WEIR CANADA INC.

SURREY FACILITY AIR QUALITY ASSESSMENT

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WEIR CANADA INC.

REPORT

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1 INTRODUCTION

Weir Canada Inc. (Weir) operates an industrial rubber rebuilding facility located at 18933 34A Avenue, Campbell Heights North, Surrey, British Columbia, Canada V3Z 1A7 (the Facility). WSP Canada Inc. (WSP) was retained by Weir to conduct an air dispersion modelling assessment in support of an air permit amendment application of the existing air permit (GVA 1081) to the Metro Vancouver Regional District (MVRD). The permit amendment addresses:

- The removal of allowances for unbuilt sources from the existing permit,
- The modification of operating limits for existing sources reflecting actual emissions as well as the actual performance of emission controls, and
- The addition of fugitive volatile organic compounds (VOC) as a source in the permit.

This report provides a refined dispersion modelling assessment of fine particulate matter ($PM_{2.5}$), inhalable particulate matter (PM_{10}), lead, VOC hazardous air pollutants (HAP), and non-HAP VOC identified in the permit amendment application.

The air quality assessment has been prepared in accordance with the British Columbia Air Quality Dispersion Modelling Guideline (AQDMG)[1] and the MVRD approved dispersion modelling plan and associated final comment tracking table (approved on March 7, 2023 by Curtis Wan). The main body of the report is organized as follows:

- Section 1 – Introduction
- Section 2 – Regulatory Framework
- Section 3 – Baseline Air Quality
- Section 4 – Emission Characterization
- Section 5 – Dispersion Modelling
- Section 6 – Summary.

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[1] British Columbia Ministry of Environment and Climate Change Strategy (2022). British Columbia Air Quality Dispersion Modelling Guideline. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/bc_dispersion_modelling_guideline.pdf

2 REGULATORY FRAMEWORK

2.1 AMBIENT AIR QUALITY CRITERIA

The management of air quality in Canada is accomplished primarily through federal and provincial government collaboration. At the federal level, the Canadian Council of Ministers of the Environment (CCME) acts as a forum for provincial governments to jointly undertake initiatives to address major environmental issues. Regarding air quality, the CCME approved the current air quality management system (AQMS) in 2012. The AQMS is a comprehensive approach for improving air quality in Canada and is the product of collaboration by the federal, provincial, and territorial governments, and stakeholders. Each province is tasked with implementing the components of the AQMS within their respective jurisdiction.

In British Columbia, the management of air quality in the Metro Vancouver region is delegated through the Environmental Management Act (EMA) to the MVRD, a regional body governed by a board constituted of elected representatives from each municipality and electoral area within the region. The "Greater Vancouver Regional District Air Quality Management Bylaw No. 1082, 2008" enables the MVRD's air quality regulatory program, which includes under Section 11 the use of permits to allow the discharge of air contaminants, subject to requirements for the protection of the environment.

As part of the AQMS, the CCME has issued Canadian Ambient Air Quality Standards (CAAQS) for ambient air quality management across the country. They have also established a new framework for air zone management within provinces that enables action tailored to specific sources of air emissions of concern in a given area. As a result of the CCME initiatives regarding the AQMS, BC and MVRD have adopted or updated air quality objectives for a number of air contaminants.

Air quality objectives are used to:

- Assess and provide context to current or historical air quality and trends;
- Guide decisions on the permitting of new or modified facilities;
- Guide decisions on episode management, such as air quality advisories;
- Develop long-term air quality management strategies and evaluate progress; and
- Aid in the development of new regulatory and non-regulatory initiatives.

The air contaminants and averaging periods considered in this dispersion modelling assessment have been selected with focus on emission sources in Weir's air permit amendment application dated February 24, 2022. Predicted fine particulate matter ($PM_{2.5}$) and inhalable particulate matter (PM_{10}) concentrations are compared against current MVRD ambient air quality objectives (AAQO)[2]. However, there are no MVRD objectives for lead, volatile organic compounds (VOC) or carbonyls. As indicated in the Metro Vancouver Dispersion Modelling Plan (Version 2.1), "If there are no Metro Vancouver objectives for the air contaminants to be modelled, then criteria from other jurisdictions (e.g., Alberta, Ontario, California, or Texas) should be used to put predicted ambient contaminant concentrations in perspective.". Thus, predicted concentrations for lead, VOC, and carbonyls are compared to

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[2] Metro Vancouver Ambient Air Quality Objectives (Updated January 2020). http://www.metrovancouver.org/services/air-quality/AirQualityPublications/CurrentAmbientAirQualityObjectives.pdf

applicable objectives from Texas[3] , Ontario[4], Alberta[5], and California[6] in this assessment. Table 2-1 below summarizes ambient air quality objectives considered in the assessment.

Table 2-1 Ambient Air Quality Objectives

Air Contaminant	Averaging Period	Statistical Form of Objective	Objective	Jurisdiction of Objective
Fine Particulate Matter (PM$_{2.5}$)	24-hour	Maximum 24-hour rolling predicted concentration	25 µg/m^3	MVRD
	Annual	Annual mean concentration	8 µg/m^3	MVRD
Inhalable Particulate Matter (PM$_{10}$)	24-hour	Maximum 24-hour rolling predicted concentration	50 µg/m^3	MVRD
	Annual	Annual mean concentration	20 µg/m^3	MVRD
Lead (Pb)	1-hour	Maximum 1-hour predicted concentration	1.5 µg/m^3	Alberta
	24-hour	Maximum 24-hour concentration	0.5 µg/m^3	Ontario
	30-day	Arithmetic mean of a 30-day period	0.2 µg/m^3	Ontario
	3-month (rolling)	Maximum predicted 3-month rolling average	0.15 µg/m^3	Texas (& US EPA NAAQS)
2-Butoxyethanol (111-76-2)	1-hour	Maximum 1-hour predicted concentration	2,900 µg/m^3	California
	24-hour	Maximum 24-hour concentration	2,400 µg/m^3	Ontario
	Annual	Annual mean concentration	3,700 µg/m^3	Texas
Ethylbenzene (100-41-4)	1-hour	Maximum 1-hour predicted concentration	26,000 µg/m^3	Texas
	24-hour	Maximum 24-hour concentration	1,000 µg/m^3	Ontario
	Annual	Annual mean concentration	570 µg/m^3	Texas
Ethyl Acetate (141-78-6)	1-hour	Maximum 1-hour predicted concentration	3,100 µg/m^3	Texas
	Annual	Annual mean concentration	1,440 µg/m^3	Texas
Ethyl Alcohol / Ethanol (64-17-5)	1-hour	Maximum 1-hour predicted concentration	18,800 µg/m^3	Texas
	Annual	Annual mean concentration	1,880 µg/m^3	Texas
Methyl ethyl ketone [MEK] (78-93-3)	1-hour	Maximum 1-hour predicted concentration	18,000 µg/m^3	Texas
	24-hour	Maximum 24-hour concentration	1,000 µg/m^3	Ontario
	Annual	Annual mean concentration	2,600 µg/m^3	Texas
Methyl isobutyl ketone [MIBK] (108-10-1)	1-hour	Maximum 1-hour predicted concentration	820 µg/m^3	Texas
	Annual	Annual mean concentration	82 µg/m^3	Texas
Tetrachloroethylene (127-18-4)	1-hour	Maximum 1-hour predicted concentration	2,000 µg/m^3	Texas
	24-hour	Maximum 24-hour concentration	360 µg/m^3	Ontario
	Annual	Annual mean concentration	26 µg/m^3	Texas

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[3] Texas Commission on Environmental Quality (TCEQ) – Toxicity Factor Database Moves into TAMIS Database: https://www.tceq.texas.gov/toxicology/database/tox.

[4] Ontario's Ambient Air Quality Criteria: Ontario's Ambient Air Quality Criteria | Ontario.ca

[5] Alberta Ambient Air Quality Objectives and Guidelines Summary: https://open.alberta.ca/dataset/0d2ad470-117e-410f-ba4f-aa352cb02d4d/resource/4ddd8097-6787-43f3-bb4a-908e20f5e8f1/download/aaqo-summary-jan2019.pdf

[6] California Air Sources Board – Ambient Air Quality Standards. https://ww2.arb.ca.gov/sites/default/files/2020-07/aaqs2.pdf.

