activities. The resulting air quality concentrations are referred to as the cumulative predicted concentration, which is compared to the relevant air quality criteria.

Table 19 summarizes the results of this assessment. The maximum predicted concentrations as a result of emissions from the Facility alone are below the relevant ambient air quality criteria at sensitive receptors. In addition, the maximum predicted cumulative concentrations as a result of emissions from the Facility combined with the existing air quality are also below the relevant ambient air quality criteria.

Contour plots for SPM, PM_{10}, $PM_{2.5}$, crystalline silica, NOx and benzo(a)pyrene are provided in Appendix B. As illustrated in the contour plots, the largest predicted concentrations of particulates, crystalline silica and NOx are generally located along the southwestern side of the property line. This is expected as the property line is immediately downwind of the extraction area and haul routes when winds are blowing from northeast directions. In general, the sensitive receptors along Palace Road were predicted to have higher concentrations than sensitive receptors along County Road 2 or those within the Town of Napanee.

For compounds related to the production of HMA, such as benzo(a)pyrene and benzene, the largest predicted concentrations occur along the northeast portion of the property line. This is expected as the property line is immediately downwind of the Plant when winds are blowing from southwest directions. There are no sensitive receptors in close proximity to the northeast portion of the property line.

As discussed in Section 2.0 above, the existing air quality for this assessment was described using the 90th percentile of monitoring data from stations located at considerable distances from the Facility as there are no local monitoring stations close by. Additionally, the station data is collected in areas where there are more significant industrial sources of air emissions. As a result, the concentrations representing the existing air quality are conservative. In addition to this, the predicted concentrations that result from the dispersion modelling assessment are also conservative because they take into consideration the worst-case meteorological conditions occurring at the same time as anticipated maximum Facility operations. In reality, there is a very low likelihood that the worst-case meteorology, the maximum Facility operations and the conditions that result in 90th percentile of the existing air quality compounds occur simultaneously. As a result, the maximum predicted cumulative concentrations presented in this assessment are conservative.

Although some of the predicted concentrations are approaching the criteria, it is also important to note that the provincial and federal assessment criteria that is used in this assessment are not regulatory limits and are frequently exceeded at various locations across Ontario due to weather conditions and long-range transportation. Instead of being used for a pass or fail compliance assessment, these criteria are to be used as benchmarks to facilitate air quality management on a regional scale and provide reference desirable levels for outdoor air quality.

Table 19: Maximum Predicted and Cumulative Concentrations

Compound	Averaging Period	Criteria [µg/m³]	Existing Concentration [µg/m³]	Existing Concentration % of Criteria	Sensitive Receptors			
					Maximum Predicted Concentration* [µg/m³]	Predicted Concentration % of Criteria	Maximum Predicted Cumulative Concentration [µg/m³]	Predicted Cumulative Concentration % Criteria
SPM	24-Hour	120	37	31%	49	41%	86	72%
	Annual	60	20	33%	3.6	6.0%	23	39%
PM_{10}	24-Hour	50	21	41%	21.1	42%	42	84%
$PM_{2.5}$	24-Hour	27	11	41%	3.7	14%	15	55%
	Annual	8.8	6	67%	0.35	4.0%	6.2	71%
Crystalline Silica	24-hour	5	2	45%	2.7	53%	4.9	98%
NO_2	1-Hour (AAQC)	400	19	5%	91	23%	109	27%
	1-Hour (CAAQS)	113	19	17%	91	80%	109	97%
	24-Hour	200	15	8%	9.6	4.8%	25	12%
	Annual	32	8	26%	0.98	3.1%	9.4	30%
SO_2	1-Hour (AAQC)	690	2.6	0.38%	0.81	0.12%	3.4	0.50%
	1-Hour (CAAQS)	183.4	2.6	1%	0.81	0.44%	3.4	1.9%
	24-Hour (AAQC)	275	3.1	1.1%	0.25	0.09%	3.3	1.2%
	24-Hour (CAAQS)	150	3.1	2.0%	0.25	0.17%	3.3	2.2%
	Annual (AAQC)	55	1.1	2.0%	0.019	0.04%	1.1	2.1%
	Annual (CAAQS)	13.1	1.1	9%	0.019	0.15%	1.1	9%
CO	1-Hour (AAQC)	36,200	343.57	0.9%	1707	4.7%	2051	5.7%
	1-Hour (NAAQO)	15,000	343.57	2.3%	1707	11%	2051	14%
	8-Hour	15,700	372	2.4%	954	6.1%	1326	8.4%
	8-Hour (NAAQO)	6000	372	6.2%	954	16%	1326	22%
Benzene	24-Hour (AAQC)	2.3	0.61	27%	0.015	0.67%	1	27%
	Annual (AAQC)	0.45	0.38	85%	0.001	0.20%	0.38	85%
BaP	24-Hour (AAQC)	0.00005	—	—	0.000016	33%	—	—
	Annual (AAQC)	0.00001	—	—	0.0000014	14%	—	—
Naphthalene	10-mins (AAQC)	50	0.22	0.43%	0.88	1.8%	1.1	2.2%
	24-Hour (AAQC)	22.5	0.05	0.24%	0.10	0.45%	0.15	0.69%
Arsenic	24-hour	0.3	—	—	0.00046	0.15%	—	—
Nickel	24-hour	0.2	—	—	0.0046	2.3%	—	—
	Annual	0.04	—	—	0.00038	0.95%	—	—
Lead	24-hour	0.5	—	—	0.00088	0.18%	—	—
	30-day	0.2	—	—	0.00034	0.17%	—	—

*Meteorological anomalies were not removed.

6.0 RECOMMENDATIONS

6.1 Modelling Refinements

The results presented in Section 5 indicate that maximum cumulative predicted concentrations from the Facility are below the relevant assessment criteria at the sensitive receptors based on this conservative assessment. However, some of the predicted concentrations are approaching the criteria, such as PM_{10}, crystalline silica and 1-hour NO_2. These predicted concentrations could be refined if the following information becomes available:

- Site-specific crystalline silica analysis data;
- Site-specific silt loading values for paved and unpaved roads;
- Site-specific meteorological data for the Facility; and
- Review of traffic and road configurations;
  - Roadways could be located further away from the sensitive receptor locations;
  - Use of haul trucks with Tier 4 rated engines.
- The wet deposition option (removal of particles from the atmosphere by precipitation) was not used in the AERMOD modelling assessment. Including wet deposition and depletion calculations in the model options would reduce the off-site predicted concentrations of particulates (dust).

If any of the above site or operational information is made available, it will be considered in the air quality assessment to be completed as part of the future ECA application.

6.2 Best Management Practices Plans for the Control of Fugitive Dust and Odour

In addition, the continued implementation of BMPPs for the control of fugitive dust and odour are recommended to assist with controlling emissions from the Facility. As Tomlinson is committed to minimizing the effects of fugitive dust and odour off-site and at sensitive receptors, updated BMPPs have been developed for the Facility. The BMPPs outline preventative and control measures to reduce the likelihood of high dust and odour emissions from the Facility. Inspections and monitoring procedures are also a part of the BMPPs and will allow for continuous improvement of the fugitive dust and odour management practices.

6.3 Air Quality Monitoring

The implementation of an air quality monitoring program once the Plant is in operation could be used to verify the predicted off-site concentrations of the indicator compounds as well as to guide the implementation and review of the fugitive dust best management practices. The monitoring program should be developed to follow the guidelines provided in the MECP *Operations Manual for Air Quality Monitoring in Ontario* (2018).

7.0 CONCLUSIONS

The results of the conservative air quality impact assessment for the proposed Napanee hot mix asphalt plant indicate that the maximum off-site predicted cumulative concentrations as a result of emissions from the Facility are below the assessment criteria. Although some of the predicted concentrations are approaching the criteria, it is important to note that the assessment criteria are not regulatory limits and are frequently exceeded at various locations across Ontario. Instead, they are to be used as screening criteria to represent an indicator of good air quality. In reality, there is a very low likelihood that the worst-case meteorology, the maximum Facility operations and the conditions that result in the 90th percentile of the existing air quality compounds would occur simultaneously. As a result, the maximum predicted cumulative concentrations presented in this assessment are very conservative.

Refinements to the modelling assessment discussed in section 6.1 will likely reduce the maximum predicted cumulative concentrations. The continued implementation of best management practices identified in the Facility's updated BMPPs can help to control fugitive dust and odour to reduce off-site effects. Implementation of an air quality monitoring program once the Plant is in operation would provide measured, off-site concentrations of the indicator compounds that could be used to evaluate the effectiveness of the BMPPs and determine whether the modelling assessment requires further refinements to better represent emissions from the Facility operations.

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Signature Page

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FIGURES

LEGEND

- PROPERTY BOUNDARY
- SUBJECT LANDS
- WATERCOURSE
- FACILITY

0 100 200

1:5,000 METRES

NOTE(S)

REFERENCE(S)

1. BASE DATA - MNRF, MECP 2021
2. BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 18

CLIENT
R.W. TOMLINSON LTD.

PROJECT
AIR QUALITY IMPACT ASSESSMENT - PROPOSED ASPHALT PLANT, TOWN OF GREATER NAPANEE, ONTARIO

TITLE
FACILITY LOCATION PLAN

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-09-14
DESIGNED	STB
PREPARED	STB
REVIEWED	SC/EKL
APPROVED	NCJ

PROJECT NO.	CONTROL	REV.	FIGURE
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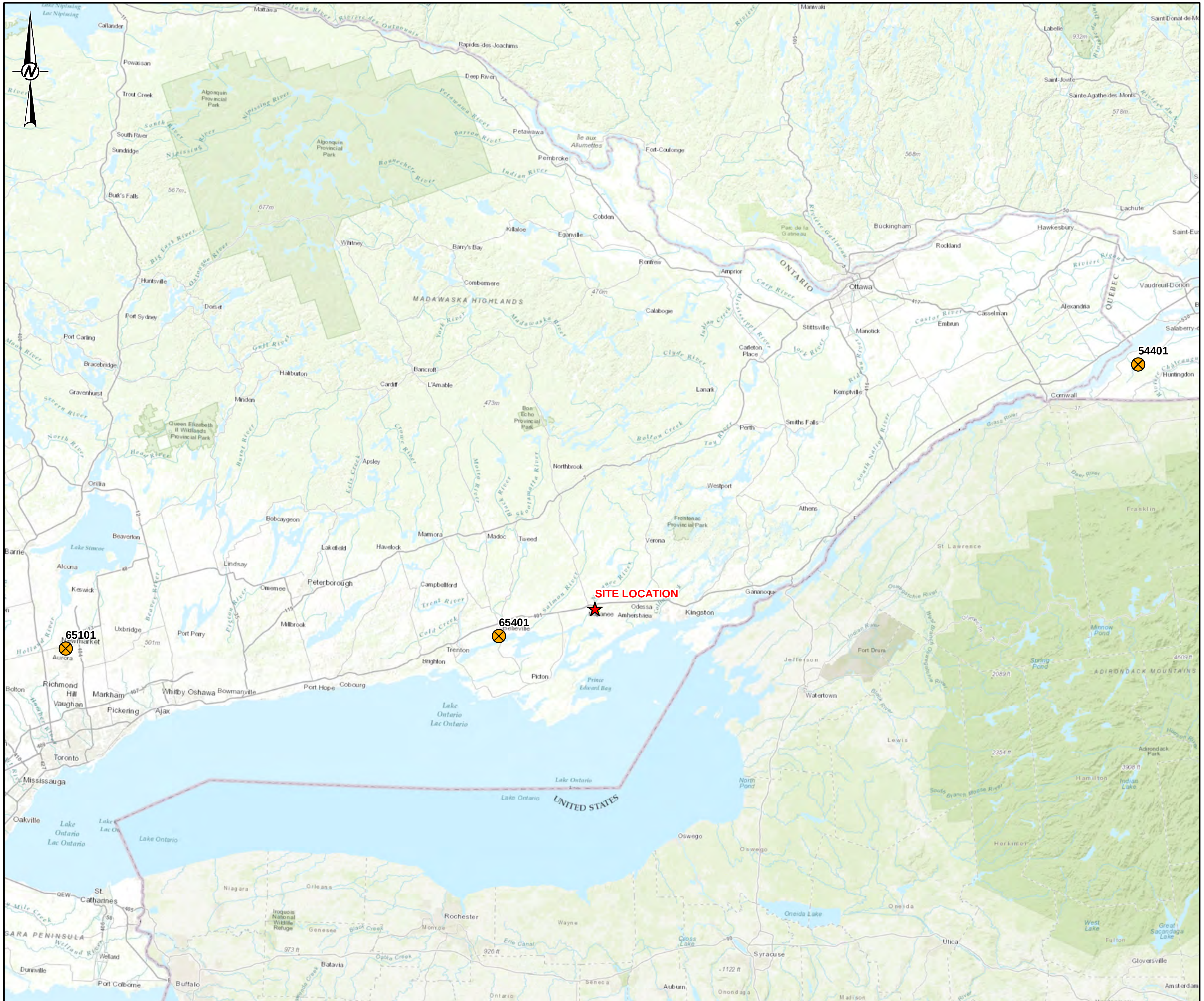

LEGEND

★ SITE LOCATION

⊗ AIR QUALITY MONITORING STATION

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1:1,500,000 KILOMETERS

NOTE(S)

REFERENCE(S)

1. BASE DATA - MNRF, MECP 2021
2. BASE IMAGERY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 18

CLIENT

R.W. TOMLINSON LTD.

