CRITERIA POLLUTANT AND TOXICS MODELING REPORT

Seekonk Asphalt
Seekonk, MA

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1. INTRODUCTION

Trinity Consultants (Trinity) was contracted to perform an atmospheric dispersion modeling for emissions from Seekonk Asphalt Plant proposed to be located on an industrial parcel at 45 Industrial Court (Assessors Map 1, Lot 157) in Seekonk, Massachusetts. This modeling was requested at a pre-application meeting with the Massachusetts Department of Environmental Protection (MassDEP) on May 4, 2021.

The site location is shown in Figure 1-1. A close-in view of the site from Google Earth with emission sources and buildings overlayed is shown in Figure 1-2. The site layout of the proposed facility is shown in Figure 1-3. The latitude and longitude coordinates of the site are approximately 41.780829°N and 71.307631°W.

The remainder of this modeling report is organized as follows:

- Section 2 discussed the basis of the assessment, and
- Section 3 describes the choice of air dispersion model, modeling procedures, meteorological data, and methodology for analyzing building downwash, terrain, and other model parameters.

The proposed modeling methods described in this modeling report are consistent with:

- The United States Environmental Protection Agency's (U.S. EPA's) user's guides for the EPA Regulatory AERMOD Modeling System available from U.S. EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) website[1]
- U.S. EPA Guideline on Air Quality Models[2]
- MassDEP Modeling Guidance for Significant Stationary Sources of Air Pollution[3]
- MassDEP Ambient Air Toxics Guidelines[4]

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[1] SCRAM website: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod

[2] U.S. EPA, Guideline on Air Quality Models, 40 CFR Part 51 - Appendix W (latest rule update, effective May 2017)

[3] MassDEP Modeling Guidance: https://www.mass.gov/doc/modeling-guidance-for-significant-stationary-sources-of-air-pollution/download (June 2011)

[4] https://www.mass.gov/service-details/massdep-ambient-air-toxics-guidelines

Figure 1-1. Location of Site

Seekonk Asphalt Plant Boundary: □

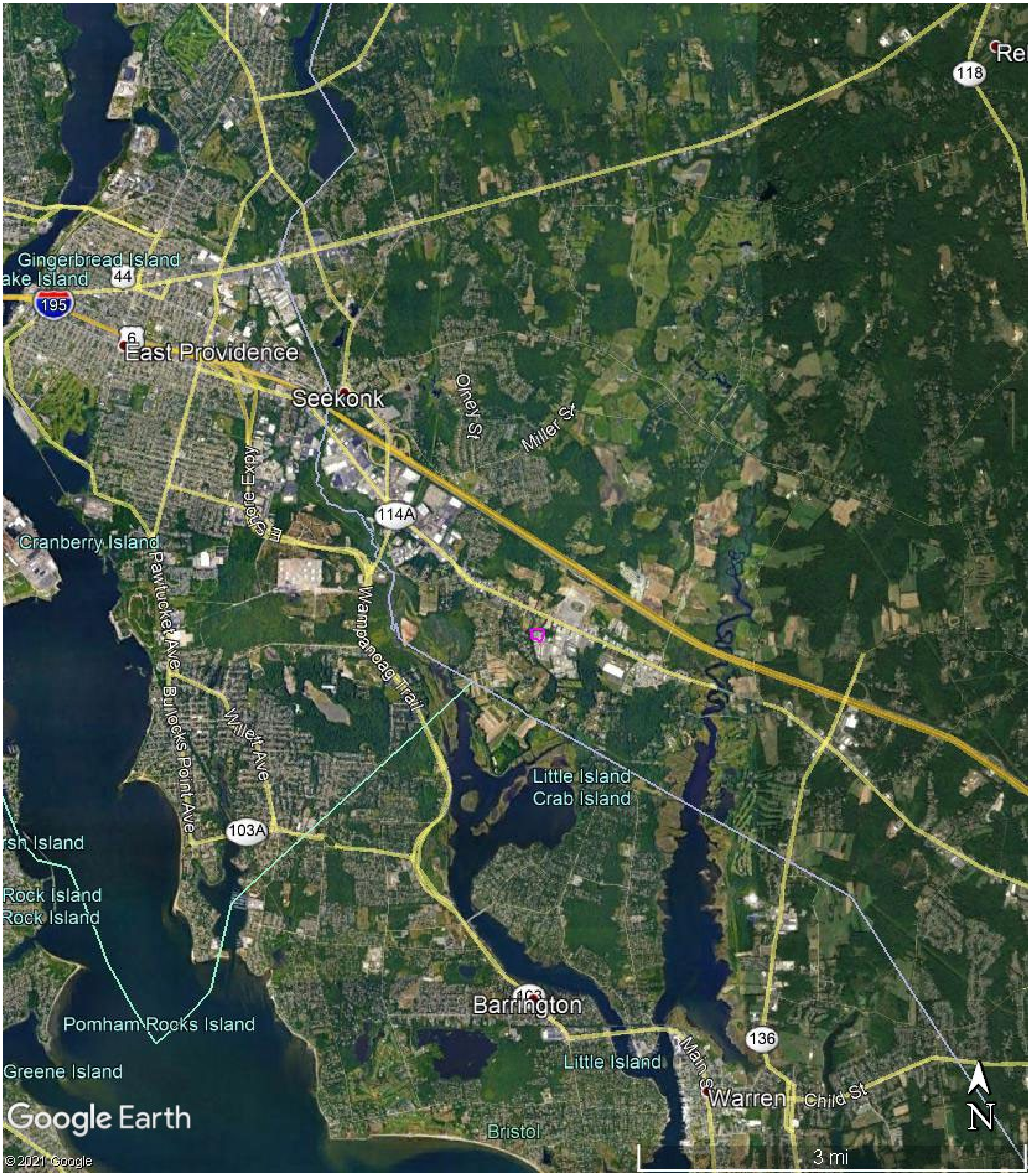


Figure 1-2. Location of Site (Close-in View)

Seekonk Asphalt Plant Boundary: □

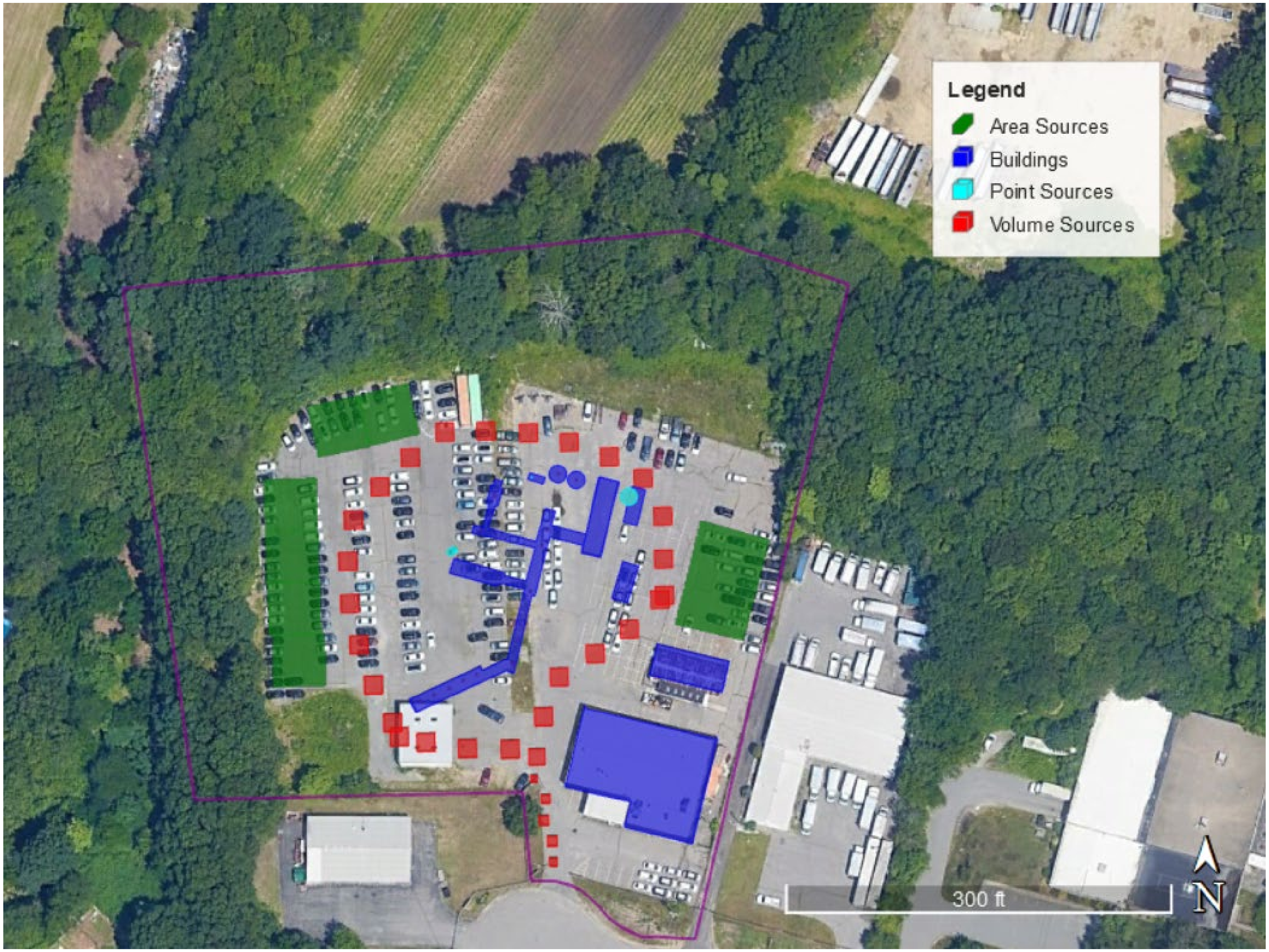
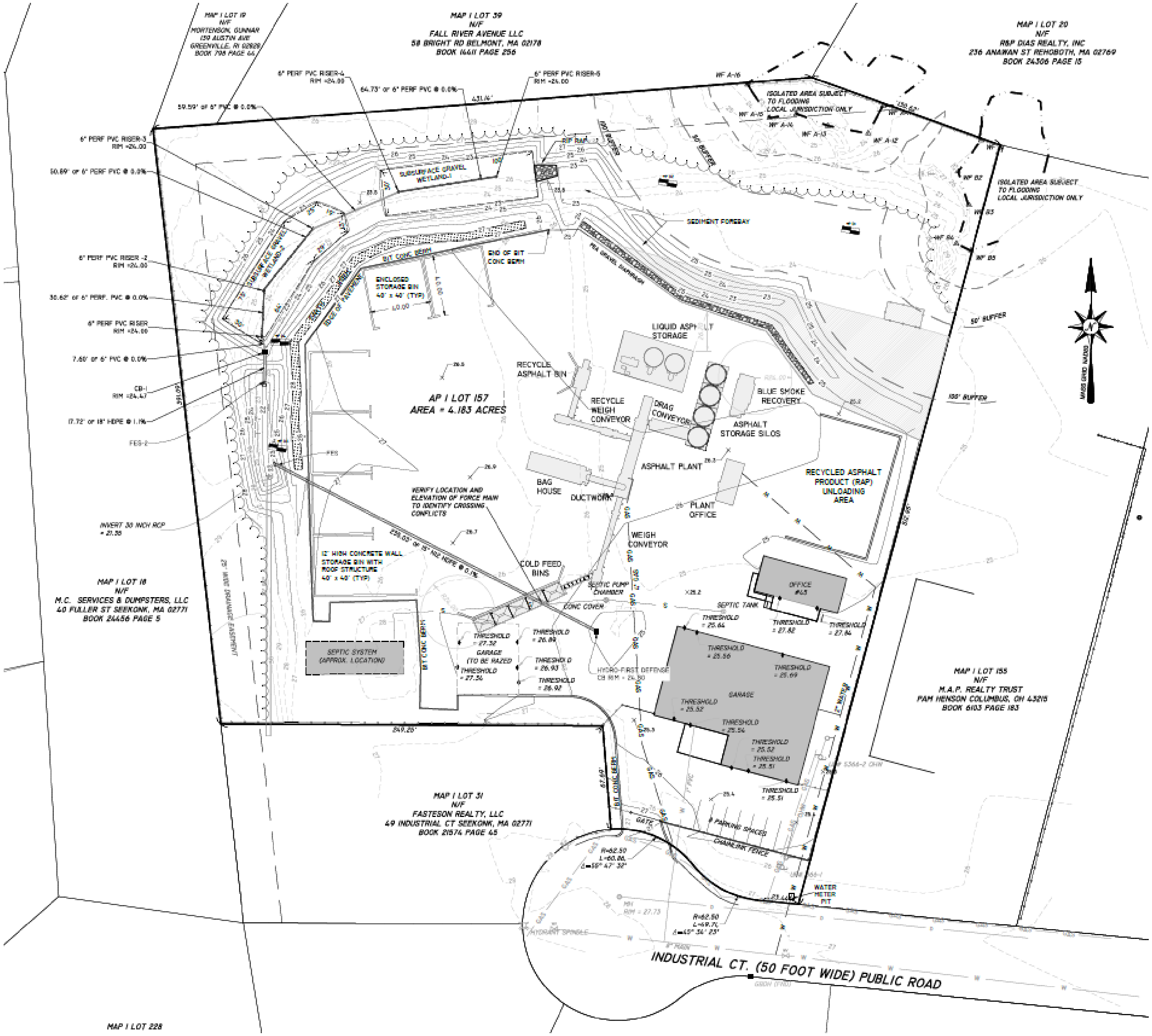


Figure 1-3. Site Layout



2. BASIS OF ASSESSMENT

The objective of this modeling analysis was to illustrate that the proposed project does not cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) and that the proposed project will meet Massachusetts air toxics guidelines for off-site impacts through air dispersion modeling.

2.1 National Ambient Air Quality Standards

A NAAQS analysis was used to determine whether the emissions from the Facility will cause or contribute to an exceedance of the NAAQS in the ambient air surrounding the facility.

The NAAQS are the maximum concentration ceilings, measured in terms of total concentration of a pollutant in the atmosphere, which define the "levels of air quality which the U.S. EPA judges are necessary, with an adequate margin of safety, to protect the public health." The NAAQS that was addressed in the air dispersion modeling analysis are shown in Table 2-1.