Air Contaminant	Averaging Period	Statistical Form of Objective	Objective	Jurisdiction of Objective
Toluene (108-88-3)	1-hour	Maximum 1-hour predicted concentration	4,500 µg/m^3	Texas
	Annual	Annual mean concentration	1,200 µg/m^3	Texas
Xylene (1330-20-7)	1-hour	Maximum 1-hour predicted concentration	2,200 µg/m^3	Texas
	24-hour	Maximum 24-hour concentration	730 µg/m^3	Ontario
	Annual	Annual mean concentration	180 µg/m^3	Texas

2.2 DUSTFALL AND LEAD DEPOSITION

Provincial dustfall objectives were originally developed in 1979 under the BC Pollution Control Objectives (PCO) as a method to assess the dustiness of an area and as a 'soiling index.' Their effectiveness for determining impacts on human or environmental health were limited and, subsequently, the PCOs were rescinded in 2006[7].

Air dispersion modelling may assist with identifying areas potentially affected by fugitive dust generated during facility operations, however, the modelled concentrations are highly uncertain due to compound uncertainty related to model inputs, namely simplistic fugitive dust emission factors, and inherent uncertainties and limitations in modeling dust dispersion and deposition. The British Columbia Ministry of Environment and Climate Change Strategy recommends careful selection of appropriate criteria when evaluating dustfall and lists the following rescinded criteria for consideration as reference:

- 'residential/parkland' PCO (1.75 mg/dm^2/day),
- 'industrial/other' PCO (2.90 mg/dm^2/day).

To provide context in regard to the potential of lead deposition from Facility operations, particle deposition modelling with focus on lead is included in this assessment and compared against the above listed PCOs as reference. Furthermore, predicted deposition rates for particulate matter will be provided for additional contextualization.

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[7] British Columbia Ministry of Environment and Climate Change Strategy. (2020). Dustfall Monitoring and Pollution Control Objectives. Technical Guidance – Regional Operations Branch, GUI-TEC-04.1: gui-tec-041_dustfall_monitoring.pdf (gov.bc.ca)

3 BASELINE AIR QUALITY

In dispersion modelling assessments, baseline air contaminant concentrations are determined in order to provide a complete indication of cumulative impacts to air quality by adding selected baseline concentrations to model predictions. The AQDMG states that baseline concentrations are due to natural and human-caused sources, with exception of the sources being modelled. In accordance with the AQDMG, baseline concentrations may be determined from historic air quality monitoring data.

MVRD operates a large network of ambient air quality monitors in the Lower Mainland. Based on their proximity to the Facility, three (3) stations are used to characterize baseline air contaminant concentrations for particulate matter: North Delta (T13), Surrey East (T15), and Langley (T27). National Air Pollution Surveillance (NAPS) data obtained at the Port Moody (100111), Burnaby South station (100119), and Abbotsford Airport (101005) stations operated by Environment and Climate Change Canada (ECCC) are used to characterize baseline air quality for lead, VOC, and carbonyl group air contaminants.

Ambient baseline values were determined as follows and are summarized in Table 3-1 below.

- Particulate matter monitoring data was pre-screened for wildfire smoke following Section 8.1.4 of the AQDMG. $PM_{2.5}$ and PM_{10} data was removed from baseline air quality calculations for periods when Metro Vancouver air quality advisories were issued due to wildfire activity in August and September of 2018 and September of 2020.
- The 98th percentile of the 24-hour rolling average values were calculated for each year (2018 – 2020) for stations T13, T15 and T27 for $PM_{2.5}$. The overall baseline is the arithmetic average of the 98th percentile calculated for each year and each station.
- The 98th percentile of the 24-hour rolling average values were calculated for each year (2018 – 2020) for station T27 for PM_{10}. The overall baseline is the 3-year arithmetic average of the 98th percentile PM_{10} data.
- Annual average $PM_{2.5}$ and PM_{10} was calculated as the annual mean of 1-hour concentrations for each year (2018 – 2020) at T13, T15 and T27 for $PM_{2.5}$ and T27 for PM_{10}. The overall baseline is the arithmetic average calculated for each year and each station.
- As the sampling interval for NAPS lead, VOC and carbonyls data is over a 24-hour period, a conversion factor equation was applied to calculate 1-hour concentrations following the method outlined in the Air Dispersion Modelling Guideline for Ontario[8] by applying the following peak to mean formula:

$$C_p = C_m (t_p/t_m)^{-p}$$

where:
C_p : Peak Concentration
C_m: Mean Averaging Concentration
t_p: Peak averaging time (1-hour)
t_m: Mean averaging time (24-hour)
p: Decay value (0.28)

Thus:

$$\text{Concentration}_{(1\text{-hour})} = \text{Concentration}_{(24\text{-hour})} * (1/24)^{-0.28}.$$

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[8] Ontario Ministry of the Environment and Climate Change (2017). Air Dispersion Modelling Guideline for Ontario [Guideline A-11]. Version 3.0. February 2017. https://files.ontario.ca/admgo-id50_aoda_v2b.pdf

- The 98th percentile of sampled data for each year and station was determined for lead, VOC and carbonyls. The overall baseline is the arithmetic average of the 98th percentile concentrations calculated for each year and each station for the respective air contaminants.
- The overall lead baseline for the 30-day and 3-month averaging periods are the arithmetic average of the 30-day and 3-month rolling average concentrations calculated based on the sampled data for each year and each station.
- The annual average lead, VOC, and carbonyl baselines were calculated as the arithmetic average of all sampled values for each year for the respective air contaminants.

A detailed overview of baseline data by monitoring station, air contaminant, averaging period and year is provided in Section 4 of Appendix A.

Table 3-1 Summary of Baseline Concentrations

Air Contaminant	Averaging Period	Statistical Form of Objective	Data Source	Objective [µg/m^3]	3-Year Average Baseline Concentration [µg/m^3]	% of Objective
Fine Particulate Matter ($PM_{2.5}$)	24-hour	Maximum 24-hour rolling concentration	MVRD	25	14.8	59%
	Annual	Annual mean concentration		8	5.3	67%
Inhalable Particulate Matter (PM_{10})	24-hour	Maximum 24-hour rolling concentration	MVRD	50	21.5	43%
	Annual	Annual mean concentration		20	9.5	48%
Lead (Pb)	1-hour	Maximum 1-hour concentration	NAPS	1.5	0.0229	1.5%
	24-hour	Maximum 24-hour concentration		0.5	0.0094	1.9%
	30-day	Arithmetic mean of a 30-day period		0.2	0.0020	1.0%
	3-month (rolling)	Maximum 3-month rolling average		0.15	0.0018	1.2%
2-Butoxyethanol (111-76-2)	Baseline data not available.					
Ethylbenzene (100-41-4)	1-hour	Maximum 1-hour concentration	NAPS	26,000	2.2	0.01%
	24-hour	Maximum 24-hour concentration		1,000	0.9	0.09%
	Annual	Annual mean concentration		570	0.3	0.05%
Ethyl Acetate (141-78-6)	Baseline data not available.					
Ethyl Alcohol / Ethanol (64-17-5)	Baseline data not available.					
Methyl ethyl ketone [MEK] (78-93-3)	1-hour	Maximum 1-hour concentration	NAPS	18,000	1.6	0.01%
	24-hour	Maximum 24-hour concentration		1,000	0.6	0.06%
	Annual	Annual mean concentration		2,600	0.2	0.01%
Methyl isobutyl ketone [MIBK] (108-10-1)	1-hour	Maximum 1-hour concentration	NAPS	820	0.4	0.04%
	Annual	Annual mean concentration		82	0.1	0.07%
Tetrachloroethylene (127-18-4)	1-hour	Maximum 1-hour concentration	NAPS	2,000	0.9	0.05%
	24-hour	Maximum 24-hour concentration		360	0.4	0.11%
	Annual	Annual mean concentration		26	0.1	0.43%
Toluene (108-88-3)	1-hour	Maximum 1-hour concentration	NAPS	4,500	12.3	0.27%
	Annual	Annual mean concentration		1,200	1.6	0.13%
Xylene (1330-20-7)	1-hour	Maximum 1-hour concentration	NAPS	2,200	8.8	0.40%
	24-hour	Maximum 24-hour concentration		730	3.6	0.50%
	Annual	Annual mean concentration		180	1.1	0.59%

4 EMISSION CHARACTERIZATION

4.1 SOURCE CHARACTERIZATION

The core function of the Facility is the application of wear resistant rubber linings to industrial components such as steel fittings, vessels, pipework and raw steel materials. Facility emissions are associated with activities such as welding, grit blasting, application of adhesives and paint to materials, as well as buffing and trimming of rubber. The following section describes processes and emission sources at the Facility. Table 4-1 below summarizes processes in form of a flow chart and lists associated emission sources.