PROJECT

AIR QUALITY IMPACT ASSESSMENT - PROPOSED ASPHALT PLANT, TOWN OF GREATER NAPANEE, ONTARIO

TITLE

AMBIENT AIR QUALITY MONITORING STATIONS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-09-07
DESIGNED	STB
PREPARED	STB
REVIEWED	SC/EKL
APPROVED	NCJ

PROJECT NO.	CONTROL	REV.	FIGURE
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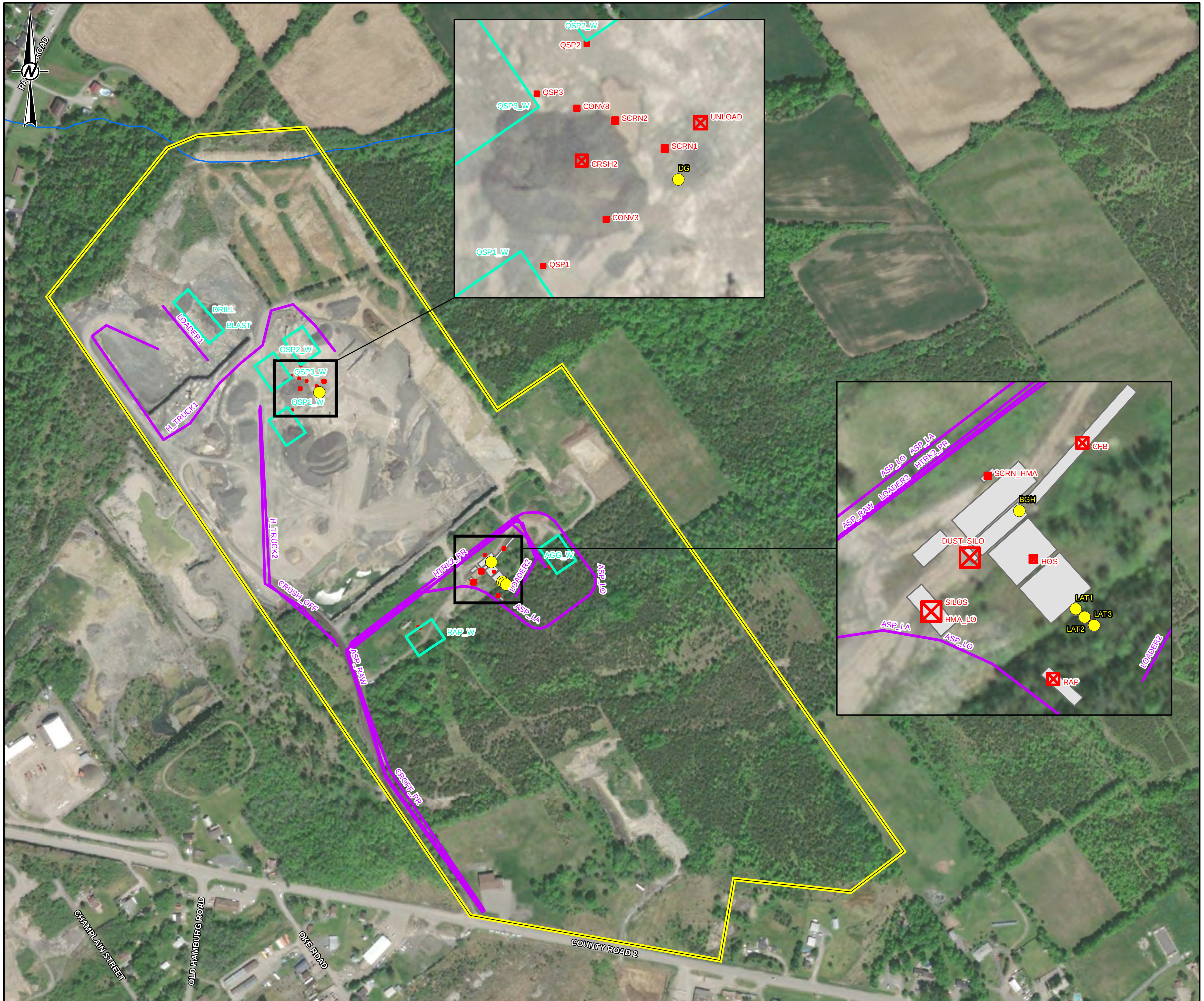


LEGEND

- POINT SOURCE
- PROPERTY BOUNDARY
- VOLUME SOURCE
- LINE VOLUME SOURCE
- AREA SOURCE
- WATERCOURSE
- FACILITY

0 100 200

1:5,000 METRES

NOTE(S)

REFERENCE(S)

1. BASE DATA - MNRF, MECP 2021
2. BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 18

CLIENT
R.W. TOMLINSON LTD.

PROJECT
AIR QUALITY IMPACT ASSESSMENT - PROPOSED ASPHALT PLANT, TOWN OF GREATER NAPANEE, ONTARIO

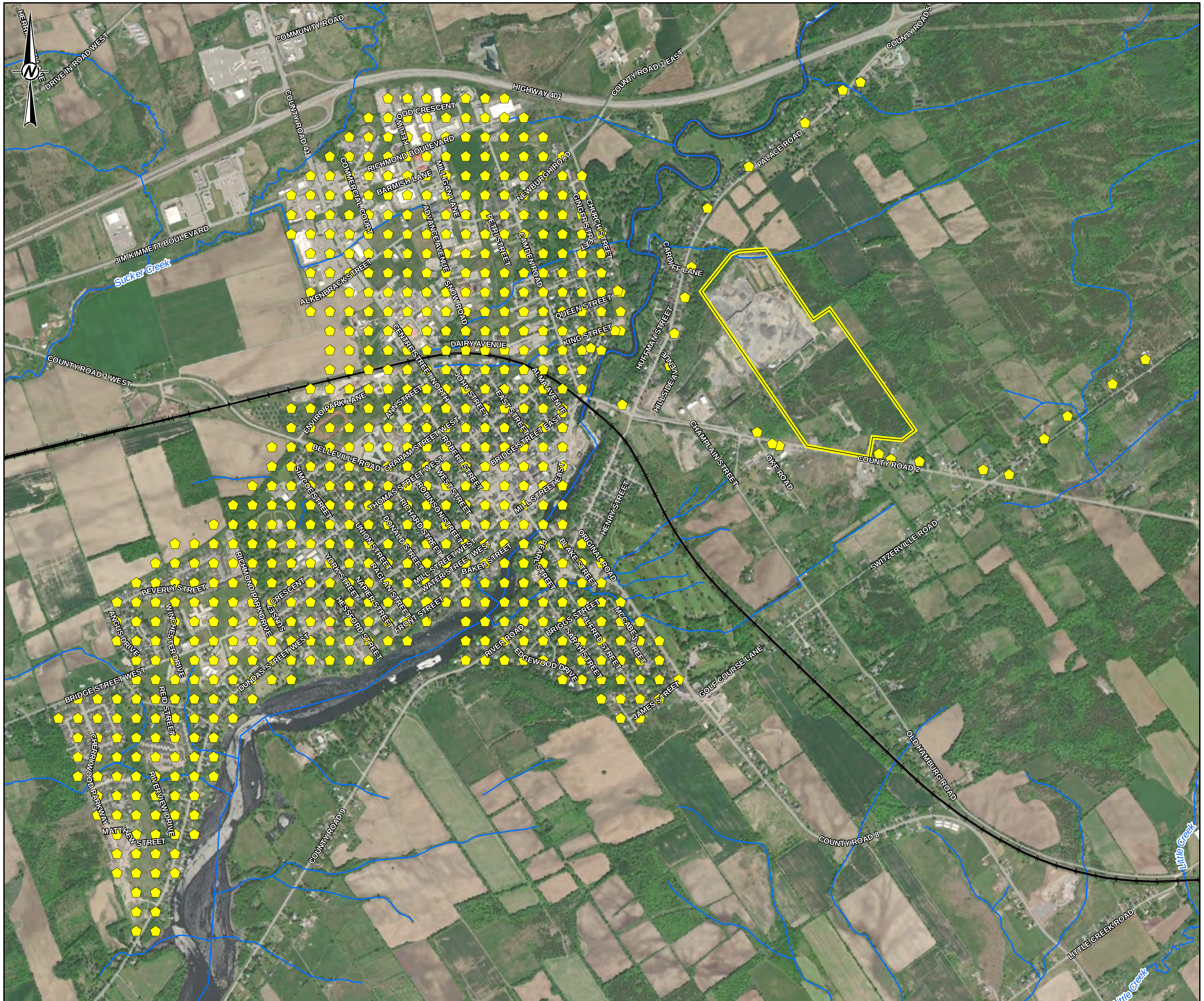
TITLE
DISPERSION MODELLING PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-14
DESIGNED	STB
PREPARED	STB
REVIEWED	SC/EKL
APPROVED	NCJ

PROJECT NO.	CONTROL	REV.	FIGURE
21467410	0001	A	3



LEGEND

- SENSITIVE RECEPTORS
- PROPERTY BOUNDARY
- RAILWAY
- WATERCOURSE

0 500 1,000

1:20,000 METRES

NOTE(S)

REFERENCE(S)

1. BASE DATA - MNRF, MECP 2021
2. BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 18

CLIENT
R.W. TOMLINSON LTD.

PROJECT
AIR QUALITY IMPACT ASSESSMENT - PROPOSED ASPHALT PLANT, TOWN OF GREATER NAPANEE, ONTARIO

TITLE
AIR QUALITY DISPERSION MODELLING RECEPTORS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-09-14
DESIGNED	STB
PREPARED	STB
REVIEWED	SC/EKL
APPROVED	NCJ

PROJECT NO.	CONTROL	REV.	FIGURE
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APPENDIX A