Table 2-1. National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)[1]
Particulate Matter < 10 μm (PM_{10})	24-hour[2]	150
Particulate Matter < 2.5 μm ($PM_{2.5}$)	24-hour[3]	35
	Annual[4]	12
Sulfur Dioxide (SO_2)	1-hour[5]	196
Carbon Monoxide (CO)	1-hour[6]	40,000
	8-hour[6]	10,000
Nitrogen Dioxide (NO_2)	1-hour[7]	188
	Annual[8]	100

Notes:
(1) http://www.epa.gov/air/criteria.html
(2) Not to be exceeded more than once per year on average over 3 years.
(3) The 3-year average of the 98th percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$.
(4) The 3-year average of the annual mean must not exceed 12 $\mu g/m^3$.
(5) The 3-year average of the 99th percentile of the daily maximum 1-hour average must not exceed 196 $\mu g/m^3$ (75 ppb).
(6) Not to be exceeded more than once per year.
(7) The 3-year average of the 98th percentile of the daily maximum 1-hour average must not exceed 188 $\mu g/m^3$ (100 ppb).
(8) Not to be exceeded.

The maximum modeled short-term and long-term time averaged concentrations at each receptor location was added to an existing background concentration and compared to the NAAQS. Table 2-2 shows the form of the monitored and modeled concentrations that was used.

Table 2-2. Form of Monitored and Modeled Values for Comparison to NAAQS

Pollutant	Averaging Period	Ambient Background Monitoring Design Value	NAAQS Modeling Demonstration
PM_{10}	24-hour	Maximum high second high (H2H) value across 3 years	Maximum high sixth high (H6H) value across 5 years
$PM_{2.5}$	24-hour	3-year average of the 98th percentile of the annual distribution of the 24-hour values	5-year average of the 98th percentile of the annual distribution of the 24-hour values
	Annual	3-year average of the annual values	5-year average of the annual values
SO_2	1-hour	3-year average of the 99th percentile of the annual distribution of the maximum daily 1-hour impacts	5-year average of the 99th percentile of the annual distribution of the maximum daily 1-hour impacts
NO_2	1-hour	3-year average of the 98th percentile of the annual distribution of the maximum daily 1- hour impacts	5-year average of the 98th percentile of the annual distribution of the maximum daily 1-hour impacts
	Annual	Maximum annual average across 3 years	Maximum annual average across 5 years
CO	1-hour	Maximum H2H value across 3 years	Maximum H2H value across 5 years
	8-hour	Maximum H2H value across 3 years	Maximum H2H value across 5 years

2.2 Significant Impact Levels

A Significant Impact Level (SIL) analysis was used to determine whether existing background sources have the potential to interact with the Facility's Significant Impact Area (SIA). The SIA's that was addressed in the air dispersion modeling analysis are shown in Table 2-1.

Table 2-3. Significant Impact Levels

Pollutant	Averaging Period	SIL (µg/m^3)	Modeling Rank
Particulate Matter < 10 µm (PM_{10})	24-hour	5	H1H
Particulate Matter < 2.5 µm ($PM_{2.5}$)	24-hour	1.2	Average of each year's H1H over 5-years
	Annual	0.3	Average of each year's H1H over 5-years
Sulfur Dioxide (SO_2)	1-hour	7.9	Average of each year's H1H over 5-years
Carbon Monoxide (CO)	1-hour	2,000	H1H
	8-hour	500	H1H
Nitrogen Dioxide (NO_2)	1-hour	7.5	Average of each year's H1H over 5-years
	Annual	100	H1H

2.3 State Toxics Permitting and Modeling

Modeling was conducted for air toxics emitted by the facility that are listed in the MassDEP Ambient Air Toxics Guidelines,[5] which include Ambient Air Limits (AALs) and Threshold Effect Exposure Limits (TELs). Compliance with the AALs and TELs was determined by comparing the predicted plant impacts with the current guideline values listed on the MassDEP website.

Table 2-4. AAL/TELs for Pollutants Emitted

Pollutant	24-hr TEL ($\mu g/m^3$)	Annual AAL ($\mu g/m^3$)
1,1,1-Trichloroethane	1038.37	1038.37
2-Methylnaphthalene	14.24	14.25
Alkanes/Alkenes	95.24	47.62
Antimony	0.02	0.02
Arsenic	0.003	0.0003
Benzene	0.6	0.1
Beryllium	0.001	0.0004
Cadmium	0.002	0.0002
Carbon Disulfide	0.1	0.1
Chloroethane	717.55	358.78
Chromium	1.36	0.68
Copper	0.54	0.54
Dichlorobenzene	81.47	81.47
Ethylbenzene	300	300
Formaldehyde	2.0	0.08
Hexavalent chromium	0.003	0.0001
Lead	0.14	0.07
Mercury	0.14	0.07
Methyl Ethyl Ketone (MEK)	200	10
Methylene Chloride	100	20
Naphthalene	14.24	14.25
Nickel	0.27	0.18
Phenol	52.33	52.33
Selenium	0.54	0.54
Styrene	200	2
Toluene	80	20
Xylene	11.8	2.72

[5] https://www.mass.gov/service-details/massdep-ambient-air-toxics-guidelines

3. AIR DISPERSION MODELING METHODOLOGY

This section of the modeling report presents the procedures that were utilized in the air dispersion modeling analysis. The techniques in this air dispersion modeling analysis are consistent with the current U.S. EPA and MassDEP guidance.

3.1 Air Dispersion Model Selection

Dispersion models predict downwind pollutant concentrations by simulating the evolution of the pollutant plume over time and space given data inputs including the quantity of emissions and the initial conditions (e.g., velocity, flowrate, and temperature) of the exhaust to the atmosphere.

The latest version (21112) of the AERMOD model was used to estimate maximum ground-level concentrations in the air dispersion analysis. AERMOD is a refined, steady-state, multiple source, air dispersion model to be used for industrial sources.[6] Following procedures outlined in the MassDEP's Modeling Guidelines, the AERMOD modeling was performed using regulatory default options.

3.2 Building Downwash Analysis

Building structures that obstruct wind flow near emission points may cause stack discharges to become caught in the turbulent wakes of these structures leading to downwash of the plumes. Wind blowing around a building creates zones of turbulence that are greater than if the building did not exist. These effects generally cause higher ground-level pollutant concentrations since building downwash inhibits dispersion from elevated stack discharges. For this reason, building downwash algorithms are considered an integral component of the selected air dispersion model.

The AERMOD model has the Plume Rise Modeling Enhancements (PRIME) algorithm incorporated in the regulatory version, and building downwash dimensions was determined by the Building Profile Input Program (BPIP PRIME), version 04274.[7] BPIP PRIME is designed to incorporate the concepts and procedures expressed in the Good Engineering Practices (GEP) Technical Support Document,[8] the Building Downwash Guidance document,[9] and other related documents, while incorporating the PRIME enhancements to improve prediction of ambient impacts in building cavities and wake regions.

If the distance between the stack and a building is >5L (L being lesser dimension of the structure [height or projected width]), downwash does not need to be considered. The buildings onsite and one nearby neighbor building was included in the BPIP PRIME analysis. The facility layout and tables documenting the building parameters are provided in Appendix A.

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[6] 40 CFR 51, Appendix W–*Guideline on Air Quality Models*, Appendix A.1– AMS/EPA Regulatory Model (AERMOD).

[7] Earth Tech, Inc., Addendum to the ISC3 User's Guide, The PRIME Plume Rise and Building Downwash Model, Concord, MA.

[8] U.S. EPA, Office of Air Quality Planning and Standards, Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised), Research Triangle Park, North Carolina, EPA 450/4-80-023R, June 1985.

[9] U.S. EPA, Office of Air Quality Planning and Standards, User's Guide to the Building Profile Input Program (Revised), Research Triangle Park, North Carolina, EPA-454/R-93-038, April 21, 2004.

3.3 Treatment of Terrain

Through the use of the AERMOD terrain preprocessor (AERMAP), AERMOD incorporates not only the receptor heights, but also an effective height (hill height scale) that represents the significant terrain features surrounding a given receptor.[10] AERMAP searches all NED points for the terrain height and location that has the greatest influence on each receptor to determine the hill height scale for that receptor.

Receptor, building, and source terrain elevations input to the model was those interpolated from 1/3 arc-second National Elevation Dataset (NED) data obtained from the U.S. Geological Survey (USGS) from datum year 1983. The array elevations was interpolated using AERMAP (version 18081).

3.4 Meteorological Data

Site-specific air dispersion models require a sequential hourly record of dispersion meteorology representative of the region within which the source is located. In the absence of site-specific measurements, the U.S. EPA guidelines recommend the use of readily available data from the closest and most representative National Weather Service (NWS) station. For refined modeling, the Guideline on Air Quality Models recommends one year of on-site data or five years of off-site representative data that includes hourly records of the following parameters:

- Wind speed,
- Wind direction,
- Air temperature,
- Micrometeorological parameters (e.g., friction velocity, Monin-Obukhov length),
- Mechanical mixing height, and
- Convective mixing height.

The first three of these parameters are directly measured by monitoring equipment located at typical surface observation stations. The friction velocity, Monin-Obukhov length, and mixing heights are derived from characteristic micrometeorological parameters and from observed and correlated values of cloud cover, solar insulation, time of day and year, and latitude of the surface observation station. Surface observation stations form a relatively dense network, are almost always found at airports, and are typically operated by the NWS. Upper air stations are fewer in number than surface observing points since the upper atmosphere is less vulnerable to local effects caused by terrain or other land influences and is therefore less variable. The NWS operates virtually all available upper air measurement stations in the United States.

AERMET, the meteorological pre-processor for AERMOD, processes raw meteorological data to generate the input files required for AERMOD. AERMINUTE and AERSURFACE are tools that may be utilized to assist with the refinement of hourly wind data and the calculation of multiple surface parameters that are required inputs in AERMET.

AERMET (version 21112) in conjunction with AERMINUTE (version 15272) and AERSURFACE (version 20060), was used to generate the meteorological data files (i.e., the surface [*.SFC] and profile [*.PFL] files) for the modeling analysis. The following sections outline the steps that was used to develop the meteorological data files.

[10] EPA, Users Guide for the AERMOD Terrain Preprocessor (AERMAP), EPA-454/B-03-003, Research Triangle Park, NC.

3.4.1 Raw Meteorological Data

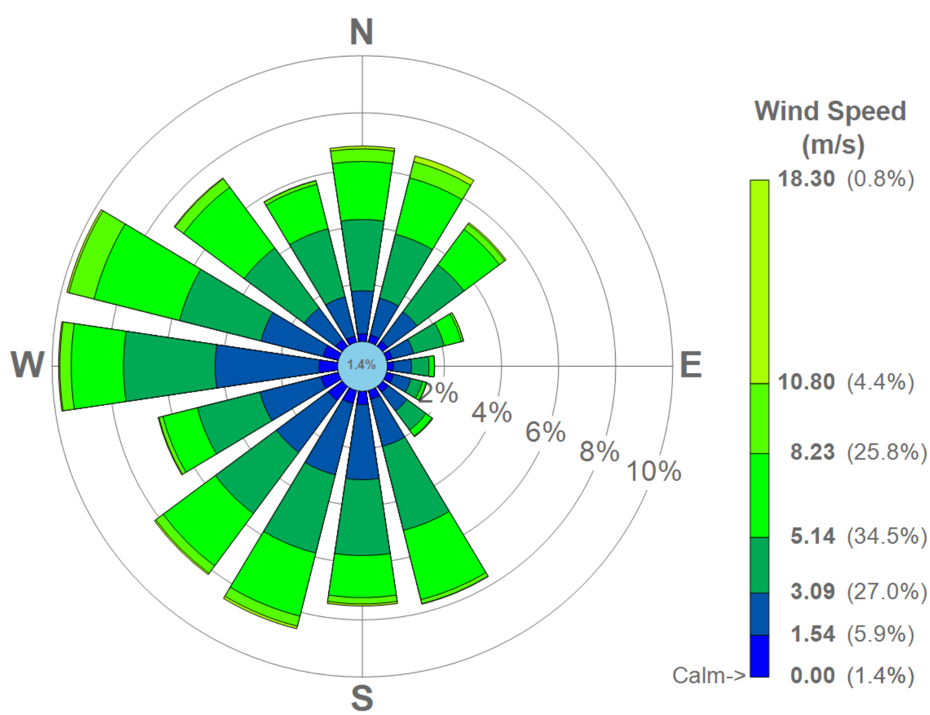
Five years (i.e., 2016-2020) of meteorological data was obtained from the meteorological stations in close proximity to the project site. However, the land use surrounding the site and surface meteorological station are evaluated to ensure the surface station is representative of the project site.

The Providence Airport (KPVD) in Providence, Rhode Island is the closest surface meteorological station to the project site. It is located approximately 7.5 miles (12 km) to the southwest of the project site. There are no significant terrain features between the project site and the meteorological station. The airport is located near industrial and high-density residential areas. Near the facility, the area is industrial and low to medium density residential. Since the meteorological station and the facility are in close proximity and have similar land use, the KPVD meteorological station is representative of the site. Therefore, the surface meteorological data (i.e., the 1-minute, 5-minute, and hourly data) from the NWS Station at KPVD was obtained from the National Environmental Centers for Environmental Information (NCEI) (formally the National Climatic Data Center [NCDC]) for the modeling analysis.[11]

The upper air meteorological data from the NWS Station in Chatham, Massachusetts was obtained from the NOAA/ESRL Radiosonde Database in FSL format.[12] This is the station that the Rhode Island DEM suggests for use with the KPVD surface station.

The five-year windrose plot for the surface data is shown in Figure 3-1. The figure shows the direction from which the wind is blowing.

Figure 3-1. KPVD Windrose Plot (2016-2020)



[11] https://www.ncdc.noaa.gov/

[12] https://ruc.noaa.gov/raobs/

AERMOD cannot calculate a concentration for calm or variable winds or if any other required data is missing for that hour. An analysis of hours with calm and variable wind data as well as any missing hours is provided in Table 3-1.[13] One-minute and five-minute ASOS data are missing from March 2017 through September 2017. This resulted in a higher number of calm and variable wind data in 2017 when compared to other years. However, the total number of calm, missing, and variable winds for each year is less than 10%, which satisfies the 90% completeness recommendation by the U.S. EPA.[14]

Table 3-1. Wind Data Recovery

Year	Hours Per Year	Calm	Variable	Missing	Total	Percent of Total Hours
2016	8,784	31	6	0	37	0.4%
2017	8,760	458	97	30	585	6.7%
2018	8,760	10	2	69	81	0.9%
2019	8,760	46	6	332	384	4.4%
2020	8,784	52	5	33	90	1.0%
Total	43,848	597	116	464	1177	2.7%

3.4.2 AERMINUTE

AERMINUTE was created to calculate the weighted average wind speed and direction to reduce the number of calm and variable winds that were reported in the hourly surface data files. Therefore, 1-minute ASOS data from KPVD was input into AERMINUTE. In addition, the 5-minute ASOS data were input into the program to supplement the 1-minute data. The output files from AERMINUTE are input into AERMET in Stage 2.