4.1.1 PROCESS DESCRITPION

The Facility receives steel components in new or used condition, with some fabrication of new components occurring on site. Repair of used components as well as on site fabrication occurs at welding stations, which are equipped with nine (9) welding exhaust collector arms. Particulate matter (PM) emitted during the welding is controlled with cartridge dust collection filters installed on each of the welding station exhausts, which discharge through nine separate stacks (**Sources 9a to 9i**). It is important to note that the welding stations are separated by a wall from the other emission sources in the Facility. Thus, it is assumed none of the fugitive emissions generated in other areas of the Facility are emitted via the welding exhausts.

After welding, the materials are cleaned by a compressed air/metallic grit stream in the Grit Blast Booth. This process generates PM, which is controlled by a fabric filter dust collector, with exhaust air discharged through a stack (**Source 8**).

Following the cleaning, rubber coatings are applied to steel components in the Custom Lining Cells (**Source 10**). In preparation for the rubber lining process, the rubber is treated with Xylene, and then adhesives containing volatile compounds are applied to adhere the rubber coatings to the components. Emissions of Xylene and the volatile adhesives are controlled through minimization of their usage, substitution with less volatile treatments (when possible), mobile carbon filter carts with suction fans that collect volatiles direction from components. The exhaust air from these carts is recirculated in the Facility. There are also 11 fixed wall and roof hung air cleaners with carbon filter cartridges circulating building indoor air, further capturing fugitive emissions. The uncaptured VOCs are exhausted through the building's HVAC vents (**Sources 10.a to 10.n**) and exhaust stacks for other operations occurring the same building area (**Sources 6, 7, and 8**).

After the rubber adhesive and rubber lining application, components are placed in steam autoclaves (steam supplied from boiler - registered under Metro Vancouver Bylaw 1087) and heat treated to cure the rubber. Steam from the heat treating autoclaves is condensed and reused, with any emissions from the condensation process vented to the main building air space via filter cartridges.

Following the heat treatment, rubber coatings on components are smoothed in the Rubber Buffing Room. This process generates PM that contains lead, which is a component of some of the rubbers used for coating. PM emissions from rubber buffing are controlled using a combination of cartridge filters on buffing stations and two-stage box filters. The exhaust air from the Rubber Buffing Room is discharged through a stack (**Source 7**).

Once buffed, some components are taken to the paint booth to have exterior surfaces painted. The paint booth is an enclosed spray booth discharging through a stack **(Source 6**).

After painting, the products are packaged and shipped. The small quantity of emissions generated by vehicles and machinery used in this process are not in the scope of this assessment.

The Facility operates Monday through Friday with a maximum of 21 hours of operations (from 4am to 1am the next day), outside of which all emissions sources and HVAC vents are shut off. Emissions calculations are based on respective maximum daily, monthly, and annual operating hours associated with this schedule.

Table 4-1 summarizes the emission sources in the Facility, as well as air contaminants emitted.

Table 4-1 Summary of Emission Sources and Associated Air Contaminants

Emission Source	Description	Air Contaminants
6	Paint Booth emissions + *fugitive VOC emissions from Custom Lining Cells* discharged through a stack.	2-Butoxyethanol, *Xylene, Ethylbenzene, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Tetrachloroethylene, Toluene, Ethyl Acetate, Ethyl Alcohol*
7	Rubber Buffing Room emissions + *fugitive VOC emissions from Custom Lining Cells* discharged through a stack.	Total Particulate Matter (TPM), PM_{10}, $PM_{2.5}$, Lead, *Xylene, Ethylbenzene, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Tetrachloroethylene, Toluene, Ethyl Acetate, Ethyl Alcohol*
8	Grit Blast booth emissions + *fugitive VOC emissions from Custom Lining Cells* discharged through a stack.	TPM, *Xylene, Ethylbenzene, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Tetrachloroethylene, Toluene, Ethyl Acetate, Ethyl Alcohol*
9 (a to i)	Nine welding stations discharging through nine stacks.	TPM, PM_{10}, $PM_{2.5}$,
10 (a to n)	Custom Lining Cells fugitive VOC emissions discharging through building HVAC vents.	Xylene, Ethylbenzene, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Tetrachloroethylene, Toluene, Ethyl Acetate, Ethyl Alcohol

Note: Information provided in *italics* indicates fugitive VOC emissions discharged through stacks.

It should be noted that Emission Source 01 thorough Emission Source 05 as included in Weir's existing permit (GVA 1081) are not considered in this assessment as they were never installed in the Facility. These sources are removed in the permit amendment application.

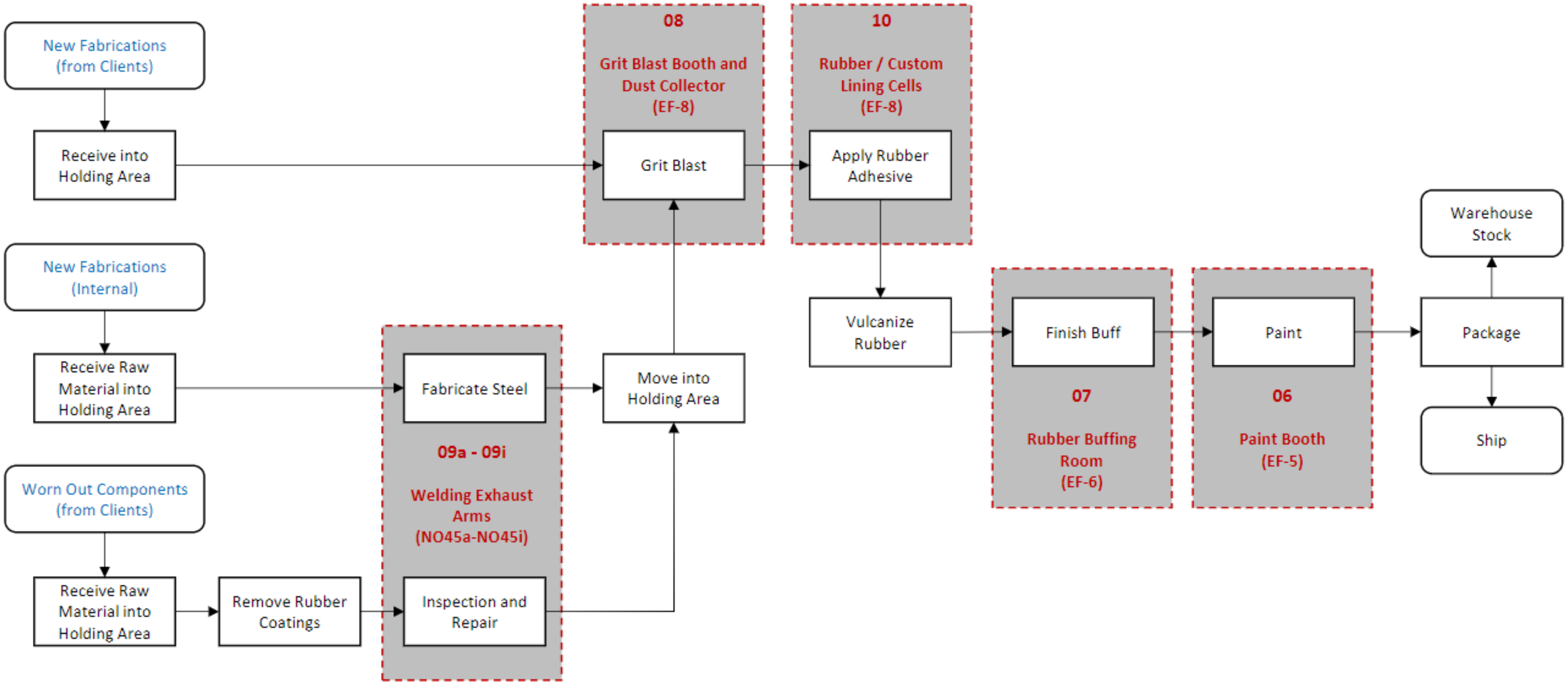

Figure 4-1 Process Flow Chart

(**Note:** Air emission sources are shown in red dashed boxes.)