Source Summary Tables

Table A1
Source Summary Table

Source Identifier	Source Description	Emission Data							
		Contaminant	CAS No.	Averaging Period [hours]	1-hr Maximum Emission Rate [g/s]	24-hr Maximum Emission Rate [g/s]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions for 24-hr Maximum emission Scenario [%]
BL-DRILL	Blast hole drilling	SPM	N/A	24-hour, Annual	1.64E-02	—	EF	Average	—
		PM10	N/A-1	24-hour	8.61E-03	—	EF	Average	—
		PM2.5	N/A-2	24-hour, Annual	1.37E-03	—	EF	Marginal	—
		Crystalline Silica	14808-60-7	24-hour	1.18E-03	—	MB	Average	—
BL-EXP	Blasting Explosives	Carbon monoxide	630-08-0	1/2-hour	3.37E+01	—	EF	Marginal	—
		Nitrogen oxides	10102-44-0	1-hour, 24-hour	3.97E-01	1.65E-02	EF	Marginal	1%
BL-FUG	Blasting Fugitives	SPM	N/A	24-hour, Annual	1.49E+00	—	EF	Average	—
		PM10	N/A-1	24-hour	7.75E-01	—	EF	Marginal	—
		PM2.5	N/A-2	24-hour, Annual	4.47E-02	—	EF	Marginal	—
		Crystalline Silica	14808-60-7	24-hour	1.06E-01	—	MB	Average	—
UNLOAD	Truck unloading	SPM	N/A	24-hour, Annual	6.67E-04	6.67E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	6.67E-04	6.67E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	6.67E-04	6.67E-04	EF	Marginal	<1%
		Crystalline silica	14808-60-7	24-hour	9.14E-05	9.14E-05	MB	Marginal	<1%
CRSH1	Crushing	SPM	N/A	24-hour, Annual	3.60E-02	3.60E-02	EF	Marginal	3%
		PM10	N/A-1	24-hour	1.62E-02	1.62E-02	EF	Average	2%
		PM2.5	N/A-2	24-hour, Annual	3.00E-03	3.00E-03	EF	Marginal	1%
		Crystalline silica	14808-60-7	24-hour	1.79E-03	1.79E-03	MB	Average	9%
SCRN1	Screening	SPM	N/A	24-hour, Annual	9.17E-02	9.17E-02	EF	Marginal	7%
		PM10	N/A-1	24-hour	3.08E-02	3.08E-02	EF	Average	4%
		PM2.5	N/A-2	24-hour, Annual	2.08E-03	2.08E-03	EF	Marginal	<1%
		Crystalline silica	14808-60-7	24-hour	3.08E-03	3.08E-03	MB	Average	16%
CONV3	Conveyor	SPM	N/A	24-hour, Annual	2.02E-03	2.02E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	6.63E-04	6.63E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	1.87E-04	1.87E-04	EF	Marginal	<1%
		Crystalline silica	14808-60-7	24-hour	9.09E-05	9.09E-05	MB	Marginal	<1%
CRSH2	Crushing	SPM	N/A	24-hour, Annual	9.16E-02	9.16E-02	EF	Marginal	7%
		PM10	N/A-1	24-hour	4.12E-02	4.12E-02	EF	Average	6%
		PM2.5	N/A-2	24-hour, Annual	7.63E-03	7.63E-03	EF	Marginal	3%
		Crystalline silica	14808-60-7	24-hour	4.54E-03	4.54E-03	MB	Average	23%
SCRN2	Screening	SPM	N/A	24-hour, Annual	1.68E-01	1.68E-01	EF	Marginal	13%
		PM10	N/A-1	24-hour	5.65E-02	5.65E-02	EF	Average	8%
		PM2.5	N/A-2	24-hour, Annual	3.82E-03	3.82E-03	EF	Marginal	1%
		Crystalline silica	14808-60-7	24-hour	5.65E-03	5.65E-03	MB	Average	29%
CONV8	Conveyor	SPM	N/A	24-hour, Annual	1.89E-03	1.89E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	6.20E-04	6.20E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	1.75E-04	1.75E-04	EF	Marginal	<1%
		Crystalline silica	14808-60-7	24-hour	8.51E-05	8.51E-05	MB	Marginal	<1%
QSP1	Quarry Stockpile 1	SPM	N/A	24-hour, Annual	4.63E-01	—	EF	Average	—
		PM10	N/A-1	24-hour	2.03E-01	—	EF	Average	—
		PM2.5	N/A-2	24-hour, Annual	3.07E-02	—	EF	Average	—
		Crystalline Silica	14808-60-7	24-hour	2.78E-02	—	MB	Average	—
QSP2	Quarry Stockpile 2	SPM	N/A	24-hour, Annual	4.25E-01	—	EF	Average	—
		PM10	N/A-1	24-hour	1.86E-01	—	EF	Average	—
		PM2.5	N/A-2	24-hour, Annual	2.81E-02	—	EF	Average	—
		Crystalline Silica	14808-60-7	24-hour	2.55E-02	—	MB	Average	—
QSP3	Quarry Stockpile 3	SPM	N/A	24-hour, Annual	4.33E-01	—	EF	Average	—
		PM10	N/A-1	24-hour	1.90E-01	—	EF	Average	—
		PM2.5	N/A-2	24-hour, Annual	2.87E-02	—	EF	Average	—
		Crystalline Silica	14808-60-7	24-hour	2.60E-02	—	MB	Average	—
DG	Crushing Plant Generator	SPM	N/A	24-hour, Annual	1.19E-02	1.19E-02	EF	Above-Average	<1%
		PM10	N/A-1	24-hour	1.19E-02	1.19E-02	EF	Above-Average	2%
		PM2.5	N/A-2	24-hour, Annual	1.15E-02	1.15E-02	EF	Above-Average	4%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.36E-01	1.36E-01	EF	Above-Average	10%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	2.62E-04	2.62E-04	EF	Above-Average	<1%
		Carbon monoxide	630-08-0	1/2-hour	7.85E-02	7.85E-02	EF	Marginal	<1%
PILE1A	Aggregate Stockpile	SPM	N/A	24-hour, Annual	7.63E-01	—	EF	Above-Average	—
		PM10	N/A-1	24-hour	3.34E-01	—	EF	Above-Average	—
		PM2.5	N/A-2	24-hour, Annual	5.05E-02	—	EF	Above-Average	—
		Crystalline Silica	14808-60-7	24-hour	4.58E-02	—	MB	Above-Average	—
PILE1S	Sand Stockpile	SPM	N/A	24-hour, Annual	1.37E-01	—	EF	Above-Average	—
		PM10	N/A-1	24-hour	5.98E-02	—	EF	Above-Average	—
		PM2.5	N/A-2	24-hour, Annual	9.05E-03	—	EF	Above-Average	—
		Crystalline Silica	14808-60-7	24-hour	8.20E-03	—	MB	Above-Average	—
PILE2	RAP Stockpile	SPM	N/A	24-hour, Annual	9.11E-02	—	EF	Above-Average	—
		PM10	N/A-1	24-hour	3.98E-02	—	EF	Above-Average	—
		PM2.5	N/A-2	24-hour, Annual	6.03E-03	—	EF	Above-Average	—
		Crystalline Silica	14808-60-7	24-hour	5.46E-03	—	MB	Above-Average	—
CFB_A	Cold Feed Bins onto conveyors - Aggregate	SPM	N/A	24-hour, Annual	7.63E-01	—	EF	Above-Average	—
		PM10	N/A-1	24-hour	3.34E-01	—	EF	Above-Average	—
		PM2.5	N/A-2	24-hour, Annual	5.05E-02	—	EF	Above-Average	—
		Crystalline Silica	14808-60-7	24-hour	4.58E-02	—	MB	Above-Average	—
CFB_S	Cold Feed Bins onto conveyors - Sand	SPM	N/A	24-hour, Annual	1.37E-01	—	EF	Above-Average	—
		PM10	N/A-1	24-hour	5.98E-02	—	EF	Above-Average	—
		PM2.5	N/A-2	24-hour, Annual	9.05E-03	—	EF	Above-Average	—
		Crystalline Silica	14808-60-7	24-hour	8.20E-03	—	MB	Above-Average	—
RAP	RAP Bins onto conveyors	SPM	N/A	24-hour, Annual	9.11E-02	—	EF	Above-Average	—
		PM10	N/A-1	24-hour	3.98E-02	—	EF	Above-Average	—
		PM2.5	N/A-2	24-hour, Annual	6.03E-03	—	EF	Above-Average	—
		Crystalline Silica	14808-60-7	24-hour	5.46E-03	—	MB	Above-Average	—
SCRN_AGG	Cold Feed Screen - Aggregate	SPM	N/A	24-hour, Annual	5.23E-02	3.34E-02	EF	Marginal	3%
		PM10	N/A-1	24-hour	1.76E-02	1.12E-02	EF	Marginal	2%
		PM2.5	N/A-2	24-hour, Annual	1.19E-03	7.59E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	1.76E-03	1.12E-03	MB	Marginal	6%
SCRN_SAND	Cold Feed Screen - Sand	SPM	N/A	24-hour, Annual	1.65E-02	7.03E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	5.55E-03	2.36E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	3.75E-04	1.60E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	5.55E-04	2.36E-04	MB	Marginal	1%
SCRN_RAP	RAP Screen	SPM	N/A	24-hour, Annual	1.10E-02	1.05E-02	EF	Marginal	<1%
		PM10	N/A-1	24-hour	3.70E-03	3.55E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	2.50E-04	2.40E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	3.70E-04	3.55E-04	MB	Marginal	2%
LAT1	Liquid Asphalt Tank 1	SPM	N/A	24-hour, Annual	—	5.66E-03	EC	Marginal	<1%
		PM10	N/A-1	24-hour	—	5.66E-03	EC	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.66E-03	EC	Marginal	2%
		Benzene	71-43-2	24-hour, Annual	—	6.42E-06	EF	Average	<1%
		Benzo(a)pyrene	50-32-8	24-hour, Annual	—	1.30E-07	EF	Average	18%
		Naphthalene	91-20-3	10-minute, 24-hour	1.77E-03	1.03E-04	EF	Average	10%
		Arsenic	7440-38-2	24-hour	—	4.36E-06	EF	Marginal	12%
		Lead	7439-92-1	30-day, 24-hour	—	8.43E-06	EF	Average	12%
		Nickel	7440-02-0	24-hour, Annual	—	2.84E-05	EF	Marginal	12%

Table A1
Source Summary Table

Source Identifier	Source Description	Emission Data							
		Contaminant	CAS No.	Averaging Period [hours]	1-hr Maximum Emission Rate [g/s]	24-hr Maximum Emission Rate [g/s]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions for 24-hr Maximum emission Scenario [%]
LAT2	Liquid Asphalt Tank 2	SPM	N/A	24-hour, Annual	—	5.66E-03	EC	Marginal	<1%
		PM10	N/A-1	24-hour	—	5.66E-03	EC	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.66E-03	EC	Marginal	2%
		Benzene	71-43-2	24-hour, Annual	—	6.42E-06	EF	Average	<1%
		Benzo(a)pyrene	50-32-8	24-hour, Annual	—	1.30E-07	EF	Average	18%
		Naphthalene	91-20-3	10-minute, 24-hour	1.77E-03	1.03E-04	EF	Average	10%
		Arsenic	7440-38-2	24-hour	—	4.36E-06	EF	Marginal	12%
		Lead	7439-92-1	30-day, 24-hour	—	8.43E-06	EF	Average	12%
		Nickel	7440-02-0	24-hour, Annual	—	2.84E-05	EF	Marginal	12%
LAT3	Liquid Asphalt Tank 3	SPM	N/A	24-hour, Annual	—	5.66E-03	EC	Marginal	<1%
		PM10	N/A-1	24-hour	—	5.66E-03	EC	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.66E-03	EC	Marginal	2%
		Benzene	71-43-2	24-hour, Annual	—	6.42E-06	EF	Average	<1%
		Benzo(a)pyrene	50-32-8	24-hour, Annual	—	1.30E-07	EF	Average	18%
		Naphthalene	91-20-3	10-minute, 24-hour	1.77E-03	1.03E-04	EF	Average	10%
		Arsenic	7440-38-2	24-hour	—	4.36E-06	EF	Marginal	12%
		Lead	7439-92-1	30-day, 24-hour	—	8.43E-06	EF	Average	12%
		Nickel	7440-02-0	24-hour, Annual	—	2.84E-05	EF	Marginal	12%
BGH	HMA Plant Baghouse	Carbon Monoxide	630-08-0	1/2-hour	1.00E+01	1.00E+01	EF	Above-Average	99%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	6.25E-01	3.99E-01	EF	Marginal	30%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	1.15E-01	7.35E-02	EF	Marginal	93%
		SPM	N/A	24-hour, Annual	1.05E+00	6.71E-01	EF	Above-Average	52%
		PM10	N/A-1	24-hour	6.75E-01	4.31E-01	EF	Average	58%
		PM2.5	N/A-2	24-hour, Annual	2.08E-01	1.33E-01	EF	Marginal	47%
		Benzene	71-43-2	24-hour, Annual	—	4.47E-03	EF	Above-Average	97%
		Benzo(a)pyrene	50-32-8	24-hour, Annual	—	4.95E-08	EF	Marginal	7%
		Naphthalene	91-20-3	10-minute, 24-hour	9.00E-04	5.75E-04	EF	Marginal	53%
		Arsenic	7440-38-2	24-hour	—	7.35E-06	EF	Marginal	21%
		Lead	7439-92-1	30-day, 24-hour	—	1.42E-05	EF	Marginal	21%
		Nickel	7440-02-0	24-hour, Annual	—	4.79E-05	EF	Marginal	21%
DUST_LO	Dust Silo Load Out	SPM	N/A	24-hour, Annual	—	5.67E-03	EF	Above-Average	<1%
		PM10	N/A-1	24-hour	—	1.52E-03	EF	Above-Average	<1%
		PM2.5	N/A-2	24-hour, Annual	—	2.27E-04	EF	—	<1%
HOS	Hot Oil System	Nitrogen oxides	10102-44-0	1-hour, 24-hour	2.47E-02	2.47E-02	EF	Above-Average	2%
		Carbon monoxide	630-08-0	1/2-hour	2.08E-02	2.08E-02	EF	Above-Average	<1%
		SPM	N/A	24-hour, Annual	1.88E-03	1.88E-03	EF	Below-Average	<1%
		PM10	N/A-1	24-hour	1.88E-03	1.88E-03	EF	Below-Average	<1%
		PM2.5	N/A-2	24-hour, Annual	1.88E-03	1.88E-03	EF	Below-Average	<1%
		Sulphur dioxide	7446-09-5	1-hour, 24-hour, Annual	1.48E-04	1.48E-04	EF	Above-Average	<1%
SILO	Asphalt Silos	SPM	N/A	24-hour, Annual	1.71E-02	1.09E-02	EF	Average	<1%
		PM10	N/A-1	24-hour	1.71E-02	1.09E-02	EF	Average	1%
		PM2.5	N/A-2	24-hour, Annual	1.71E-02	1.09E-02	EF	Average	4%
		Carbon monoxide	630-08-0	1/2-hour	7.50E-05	7.50E-05	EF	Average	<1%
		Benzo(a)pyrene	50-32-8	24-hour, Annual	—	1.29E-07	EF	Average	17%
		Naphthalene	91-20-3	10-minute, 24-hour	1.60E-04	1.02E-04	EF	Average	9%
		Benzene	71-43-2	24-hour, Annual	—	8.63E-05	EF	Average	2%
		Arsenic	7440-38-2	24-hour	—	7.35E-06	EF	Marginal	21%
		Lead	7439-92-1	30-day, 24-hour	—	1.42E-05	EF	Marginal	21%
		Nickel	7440-02-0	24-hour, Annual	—	4.79E-05	EF	Marginal	21%
LO	Asphalt Load Out	SPM	N/A	24-hour, Annual	1.63E-02	1.04E-02	EF	Average	<1%
		PM10	N/A-1	24-hour	1.63E-02	1.04E-02	EF	Average	1%
		PM2.5	N/A-2	24-hour, Annual	1.63E-02	1.04E-02	EF	Average	4%
		Carbon monoxide	630-08-0	1/2-hour	4.67E-02	4.67E-02	EF	Average	<1%
		Benzo(a)pyrene	50-32-8	24-hour, Annual	—	1.74E-07	EF	Average	23%
		Naphthalene	91-20-3	10-minute, 24-hour	1.48E-04	9.43E-05	EF	Average	9%
		Benzene	71-43-2	24-hour, Annual	—	4.79E-05	EF	Average	1%
		Arsenic	7440-38-2	24-hour	—	7.35E-06	EF	Marginal	21%
		Lead	7439-92-1	30-day, 24-hour	—	1.42E-05	EF	Marginal	21%
		Nickel	7440-02-0	24-hour, Annual	—	4.79E-05	EF	Marginal	21%
LOADER1	4 Loaders (at Quarry)	SPM	N/A	24-hour, Annual	3.18E-01	—	EF	Above Average	—
		PM10	N/A-1	24-hour	8.10E-02	—	EF	Above Average	—
		PM2.5	N/A-2	24-hour, Annual	8.10E-03	—	EF	Above Average	—
		Crystalline Silica	14808-60-7	24-hour	1.11E-02	—	EF	Above Average	—
H_TRUCK1	Haul Trucks (Quarry to Crushing plant)	SPM	N/A	24-hour, Annual	2.30E+00	—	EF	Above Average	—
		PM10	N/A-1	24-hour	5.85E-01	—	EF	Above Average	—
		PM2.5	N/A-2	24-hour, Annual	5.85E-02	—	EF	Above Average	—
		Crystalline Silica	14808-60-7	24-hour	8.03E-02	—	EF	Above Average	—
H_TRUCK2	Haul Trucks (Crushing plant to HMA plant)	SPM	N/A	24-hour, Annual	7.04E-01	—	EF	Above Average	—
		PM10	N/A-1	24-hour	1.79E-01	—	EF	Above Average	—
		PM2.5	N/A-2	24-hour, Annual	1.79E-02	—	EF	Above Average	—
		Crystalline Silica	14808-60-7	24-hour	2.46E-02	—	EF	Above Average	—
CRUSH_OFF	Shipping Trucks (processed aggregate shipped	SPM	N/A	24-hour, Annual	8.45E-01	—	EF	Above Average	—
		PM10	N/A-1	24-hour	2.15E-01	—	EF	Above Average	—
		PM2.5	N/A-2	24-hour, Annual	2.15E-02	—	EF	Above Average	—
		Crystalline Silica	14808-60-7	24-hour	2.95E-02	—	EF	Above Average	—
LOADER2	Loader (at HMA plant)	SPM	N/A	24-hour, Annual	1.32E+00	—	EF	Above Average	—
		PM10	N/A-1	24-hour	3.37E-01	—	EF	Above Average	—
		PM2.5	N/A-2	24-hour, Annual	3.37E-02	—	EF	Above Average	—
		Crystalline Silica	14808-60-7	24-hour	4.62E-02	—	EF	Above Average	—
ASP_LO	Shipping Trucks (Asphalt load out from HMA	SPM	N/A	24-hour, Annual	1.70E-01	—	EF	Above Average	13%
		PM10	N/A-1	24-hour	3.26E-02	—	EF	Above Average	4%
		PM2.5	N/A-2	24-hour, Annual	7.89E-03	—	EF	Above Average	3%
		Crystalline Silica	14808-60-7	24-hour	4.47E-03	—	EF	Above Average	23%
ASP_RAW	Shipping Trucks (Sand and RAP delivery to	SPM	N/A	24-hour, Annual	6.98E-02	—	EF	Above Average	5%
		PM10	N/A-1	24-hour	1.34E-02	—	EF	Above Average	2%
		PM2.5	N/A-2	24-hour, Annual	3.24E-03	—	EF	Above Average	1%
		Crystalline Silica	14808-60-7	24-hour	1.84E-03	—	EF	Above Average	9%
W_TRUCK	Water truck	SPM	N/A	24-hour, Annual	0.00E+00	—	EF	Above Average	—
		PM10	N/A-1	24-hour	0.00E+00	—	EF	Above Average	—
		PM2.5	N/A-2	24-hour, Annual	0.00E+00	—	EF	Above Average	—
		Crystalline Silica	14808-60-7	24-hour	0.00E+00	—	EF	Above Average	—
ASP_LA	Shipping Trucks (Liquid asphalt delivery to	SPM	N/A	24-hour, Annual	2.40E-03		EF	Above Average	<1%
		PM10	N/A-1	24-hour	4.60E-04		EF	Above Average	<1%
		PM2.5	N/A-2	24-hour, Annual	1.11E-04		EF	Above Average	<1%
		Crystalline Silica	14808-60-7	24-hour	6.31E-05		EF	Above Average	<1%
HTRK2_PR	Haul Trucks (Crushing plant to HMA plant on	SPM	N/A	24-hour, Annual	1.17E-01		EF	Above Average	<1%
		PM10	N/A-1	24-hour	2.24E-02		EF	Above Average	<1%
		PM2.5	N/A-2	24-hour, Annual	5.43E-03		EF	Above Average	<1%
		Crystalline Silica	14808-60-7	24-hour	3.08E-03		EF	Above Average	<1%
CROFF_PR	Shipping Trucks (aggregate shipped offsite	SPM	N/A	24-hour, Annual	1.08E-01		EF	Above Average	<1%
		PM10	N/A-1	24-hour	2.07E-02		EF	Above Average	<1%
		PM2.5	N/A-2	24-hour, Annual	5.01E-03		EF	Above Average	<1%
		Crystalline Silica	14808-60-7	24-hour	2.84E-03		EF	Above Average	<1%
QSP1_W	Crusher Stockpiles Wind Erosion	SPM	N/A	24-hour, Annual	—	6.71E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	—	3.35E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.03E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	—	4.60E-04	EF	Marginal	2%