In the AERMINUTE input file, the IFWGROUP denotes if the station is part of the Ice Free Winds (IFW) group, meaning the station uses a sonic anemometer instead of a cup and vane anemometer. AERMINUTE treats wind speeds less than 2 knots differently based on whether the station is part of the IFW group or not. The KPVD station uses a sonic anemometer, and the commission date was 7/17/2009.[15]

3.4.3 AERSURFACE

Several inputs listed below are required to run the AERSURFACE program:

- Surface Parameters
- Season Determination
- Moisture Determination
- Airport vs Non-Airport Sectors

Each of these parameters are discussed in detail below.

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[13] The number of calm and variable wind data are provided in the AERMET stage 3 report. The total number of variable wind data and missing hours is provided in the AERMOD output files. As such, the number of missing hours is determined by subtracting the varible hours from the total missing/variable hours represented in the AERMOD output file.

[14] U.S. EPA, "Meteorological Monitoring Guidance for Regulatory Modeling Applications," EPA-454/R-99-005, dated Feb. 2000.

[15] https://www.weather.gov/media/asos/ASOS%20Implementation/IFW_stat.pdf

3.4.3.1 Surface Parameters

AERMOD uses several different boundary layer parameters to model how pollutants disperse in the atmosphere. Many of these parameters are not observed but are estimated from other variables that are more easily measured. To make these estimates, AERMET requires the following surface characteristics:

- Surface roughness length (z_o) – the height above the ground at which horizontal wind velocity is typically zero,
- Noon-time albedo (r) – the fraction of radiation reflected by the surface, and
- Daytime Bowen ratio (B_o) – the ratio of the sensible heat flux (H) to the latent heat flux (λE).

The U.S. EPA developed AERSURFACE to calculate the above parameters based on USGS land use and land cover (LULC) data. Starting with version 20060, impervious surface and tree canopy data can also be input into AERSURFACE. Therefore, LULC, tree canopy, and impervious surface data from 2016 was downloaded from the USGS using the Multi-Resolution Land Characteristics Consortium (MRLC) viewer.[16] The geotif files was directly input into AERSURFACE.

The albedo and Bowen ratio determination was based on a 10-km by 10-km area centered on the meteorological station. The surface roughness length determination was based on an inverse distance weighted geometric mean for a recommended upwind fetch of 1-km relative to the meteorological station. The surface roughness length may vary by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees. More information on the sector identification is provided in Section 3.4.3.4 below.

3.4.3.2 Season Determination

Table 3-2 shows the meteorological season (midsummer, autumn, late autumn, winter, or spring) used for each month of the modeling period. This was determined based on snow depth observations as well as monthly average temperatures.

Per recommendation from MassDEP, snow cover was determined from the National Operation Hydraulic Remote Sensing Center, Interactive Snow Information.[17] The width of the evaluation area was set to 600 and the height was set to 400. The observed snow depth was not recorded consistently, so the modeled snow depth was evaluated for the 5-year modeling period. If a month had 50% of the days with at least 1 inch of snow on the ground, the month was considered to have continuous snow cover. Based on the snow cover evaluation, February 2017 was the only month considered to have continuous snow cover for the 5-year modeling period.

Monthly average and monthly minimum temperatures were also evaluated:

- Winter Months
  - Average monthly temperatures below ~40 °F, and typically included at least one hard freeze (i.e., low temperature below 30 °F).
  - As mentioned, the only month set to winter with continuous snow cover was February 2017.

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[16] https://www.mrlc.gov/viewer/

[17] https://www.nohrsc.noaa.gov/interactive/html/graph.html?station=KPVD&w=600&h=400&o=a&uc=0&by=2020&bm=1&bd=1&bh=0&ey=2020&em=1&ed=31&eh=23&data=1&units=0&region=us

- Spring Months
  - Evaluated for the transition from winter to summer.
  - These are cooler months (temperatures between ~40 °F and ~65 °F) without a hard freeze (i.e., low temperature below 30 °F). For example, the average monthly temperature for March 2018 was 38.8 °F, but there was no hard freeze so it was assigned to be a spring month.
- Summer Months
  - Average monthly temperatures greater than ~65 °F.
- Autumn Months with Unharvested Crops
  - Evaluated for transition from summer to winter.
  - These are cooler months (temperatures between ~40 °F and ~70 °F) without a hard freeze (i.e., temperature below 30 °F).

Table 3-2. Seasonal Determination for AERSURFACE Input

	Model Year and Assigned Season Category				
Month	**2016**	**2017**	**2018**	**2019**	**2020**
Jan	3	3	3	3	3
Feb	3	4	3	3	3
Mar	5	3	5	3	5
Apr	5	5	5	5	5
May	5	5	5	5	5
Jun	1	1	1	1	1
Jul	1	1	1	1	1
Aug	1	1	1	1	1
Sep	2	2	2	2	2
Oct	2	2	2	2	2
Nov	2	2	2	2	2
Dec	3	3	3	3	3

1) Midsummer with lush vegetation
2) Autumn with unharvested cropland
3) Late autumn after frost and harvest, or winter with no snow
4) Winter with continuous snow on the ground
5) Transitional spring (partial green coverage, short annuals)

3.4.3.3 Moisture Determination

Precipitation data was used to determine whether "dry", "average," or "wet" conditions should be specified in AERSURFACE. The AERSURFACE User's guide suggests reviewing 30-years of precipitation data to determine the moisture conditions. It recommends that "wet" conditions should be assumed for the upper 30th percentile data, "dry" for the lower 30th percentile, and "average" for the remainder. The moisture determination for KPVD is presented in Table 3-3.

Table 3-3. KPVD Moisture Determination

Climatology (1991-2020) Precip. (in)			Year	Annual Precip. (in)	Wet, Dry, or Average?
Average	70th Percentile	30th Percentile			
47.5	51.0	42.7	2016	40.0	Dry
			2017	49.0	Average
			2018	63.5	Wet
			2019	52.0	Wet
			2020	44.7	Average

3.4.3.4 Airport vs. Non-Airport Sectors

To evaluate the surface roughness length, a 1-km radius area around the station was split into twelve 30° sectors. The recently updated version of AERSURFACE (version 20060) requires that the land use for each sector at the weather station location be classified as "airport" or "non-airport," where "airport" conditions consist of runways and short grass.

Impervious surface, tree canopy, and LULC data from 2016 downloaded from the MRLC viewer[18] is used to evaluate the area, based on the default method for determining surface roughness length (i.e., a 1-km radius around the meteorological tower). Figures of the impervious surface, tree canopy, and LULC data as well as an aerial image are provided in Appendix B. The determination of airport and non-airport sectors based on a review of the land characteristics surrounding the KPVD meteorological station is provided below (sector labeling starts at 0° [north] for Sector 1 increasing clockwise at 30° increments):

- **Airport**
  - Sectors 1, 2, 3 and 7 mostly (if not entirely) consist of runways and short grasses. In addition, there is no tree canopy in these sectors. As such, these sectors was classified as airport.
  - Sectors 4 through 6 have a higher amount of trees with some buildings starting approximately 0.6 km away from the station. A majority of this area is classified as medium to high intensity developed areas. In addition, the area with the trees and buildings has less impervious service and a higher amount of tree canopy. However, the surface roughness length is based on an inverse distance weighted geometric mean so the land closer to the station is weighted more than the area towards the edge of the 1-km domain. Furthermore, areas with less impervious surfaces and more tree canopy are not affected by the airport/non-airport determination. As such, since a majority of the land near the station is paved with short grasses, these sectors was classified as airport.
  - Sectors 8 and 9 have some buildings and trees/shrubs close to 1-km away from the station. However, most of the sectors are paved with short grasses, so these sectors was classified as airport.
- **Non-Airport**
  - Sectors 10 through 12 contain a large portion of buildings and the terminal. As such, these sectors was classified as non-airport.

3.4.4 AERMET

The AERMET program is ran in three stages. The meteorological station information was defined in Stage 1 and the data was extracted for the specified dates. Average hourly wind data from AERMINUTE was merged with the hourly surface and upper air data in Stage 2. Surface characteristics from AERSURFACE was input into the program in Stage 3. In addition, the following regulatory default options was defined in Stage 3:

[18] https://www.mrlc.gov/viewer/

- NWS hourly wind directions was randomized;
- The "REFLEVEL SUBNWS" was selected as required for runs that do not process site-specific data;
- Adjust friction velocity (ADJ_U*) option was selected;
- The anemometer height was set to 33 ft (10.06 m);[19] and
- The 1-min ASOS wind speed threshold of 0.5 meters per second was selected with the THRESH_1MIN keyword.

The processed files was provided to MassDEP along with modeling files.

3.5 Coordinate System

In all modeling analysis data files, the location of emission sources, structures, and receptors, was represented in the Universal Transverse Mercator (UTM) coordinate system. The UTM grid divides the world into coordinates that are measured in north meters (measured from the equator) and east meters (measured from the central meridian of a particular zone, which is set at 500 km). The datum for this modeling analysis is based on North American Datum 1983 (NAD 83). UTM coordinates for this analysis all reside within UTM Zone 19.

3.6 Urban/Rural Option

Categorizing an area as urban or rural is determined by land use classification or population. Appendix W specifies the land use procedure is considered more definitive; therefore, the land use procedure was used to classify the area around the facility for modeling purposes.

The land use designation (i.e., urban versus rural) is determined based on a three-kilometer radius circle area surrounding the facility. LULC data from 2016 are available from the USGS using the MRLC viewer.[20] Two categories from the 2016 LULC data are classified as urban:

- Developed, medium intensity (Code 23); and
- Developed, high intensity (Code 24).

All other categories have rural characteristics. If urban land use types account for 50% or more of the area within 3 km of the facility, urban dispersion coefficients was used. Otherwise, appropriate rural dispersion coefficients was used.

An aerial image of the area as well as the 2016 LULC data are provided in Appendix Figure B-1 and Appendix Figure B-2, respectively. While the area in the immediate vicinity of the facility is industrial, the remainder of the area within three kilometers consists of some high intensity development, low intensity residential, wetlands, and cultivated crops. AERSURFACE was utilized to evaluate the 2016 LULC data. Based on a preliminary analysis, the area surrounding the facility is approximately 23% urban. As such, the rural option was selected for the modeling analysis. However, the final AERSURFACE analysis and associated modeling files was provided with the final modeling report.

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[19] https://www.weather.gov/asos/ASOSImplementation

[20] https://www.mrlc.gov/viewer/

3.7 NO_2 Modeling Methodology

Appendix W describes a three-tier NO_2 modeling approach for the conversion of nitric oxide (NO) to NO_2. These tiers are regulatory options provided in AERMOD and each consider increasingly complex considerations of NO to NO_2 conversion chemistry. The three tiers are listed below:

- Tier 1 – Assumes total conversion of NO to NO_2.
- Tier 2 – The Ambient Ratio Method Version 2 (ARM2) assumes that the conversion of NO to NO_2 will reach an equilibrium level in the atmosphere. The default minimum ratio is 0.5 and the maximum default ratio is 0.9.
- Tier 3 –The U.S. EPA has implemented two Tier 3 options, Ozone Limiting Method (OLM) and Plume Volume Molar Ratio Method (PVMRM), into AERMOD as regulatory default options. Both options require ambient ozone concentrations (typically, concurrent hourly ozone concentrations) as well as source-specific NO_2/NOx in-stack ratios. U.S. EPA memorandums do not indicate any preference between PVMRM and OLM.

The regulatory default ARM2 modeling option was selected for the 1-hour and annual average NO_2 modeling.

3.8 Receptor Grids

For this air dispersion modeling analysis, ground-level concentrations was calculated along the facility boundary and within a Cartesian receptor grid. As mentioned in Section 3.3, receptor elevations and hill height scales required by AERMOD was determined using the AERMAP terrain preprocessor.

3.8.1 Cartesian Receptor Grid

- 25-meter (25-m) spaced receptors covering a region that extends to 500 m;
- 50-m spaced receptors covering a region from 500 m to 1.5 km;
- 100-m spaced receptors covering a region from 1.5 km to 3.0 km; and
- 500-m spaced receptors covering a region from 3.0 km to 5.0 km.

The receptor grid is defined in Figure 3-2 below. The maximum modeled impacts was reviewed to ensure they are located within the 25-m spaced receptors. Additional refined grids was added, if needed. In addition, the receptor grid was extended out to 20 km, if needed.

3.8.2 Boundary Receptors

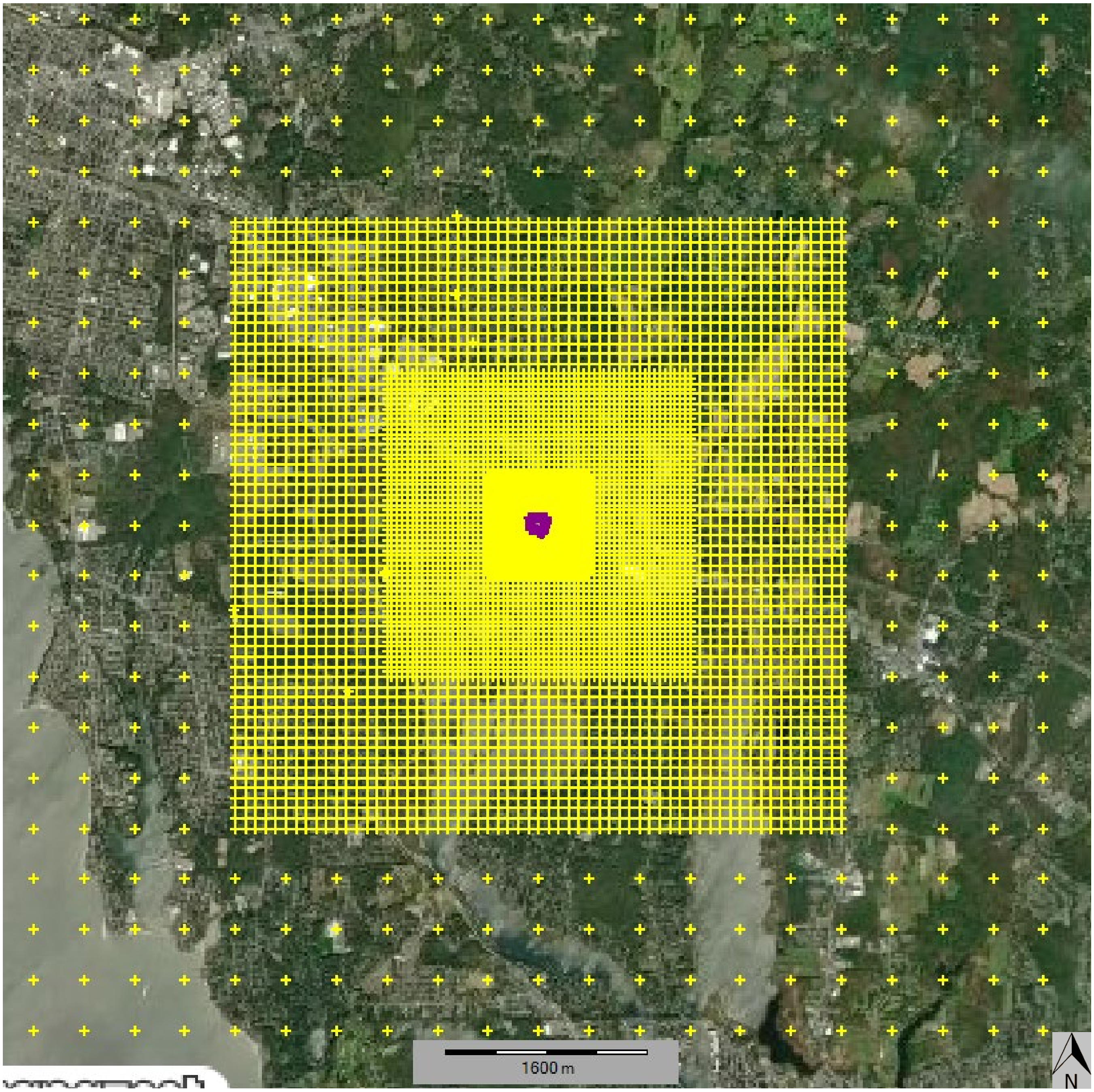
Receptors was placed along the length of the boundary spaced at 10-m intervals. The boundary receptors are shown in Appendix Figure A-1.