4.1.2 SOURCE PARAMETERS

The emission sources evaluated in this assessment include:

- The paint booth stack (Source 6),
- The rubber buffing room stack (Source 7),
- The grit blast booth stack (Source 8),
- Nine (9) welding station exhaust stacks (Source 9.a – 9.i), and
- 14 HVAC vents (Source 10.a – 10.n).

The source characteristics for all emission sources are summarized in Table 4-2 and source locations are shown in Figure 4-2 below. Detailed source parameters were determined based on information provided by Weir, stack testing performed at the Facility, manufacturer's specifications, and the site plan.

Table 4-2 Emission Source Parameters

Source ID	Description	X (m)	Y (m)	Annual Operating Hours (h/y)	Base Elevation (m)	Height (m)	Discharge Area (m^2)	Diameter (m)	Maximum Dry Flow Rate (dscm/min)	Maximum Wet Flow Rate[a] (wet m^3/min @ actual O_2)	Exit Velocity (dscm/min)	Exit Temperature (°C)
6	Paint Booth discharging through a Stack	521,798	5,434,693	940	42.8	13.6	1.17	1.22	1,133	1,141	16.3	During the heating season (October - April), Facility indoor air is heated to 18°C. Emissions will be modelled at 18°C during this period. During the non-heating season, hourly exit temperature will be modelled at the higher of either 18°C, or the hourly outdoor ambient temperature plus a 3°C uplift to account for manufacturing heat inputs within the building.
7	Rubber Buffing Room discharging through a Stack	521,826	5,434,711	2,250	42.8	13.6	0.65	0.91	1,000	1,007	25.8	
8	Grit Blast Booth discharging through a Stack	521,855	5,434,768	4,500	42.8	6.3	0.46	0.76	566	570	20.8	
9.a[b]	One of the nine Welding Stations discharging through a Stack	521,859	5,434,744	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.b[b]		521,859	5,434,740	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.c[b]		521,858	5,434,735	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.d[b]		521,858	5,434,731	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.e[b]		521,858	5,434,726	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.f[b]		521,858	5,434,722	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.g[b]		521,876	5,434,737	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.h[b]		521,876	5,434,731	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
9.i[b]		521,877	5,434,758	3,000	42.8	10.5	0.03	0.20	26	26	13.6	
10.a	Custom Lining Cells fugitive VOC emissions discharging through building HVAC vents	521,770	5,434,711	5,500	42.8	10.5	0.82	1.02	227	228	4.6	
10.b		521,769	5,434,701	5,500	42.8	10.5	0.82	1.02	227	228	4.6	
10.c		521,770	5,434,730	5,500	42.8	10.5	0.57	0.85	142	143	4.2	
10.d		521,830	5,434,757	5,500	42.8	10.5	0.82	1.02	184	185	3.8	
10.e		521,797	5,434,689	5,500	42.8	10.5	1.58	1.42	566	570	6.0	
10.f		521,793	5,434,748	5,500	42.8	10.5	1.58	1.42	566	570	6.0	
10.g*		521,812	5,434,715	5,500	42.8	10.5	1.19	1.23	708	713	10.0	
10.h		521,817	5,434,762	5,500	42.8	10.5	0.82	1.02	212	214	4.3	
10.i		521,849	5,434,757	5,500	42.8	10.5	1.58	1.42	595	599	6.3	
10.j		521,830	5,434,724	5,500	42.8	10.5	0.57	0.85	156	157	4.6	
10.k		521,830	5,434,748	5,500	42.8	10.5	0.57	0.85	156	157	4.6	
10.l		521,849	5,434,699	5,500	42.8	10.5	0.36	0.68	57	57	2.6	
10.m		521,849	5,434,721	5,500	42.8	10.5	0.36	0.68	57	57	2.6	
10.n		521,807	5,434,763	5,500	42.8	10.5	0.82	1.02	212	214	4.3	

[a] : The maximum wet flow rate was calculated based on the following conditions: standard temperature of 20°C, O_2 volumetric content of 20.9%, H_2O volumetric content of 0.7%. Oxygen correction was not applied.

[b]: All sources discharge emissions vertically in an upward direction, except for sources 9.a – 9.i and 10.g, which discharge in a downward direction. These sources were modelled with a vertical momentum flux of zero.

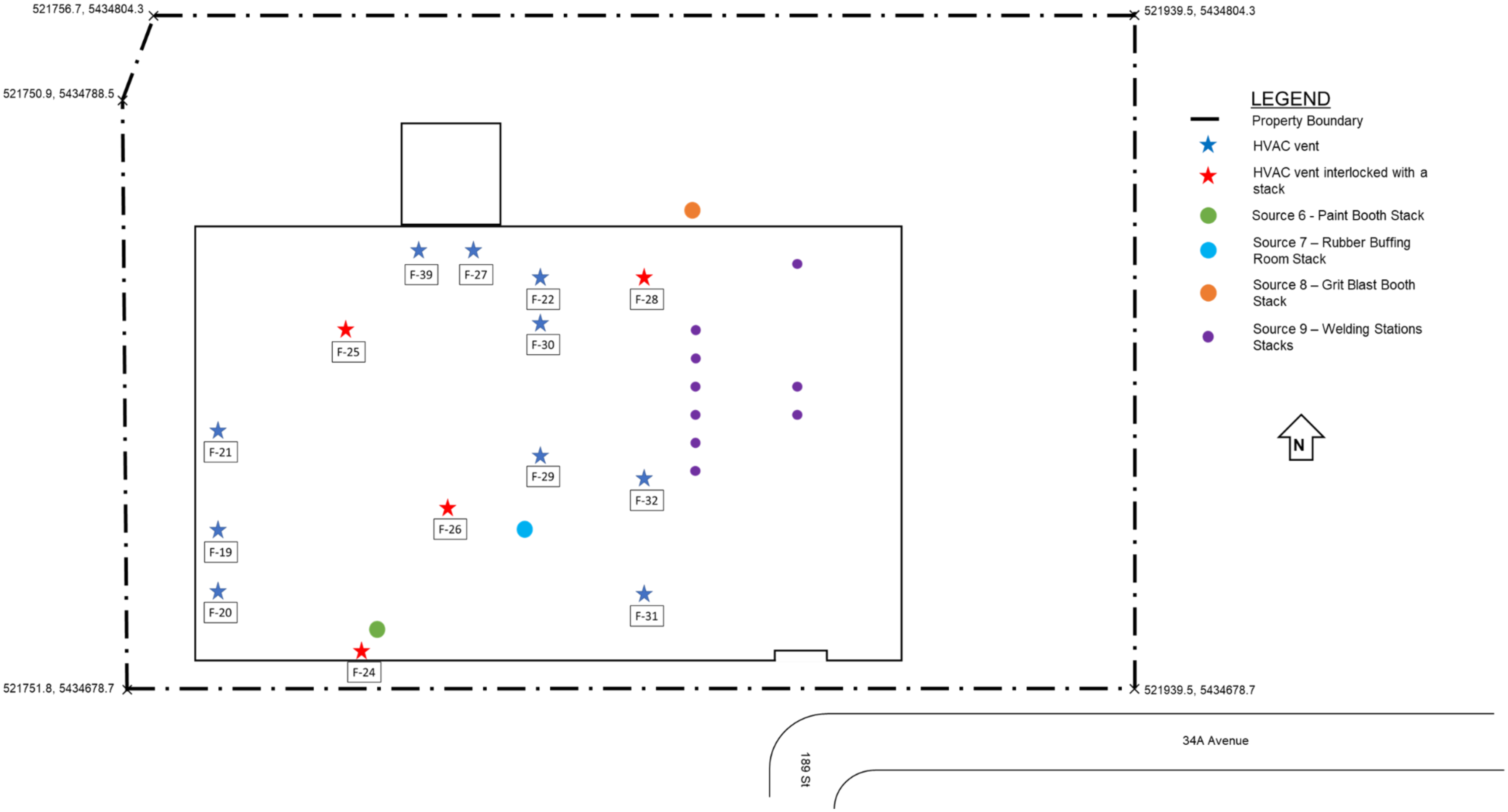

Figure 4-2 Facility Site Plan with Source Locations

4.2 EMISSION ESTIMATION METHODOLOGY

For the purposes of this assessment, emissions have been estimated for all Facility sources considered in the permit amendment application for the following air contaminants:

- **Non-Fugitive:**
    - Fine Particulate Matter ($PM_{2.5}$),
    - Inhalable Particulate Matter (PM_{10}),
    - Lead (Pb),
    - 2-Butoxyethanol (111-76-2),
- **Fugitive:**
    - Ethylbenzene (100-41-4),
    - Ethyl Acetate (141-78-6),
    - Ethyl Alcohol / Ethanol (64-17-5),
    - Methyl ethyl ketone [MEK] (78-93-3),
    - Methyl isobutyl ketone [MIBK] (108-10-1),
    - Tetrachloroethylene (127-18-4),
    - Toluene (108-88-3), and
    - Xylene (1330-20-7).