Table A1
Source Summary Table

Source Identifier	Source Description	Emission Data							
		Contaminant	CAS No.	Averaging Period [hours]	1-hr Maximum Emission Rate [g/s]	24-hr Maximum Emission Rate [g/s]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions for 24-hr Maximum emission Scenario [%]
QSP2_W	Crusher Stockpiles Wind Erosion	SPM	N/A	24-hour, Annual	—	6.71E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	—	3.35E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.03E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	—	4.60E-04	EF	Marginal	2%
QSP3_W	Crusher Stockpiles Wind Erosion	SPM	N/A	24-hour, Annual	—	6.71E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	—	3.35E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.03E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	—	4.60E-04	EF	Marginal	2%
AGG_W	HMA-Aggregate and Sand Stockpile Wind	SPM	N/A	24-hour, Annual	—	6.71E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	—	3.35E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	5.03E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	—	4.60E-04	EF	Marginal	2%
RAP_W	HMA-RAP Stockpile Wind Erosion	SPM	N/A	24-hour, Annual	—	8.60E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	—	4.30E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	—	6.45E-04	EF	Marginal	<1%
		Crystalline Silica	14808-60-7	24-hour	—	5.90E-04	EF	Marginal	3%
LOADER1_T	Loaders (at Quarry) - Tailpipe emissions	SPM	N/A	24-hour, Annual	3.59E-03	3.59E-03	EF	Marginal	<1%
		PM10	N/A-1	24-hour	3.59E-03	3.59E-03	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	3.48E-03	3.48E-03	EF	Marginal	1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	7.37E-02	7.37E-02	EF	Marginal	6%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	1.29E-03	1.29E-03	EF	Marginal	2%
		Carbon monoxide	630-08-0	1/2-hour	2.56E-02	—	EF	Marginal	—
LOADER2_T	Loader (at HMA plant) - Tailpipe emissions	SPM	N/A	24-hour, Annual	8.97E-04	8.97E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	8.97E-04	8.97E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	8.70E-04	8.70E-04	EF	Marginal	<1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.84E-02	1.84E-02	EF	Marginal	1%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	3.23E-04	3.23E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	6.40E-03	—	EF	Marginal	—
H_TRUCK1_T	Haul Trucks (Quarry to Crushing plant) -	SPM	N/A	24-hour, Annual	1.77E-02	1.77E-02	EF	Marginal	1%
		PM10	N/A-1	24-hour	1.77E-02	1.77E-02	EF	Marginal	2%
		PM2.5	N/A-2	24-hour, Annual	1.71E-02	1.71E-02	EF	Marginal	6%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.43E-01	1.43E-01	EF	Marginal	11%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	2.68E-04	2.68E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	8.07E-02	—	EF	Marginal	—
H_TRUCK2_T	Haul Trucks (Crushing plant to HMA plant) -	SPM	N/A	24-hour, Annual	1.77E-02	1.77E-02	EF	Marginal	1%
		PM10	N/A-1	24-hour	1.77E-02	1.77E-02	EF	Marginal	2%
		PM2.5	N/A-2	24-hour, Annual	1.71E-02	1.71E-02	EF	Marginal	6%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.43E-01	1.43E-01	EF	Marginal	11%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	2.68E-04	2.68E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	8.07E-02	—	EF	Marginal	—
HTRK2_PR_T	Haul Trucks (Crushing plant to HMA plant) -	SPM	N/A	24-hour, Annual	1.77E-02	1.77E-02	EF	Marginal	1%
		PM10	N/A-1	24-hour	1.77E-02	1.77E-02	EF	Marginal	2%
		PM2.5	N/A-2	24-hour, Annual	1.71E-02	1.71E-02	EF	Marginal	6%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.43E-01	1.43E-01	EF	Marginal	11%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	2.68E-04	2.68E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	8.07E-02	—	EF	Marginal	—
W_TRUCK_T	Water Truck - Tailpipe emissions	SPM	N/A	24-hour, Annual	1.77E-02	1.77E-02	EF	Marginal	1%
		PM10	N/A-1	24-hour	1.77E-02	1.77E-02	EF	Marginal	2%
		PM2.5	N/A-2	24-hour, Annual	1.71E-02	1.71E-02	EF	Marginal	6%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.43E-01	1.43E-01	EF	Marginal	11%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	2.68E-04	2.68E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	8.07E-02	—	EF	Marginal	—
ASP_RAW_T	Shipping Trucks (Sand and RAP delivery to	SPM	N/A	24-hour, Annual	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	8.37E-04	8.37E-04	EF	Marginal	<1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.73E-02	1.73E-02	EF	Marginal	1%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	4.37E-04	4.37E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	1.34E+00	—	EF	Marginal	—
ASP_LO_T	Shipping Trucks (Asphalt load out from HMA	SPM	N/A	24-hour, Annual	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	8.37E-04	8.37E-04	EF	Marginal	<1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.73E-02	1.73E-02	EF	Marginal	1%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	4.37E-04	4.37E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	1.34E+00	—	EF	Marginal	—
CRUSH_OFF_T	Shipping Trucks (processed aggregate shipped	SPM	N/A	24-hour, Annual	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	8.37E-04	8.37E-04	EF	Marginal	<1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.73E-02	1.73E-02	EF	Marginal	1%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	4.37E-04	4.37E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	1.34E+00	—	EF	Marginal	—
CROFF_PR_T	Shipping Trucks (aggregate shipped offsite	SPM	N/A	24-hour, Annual	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	8.37E-04	8.37E-04	EF	Marginal	<1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.73E-02	1.73E-02	EF	Marginal	1%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	4.37E-04	4.37E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	1.34E+00	—	EF	Marginal	—
ASP_LA_T	Shipping Trucks (Liquid asphalt delivery to	SPM	N/A	24-hour, Annual	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM10	N/A-1	24-hour	8.63E-04	8.63E-04	EF	Marginal	<1%
		PM2.5	N/A-2	24-hour, Annual	8.37E-04	8.37E-04	EF	Marginal	<1%
		Nitrogen Oxides	10102-44-0	1-hour, 24-hour	1.73E-02	1.73E-02	EF	Marginal	1%
		Sulphur Dioxide	7446-09-5	1-hour, 24-hour, Annual	4.37E-04	4.37E-04	EF	Marginal	<1%
		Carbon monoxide	630-08-0	1/2-hour	1.34E+00	—	EF	Marginal	—

Notes: Emission rates vary by hour of day and by wind speed for the material handling sources - PILE1A, PILE1S, RAP_MH, CFB_A, CFB_S, RAP, and QSP1 to QSP3. This table presents only the maximum possible emission rate, based on the maximum hourly wind speed of 15.4 m/s obtained from the "Crops" meteorological data set for Eastern dataset ("Massena").
"—" - No data or not applicable
"V-ST" - Validated Source Test, "ST" - Source Test, "EF" - Emission Factor, "MB" Mass Balance, "EC" - Engineering Calculation
Data Quality Categories: "Highest"; "Above-Average"; "Average"; and "Marginal"