3.8.3 Sensitive Receptors

The cartesian grid spacing near the facility is dense enough (i.e., 25-m spacing) to ensure maximum modeling impacts are identified in the nearby residential areas. As such, discrete receptors will not be placed within the nearby residential areas.

Figure 3-2. Cartesian Receptor Grid

Discrete Receptor: + Boundary Receptor: +



3.9 Background Concentrations

In evaluating cumulative impacts with respect to the NAAQS, maximum modeled impacts are added to representative ambient background concentrations and compared to the applicable NAAQS. Background concentrations represent the air quality concentrations due to sources that are not explicitly modeled (e.g., mobile sources, small but local stationary sources, non-regulated fugitive sources, and large but distant sources). Selection of the existing monitoring data that are "representative" of the ambient air quality in the area surrounding the facility was determined based on the following three criteria:

1. Monitor location,
2. Data quality, and
3. Data currentness.

For the monitor location criteria, key considerations include proximity to the significant impact area of the facility, similarity of emission sources impacting the monitor to the emission sources impacting the airshed surrounding the facility, and the similarity of the LULC surrounding the monitor and facility. The data quality criteria refers to the monitor being an approved State or Local Air Monitoring Stations (SLAMS) or similar monitor type subject to the quality assurance requirements in 40 CFR Part 58 Appendix A. Data currentness refers to the fact that the most recent three complete years of quality assured data are generally preferred.

There are five stations within 10 miles from the facility. The closest station is the Francis School monitor (AQS Site ID: 44-007-1010) in East Providence, Rhode Island, which is 4.9 miles (8.0 km) to the north of the facility. The second closest station is the CCRI Liston Campus Rooftop (CCRI) monitor (AQS Site ID: 44-007-0022) in Providence, Rhode Island, which is 5.6 miles (9.0 km) northeast of the facility.

The Francis School monitor is located near a school, industrial areas, and medium to high density residential areas. The CCRI monitor is located in an industrial area, surrounded by a high-density residential area. The facility is located near an industrial area, low to medium density residential areas, wetlands, and agriculture land. Both monitors are part of the SLAMS network. Ambient air data are available for 2018 to 2020. Since the monitors are near the facility, have similar land use, meet quality assurance requirements, and have current data, both are representative of the facility and was used to determine the background concentrations.

The Francis monitor recorded 2018-2020 ambient air data for all pollutants, except PM_{10}. The Francis School monitor started recording PM_{10} in 2020. As such, The PM_{10} background concentration was based on data from the Francis School monitor for 2020, and the CCRI monitor for 2018 and 2019. Background data were obtained from U.S. EPA's AirData website.[21] Table 3-4 presents the representative background concentrations.

[21] https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=5f239fd3e72f424f98ef3d5def547eb5&extent=-146.2334,13.1913,-46.3896,56.5319

Table 3-4. Background Concentrations

Pollutant	Averaging Period	2018-2020 Ambient Concentration[1] (μg/m^3)	Monitor Location
PM_{10}	24-hour	30.0	CCRI (2018, 2019); Francis School (2020)
$PM_{2.5}$	98th 24-hour	17.4	Francis School
	Annual	6.3	Francis School
SO_2	99th 1-hour	5.7	Francis School
CO	1-hour	1,802	Francis School
	8-hour	1,146	Francis School
NO_2	98th 1-hour	74.2	Francis School
	Annual	12.4	Francis School

[1] See Table 2-2 for descriptions of the ambient background monitoring design values.

3.10 Source Types and Stack Parameters

The AERMOD dispersion model allows for emissions units to be represented as point, area, or volume sources. Emission points that exhaust from a vertical, unobstructed stacks was modeled as point sources using the POINT keyword.

Emissions that disperse in three dimensions with little or no plume rise was modeled as volume sources using the VOLUME keyword. The calculation of the volume source parameters was based on Section 3.3.2.2 of the AERMOD user's guide. The parameters required for volume sources are described below:

- Total Structure Height
- Release Height
- Equivalent Square
  - AERMOD requires that the base of a volume source be square. Therefore, the equivalent square is calculated by taking the square root of the area of the length and width of the volume base.
- Initial Lateral Dimension
  - Since these are single volume sources, the initial lateral dimension is based on the length of the side (i.e., the equivalent square) divided by 4.3.
- Initial Vertical Dimension
  - The initial vertical dimension is based on the vertical dimension of the source divided by 2.15.

The site layout in Appendix A depicts the approximate locations of the sources that was modeled and which type was modeled (point, volume or area). The locations, elevations, and source parameters are included in Appendix C.

3.11 Emission Rates

Emissions were calculated for the following emission sources:

- Hot mix asphalt (HMA) drum dryer (exhausts through the baghouse)

- Hot oil heater
- HMA silo filling (exhausts through the drum dryer and subsequently the baghouse)
- HMA silo loadout (exhausts through the Blue Smoke Abatement System)
- HMA storage tanks
- Raw materials handling
- Storage piles
- Roadway dust

The modeling assumes that the facility will operate 12 hours per day (7 AM to 7 PM) Monday through Friday and 7 AM to 5 PM on Saturdays. The hot oil heater emissions, wind erosion and breathing losses from tanks are assumed to be continuous year-round. Annual emissions were based on the production of 250,000 tons per year of HMA. Emissions rates to be used in the modeling are included in Appendix D.

3.12 Background Sources

There were no background sources included since those facilities considered were not are located within or adjacent to the Facility's Significant Impact Area. Background sources were identified using US EPA's EJ Screen mapping tool[22] and are shown in Table 3-5 below.

Table 3-5. Potential Background Sources

Facility Name	Address	Distance Away (km)
US Watercraft, LLC	373 Market Street, Warren, RI	4.7
Oldcastle Infrastructure	41 Almeida Road, Rehoboth, MA	1.5

3.13 GEP Stack Height Analysis

The U.S. EPA has promulgated stack height regulations that restrict the use of stack heights in excess of GEP in air dispersion modeling analyses. Under these regulations, that portion of a stack in excess of the GEP height is generally not creditable when modeling to determine source impacts. This essentially prevents the use of excessively tall stacks to reduce ground-level pollutant concentrations. The minimum stack height where the effects of downwash are minimized, called the formula GEP stack height, is defined by the following formula:

$H_{f\text{-}GEP} = H + 1.5L$, where:

$H_{f\text{-}GEP}$ = formula GEP stack height,
H = structure height, and
L = lesser dimension of the structure (height or projected width).

[22] https://ejscreen.epa.gov/mapper/

In general, the GEP stack height limit is the greater of 65 meters (measured from the ground-level elevation at the base of the stack) or the formula GEP stack height.[23] The proposed stack heights of the modeled sources are less than their GEP heights, therefore, their proposed heights was modeled. GEP stack height does not apply to volume sources.

[23] 40 CFR §51.100(ii).

4. MODELING RESULTS

4.1 Worst-Case Dryer Load

An analysis was used to determine the worst-case load for the drum dryer to be used in the final facility-wide runs. The following load conditions were evaluated: 50%, 75%, and 100%. As shown in Table 4-1, 100% load conditions caused the worst-case impacts for the short-term averages (1-hour, 8-hour and 24-hour) and 50% load was used for the annual averages.

Table 4-1. Worst Case Load Conditions for Drum Dyer

Averaging Period	Worst Case Predicted Concentration (μg/m³ per g/s)			
	50% Load	75% Load	100% Load	Worst Case
1-hour	67.68	76.94	86.16	100% Load
8-hour	58.22	69.95	79.30	100% Load
24-hour	51.94	62.46	74.15	100% Load
Annual	3.25	2.95	2.45	50% Load

4.2 Significant Impact Areas

The modeled impacts due to emissions from the facility were compared to the significant impact levels, as shown in Table 4-2.

Table 4-2. Maximum Modeled Concentrations for Comparison to the SIL

Pollutant	Averaging Period	Maximum Modeled Concentration (μg/m³)	SIL (μg/m³)
PM_{10}	24-hour	146.1	5
$PM_{2.5}$	24-hour	23.9	1.2
	Annual	1.17	0.3
SO_2	1-hour	8.6	7.9
CO	1-hour	203.0	2,000
	8-hour	179.5	500
NO_2	1-hour	87.2	7.5
	Annual	4.10	1

The significant impact areas were calculated for the pollutants with impacts above the SILs. As shown below in Table 4-3, the SIAs are all less than 1 kilometer, therefore, it is unlikely that background sources would interact with the Facility to create a situation where the cumulative impact was above the NAAQS and the Facility's contribution was significant. Therefore, background sources were not included.

Table 4-3. Significant Impact Areas

Pollutant	Averaging Period	Significant Impact Area (km)
PM_{10}	24-hour	0.67
$PM_{2.5}$	24-hour	0.57
	Annual	0.17
SO_2	1-hour	0.08
NO_2	1-hour	0.79
	Annual	0.20

4.3 National Ambient Air Quality Standards

The worst-case offsite concentrations predicted by AERMOD for emissions from the Facility are presented in Table 4-4 along with the existing ambient concentration and the total concentration. The total concentration was then compared to the NAAQS. All of the predicted total concentrations are below the NAAQS, therefore, the proposed Facility will not cause or contribute to an exceedance of the NAAQS.

Table 4-4. Maximum Modeled Total Offsite Concentrations Modeled Over Five Years

Pollutant	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-hour	112.5	30	142.5	150
$PM_{2.5}$	24-hour	15.39	17.4	32.8	35
	Annual	1.2	6.3	7.5	12
SO_2	1-hour	8.2	5.7	13.9	196
CO	1-hour	203	1,802	1981.5	40,000
	8-hour	179.5	1,146	1325.5	10,000
NO_2	1-hour	50.4	74.2	124.6	188
	Annual	4.1	12.4	16.5	100

4.4 State Toxics Modeling

Modeling was conducted for air toxics and compared to the AALs and TELs. The modeled results are shown in Table 4-5 and 4-6 and are below all the respective AALs and TELs.

Table 4-5. Maximum Concentrations for 24-hr Air Toxics

Pollutant	Maximum Modeled Concentration ($\mu g/m^3$)	24-hr TEL ($\mu g/m^3$)
Benzene	0.40478	0.6
Carbon Disulfide	0.0025	0.1
Chloroethane	0.00019	717.55
Dichlorobenzene	0.00081	81.47
Ethylbenzene	0.2511	300
Formaldehyde	1.42687	2
Methylene Chloride	0.00009	100
Naphthalene	0.07639	14.24
Phenol	0.00123	52.33
Styrene	0.51638	200
Toluene	0.03749	80
1,1,1-Trichloroethane	0.00028	1038.37
Xylene	0.21184	11.8
Arsenic	0.00058	0.003
Beryllium	0.00026	0.001
Cadmium	0.0006	0.002
Chromium	0.00526	1.36
Copper	0.00325	0.54
Lead	0.00179	0.14
Mercury	0.00025	0.14
Nickel	0.06534	0.27
Selenium	0.00036	0.54
Antimony	0.00019	0.02

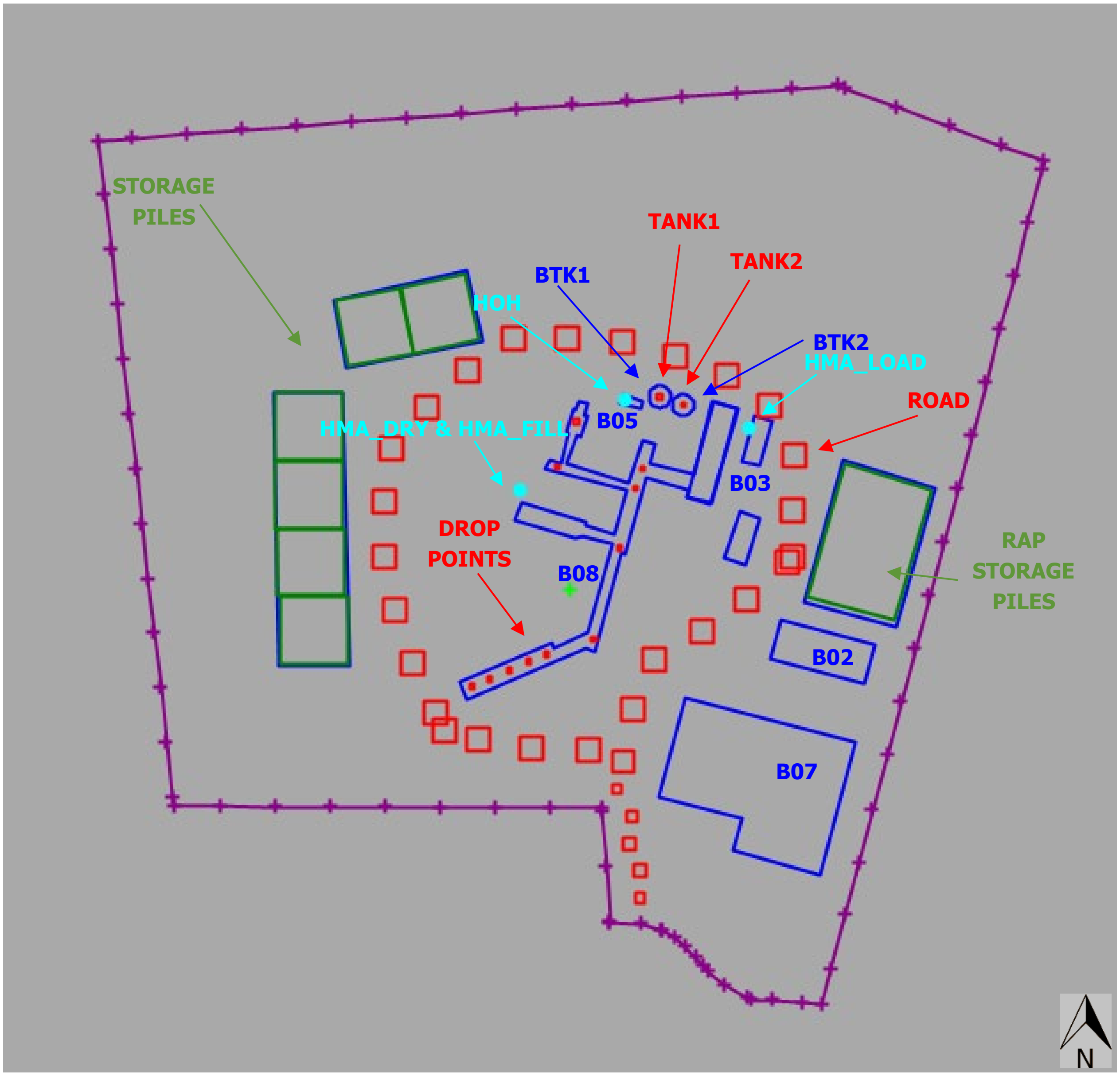
Table 4-6. Maximum Concentrations for Annual Air Toxics