4.2.1 NON-FUGITIVE EMISSIONS

The following sections detail the emissions estimation methodology for non-fugitive emissions from the Facility. Maximum emissions for particulate matter, lead, and 2-Butoxyethanol are summarized in Table 4-3 below. Further details are provided in Appendix A.

4.2.1.1 *PARTICULATE MATTER*

Maximum emission quality for Total Particulate Matter was determined through review of facility emission test results and limits typically employed in Metro Vancouver air permits for similar types of control equipment, as well as consideration of the lowest level that can be reliably verified through emissions compliance testing. This resulted in an emission quality of 5 mg/m^3 for the Rubber Buffing, Grit Blast and Welding Station (sources 7, 8 and 9), which was then multiplied by permitted stack flow rates to estimate emissions quantities.

$PM_{2.5}$ and PM_{10} size fractions for the Rubber Buffing and Grit Blast (sources 7 and 8) were calculated using emission factors for sand blasting of mild steel panels[9]. To estimate emissions for the $PM_{2.5}$ and PM_{10} size fractions, the TPM maximum emission quantity was multiplied by the ratio of the TPM emission factor and the $PM_{2.5}$ and PM_{10} emission factor, respectively.

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[9] US EPA (1997). AP42 Fifth Edition, Volume I, Chapter 13.2.6: Miscellaneous Sources – Abrasive Blasting. October 1997. https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s02-6.pdf [Accessed: Feb 03, 2023]

For the Welding Stations (sources 9a to 9i), the PM_{10} emissions were assumed to be equal to TPM emissions and $PM_{2.5}$ emissions were assumed to be 75% of PM_{10} emissions, per guidance from Environment and Climate Change[10].

4.2.1.2 *LEAD*

The Safety Data Sheet (SDS) for the rubber used by Weir indicates an elemental lead content of approximately 6% (occurring as Pb_3O_4 and PbO). No other metals are expected to be present in significant amounts in the rubber being buffed. As such, only a limit for lead was considered in the assessment. Maximum lead emissions were determined based on the WorkSafeBC 8-hour time weighted average occupational exposure limit for lead ($0.05 mg/m^3$)[11] and the maximum permitted stack flow rate.

4.2.1.3 *2-BUTOXYETHANOL*

2-Butoxyethanol is a component of the paint used in the Facility and is emitted only in the Paint Booth (source 6). Maximum 2-Butoxyethanol emissions were conservatively estimated based on the Texas Department of Environment Quality Short Term (1-hour) Effects Screening Level[12] (ESL). The product of the ESL concentration and the maximum permitted Paint Booth stack flow rate is higher than the potential concentration from evaporated 2-Butoxyethanol at maximum paint application rate employed by the Facility.

Table 4-3 Maximum Emissions for Non-Fugitive Air Contaminants

Source	Maximum Emissions (kg/hr)			
	PM_{10}	$PM_{2.5}$	Lead	2-Butoxyethanol
6	-	-	-	0.1971
7	0.1444	0.0144	0.0030	-
8	0.0818	0.0082	-	-
9 (a to i)	0.0077	0.0057	-	-
9 (total)	0.0689	0.0516	-	-
Facility Total	**0.3027**	**0.0800**	**0.0030**	**0.1971**

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[10] Government of Canada – Environment and Climate Change (2021). Arc welding, cutting and spraying activities: guide to reporting. April 2021. https://www.canada.ca/en/environment-climate-change/services/national-pollutant-release-inventory/report/tools-calculating-emissions/arc-welding-cutting-spraying-calculator.html [Accessed: Feb 03, 2023]

[11] WorkSafeBC. Exposure limit for Lead (CAS 7439-92-1). https://elimit.online.worksafebc.com/substance/lead-inorganic-compounds-as-pb/ [Accessed: Feb 03, 2023]

[12] Texas Department of Environmental Quality (2016). Short Term Effects Screening Level for 2-butoxyethanol (CAS 111-76-2). November 2016. https://www.tceq.texas.gov/toxicology/esl/list_main.html/#esl_2 [Accessed: Feb 03, 2023]

4.2.2 FUGITIVE EMISSIONS

The following sections detail the emission estimation methodology for fugitive emissions from the Facility. Further details are provided in Appendix A.

4.2.2.1 TOTAL FUGITIVE EMISSIONS CALCULATION

Fugitive VOC emissions of Xylene, Ethylbenzene, MEK, MIBK, Tetrachloroethylene, Toluene, Ethyl Acetate and Ethyl Alcohol from the Facility are generated during the application of rubber adhesives and adhesive surface treatments in the Custom Lining Cells. The total annual uncontrolled VOC emissions (tonnes/year) were estimated as

$$Uncontrolled\ emission\ quantity = x_{VOC} * M,$$

where x_{VOC} is the mass fraction of the respective VOC, found in the adhesive's Safety Data Sheet, and M is the amount of adhesive used in a year (tonnes/year). This calculation is conservative as it assumes that all of the VOC in the adhesive volatilize within the facility.

To estimate the control efficiency of the carbon filtration systems, the total annual carbon adsorption capacity was determined for each filter. Based on the carbon content of each VOC, the amount of captured VOC was estimated on an annual basis. Subsequently, the controlled VOC emission quantity was estimated by subtracting the amount captured by the filters from the uncontrolled emission rates.

4.2.2.2 FUGITIVE EMISSIONS ALLOCATION

Given the fugitive nature of the VOC, it is assumed that emissions from the Custom Lining Cells disperse uniformly throughout the Facility. All air drawn through the Paint Booth, Rubber Buffing and Grit Blast, and subsequently discharged via associated stacks (permitted sources, 6, 7, and 8) is building indoor air, so it would be expected to contain the same concentration of indoor fugitives as air emitted through normal operation of the building HVAC system. Therefore, the maximum fugitive emissions were distributed proportionally to the flow rate of each permitted emission source and HVAC fan.

It should be noted that four of the HVAC system fans are interlocked with permitted emission source fans. Therefore, whenever the permitted source is in operation, the HVAC's fan is turned off and vice versa. To assess the potential impact of fugitive VOC emissions being discharged from these varying interlock settings, the following two emissions scenarios were developed and included in the dispersion modelling assessment:

- **HVAC-Only Scenario**, in which it is assumed that none of the permitted source fans (6, 7 and 8) are in operation, and fugitive emissions are picked up only by the HVAC system fans.

- **HVAC and Stacks Scenario**, in which it is assumed that all of the permitted source fans (6, 7 and 8) are in operation. Therefore, the fugitive emissions are picked up by the permitted source fans and the HVAC system fans not interlocked with permitted source fans.

Maximum emissions from fugitive air contaminants for both scenarios are summarized in Table 4-4 below, while Table 4-5 details the emissions allocations for HVAC vents and permitted sources for each scenario. As discussed in Section 4.1.1, the air intake for the welding stations is separated from the rest of the Facility, thus, no fugitive VOC emissions are allocated to sources 9a to 9i.