Table A2
Dispersion Modelling Source Summary Table

Point Sources

Modelling ID	Source ID(s)	Source Description	Type of Source	Modelling Source Data: Stack Height Above Grade [m]	Stack Gas Exit Velocity [m/s]	Stack Inner Diameter [m]	Stack Exit Gas Temperature [°C]	X Coordinate [m]	Y Coordinate [m]	Emissions Data: Contaminant	CAS No.	Maximum 1-hr Emission Rate [g/s]	Maximum 24-hr Emission Rate [g/s]	Averaging Period
LAT1	LAT1	Liquid Asphalt Tank 1	Point Vertical	19.50	0.001	0.001	149.00	345839	4901854	SPM	N/A	—	5.66E-03	24-hour, Annual
										PM10	N/A-1	—	5.66E-03	24-hour
										PM2.5	N/A-2	—	5.66E-03	24-hour, Annual
										Benzene	71-43-2	—	6.42E-06	24-hour, Annual
										Benzo(a)pyrene	50-32-8	—	1.30E-07	24-hour, Annual
										Naphthalene	91-20-3	1.77E-03	1.03E-04	10-minute, 24-hour
										Arsenic	7440-38-2	—	4.36E-06	24-hour
										Lead	7439-92-1	—	8.43E-06	30-day, 24-hour
										Nickel	7440-02-0	—	2.84E-05	24-hour, Annual
LAT2	LAT2	Liquid Asphalt Tank 2	Point Vertical	19.50	0.001	0.001	149.00	345841	4901852	SPM	N/A	—	5.66E-03	24-hour, Annual
										PM10	N/A-1	—	5.66E-03	24-hour
										PM2.5	N/A-2	—	5.66E-03	24-hour, Annual
										Benzene	71-43-2	—	6.42E-06	24-hour, Annual
										Benzo(a)pyrene	50-32-8	—	1.30E-07	24-hour, Annual
										Naphthalene	91-20-3	1.77E-03	1.03E-04	10-minute, 24-hour
										Arsenic	7440-38-2	—	4.36E-06	24-hour
										Lead	7439-92-1	—	8.43E-06	30-day, 24-hour
										Nickel	7440-02-0	—	2.84E-05	24-hour, Annual
LAT3	LAT3	Liquid Asphalt Tank 3	Point Vertical	19.50	0.001	0.001	149.00	345843	4901849	SPM	N/A	—	5.66E-03	24-hour, Annual
										PM10	N/A-1	—	5.66E-03	24-hour
										PM2.5	N/A-2	—	5.66E-03	24-hour, Annual
										Benzene	71-43-2	—	6.42E-06	24-hour, Annual
										Benzo(a)pyrene	50-32-8	—	1.30E-07	24-hour, Annual
										Naphthalene	91-20-3	1.77E-03	1.03E-04	10-minute, 24-hour
										Arsenic	7440-38-2	—	4.36E-06	24-hour
										Lead	7439-92-1	—	8.43E-06	30-day, 24-hour
										Nickel	7440-02-0	—	2.84E-05	24-hour, Annual
BGH	BGH	HMA Plant Baghouse	Point Vertical	13.72	22.315	1.55	121.00	345824	4901879	Carbon Monoxide	630-08-0	1.00E+01	1.00E+01	1/2-hour
										Nitrogen Oxides	10102-44-0	6.25E-01	3.99E-01	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	1.15E-01	7.35E-02	1-hour, 24-hour, Annual
										SPM	N/A	1.05E+00	6.71E-01	24-hour, Annual
										PM10	N/A-1	6.75E-01	4.31E-01	24-hour
										PM2.5	N/A-2	2.08E-01	1.33E-01	24-hour, Annual
										Benzene	71-43-2	—	4.47E-03	24-hour, Annual
										Benzo(a)pyrene	50-32-8	—	4.95E-08	24-hour, Annual
										Naphthalene	91-20-3	9.00E-04	5.75E-04	10-minute, 24-hour
										Arsenic	7440-38-2	—	7.35E-06	24-hour
										Lead	7439-92-1	—	1.42E-05	30-day, 24-hour
										Nickel	7440-02-0	—	4.79E-05	24-hour, Annual
DG	DG	Crushing Plant Generator	Point Vertical	4.17	60.7590	0.15	426.30	345602	4902098	SPM	N/A	1.19E-02	1.19E-02	24-hour, Annual
										PM10	N/A-1	1.19E-02	1.19E-02	24-hour
										PM2.5	N/A-2	1.15E-02	1.15E-02	24-hour, Annual
										Nitrogen Oxides	10102-44-0	1.36E-01	1.36E-01	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	2.62E-04	2.62E-04	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	7.85E-02	7.85E-02	1/2-hour

Area Sources

Modelling ID	Source ID(s)	Source Description	Type of Source	Height Above Grade [m]	Area [m²]	Initial vertical dimension [m]	Release Height [m]	X-Coordinate [m]	Y-Coordinate [m]	Contaminant	CAS No.	Maximum 1-hr Emission Rate [g/s]	Maximum 24-hr Emission Rate [g/s]	Averaging Period [hours]
BLAST	BL-DRILL, BL-EXP, BL-FUG	Blast hole drilling, Blasting Explosives, Blasting Fugitives	Area	1.00	1750.00	0.23	1.00	345414	4902214	SPM	N/A	8.52E-04	—	24-hour, Annual
										PM10	N/A-1	4.43E-04	—	24-hour
										PM2.5	N/A-2	2.56E-05	—	24-hour, Annual
										Crystalline Silica	14808-60-7	6.08E-05	—	24-hour
										Carbon monoxide	630-08-0	1.93E-02	—	1/2-hour
										Nitrogen oxides	10102-44-0	2.27E-04	9.44E-06	1-hour, 24-hour
DRILL	BL-DRILL	Blast hole drilling	Area	1.00	1750.00	0.23	1.00	345414	4902214	SPM	N/A	9.37E-06	—	24-hour, Annual
										PM10	N/A-1	4.92E-06	—	24-hour
										PM2.5	N/A-2	7.80E-07	—	24-hour, Annual
										Crystalline Silica	14808-60-7	6.75E-07	—	24-hour
QSP1_W	QSP1_W	Crusher Stockpiles Wind Erosion	Area	14.00	1200.00	3.26	7.00	345560	4902029	SPM	N/A	—	5.59E-06	24-hour, Annual
										PM10	N/A-1	—	2.79E-06	24-hour
										PM2.5	N/A-2	—	4.19E-07	24-hour, Annual
										Crystalline Silica	14808-60-7	—	3.83E-07	24-hour
QSP2_W	QSP2_W	Crusher Stockpiles Wind Erosion	Area	14.00	1200.00	3.26	7.00	345579	4902133	SPM	N/A	—	5.59E-06	24-hour, Annual
										PM10	N/A-1	—	2.79E-06	24-hour
										PM2.5	N/A-2	—	4.19E-07	24-hour, Annual
										Crystalline Silica	14808-60-7	—	3.83E-07	24-hour
QSP3_W	QSP3_W	Crusher Stockpiles Wind Erosion	Area	14.00	1200.00	3.26	7.00	345542	4902099	SPM	N/A	—	5.59E-06	24-hour, Annual
										PM10	N/A-1	—	2.79E-06	24-hour
										PM2.5	N/A-2	—	4.19E-07	24-hour, Annual
										Crystalline Silica	14808-60-7	—	3.83E-07	24-hour
AGG_W	AGG_W	HMA-Aggregate and Sand Stockpile Wind	Area	14.00	1200.00	3.26	7.00	345909	4901864	SPM	N/A	—	5.59E-06	24-hour, Annual
										PM10	N/A-1	—	2.79E-06	24-hour
										PM2.5	N/A-2	—	4.19E-07	24-hour, Annual
										Crystalline Silica	14808-60-7	—	3.83E-07	24-hour
RAP_W	RAP_W	HMA-RAP Stockpile Wind Erosion	Area	14.00	1200.00	3.26	7.00	345714	4901783	SPM	N/A	—	7.17E-06	24-hour, Annual
										PM10	N/A-1	—	3.58E-06	24-hour
										PM2.5	N/A-2	—	5.37E-07	24-hour, Annual
										Crystalline Silica	14808-60-7	—	4.91E-07	24-hour

Volume Sources

Modelling ID	Source ID(s)	Source Description	Type of Source	Height Above Grade [m]	Initial lateral dimension [m]	Initial vertical dimension [m]	Release Height [m]	X-Coordinate [m]	Y-Coordinate [m]	Contaminant	CAS No.	Maximum 1-hr Emission Rate [g/s]	Maximum 24-hr Emission Rate [g/s]	Averaging Period [hours]
UNLOAD	UNLOAD, CRSH1	Truck unloading, Crushing	Volume	1.68	0.77	0.39	0.84	345608	4902112	SPM	N/A	3.67E-02	3.67E-02	24-hour, Annual
										PM10	N/A-1	1.69E-02	1.69E-02	24-hour
										PM2.5	N/A-2	3.67E-03	3.67E-03	24-hour, Annual
										Crystalline Silica	14808-60-7	1.88E-03	1.88E-03	24-hour
SCRN1	SCRN1	Screening	Volume	0.61	0.35	0.28	0.30	345599	4902106	SPM	N/A	9.17E-02	9.17E-02	24-hour, Annual
										PM10	N/A-1	3.08E-02	3.08E-02	24-hour
										PM2.5	N/A-2	2.08E-03	2.08E-03	24-hour, Annual
										Crystalline silica	14808-60-7	3.08E-03	3.08E-03	24-hour
CONV3	CONV3	Conveyor	Volume	1.52	0.28	0.35	0.76	345584	4902087	SPM	N/A	2.02E-03	2.02E-03	24-hour, Annual
										PM10	N/A-1	6.63E-04	6.63E-04	24-hour
										PM2.5	N/A-2	1.87E-04	1.87E-04	24-hour, Annual
										Crystalline silica	14808-60-7	9.09E-05	9.09E-05	24-hour
CRSH2	CRSH2	Crushing	Volume	0.61	0.70	0.28	0.30	345577	4902102	SPM	N/A	9.16E-02	9.16E-02	24-hour, Annual
										PM10	N/A-1	4.12E-02	4.12E-02	24-hour
										PM2.5	N/A-2	7.63E-03	7.63E-03	24-hour, Annual
										Crystalline silica	14808-60-7	4.54E-03	4.54E-03	24-hour
SCRN2	SCRN2	Screening	Volume	1.83	0.35	0.85	0.91	345586	4902113	SPM	N/A	1.68E-01	1.68E-01	24-hour, Annual
										PM10	N/A-1	5.65E-02	5.65E-02	24-hour
										PM2.5	N/A-2	3.82E-03	3.82E-03	24-hour, Annual
										Crystalline silica	14808-60-7	5.65E-03	5.65E-03	24-hour
CONV8	CONV8	Conveyor	Volume	1.83	0.28	0.43	0.91	345576	4902116	SPM	N/A	1.89E-03	1.89E-03	24-hour, Annual
										PM10	N/A-1	6.20E-04	6.20E-04	24-hour
										PM2.5	N/A-2	1.75E-04	1.75E-04	24-hour, Annual
										Crystalline silica	14808-60-7	8.51E-05	8.51E-05	24-hour
QSP1	QSP1	Quarry Stockpile 1	Volume	3.05	0.23	0.71	1.52	345568	4902075	SPM	N/A	4.63E-01	—	24-hour, Annual
										PM10	N/A-1	2.03E-01	—	24-hour
										PM2.5	N/A-2	3.07E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	2.78E-02	—	24-hour
QSP2	QSP2	Quarry Stockpile 2	Volume	3.05	0.23	0.71	1.52	345579	4902133	SPM	N/A	4.25E-01	—	24-hour, Annual
										PM10	N/A-1	1.86E-01	—	24-hour
										PM2.5	N/A-2	2.81E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	2.55E-02	—	24-hour
QSP3	QSP3	Quarry Stockpile 3	Volume	2.44	0.23	0.57	1.22	345566	4902120	SPM	N/A	4.33E-01	—	24-hour, Annual
										PM10	N/A-1	1.90E-01	—	24-hour
										PM2.5	N/A-2	2.87E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	2.60E-02	—	24-hour
DG	DG	Crushing Plant Generator	Volume	4.17	0.00	0.00	0.15	345602	4902098	SPM	N/A	1.19E-02	1.19E-02	24-hour, Annual
										PM10	N/A-1	1.19E-02	1.19E-02	24-hour
										PM2.5	N/A-2	1.15E-02	1.15E-02	24-hour, Annual
										Nitrogen Oxides	10102-44-0	1.36E-01	1.36E-01	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	2.62E-04	2.62E-04	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	7.85E-02	7.85E-02	1/2-hour
AGG_MH	PILE1A, PILE1S	Aggregate Stockpile , Sand Stockpile	Volume	4.00	0.70	0.93	2.00	345901	4901873	SPM	N/A	9.00E-01	—	24-hour, Annual
										PM10	N/A-1	3.94E-01	—	24-hour
										PM2.5	N/A-2	5.96E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	5.40E-02	—	24-hour
RAP_MH	PILE2	RAP Stockpile	Volume	4.00	0.70	0.93	2.00	345731	4901795	SPM	N/A	9.11E-02	—	24-hour, Annual
										PM10	N/A-1	3.98E-02	—	24-hour
										PM2.5	N/A-2	6.03E-03	—	24-hour, Annual
										Crystalline Silica	14808-60-7	5.46E-03	—	24-hour
CFB	CFB_A, CFB_S	Cold Feed Bins onto conveyors - Aggregate, Cold Feed Bins onto conveyors - Sand	Volume	5.90	0.70	1.37	2.95	345840	4901896	SPM	N/A	9.00E-01	—	24-hour, Annual
										PM10	N/A-1	3.94E-01	—	24-hour
										PM2.5	N/A-2	5.96E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	5.40E-02	—	24-hour