Pollutant	Maximum Modeled Concentration ($\mu g/m^3$)	Annual AAL ($\mu g/m^3$)
Benzene	0.00506	0.1
Carbon Disulfide	0.00009	0.1
Chloroethane	0.00001	358.78
Dichlorobenzene	0.00013	81.47
Ethylbenzene	0.00397	300
Formaldehyde	0.02195	0.08
Methylene Chloride	0.00001	20
Naphthalene	0.0028	14.24
Phenol	0.00004	52.33
Styrene	0.07997	2
Toluene	0.00224	20
1,1,1-Trichloroethane	0.00005	1038.37
Xylene	0.00443	2.72
Arsenic	0.00001	0.0003
Beryllium	0.00004	0.0004
Cadmium	0.00014	0.0002
Chromium	0.00009	0.68
Copper	0.00013	0.54
Lead	0.00029	0.07
Mercury	0.00001	0.07
Nickel	0.00081	0.18
Selenium	0	0.54
Antimony	0	0.02

APPENDIX A. FACILITY SITE LAYOUT & BUILDING DIMENSIONS

Appendix Figure A-1. Facility Site Layout

BPIP Structure: ☐ Volume Source: ☐ Point Source: • Area Source: ☐ Discrete Receptor: + Boundary Receptor: +



Appendix Table A-1. Rectangular Building Dimensions

ID	Description	X Coord (m)	Y Coord (m)	Elevation (m)	Height		X-Length		Y-Length		Angle
					(ft)	(m)	(ft)	(m)	(ft)	(m)	
B02	Office 1	308234.8	4628058.6	7.54	12	3.66	24.3	7.40	57.1	17.4	104.9
B03	Office 2	308224.5	4628069.7	7.53	15	4.57	12.6	3.83	29.2	8.89	18
B05	Hot oil heater	308205.5	4628097.9	7.45	8.79	2.68	12.5	3.80	5.3	1.61	17.90
B08_T2	Baghouse, Conveyors, and Silos (Tier 2)	308222.3	4628098.0	7.4	39.9	12.15	58.4	7.40	14.8	17.4	104.9
BSMK	Blue Smoke Structure	308229.9	4628095.6	7.39	12	3.66	28.2	8.60	10.8	3.30	105.3

Appendix Table A-2. Circular Building Dimensions

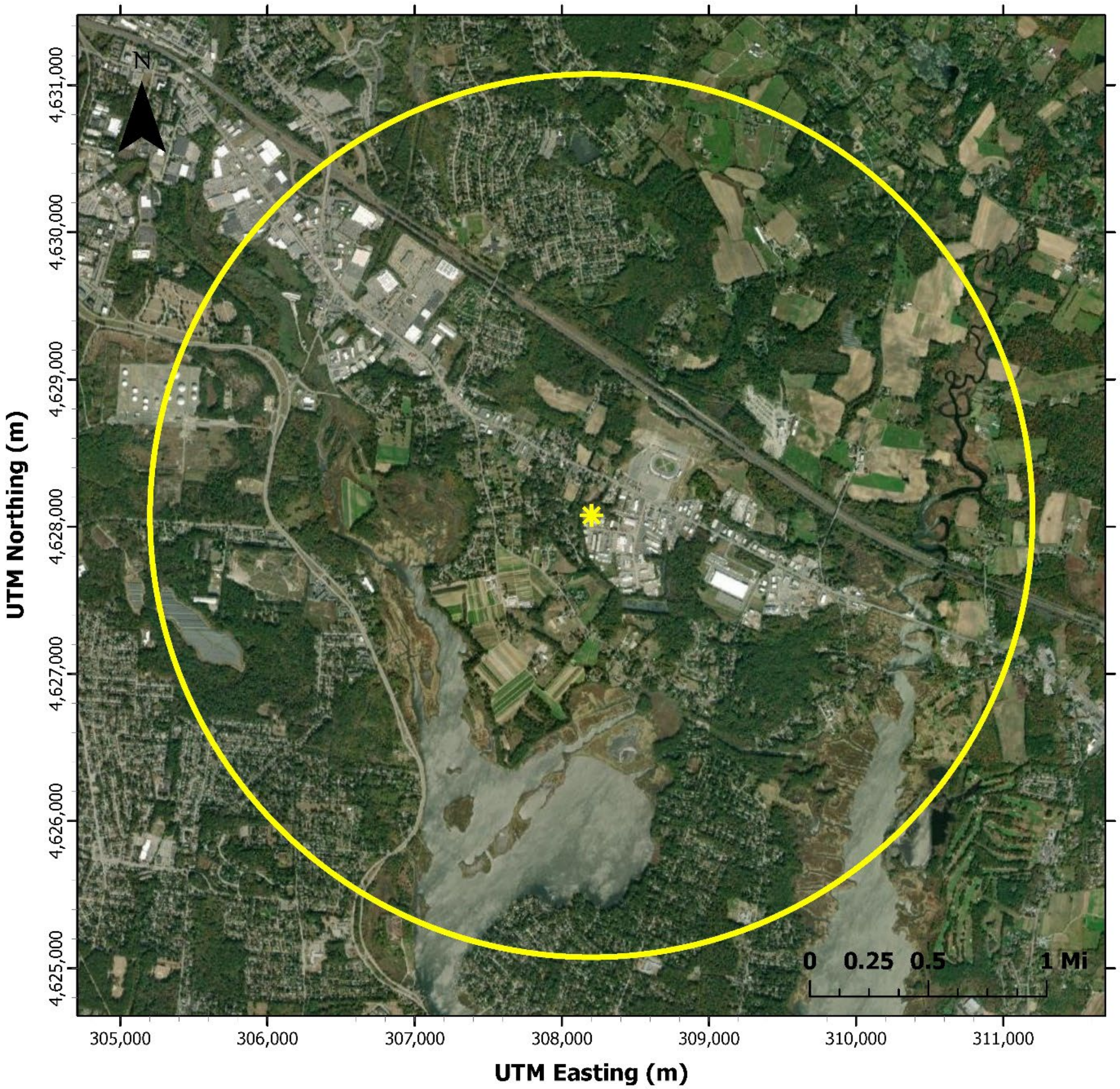
ID	Description	X Coord (m)	Y Coord (m)	Elevation (m)	Height		Radius		Corners
					(ft)	(m)	(ft)	(m)	
BTK1	Storage Tank 1	308212.7	4628099	7.42	40	12.19	6.6	2.00	24
BTK2	Storage Tank 2	308216.9	4628097.5	7.42	40	12.19	6.6	2.00	24

Appendix Table A-3. Polygon Building Dimensions

ID	Description	X Coord (m)	Y Coord (m)	Elevation (m)	Height (ft)	Height (m)
B06	Garage 1	308217.3	4628044.5	7.67	18.0	5.49
B08	Baghouse, Conveyors, and Silos (Tier 1)	308227.0	4628096.8	7.39	12.0	3.66
STORAGE	Storage Bin Enclosed Building	308155.3	4628099.8	7.67	12.0	3.66
STORAGE2	Storage Bin Enclosed 2	308153.5	4628116.6	7.82	12.0	3.66
RAP	RAP Unloading	308246	4628087.5	7.4	12.0	3.66

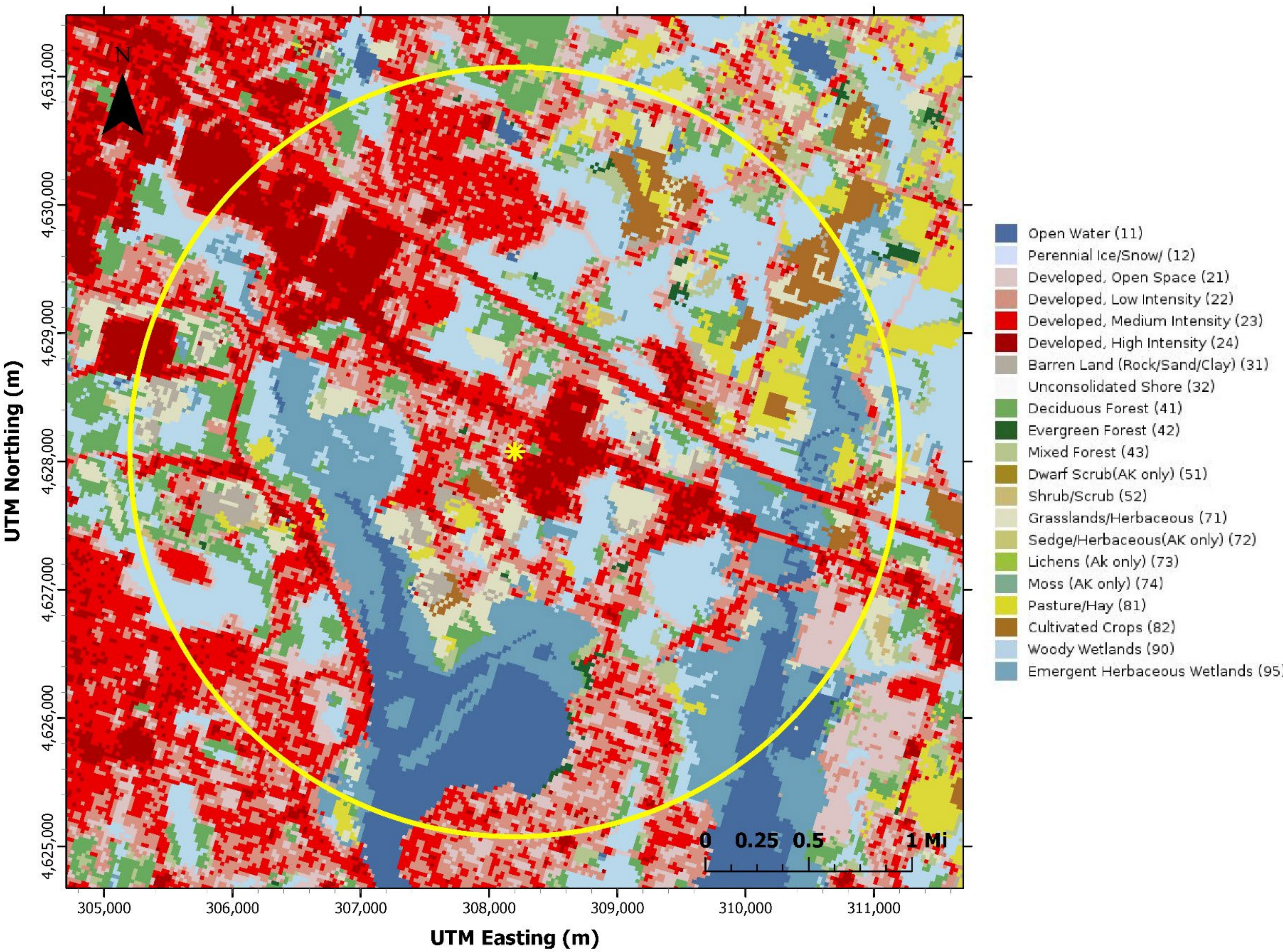
APPENDIX B. LAND USE FIGURES

Appendix Figure B-1. Facility Land Use – 3-km Radius – Aerial



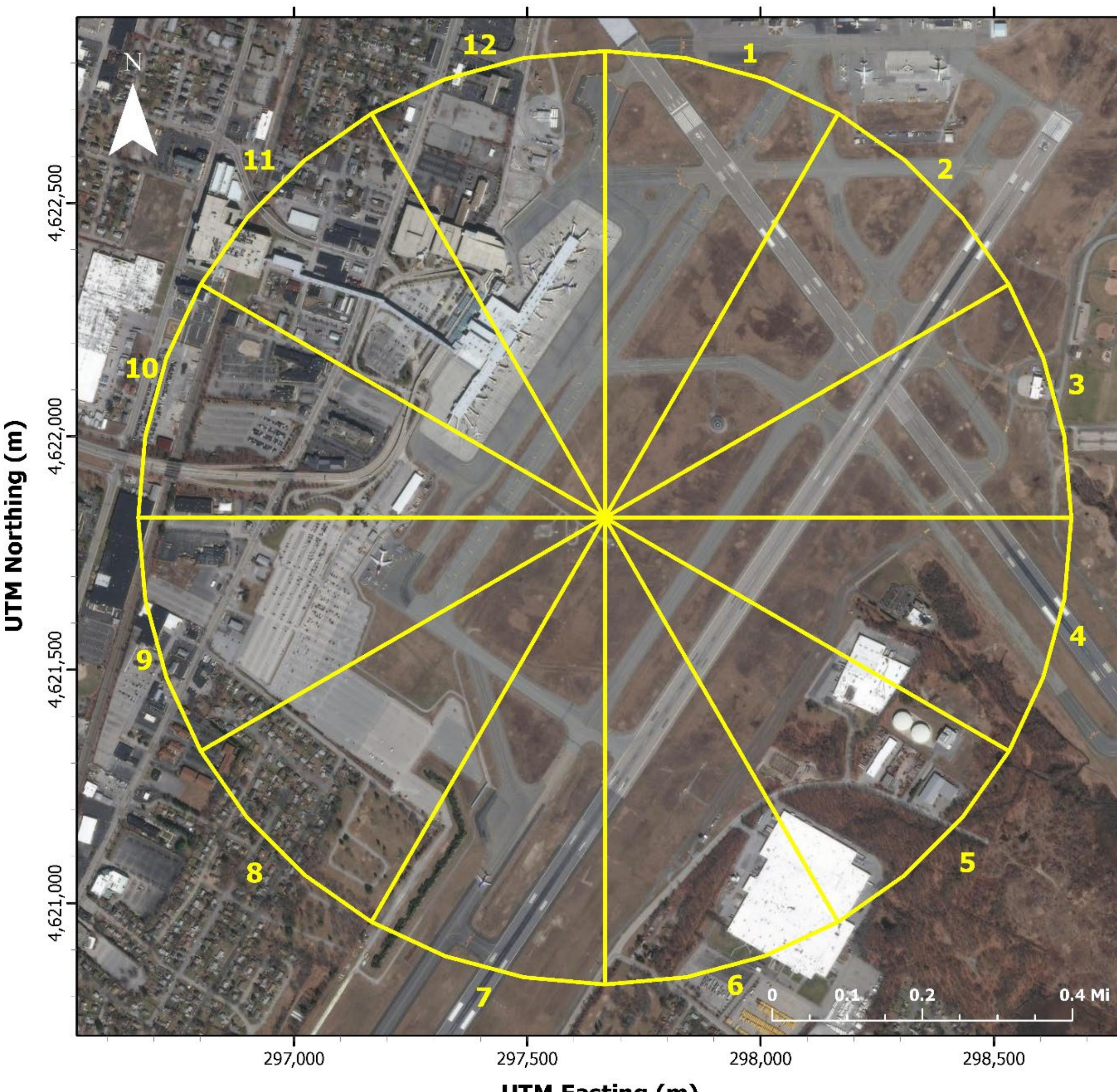
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-2. Facility Land Use – 3-km Radius – Land Cover