Table 4-4 Maximum Emission Quantity for Fugitive Gases

Source	**Maximum Emissions (kg/hr)**							
	Xylene	**Ethylbenzene**	**Methyl Ethyl Ketone**	**Methyl Isobutyl Ketone**	**Tetrachloroethylene**	**Toluene**	**Ethyl Acetate**	**Ethyl Alcohol**
HVAC-Only Scenario								
6	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-
10 (total)	2.4190	0.1648	0.0527	0.2044	0.0527	0.1846	0.0733	0.0018
HVAC and Stacks Scenario								
6	0.6334	0.0432	0.0138	0.0535	0.0138	0.0483	0.0192	0.0005
7	0.5590	0.0381	0.0122	0.0472	0.0122	0.0427	0.0169	0.0004
8	0.3164	0.0216	0.0069	0.0267	0.0069	0.0241	0.0096	0.0002
10 (total)	0.9102	0.0620	0.0198	0.0769	0.0198	0.0695	0.0276	0.0007
Facility Total	**2.4190**	**0.1648**	**0.0527**	**0.2044**	**0.0527**	**0.1846**	**0.0733**	**0.0018**

Table 4-5 Fugitive Emissions Allocation for the HVAC-Only and HAVC and Stacks Emissions Scenarios

Source ID	Description	Cross Sectional Area (m^2)	Maximum Exhaust Gas Dry Flow Rate (dscm/min)	HVAC-Only Scenario: Allocation Percentage (%)	HVAC and Stacks Scenario: Allocation Percentage (%)	Comments
6	Paint Booth discharging through a Stack	1.17	1133	**0%**	26.18%	**-**
7	Rubber Buffing Room discharging through a Stack	0.65	1000	**0%**	23.11%	**-**
8	Grit Blast Booth discharging through a Stack	0.46	566	**0%**	13.08%	**-**
10.a	HVAC fan F-19	0.82	227	5.57%	5.24%	-
10.b	HVAC fan F-20	0.82	227	5.57%	5.24%	-
10.c	HVAC fan F-21	0.57	142	3.48%	3.27%	-
10.d	HVAC fan F-22	0.82	184	4.53%	4.25%	-
10.e	HVAC fan F-24	1.58	566	13.94%	**0%**	Interlocked to Paint Booth Exhaust Fan. Turned off in HVAC and Stacks scenario.
10.f	HVAC fan F-25	1.58	566	13.94%	**0%**	Interlocked to Paint Booth Exhaust Fan. Turned off in HVAC and Stacks scenario.
10.g	HVAC fan F-26	1.19	708	17.42%	**0%**	Interlocked to Rubber Buffing Exhaust Fan. Turned off in HVAC and Stacks scenario.
10.h	HVAC fan F-27	0.82	212	5.23%	4.91%	-
10.i	HVAC fan F-28	1.58	595	14.63%	**0%**	Interlocked to Grit Blast Exhaust Fan. Turned off in HVAC and Stacks scenario.
10.j	HVAC fan F-29	0.57	156	3.83%	3.60%	-
10.k	HVAC fan F-30	0.57	156	3.83%	3.60%	-
10.l	HVAC fan F-31	0.36	57	1.39%	1.31%	-
10.m	HVAC fan F-32	0.36	57	1.39%	1.31%	-
10.n	HVAC fan F-39	0.82	212	5.23%	4.91%	-

5 DISPERSION MODELLING

5.1 DISPERSION MODELLING METHODOLOGY

The CALPUFF modelling suite (CALMET, CALPUFF, CALPOST) was used to model air emissions and predict ambient concentrations of air contaminants and deposition of particles from Facility operations. CALPUFF is a three-dimensional, multi-species non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on transport, transformation and removal processes of air contaminant releases to the atmosphere and predicts ambient air quality concentrations for a wide range of meteorological conditions and local terrain influences.

The air quality assessment was completed following the guidance and recommendations of the latest version of the AQDMG and in accordance with the dispersion modelling plan approved by MVRD. Particle deposition modelling was conducted following AQDMG recommendations and the Newfoundland and Labrador Guideline for Plume Dispersion Modelling to allow for parameterization adjustments for high density particles such as lead.

Modelling was conducted for a 3-year modelling period from January 1, 2018 – December 31, 2020. All CALMET and CALPUFF inputs and model switches were determined based on the recommendations set out in the AQDMG. CALPUFF was run using variable point source input files to allow for parameterization of Facility operating hours as well as variable stack exit temperatures. Further details regarding the modelling methodology and quality assurance and quality control (QA/QC) of the meteorological model and data are presented in Appendix A and Appendix C, respectively.

For the purposes of this assessment, potential air quality impacts and particle deposition from the following air contaminants were modelled:

Air Contaminants:

- Fine Particulate Matter ($PM_{2.5}$),
- Inhalable Particulate Matter (PM_{10}),
- Lead (Pb),
- 2-Butoxyethanol (111-76-2),
- Ethylbenzene (100-41-4),
- Ethyl Acetate (141-78-6),
- Ethyl Alcohol / Ethanol (64-17-5),
- Methyl ethyl ketone [MEK] (78-93-3),
- Methyl isobutyl ketone [MIBK] (108-10-1),
- Tetrachloroethylene (127-18-4),
- Toluene (108-88-3),
- Xylene (1330-20-7),

Particle Deposition:

- Lead,
- Particulate Matter.

5.2 DISPERSION MODELLING RESULTS

Ambient air concentrations and particle deposition were predicted using the CALPUFF modelling system as per the methods described above and further detailed in Appendix A. The dispersion modelling results represent estimates of air quality impacts based on maximum emissions from Facility operations as proposed in the amendment application for the existing air permit (GVA1081) for the Facility.

Summary tables provided in the following sections show predicted air contaminant concentrations as well as particle deposition at the maximum point of impingement (MPOI). Ambient baseline concentrations were added to assess the cumulative (modelled + baseline) air quality impacts. The results were compared to ambient air quality objectives (MVRD AAQO) and criteria from other jurisdictions considered in this assessment (Section 2.1). The spatial distribution of select predicted ambient air contaminants and particulate deposition is shown in the form of isopleth figures. Additional results tables summarizing predicted air contaminant concentrations at sensitive receptor types are presented in Appendix B.

5.2.1 NON-FUGITIVE AIR CONTAMINANTS

The dispersion modelling results for particulate matter ($PM_{2.5}$, PM_{10}), lead, and 2-Butoxyethanol are summarized in Table 5-1 below.

Modelled and cumulative (modelled + baseline) particulate matter concentrations for $PM_{2.5}$ and PM_{10} are predicted to fall below the MVRD ambient air quality objectives for the 24-hour (rolling average) and annual averaging periods at all receptors over the three-year modelling period (2018 -2020). Predicted cumulative $PM_{2.5}$ and PM_{10} concentrations range between 55 % and 85 % of the MVRD AAQO. The emission contributions from the Facility for both the $PM_{2.5}$ and PM_{10} size fractions are low compared to the contribution of ambient baseline PM. Facility modelled PM contributions range from 11 % to 39% of the respective cumulative PM concentration. Figure 5-1 and Figure 5-2 show the spatial distribution of predicted $PM_{2.5}$ concentrations, while Figure 5-3 and Figure 5-4 show predicted PM_{10} concentrations. The maximum point of impingement is located on the north side of the Facility and predicted impacts from Facility emissions are localized near the fenceline.

Modelled and cumulative (modelled + baseline) lead concentrations are predicted to fall below the respective ambient air quality criteria for all averaging periods and at all receptors over the three-year modelling period (2018 - 2020). Predicted cumulative lead concentrations range between 8.3 % (30-day averaging period) and 26 % (1-hour averaging period) of the respective criteria. The spatial distribution of predicted lead concentrations is shown in Figure 5-5 through Figure 5-8. The MPOI for all averaging periods is located at a fenceline receptor. As evident from the isopleths, predicted impacts are localized near the Facility fenceline.

Modelled 2-Butoxyethanol concentrations for all averaging periods fall well below the respective critiera, ranging from 0.002 % to 0.6 % of the criteria. In accordance with the approved modelling plan, isopleths for 2-Butoxyethanol are not presented given the low predicted concentrations.

Table 5-1 Summary of Predicted Concentrations for Non-Fugitive Air Contaminants

Description of Standard						Modelled Concentration (µg/m^3)				Percentage of Criteria (%)
Air Contaminant	**Averaging Period**	**Statistical Form**	**Jurisdiction**	**Criteria (µg/m^3)**	**Baseline Concentration (µg/m^3)**	**2018**	**2019**	**2020**	**Cumulative (Modelled + Baseline)**	
$PM_{2.5}$	24-hour	Maximum [RA][a]	MVRD	25	14.8	6.4	**6.5**	6.1	21.2	85
	Annual	Maximum		8	5.3	0.6	0.6	**0.7**	6.0	75
PM_{10}	24-hour	Maximum [RA][a]	MVRD	50	21.5	**13.7**	13.4	12.6	35.1	70
	Annual	Maximum		20	9.5	1.4	1.3	**1.5**	11.0	55
Lead	1-hour	Maximum	Alberta	1.5	0.02	0.3	**0.4**	0.3	0.4	26
	24-hour	Maximum	Ontario	0.5	0.01	0.10	**0.11**	0.10	0.12	23
	30-day	Maximum	Ontario	0.2	0.0020	0.013	0.012	**0.015**	0.017	8.3
	3-month	Maximum [RA][b]	Texas (NAAQS)	0.15	0.0018	0.012	0.012	**0.013**	0.015	10
2-Butoxyethanol	1-hour	Maximum	California	2,900	-	**18.5**	16.1	17.6	18.5	0.6
	24-hour	Maximum	Ontario	2,400	-	**5.0**	4.7	4.3	5.0	0.2
	Annual	Maximum	Texas	3,700	-	0.08	**0.09**	0.08	0.09	0.002

Note: The maximum year over the 3-year modelling period is highlighted in **bold**.