Volume Sources

Modelling ID	Source ID(s)	Source Description	Type of Source	Height Above Grade [m]	Initial lateral dimension [m]	Initial vertical dimension [m]	Release Height [m]	X-Coordinate [m]	Y-Coordinate [m]	Contaminant	CAS No.	Maximum 1-hr Emission Rate [g/s]	Maximum 24-hr Emission Rate [g/s]	Averaging Period [hours]
RAP	RAP, SCRN_RAP	RAP Bins onto conveyors, RAP Screen	Volume	4.30	0.70	1.00	2.15	345833	4901836	SPM	N/A	1.02E-01	1.05E-02	24-hour, Annual
										PM10	N/A-1	4.35E-02	3.55E-03	24-hour
										PM2.5	N/A-2	6.28E-03	2.40E-04	24-hour, Annual
										Crystalline Silica	14808-60-7	5.83E-03	3.55E-04	24-hour
SCRN_HMA	SCRN_AGG, SCRN_SAND	Cold Feed Screen - Aggregate, Cold Feed Screen - Sand	Volume	6.20	0.35	2.88	3.10	345816	4901888	SPM	N/A	6.88E-02	4.04E-02	24-hour, Annual
										PM10	N/A-1	2.31E-02	1.36E-02	24-hour
										PM2.5	N/A-2	1.56E-03	9.18E-04	24-hour, Annual
										Crystalline Silica	14808-60-7	2.31E-03	1.36E-03	24-hour
DUST_SILO	DUST_LO	Dust Silo Load Out	Volume	—	1.71	1.02	4.40	345811	4901867	SPM	N/A	—	5.67E-03	24-hour, Annual
										PM10	N/A-1	—	1.52E-03	24-hour
										PM2.5	N/A-2	—	2.27E-04	24-hour, Annual
HOS	HOS	Hot Oil System	Volume	4.17	0.60	1.94	2.08	345828	4901866	Nitrogen oxides	10102-44-0	2.47E-02	2.47E-02	1-hour, 24-hour
										Carbon monoxide	630-08-0	2.08E-02	2.08E-02	1/2-hour
										SPM	N/A	1.88E-03	1.88E-03	24-hour, Annual
										PM10	N/A-1	1.88E-03	1.88E-03	24-hour
										PM2.5	N/A-2	1.88E-03	1.88E-03	24-hour, Annual
										Sulphur dioxide	7446-09-5	1.48E-04	1.48E-04	1-hour, 24-hour, Annual
SILOS	SILO	Asphalt Silos	Volume	20.00	1.19	9.30	10.00	345801	4901853	SPM	N/A	1.71E-02	1.09E-02	24-hour, Annual
										PM10	N/A-1	1.71E-02	1.09E-02	24-hour
										PM2.5	N/A-2	1.71E-02	1.09E-02	24-hour, Annual
										Carbon monoxide	630-08-0	7.50E-05	7.50E-05	1/2-hour
										Benzo(a)pyrene	50-32-8	—	1.29E-07	24-hour, Annual
										Naphthalene	91-20-3	1.60E-04	1.02E-04	10-minute, 24-hour
										Benzene	71-43-2	—	8.63E-05	24-hour, Annual
										Arsenic	7440-38-2	—	7.35E-06	24-hour
										Lead	7439-92-1	—	1.42E-05	30-day, 24-hour
										Nickel	7440-02-0	—	4.79E-05	24-hour, Annual
HMA_LO	LO	Asphalt Load Out	Volume	4.40	1.19	1.02	2.20	345801	4901853	SPM	N/A	1.63E-02	1.04E-02	24-hour, Annual
										PM10	N/A-1	1.63E-02	1.04E-02	24-hour
										PM2.5	N/A-2	1.63E-02	1.04E-02	24-hour, Annual
										Carbon monoxide	630-08-0	4.67E-02	4.67E-02	1/2-hour
										Benzo(a)pyrene	50-32-8	—	1.74E-07	24-hour, Annual
										Naphthalene	91-20-3	1.48E-04	9.43E-05	10-minute, 24-hour
										Benzene	71-43-2	—	4.79E-05	24-hour, Annual
										Arsenic	7440-38-2	—	7.35E-06	24-hour
										Lead	7439-92-1	—	1.42E-05	30-day, 24-hour
										Nickel	7440-02-0	—	4.79E-05	24-hour, Annual

Line Volume Sources

Modelling ID	Source ID(s)	Source Description	Type of Source	Configuration	Plume Width	Line Volume Type	Line Volume Height	X-Coordinate [m]	Y-Coordinate [m]	Contaminant	CAS No.	Maximum 1-hr Emission Rate [g/s]	Maximum 24-hr Emission Rate [g/s]	Averaging Period [hours]
LOADER1	LOADER1	4 Loaders (at Quarry)	Line Volume	Adjacent	9	Surface-Based	7	345400	4902209	SPM	N/A	3.21E-01	—	24-hour, Annual
										PM10	N/A-1	8.45E-02	—	24-hour
										PM2.5	N/A-2	1.16E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	1.11E-02	—	24-hour
										Nitrogen Oxides	10102-44-0	7.37E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	1.29E-03	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	2.56E-02	—	1/2-hour
H_TRUCK1	H_TRUCK1	Haul Trucks (Quarry to Crushing plant)	Line Volume	Adjacent	14	Surface-Based	7	345394	4902154	SPM	N/A	2.31E+00	—	24-hour, Annual
										PM10	N/A-1	6.03E-01	—	24-hour
										PM2.5	N/A-2	7.57E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	8.03E-02	—	24-hour
										Nitrogen Oxides	10102-44-0	1.43E-01	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	2.68E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	8.07E-02	—	1/2-hour
H_TRUCK2	H_TRUCK2	Haul Trucks (Crushing plant to HMA plant)	Line Volume	Adjacent	14	Surface-Based	7	345526	4902080	SPM	N/A	7.21E-01	—	24-hour, Annual
										PM10	N/A-1	1.97E-01	—	24-hour
										PM2.5	N/A-2	3.51E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	2.46E-02	—	24-hour
										Nitrogen Oxides	10102-44-0	1.43E-01	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	2.68E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	8.07E-02	—	1/2-hour
CRUSH_OFF	CRUSH_OFF	Shipping Trucks (processed aggregate shipped offsite from crushing plant)	Line Volume	Adjacent	14	Surface-Based	7	345525	4902076	SPM	N/A	8.45E-01	—	24-hour, Annual
										PM10	N/A-1	2.16E-01	—	24-hour
										PM2.5	N/A-2	2.24E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	2.95E-02	—	24-hour
										Nitrogen Oxides	10102-44-0	1.73E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	4.37E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	1.34E+00	—	1/2-hour
LOADER2	LOADER2	Loader (at HMA plant)	Line Volume	Adjacent	9	Surface-Based	7	345712	4901820	SPM	N/A	1.32E+00	—	24-hour, Annual
										PM10	N/A-1	3.38E-01	—	24-hour
										PM2.5	N/A-2	3.45E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	4.62E-02	—	24-hour
										Nitrogen Oxides	10102-44-0	1.84E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	3.23E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	6.40E-03	—	1/2-hour
ASP_LO	ASP_LO	Shipping Trucks (Asphalt load out from HMA plant)	Volume	Adjacent	14	Surface-Based	7	345813	4901427	SPM	N/A	1.71E-01	—	24-hour, Annual
										PM10	N/A-1	3.35E-02	—	24-hour
										PM2.5	N/A-2	8.73E-03	—	24-hour, Annual
										Crystalline Silica	14808-60-7	4.47E-03	—	24-hour
										Nitrogen Oxides	10102-44-0	1.73E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	4.37E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	1.34E+00	—	1/2-hour
ASP_RAW	ASP_RAW	Shipping Trucks (Sand and RAP delivery to HMA plant)	Line Volume	Adjacent	14	Surface-Based	7	345813	4901430	SPM	N/A	7.06E-02	—	24-hour, Annual
										PM10	N/A-1	1.43E-02	—	24-hour
										PM2.5	N/A-2	4.08E-03	—	24-hour, Annual
										Crystalline Silica	14808-60-7	1.84E-03	—	24-hour
										Nitrogen Oxides	10102-44-0	1.73E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	4.37E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	1.34E+00	—	1/2-hour

Line Volume Sources

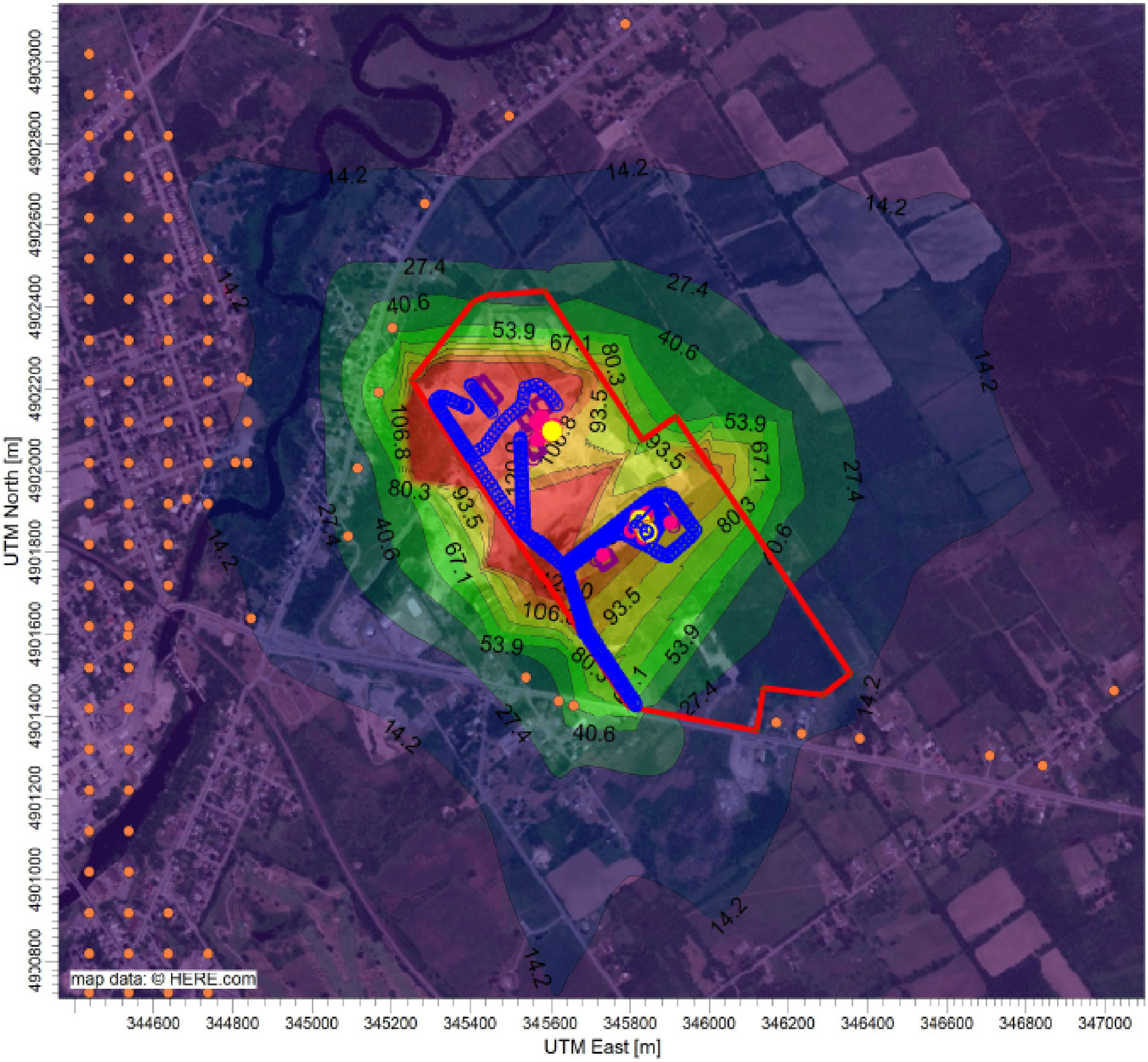
Modelling ID	Source ID(s)	Source Description	Type of Source	Configuration	Plume Width	Line Volume Type	Line Volume Height	X-Coordinate [m]	Y-Coordinate [m]	Contaminant	CAS No.	Maximum 1-hr Emission Rate [g/s]	Maximum 24-hr Emission Rate [g/s]	Averaging Period [hours]
ASP_LA	ASP_LA	Shipping Trucks (Liquid asphalt delivery to plant)	Line Volume	Adjacent	14	Surface-Based	7	345813	4901427	SPM	N/A	3.26E-03	—	24-hour, Annual
										PM10	N/A-1	1.32E-03	—	24-hour
										PM2.5	N/A-2	9.48E-04	—	24-hour, Annual
										Crystalline Silica	14808-60-7	6.31E-05	—	24-hour
										Nitrogen Oxides	10102-44-0	1.73E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	4.37E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	1.34E+00	—	1/2-hour
HTRK2_PR	HTRK2_PR	Haul Trucks (Crushing plant to HMA plant on paved roads)	Line Volume	Adjacent	14	Surface-Based	7	345638	4901762	SPM	N/A	1.35E-01	—	24-hour, Annual
										PM10	N/A-1	4.01E-02	—	24-hour
										PM2.5	N/A-2	2.26E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	3.08E-03	—	24-hour
										Nitrogen Oxides	10102-44-0	1.43E-01	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	2.68E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	8.07E-02	—	1/2-hour
CROFF_PR	CROFF_PR	Shipping Trucks (aggregate shipped offsite from crusher on PR)	Line Volume	Adjacent	14	Surface-Based	7	345637	4901762	SPM	N/A	1.09E-01	—	24-hour, Annual
										PM10	N/A-1	2.16E-02	—	24-hour
										PM2.5	N/A-2	5.85E-03	—	24-hour, Annual
										Crystalline Silica	14808-60-7	2.84E-03	—	24-hour
										Nitrogen Oxides	10102-44-0	1.73E-02	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	4.37E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	1.34E+00	—	1/2-hour
W_TRUCK	W_TRUCK	Water truck	Line Volume	Adjacent	14	Surface-Based	7	345393	4902157	SPM	N/A	1.77E-02	—	24-hour, Annual
										PM10	N/A-1	1.77E-02	—	24-hour
										PM2.5	N/A-2	1.71E-02	—	24-hour, Annual
										Crystalline Silica	14808-60-7	—	—	24-hour
										Nitrogen Oxides	10102-44-0	1.43E-01	—	1-hour, 24-hour
										Sulphur Dioxide	7446-09-5	2.68E-04	—	1-hour, 24-hour, Annual
										Carbon monoxide	630-08-0	8.07E-02	—	1/2-hour