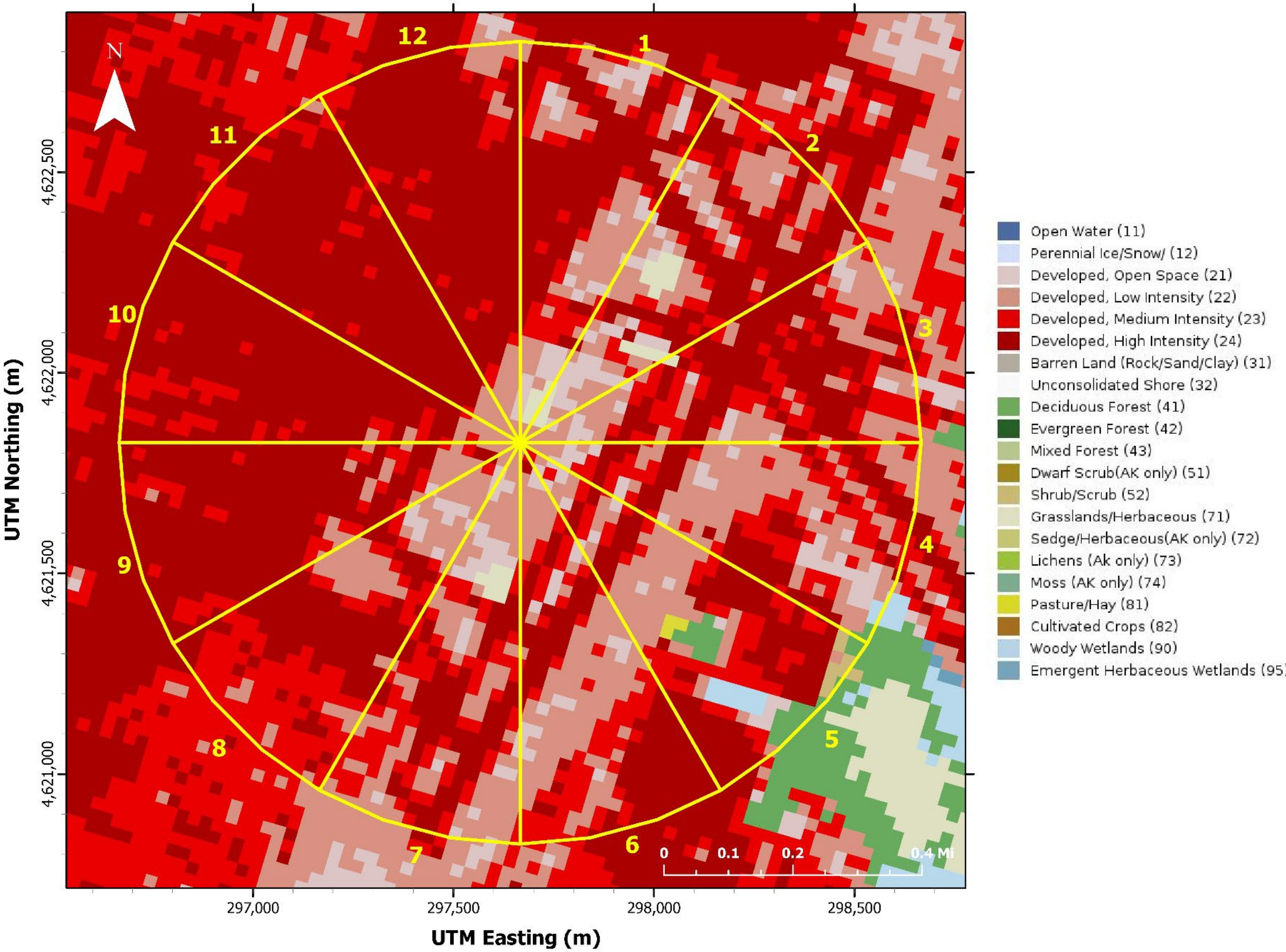
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-3. PVD Land Use – 1-km Radius – Aerial



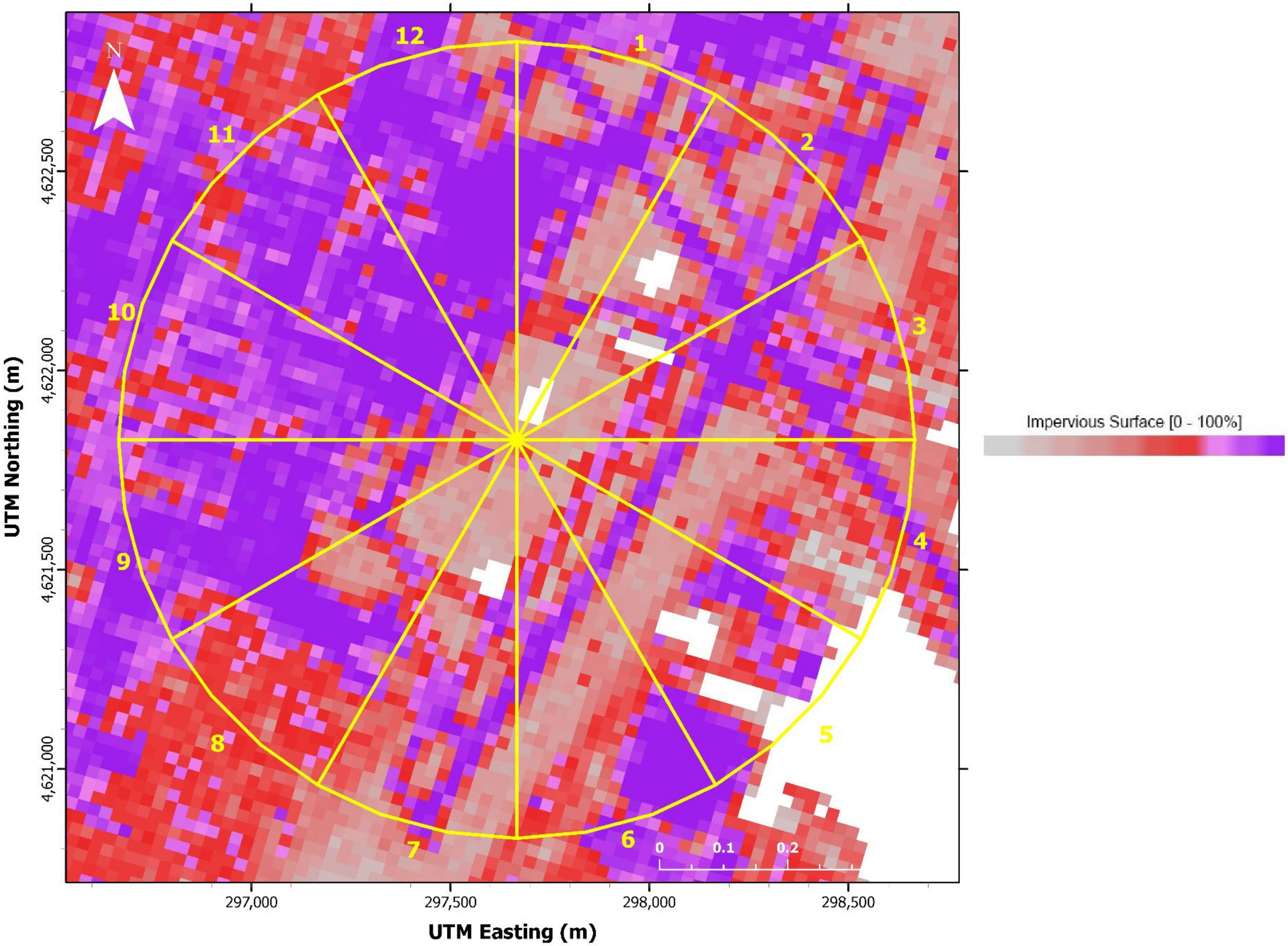
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-4. PVD Land Use – 1-km Radius – Land Cover



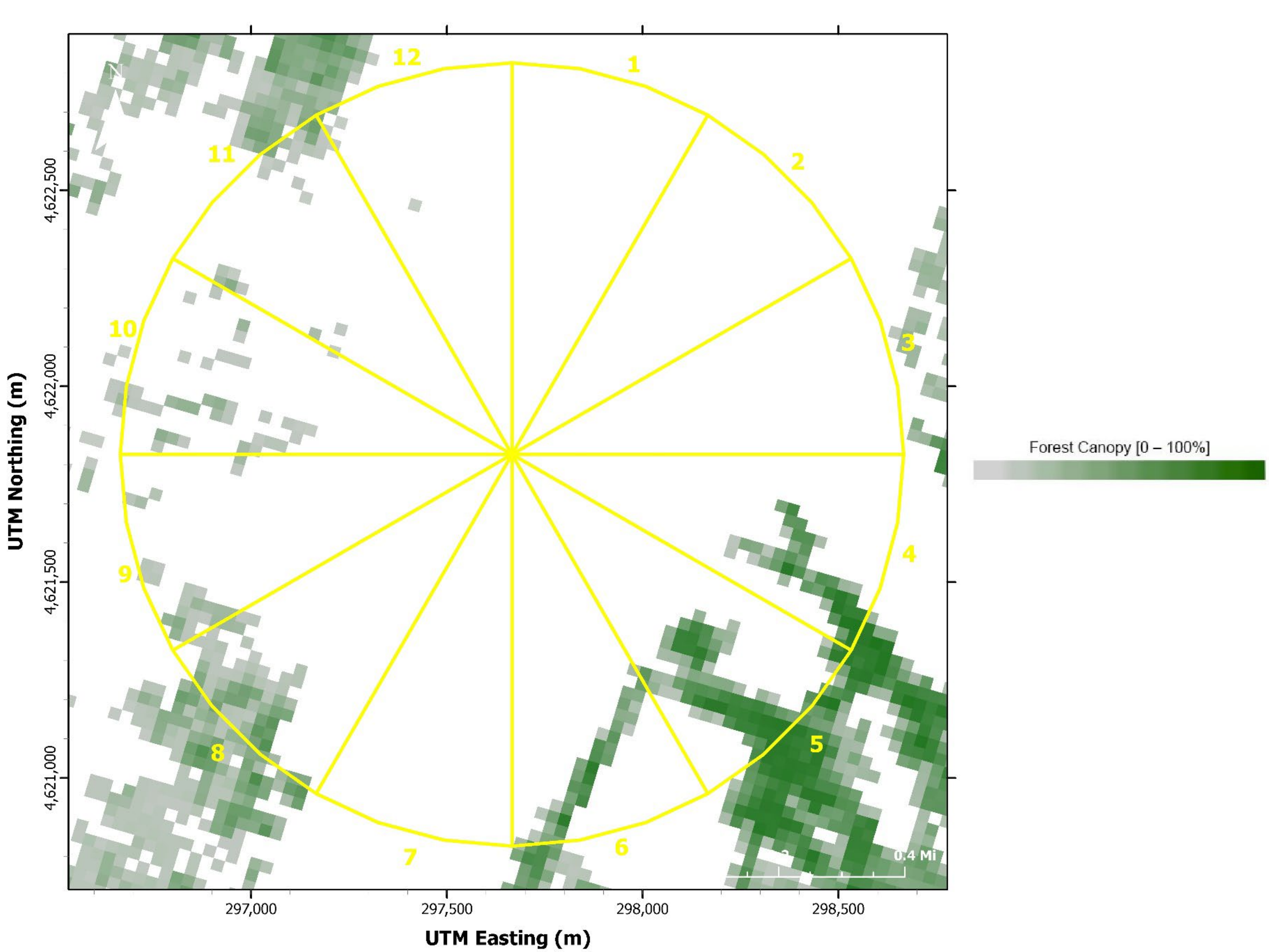
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-5. PVD Land Use – 1-km Radius – Impervious Surface