[a]: Based on a 24-hour rolling average.

[b]: Based on a 3-month rolling average.

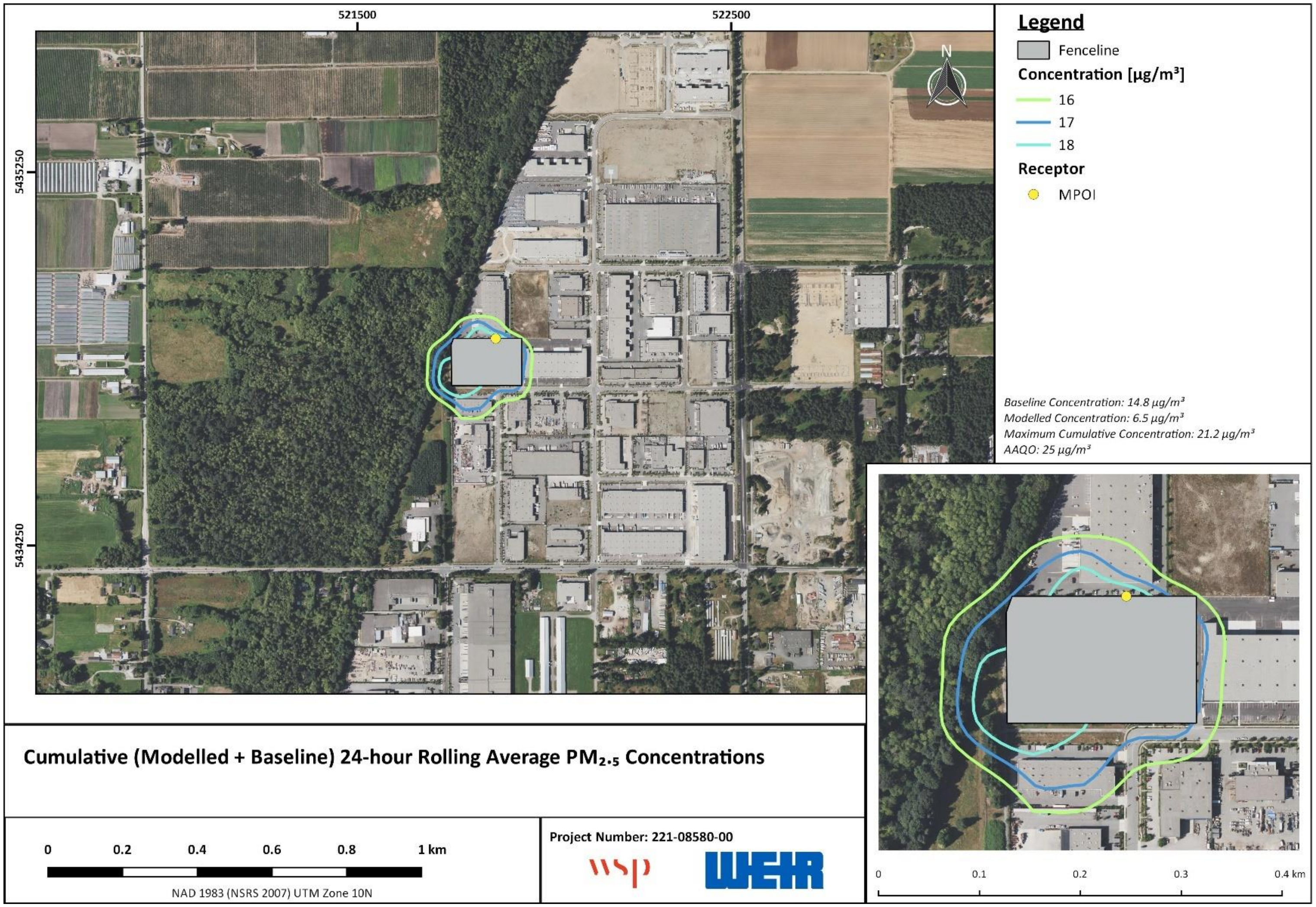
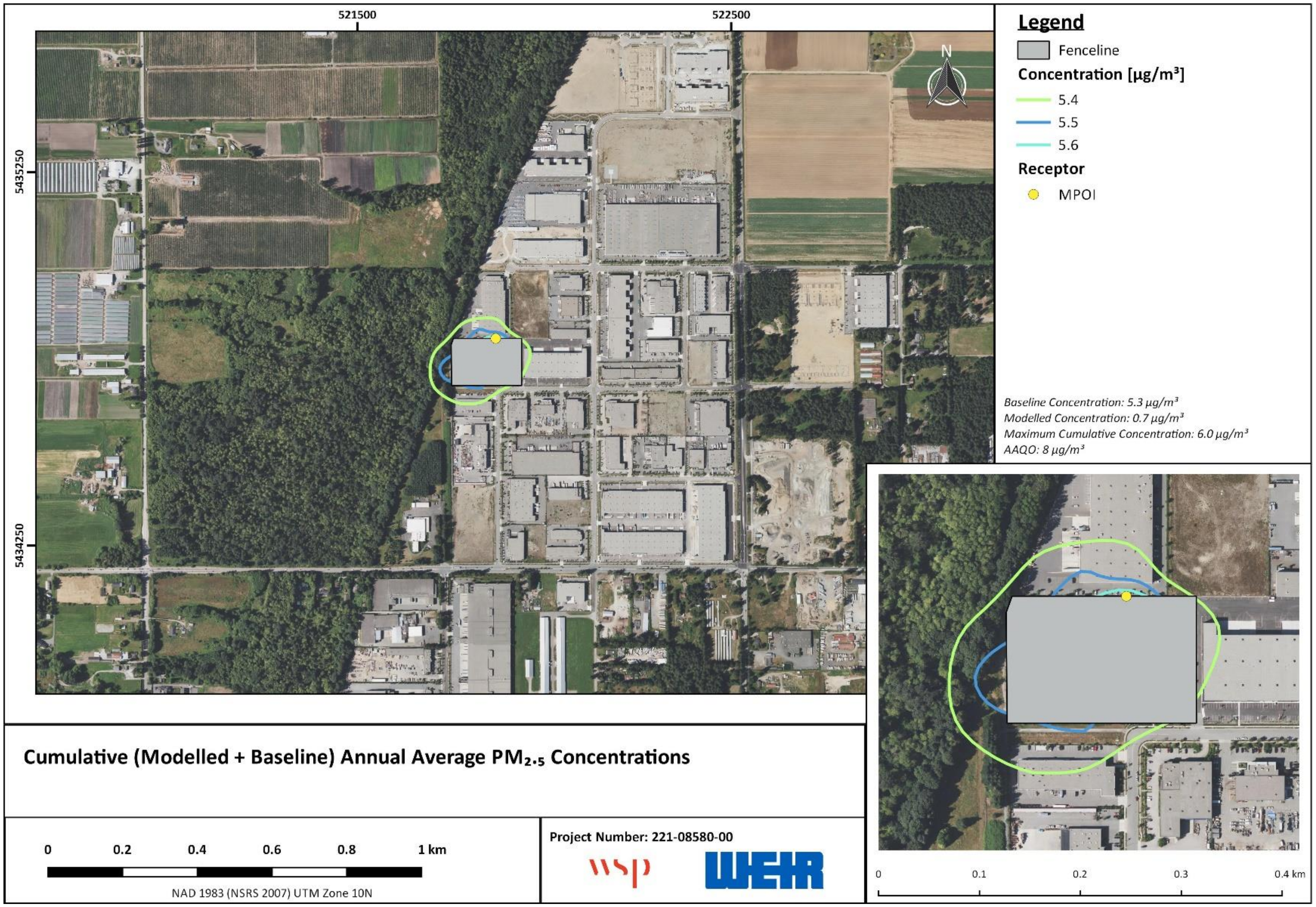


Figure 5-1 **Cumulative (Modelled + Baseline) 24-hour Rolling Average $PM_{2.5}$ Concentrations**