APPENDIX B

Contour Plots

Maximum Predicted Concentration Contour Plot - 24-hr, SPM

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

Max: 289 [ug/m^3] at (345375.52, 4902040.31)

ug/m^3

1 | 14 | 27 | 41 | 54 | 67 | 80 | 94 | 107 | 120

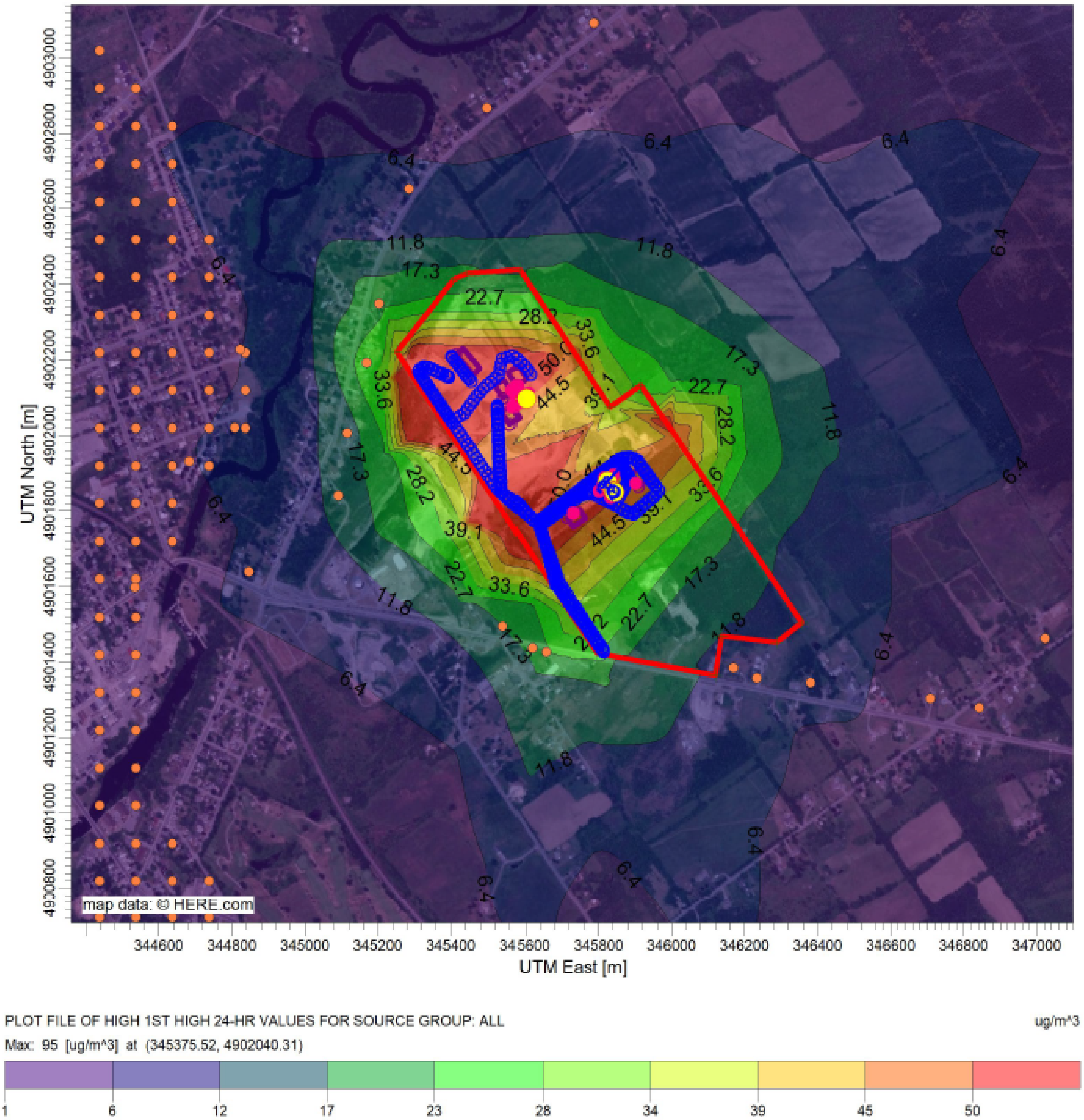
Legend	**SOURCES:** 41	**SPM AAQC (24-hr) = 120 ug/m3**
Property Boundary	**RECEPTORS:** 988	Made by: SC **Checked by: EKL**
Discrete Sensitive Receptor Point Source	**OUTPUT TYPE:** Concentration	**SCALE:** 1:14,000 0 — 0.5 km
Volume Source Area Source Line Volume Source	**MAX:** 289 ug/m^3	**DATE:** 2021-09-27

GOLDER
MEMBER OF WSP

PROJECT NO.: 21467410

Maximum Predicted Concentration Contour Plot - 24-hr, PM10

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



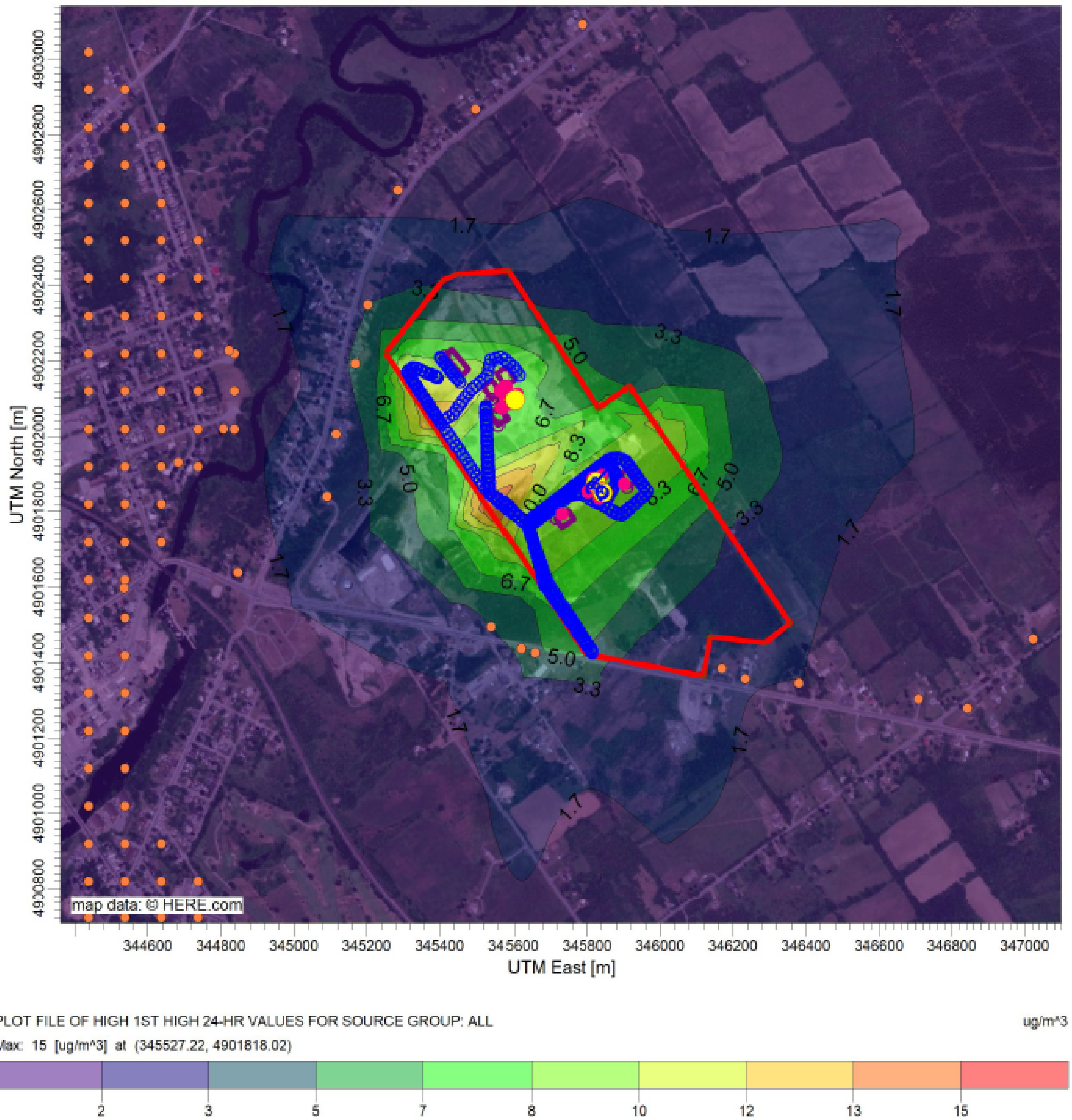
Legend

- Property Boundary
- Discrete Sensitive Receptor
- Point Source
- Volume Source
- Area Source
- Line Volume Source

SOURCES: 41	PM10 AAQC (24-hr) = 50 ug/m3	
RECEPTORS: 988	Made by: SC **Checked by: EKL**	GOLDER MEMBER OF WSP
OUTPUT TYPE: Concentration	SCALE: 1:14,000 0 — 0.5 km	
MAX: 95 ug/m^3	DATE: 2021-09-27	PROJECT NO.: **21467410**

Maximum Predicted Concentration Contour Plot - 24-hr, PM2.5

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



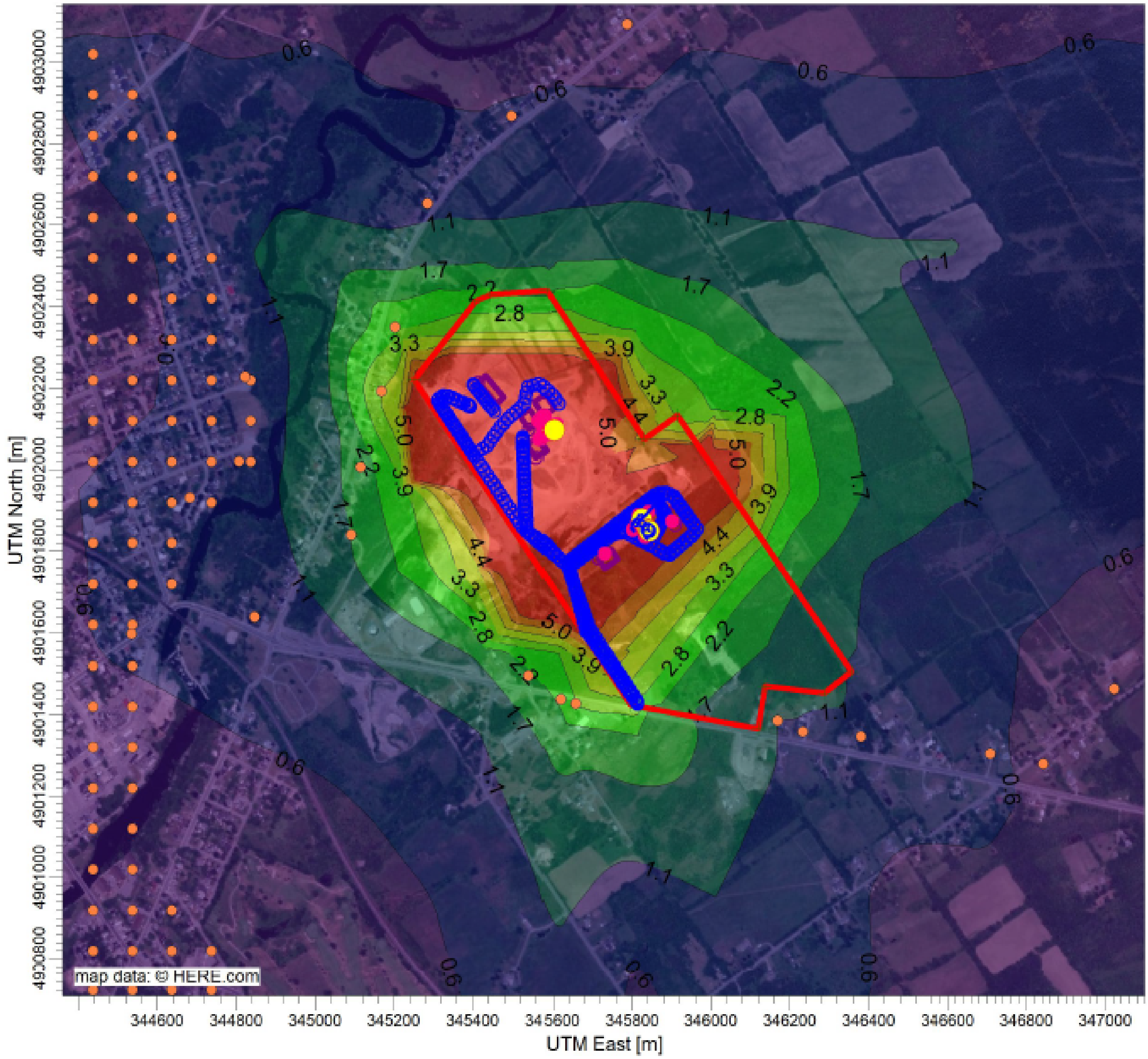
Legend

- Property Boundary
- Discrete Sensitive Receptor
- Point Source
- Volume Source
- Area Source
- Line Volume Source

SOURCES: 41	PM2.5 AAQC (24-hr) = 27 ug/m3	
RECEPTORS: 988	Made by: SC **Checked by: EKL**	GOLDER MEMBER OF WSP
OUTPUT TYPE: Concentration	SCALE: 1:14,000 0 — 0.5 km	
MAX: 15 ug/m^3	DATE: 2021-09-27	PROJECT NO.: 21467410

Maximum Predicted Concentration Contour Plot - 24-hr, Crystalline Silica

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 12 [ug/m^3] at (345375.52, 4902040.31)