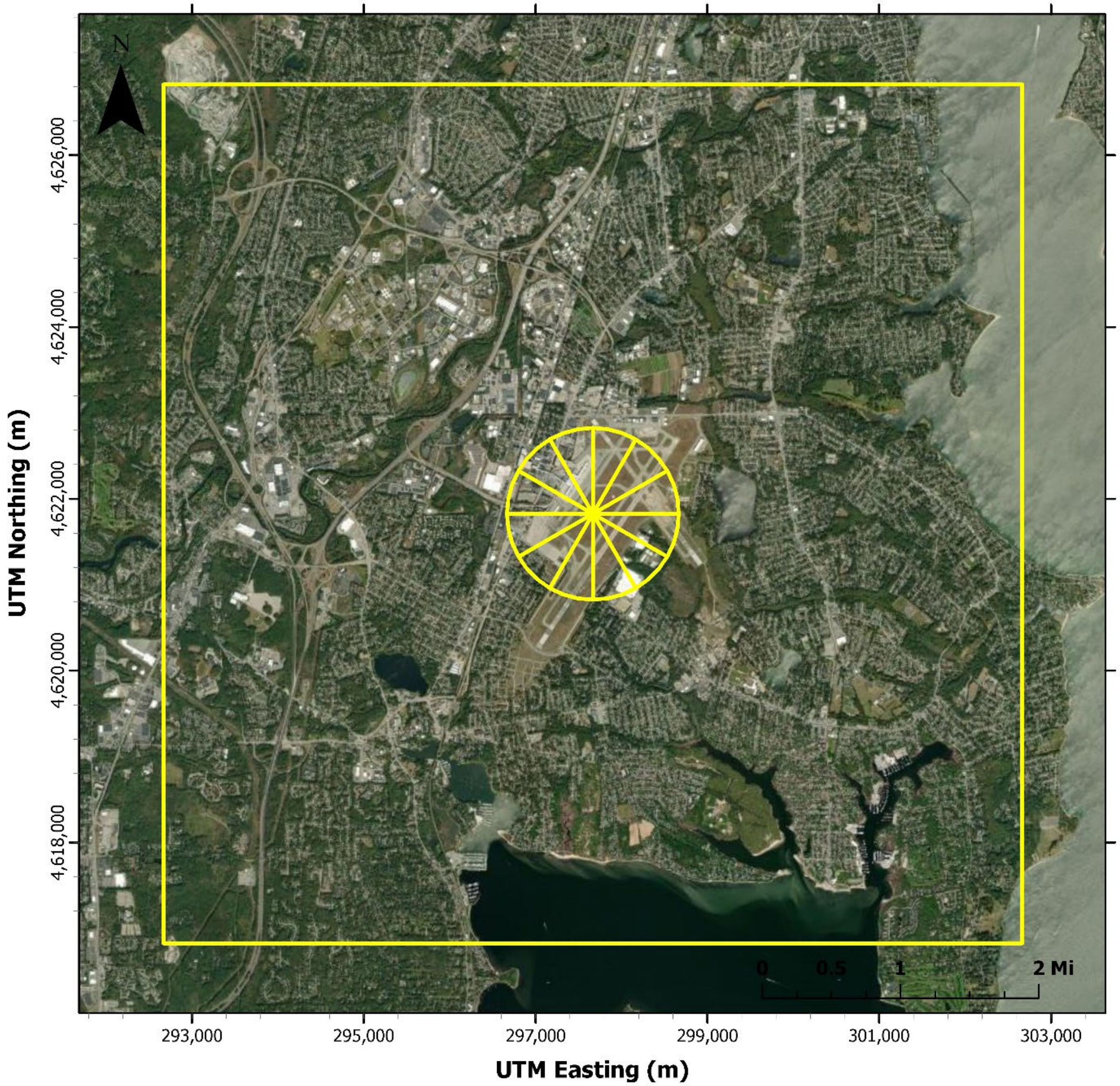
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-6. PVD Land Use – 1-km Radius – Tree Canopy



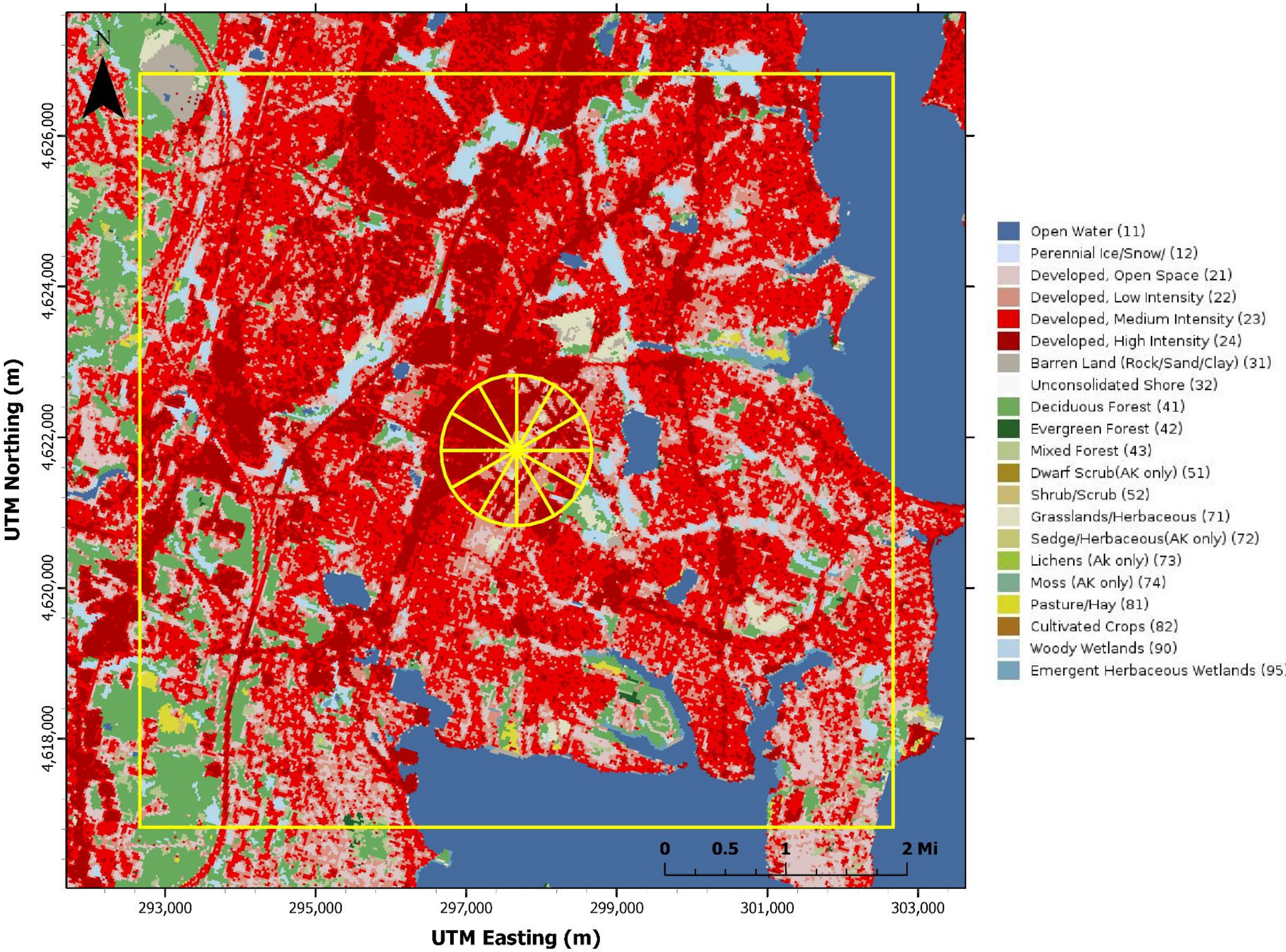
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-7. PVD Land Use – 10x10 km Grid & 1-km Radius – Aerial



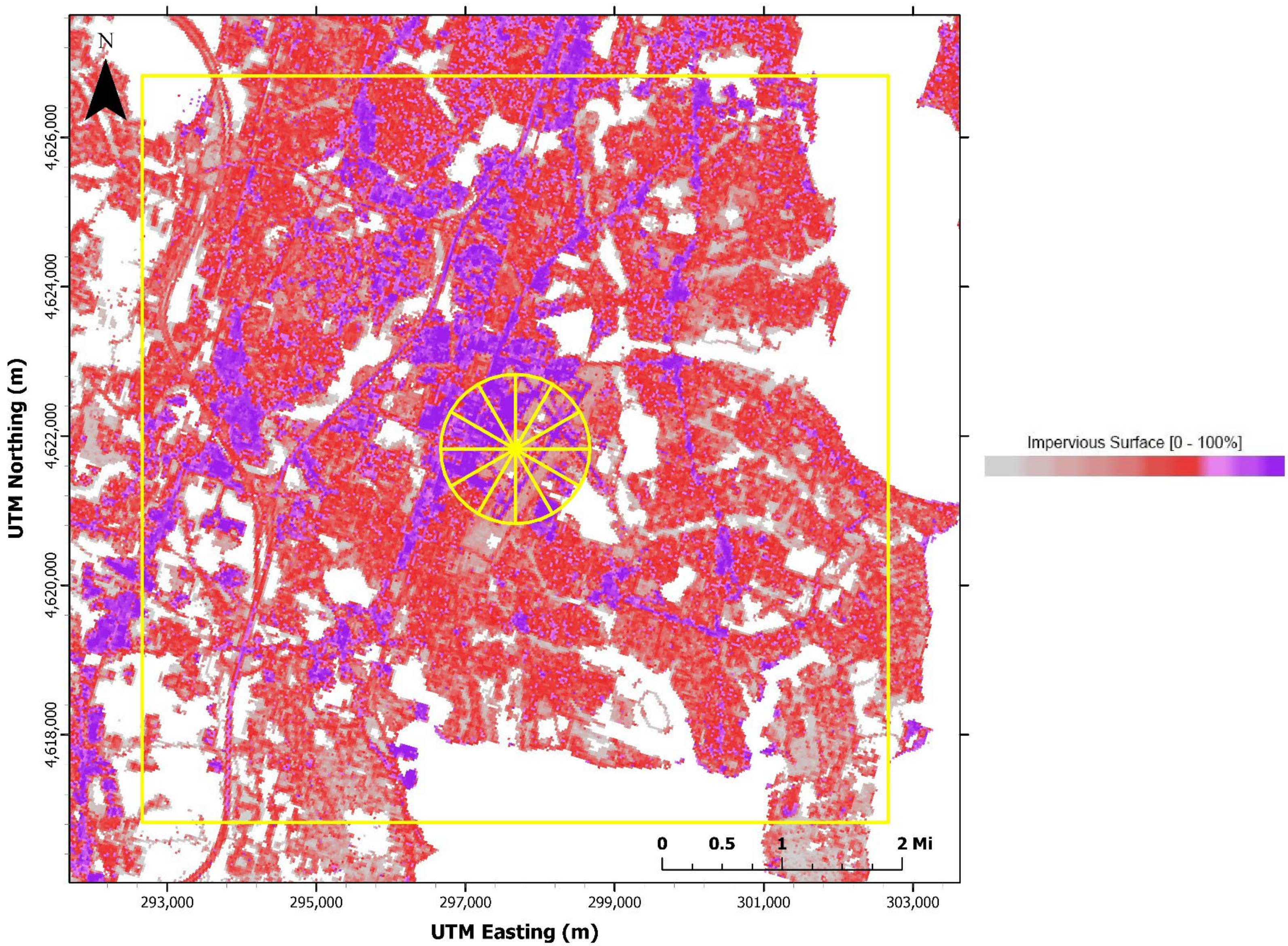
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-8. PVD Land Use – 10x10 km Grid & 1-km Radius – Land Cover



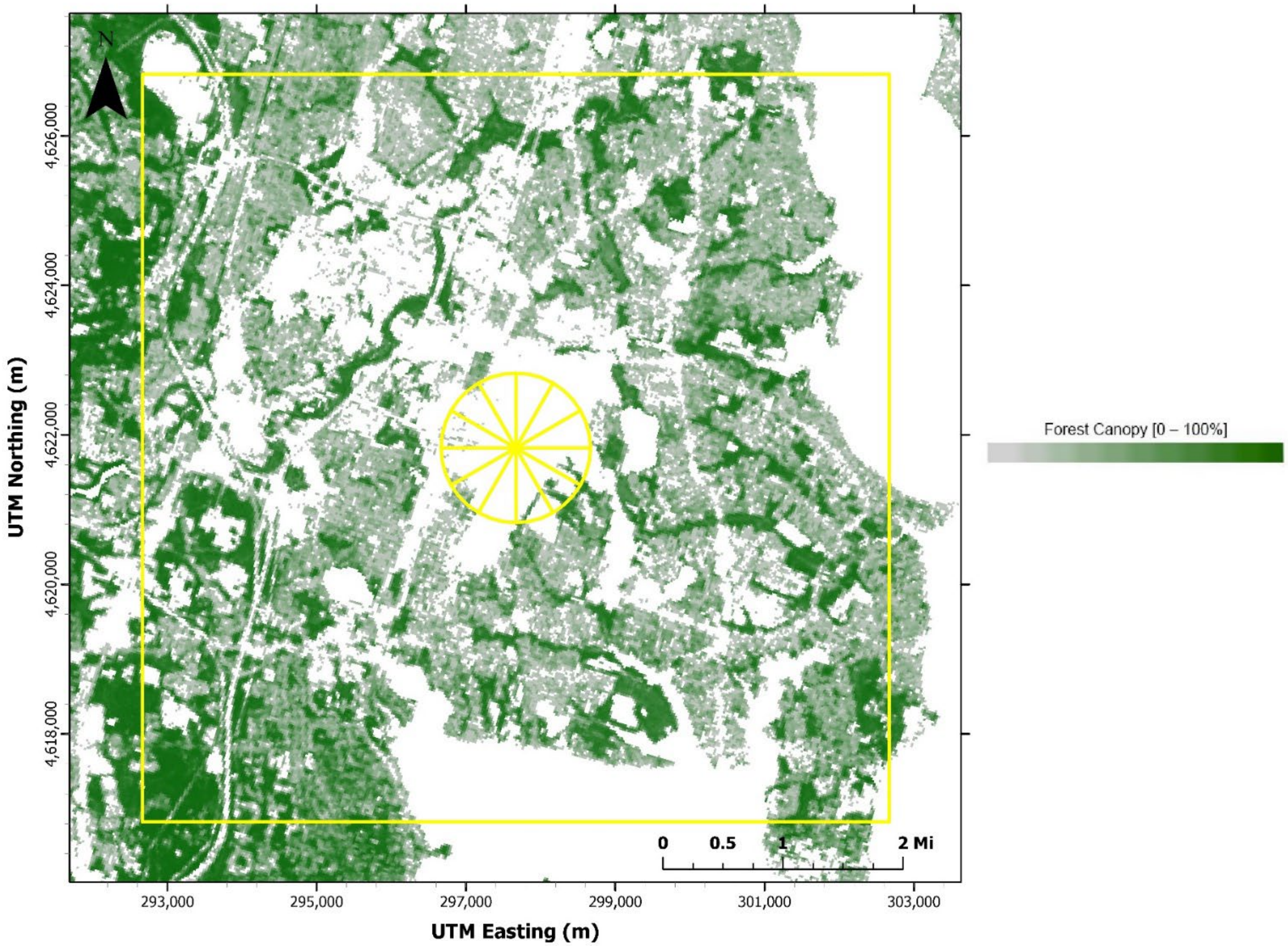
All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-9. PVD Land Use – 10x10 km Grid & 1-km Radius – Impervious Surface



All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

Appendix Figure B-10. PVD Land Use – 10x10 km Grid & 1-km Radius – Tree Canopy



All Coordinates shown in UTM Coordinates,
Zone 19, NAD 83 Datum

APPENDIX C. SOURCE PARAMETERS

Appendix Table C-1. Point Source Parameters

AERMOD ID	Description	X Coord. (m)	Y Coord. (m)	Elevation (m)
BAGHSE	HMA Drum Dryer	308187.6	4628081.8	7.78
HOH	Hot Oil Heater	308206.4	4628098.4	7.45
BLUESMK	Blue Smoke System	308229.1	4628093.2	7.4

Appendix Table C-2. Point Source Parameters

AERMOD ID	Stack Height		Stack Temperature		Stack Flow (acfm)	Stack Velocity[1]		Stack Diameter	
	(ft)	(m)	(°F)	(K)		(fps)	(m/s)	(ft)	(m)
BAGHSE100	40	12.19	275	408.15	47,000	40.1	12.22	5	1.52
BAGHSE75	40	12.19	275	408.15	35,250	30.1	9.17	5	1.52
BAGHSE50	40	12.19	275	408.15	23,500	20.1	6.11	5	1.52
HOH	8.8	2.68	400	477.6	682	13.1	4.0	1.05	0.32
BLUESMK	15	4.57	Ambient	Ambient	40,000	5.0	1.53	13	3.6

Appendix Table C-3. Volume Source Parameters

AERMOD ID	Description	X Coord. (m)	Y Coord. (m)	Elevation (m)	Release Height[1] (m)	Initial Lateral Dimension[2] (m)	Initial Vertical Dimension[3] (m)
Tank1	Storage tank 1 (30,000 gal)	308212.7	4628099.0	7.42	12.19	0.8	6.74
Tank2	Storage tank 2 (30,000 gal)	308216.9	4628097.5	7.42	12.19	0.8	6.74
VOL01	Cold Feed Bin 1	308178.7	4628046.4	8.12	1.83	0.8	0.85
VOL02	Cold Feed Bin 2	308181.9	4628047.8	8.07	1.83	0.8	0.85
VOL03	Cold Feed Bin 3	308185.5	4628049.3	7.99	1.83	0.8	0.85
VOL04	Cold Feed Bin 4	308188.9	4628051.0	7.92	1.83	0.8	0.85
VOL05	Cold Feed Bin 5	308192.1	4628052.3	7.86	1.83	0.8	0.85
VOL06	Weigh Conveyor w/ Scalping Screen	308200.7	4628055.1	7.75	3.37	0.7	3.13
VOL07	Recycle Weigh Conveyor w/ Scalping Screen	308194.2	4628086.1	7.69	3.37	0.7	3.13
VOL08	Recycle Asphalt Bin	308197.5	4628094.4	7.6	1.83	0.8	1.70
VOL09	Weigh Conveyor to Mixer	308208.4	4628082.3	7.55	3.37	0.7	3.13
VOL10	Recycle Conveyor to Mixer	308205.4	4628071.6	7.65	3.37	0.7	3.13
VOL11	Mixer to Drag Conveyor	308209.7	4628086.0	7.51	3.37	0.7	3.13
RDA01	Haul Roads	308209.0	4628013.0	8.09	2.55	2.32	2.37
RDA02	Haul Roads	308207.7	4628022.9	7.89	2.55	2.05	2.37
RDA03	Haul Roads	308205.9	4628032.8	7.66	2.55	3.79	2.37
RDA04	Haul Roads	308207.7	4628042.2	7.67	2.55	4.19	2.37
RDA05	Haul Roads	308211.6	4628051.4	7.67	2.55	4.19	2.37
RDA06	Haul Roads	308220.2	4628056.6	7.62	2.55	4.19	2.37
RDA07	Haul Roads	308228.4	4628062.2	7.53	2.55	4.19	2.37
RDA08	Haul Roads	308235.8	4628068.9	7.48	2.55	4.19	2.37
RDA09	Haul Roads	308236.9	4628069.9	7.48	2.55	4.19	2.37
RDA10	Haul Roads	308236.9	4628078.4	7.45	2.55	4.19	2.37
RDA11	Haul Roads	308237.0	4628088.4	7.41	2.55	4.19	2.37
RDA12	Haul Roads	308232.6	4628097.4	7.37	2.55	4.19	2.37
RDA13	Haul Roads	308224.8	4628102.7	7.36	2.55	4.19	2.37
RDA14	Haul Roads	308212.7	4628099.0	7.42	2.55	4.19	2.37

AERMOD ID	Description	X Coord. (m)	Y Coord. (m)	Elevation (m)	Release Height[1] (m)	Initial Lateral Dimension[2] (m)	Initial Vertical Dimension[3] (m)
RDA15	Haul Roads	308205.9	4628108.8	7.42	2.55	4.19	2.37
RDA16	Haul Roads	308195.9	4628109.5	7.48	2.55	4.19	2.37
RDA17	Haul Roads	308186.2	4628109.5	7.55	2.55	4.19	2.37
RDA18	Haul Roads	308177.9	4628103.8	7.7	2.55	4.19	2.37
RDA19	Haul Roads	308170.6	4628097.1	7.78	2.55	4.19	2.37
RDA20	Haul Roads	308164.1	4628089.5	7.77	2.55	4.19	2.37
RDA21	Haul Roads	308162.6	4628079.9	7.78	2.55	4.19	2.37
RDA22	Haul Roads	308162.8	4628069.9	7.79	2.55	4.19	2.37
RDA23	Haul Roads	308164.6	4628060.2	7.91	2.55	4.19	2.37
RDA24	Haul Roads	308167.8	4628050.7	8.11	2.55	4.19	2.37
RDA25	Haul Roads	308172.1	4628041.7	8.26	2.55	4.19	2.37
RDA26	Haul Roads	308173.6	4628038.4	8.3	2.55	4.19	2.37
RDA27	Haul Roads	308179.8	4628036.9	8.25	2.55	4.19	2.37
RDA28	Haul Roads	308189.6	4628035.2	8.02	2.55	4.19	2.37
RDA29	Haul Roads	308199.6	4628034.8	7.76	2.55	4.19	2.37
RDA30	Haul Roads	308205.0	4628027.7	7.79	2.55	1.54	2.37
RDA31	Haul Roads	308207.1	4628017.9	8.02	2.55	2.28	2.37
RDA32	Haul Roads	308209.1	4628008.1	8.19	2.55	1.80	2.37

[1] The release height is the height of the volume source.

[2] The initial lateral dimension should be set equal to the volume source's width divided by 4.3.

[3] The initial vertical dimension should be set equal to source height divided by 2.15.

Appendix Table C-4. Area Source Parameters

AERMOD ID	Description	X Coord. (m)	Y Coord. (m)	Elevation (m)	Release Height (m)	X Length (m)	Y Length (m)
PILE1	Storage Pile	308144.0	4628062.8	8.45	3.05	12.2	12.2
PILE2	Storage Pile	308143.3	4628075.1	8.08	3.05	12.2	12.2
PILE3	Storage Pile	308143.0	4628087.2	7.64	3.05	12.2	12.2
PILE4	Storage Pile	308143.0	4628099.6	7.39	3.05	12.2	12.2
PILE5	Storage Pile	308153.8	4628116.4	7.82	3.05	12.2	12.2
PILE6	Storage Pile	308165.5	4628118.7	7.71	3.05	12.2	12.2
RAP	Storage Pile	308258.8	4628065.1	7.4	3.05	103.8	25.6

APPENDIX D. EMISSION RATES

		Short Term (lb/hr)						
Pollutant	Drum Dryer [1]	Oil Heater	Silo Filing [2]	Loadout [2]	Storage Tanks (per tank)	Haul Roads	Conveyors	Storage Piles
PM10	2.60E+00	2.04E-02	9.10E-02	3.72E-03	-	6.82E-01	5.56E-01	2.08E-02
PM2.5	2.60E+00	2.04E-02	9.10E-02	3.72E-03	-	1.67E-01	8.42E-02	3.15E-03
SO2	7.65E-01	7.61E-03	-	-	-	-	-	-
NOx	2.03E+00	2.04E-01	-	-	-	-	-	-
CO	1.85E+01	1.16E-01	7.57E-02	8.65E-02	7.13E-04	-	-	-
Naphthalene	8.55E-04	1.15E-05	7.11E-04	1.63E-05	-	-	-	-
Phenol	-	-	-	2.34E-05	0.00E+00	-	-	-
Benzene	8.78E-02	2.91E-06	1.25E-05	1.39E-04	1.19E-07	-	-	-
Carbon Disulfide	-	-	6.25E-06	3.47E-05	1.19E-06	-	-	-
Chloroethane	-	-	1.56E-06	5.60E-07	1.49E-08	-	-	-
Ethylbenzene	5.40E-02	6.48E-07	1.49E-05	7.47E-04	1.43E-07	-	-	-
Formaldehyde	3.08E-01	3.36E-04	2.70E-04	2.35E-04	8.32E-04	-	-	-
Styrene	-	-	2.11E-06	1.95E-05	4.16E-07	-	-	-
Toluene	1.71E-03	6.32E-05	2.42E-05	5.60E-04	4.76E-06	-	-	-
1,1,1-Trichloroethane	-	2.41E-06	-	0.00E+00	-	-	-	-
Arsenic	1.26E-04	2.77E-07	-	-	-	-	-	-
Beryllium	0.00E+00	1.66E-08	-	-	-	-	-	-
Cadmium	9.23E-05	1.52E-06	-	-	-	-	-	-
Selenium	7.88E-05	3.32E-08	-	-	-	-	-	-
Antimony	4.05E-05	-	-	-	-	-	-	-
n-Hexane	-	-	-	-	3.81E-07	-	-	-
Alkanes	-	-	-	-	-	-	-	-
Xylene	4.50E-02	1.11E-06	1.00E-04	1.31E-03	9.28E-07	-	-	-
Chromium	1.14E-03	1.94E-06	-	-	-	-	-	-
Hexavalent Chromium	1.01E-04	-	-	-	-	-	-	-
Lead	1.40E-04	1.54E-05	-	-	-	-	-	-
Mercury	5.40E-05	3.60E-07	-	-	-	-	-	-
Nickel	1.42E-02	2.91E-06	-	-	-	-	-	-
Copper	6.98E-04	-	-	-	-	-	-	-
Methylene Chloride	-	-	1.06E-07	0.00E+00	2.02E-08	-	-	-
2-Methylnaphthalene	2.03E-02	3.32E-08	2.06E-03	3.10E-05	-	-	-	-
Tetrachloroethene	-	-	-	2.05E-05	-	-	-	-
Chloromethane	-	-	8.99E-06	4.00E-05	8.92E-08	-	-	-
Dichlorobenzene	-	1.66E-06	-	-	-	-	-	-
2-Butanone	-	-	-	-	1.49E-07	-	-	-

[1] Exhausts through baghouse stack.
[2] Exhausts through Blue Smoke Abatement System stack.

Conversions:

8760	hrs/yr	Storage Piles, Storage Tanks, Hot Oil Heater
3756	hrs/yr	Monday through Saturday, 7 AM to 7 PM. Other sources
2000	lb/ton	

	Annual (lb/hr)								
Pollutant	**Drum Dryer 50% [1]**	**Drum Dryer [1]**	**Oil Heater**	**Silo Filing [2]**	**Loadout [2]**	**Storage Tanks (per tank)**	**Haul Roads**	**Conveyors**	**Storage Piles**
PM10	6.93E-01	1.39E+00	2.04E-02	2.69E-02	1.10E-03	-	1.79E-01	1.64E-01	5.88E-03
PM2.5	6.93E-01	1.39E+00	2.04E-02	2.69E-02	1.10E-03	-	4.40E-02	2.49E-02	8.90E-04
SO2	2.04E-01	4.07E-01	7.61E-03	-	-	-	-	-	-
NOx	5.39E-01	1.08E+00	2.04E-01	-	-	-	-	-	-
CO	4.91E+00	9.82E+00	1.16E-01	2.24E-02	2.56E-02	7.13E-04	-	-	-
Naphthalene	2.28E-04	4.55E-04	1.15E-05	2.10E-04	4.81E-06	-	-	-	-
Phenol	-	-	-	-	6.93E-06	0.00E+00	-	-	-
Benzene	2.34E-02	4.67E-02	2.91E-06	3.70E-06	4.10E-05	1.19E-07	-	-	-
Carbon Disulfide	-	-	-	1.85E-06	1.03E-05	1.19E-06	-	-	-
Chloroethane	-	-	-	4.62E-07	1.66E-07	1.49E-08	-	-	-
Ethylbenzene	1.44E-02	2.88E-02	6.48E-07	4.39E-06	2.21E-04	1.43E-07	-	-	-
Formaldehyde	8.21E-02	1.64E-01	3.36E-04	7.98E-05	6.94E-05	8.32E-04	-	-	-
Styrene	-	-	-	6.24E-07	5.76E-06	4.16E-07	-	-	-
Toluene	4.55E-04	9.11E-04	6.32E-05	7.17E-06	1.66E-04	4.76E-06	-	-	-
1,1,1-Trichloroethane	-	-	2.41E-06	-	0.00E+00	-	-	-	-
Arsenic	3.35E-05	6.71E-05	2.77E-07	-	-	-	-	-	-
Beryllium	0.00E+00	0.00E+00	1.66E-08	-	-	-	-	-	-
Cadmium	2.46E-05	4.91E-05	1.52E-06	-	-	-	-	-	-
Selenium	2.10E-05	4.19E-05	3.32E-08	-	-	-	-	-	-
Antimony	1.08E-05	2.16E-05	-	-	-	-	-	-	-
n-Hexane	-	-	-	-	-	3.81E-07	-	-	-
Alkanes	-	-	-	-	-	-	-	-	-
Xylene	1.20E-02	2.40E-02	1.11E-06	2.97E-05	3.87E-04	9.28E-07	-	-	-
Chromium	3.03E-04	6.05E-04	1.94E-06	-	-	-	-	-	-
Hexavalent Chromium	2.70E-05	5.39E-05	-	-	-	-	-	-	-
Lead	3.71E-05	7.43E-05	1.54E-05	-	-	-	-	-	-
Mercury	1.44E-05	2.88E-05	3.60E-07	-	-	-	-	-	-
Nickel	3.77E-03	7.55E-03	2.91E-06	-	-	-	-	-	-
Copper	1.86E-04	3.71E-04	-	-	-	-	-	-	-
Methylene Chloride	-	-	-	3.12E-08	0.00E+00	2.02E-08	-	-	-
2-Methylnaphthalene	5.39E-03	1.08E-02	3.32E-08	6.09E-04	9.16E-06	-	-	-	-
Tetrachloroethene	-	-	-	-	6.08E-06	-	-	-	-
Chloromethane	-	-	-	2.66E-06	1.18E-05	8.92E-08	-	-	-
Dichlorobenzene	-	-	1.66E-06	-	-	-	-	-	-
2-Butanone	-	-	-	-	-	1.49E-07	-	-	-