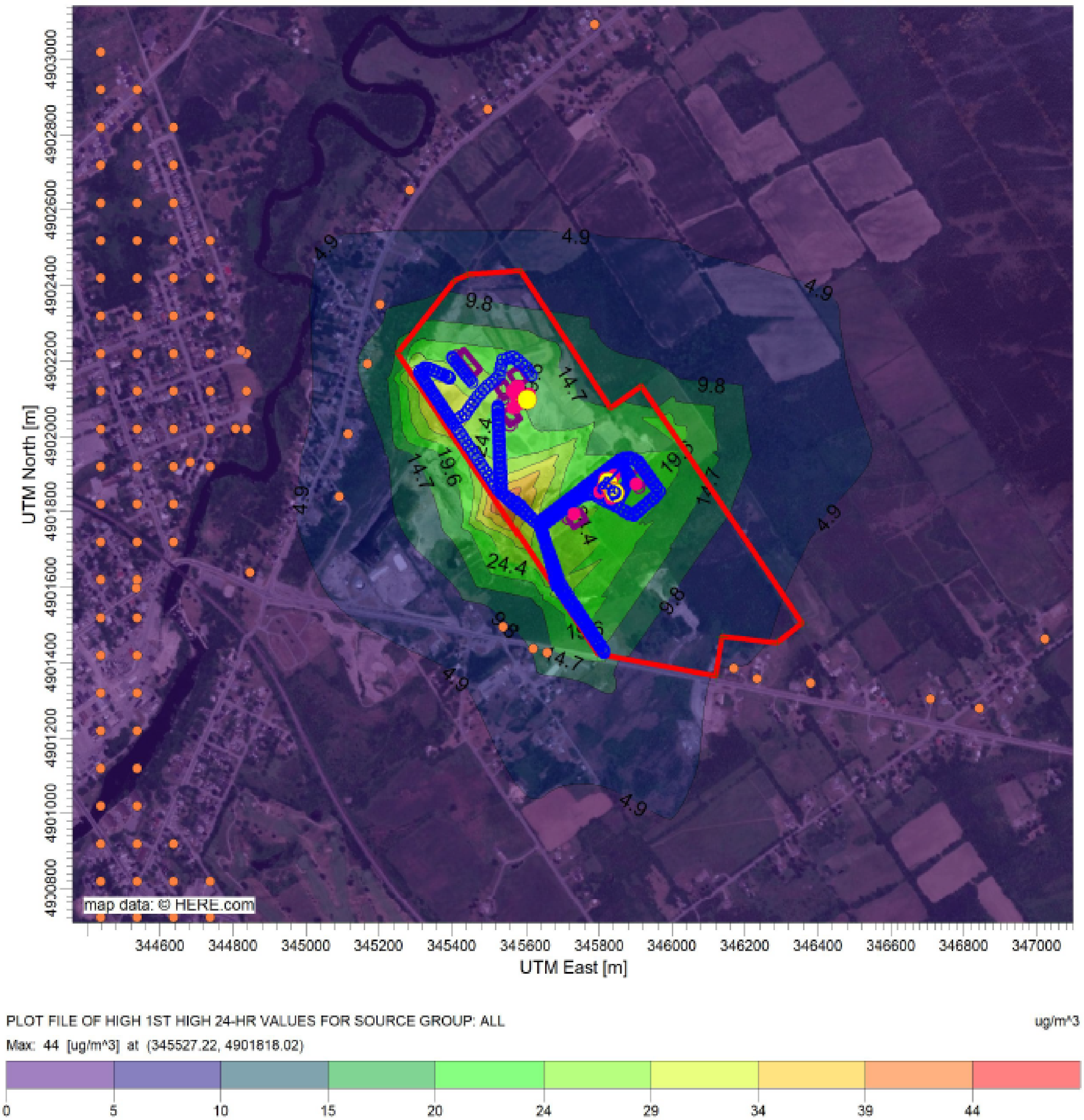
0 1 1 2 2 3 3 4 4 5

Legend

- Property Boundary
- Discrete Sensitive Receptor
- Point Source
- Volume Source
- Area Source
- Line Volume Source

SOURCES: 41	Crystalline Silica AAQC (24-hr) = 5 ug/m3	
RECEPTORS: 988	Made by: SC **Checked by: EKL**	GOLDER MEMBER OF WSP
OUTPUT TYPE: Concentration	SCALE: 1:14,000 0 0.5 km	
MAX: 12 ug/m^3	DATE: 2021-09-27	PROJECT NO.: **21467410**

Maximum Predicted Concentration Contour Plot - 24-hr, NOX
R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



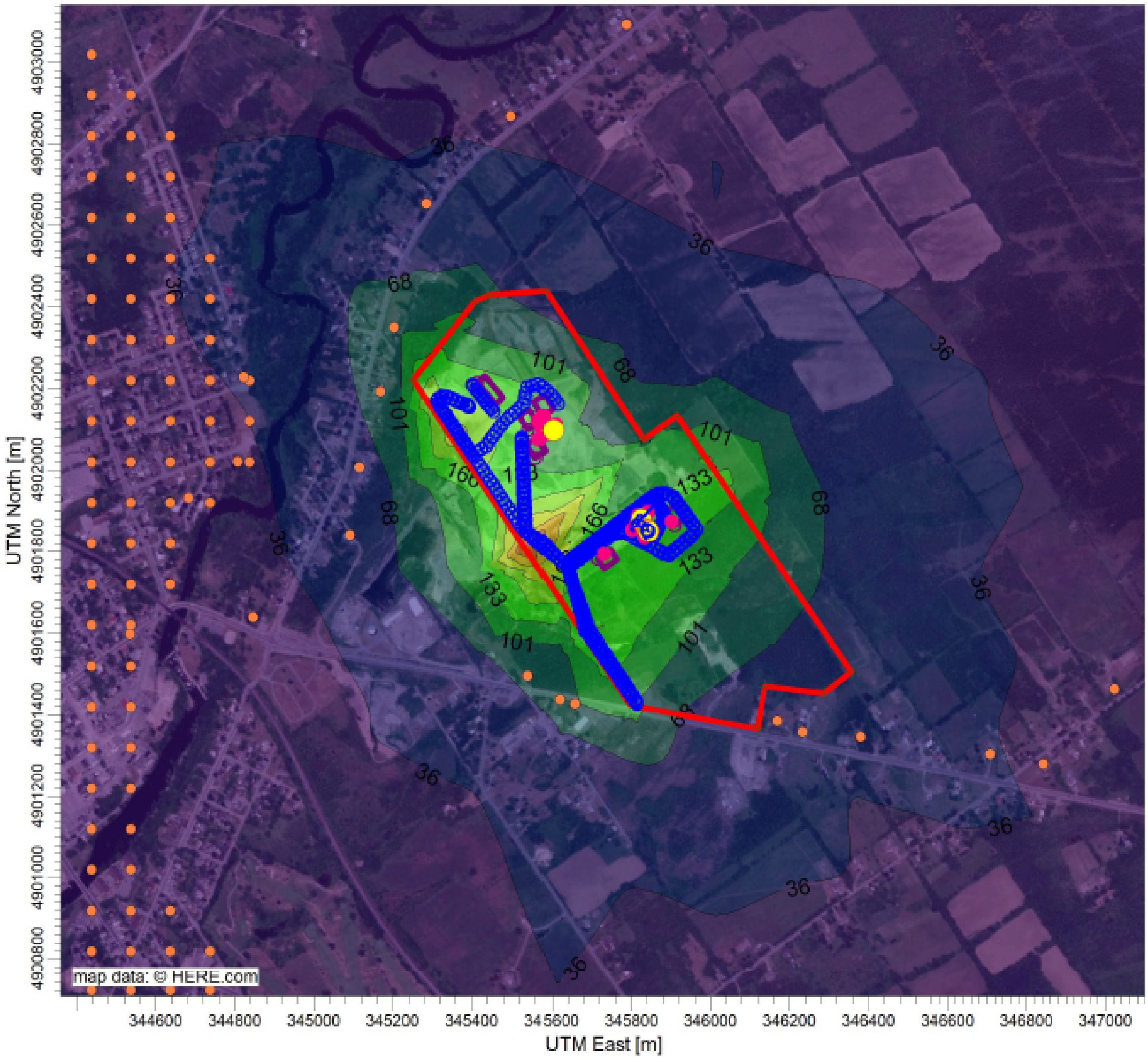
Legend

- Property Boundary
- Discrete Sensitive Receptor
- Point Source
- Volume Source
- Area Source
- Line Volume Source

SOURCES: 41	NOx AAQC (24-hr) = 200 ug/m3	
RECEPTORS: 988	Made by: SC Checked by: EKL	GOLDER MEMBER OF WSP
OUTPUT TYPE: Concentration	SCALE: 1:14,000 (0 – 0.5 km)	
MAX: 44 ug/m^3	DATE: 2021-09-27	PROJECT NO.: 21467410

Maximum Predicted Concentration Contour Plot - 1-hr, NOX

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 296 [ug/m^3] at (345532.84, 4901809.79)

3 | 36 | 68 | 101 | 133 | 166 | 198 | 231 | 263 | 296

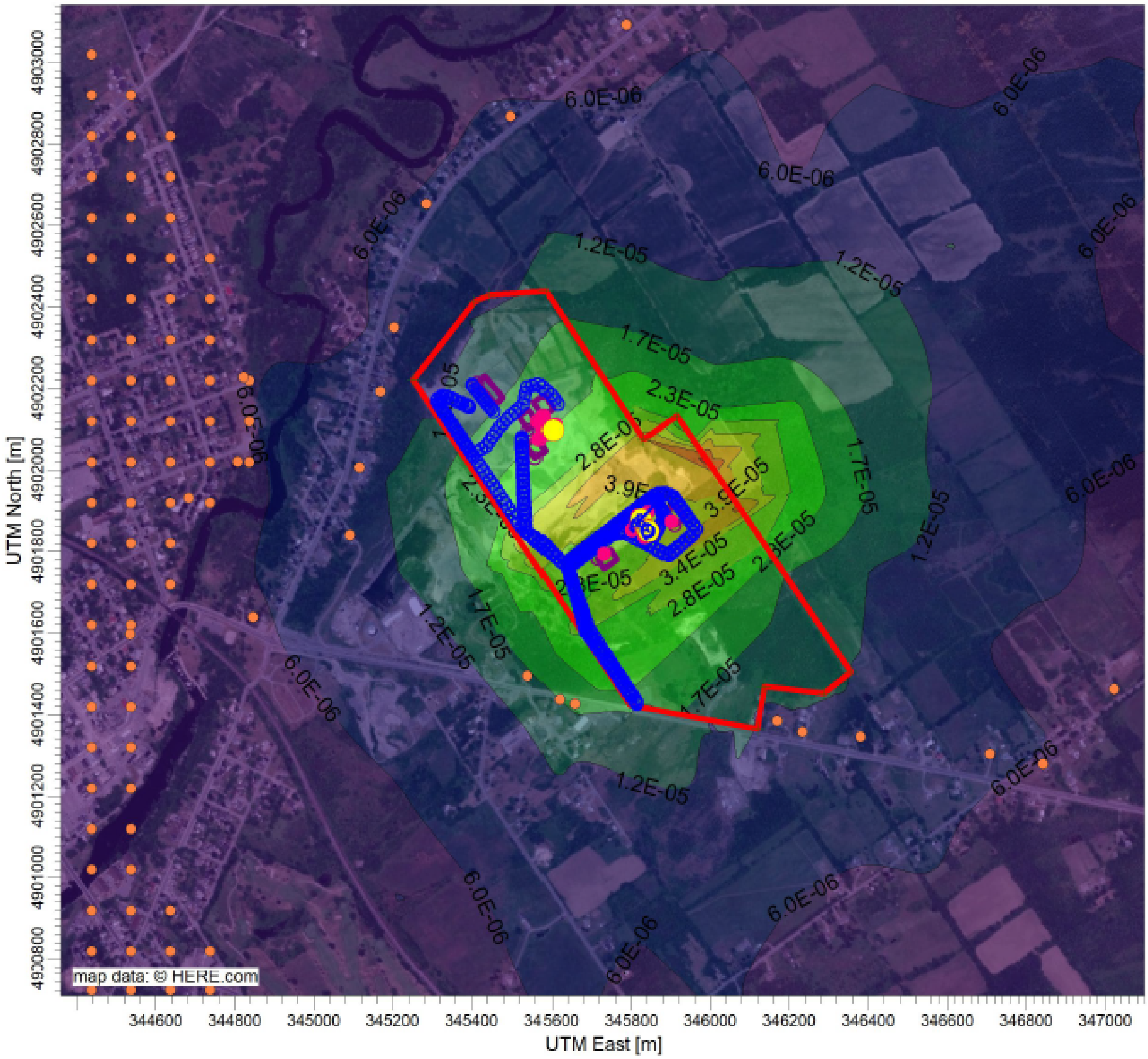
Legend

- Property Boundary
- Discrete Sensitive Receptor
- Point Source
- Volume Source
- Area Source
- Line Volume Source

SOURCES: 41	NOx AAQC (1-hr) = 400 ug/m3	
RECEPTORS: 988	Made by: SC Checked by: EKL	GOLDER MEMBER OF WSP
OUTPUT TYPE: Concentration	SCALE: 1:14,000 0 — 0.5 km	
MAX: 296 ug/m^3	DATE: 2021-09-27	PROJECT NO.: 21467410

Maximum Predicted Concentration Contour Plot - 24-hr, BaP

R.W. Tomlinson Ltd. Proposed Asphalt Plant, Town of Greater Napanee, Ontario



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 5.1E-05 [ug/m^3] at (345995.34, 4902018.89)

5.1E-07 | 6.0E-06 | 1.2E-05 | 1.7E-05 | 2.3E-05 | 2.8E-05 | 3.4E-05 | 3.9E-05 | 4.5E-05 | 5.0E-05

Legend

- Property Boundary
- Discrete Sensitive Receptor
- Point Source
- Volume Source
- Area Source
- Line Volume Source

SOURCES: 41	BaP AAQC (24-hr) = 0.00005 ug/m3	
RECEPTORS: 988	Made by: SC **Checked by: EKL**	GOLDER MEMBER OF WSP
OUTPUT TYPE: Concentration	SCALE: 1:14,000 0 0.5 km	
MAX: 5.1E-05 ug/m^3	DATE: 2021-09-27	PROJECT NO.: 21467410

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