Baseline Concentration: 5.3 µg/m³
Modelled Concentration: 0.7 µg/m³
Maximum Cumulative Concentration: 6.0 µg/m³
AAQO: 8 µg/m³

Figure 5-2 **Cumulative (Modelled + Baseline) Annual Average $PM_{2.5}$ Concentrations**

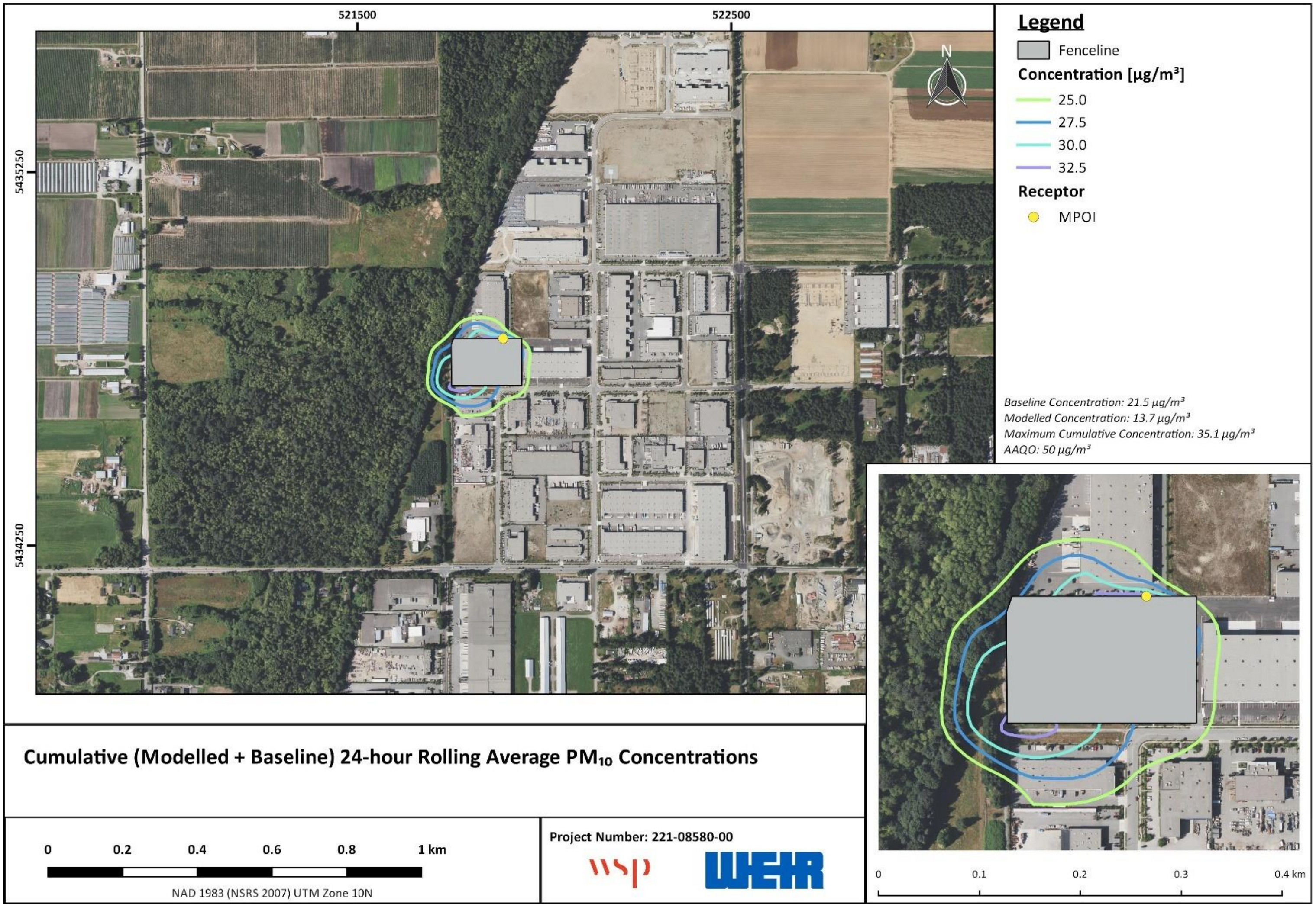
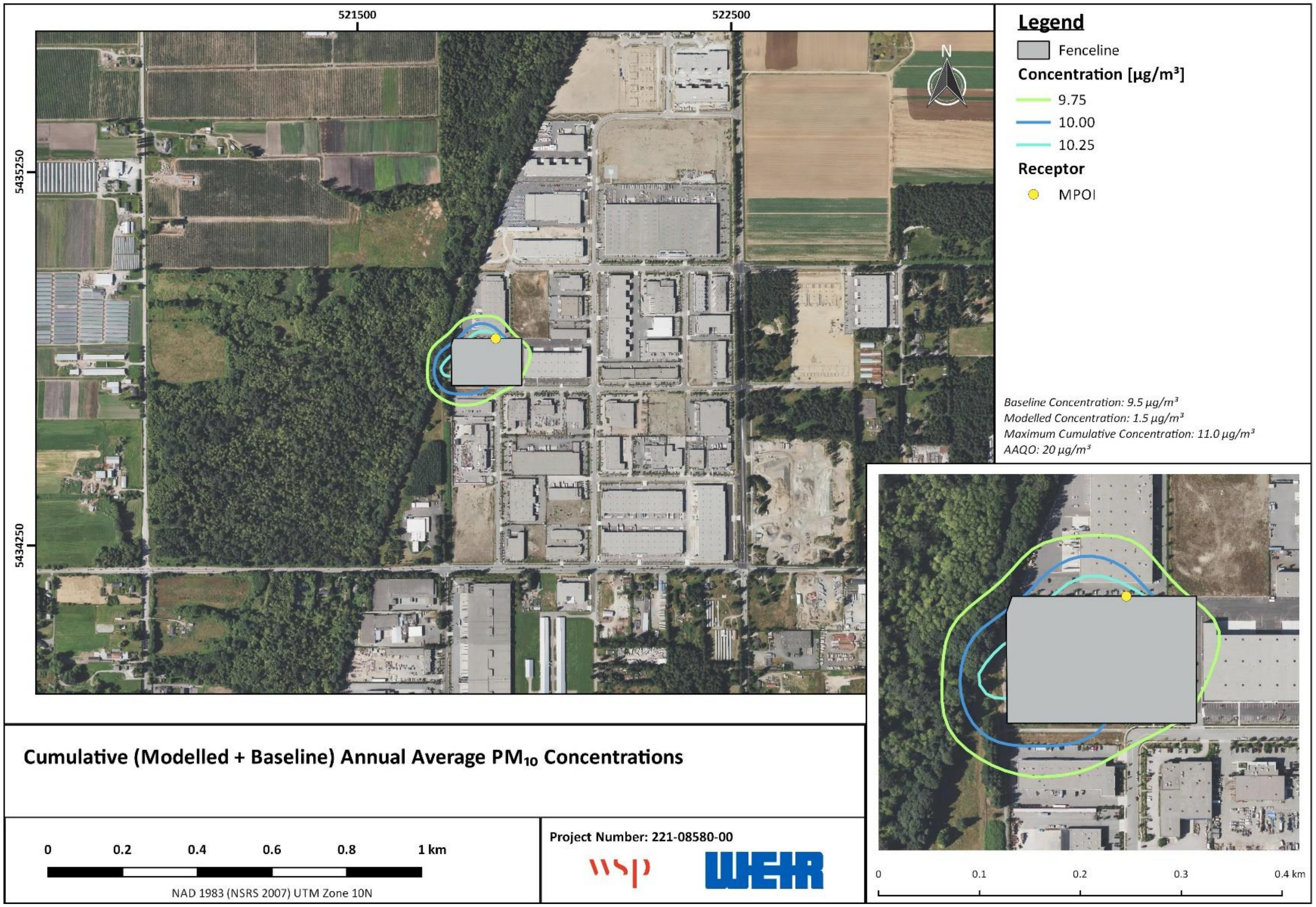


Figure 5-3 Cumulative (Modelled + Baseline) 24-hour Rolling Average PM_{10} Concentrations



Cumulative (Modelled + Baseline) Annual Average PM_{10} Concentrations

Baseline Concentration: 9.5 µg/m³
Modelled Concentration: 1.5 µg/m³
Maximum Cumulative Concentration: 11.0 µg/m³
AAQO: 20 µg/m³

Figure 5-4 **Cumulative (Modelled + Baseline) Annual Average PM_{10} Concentrations**

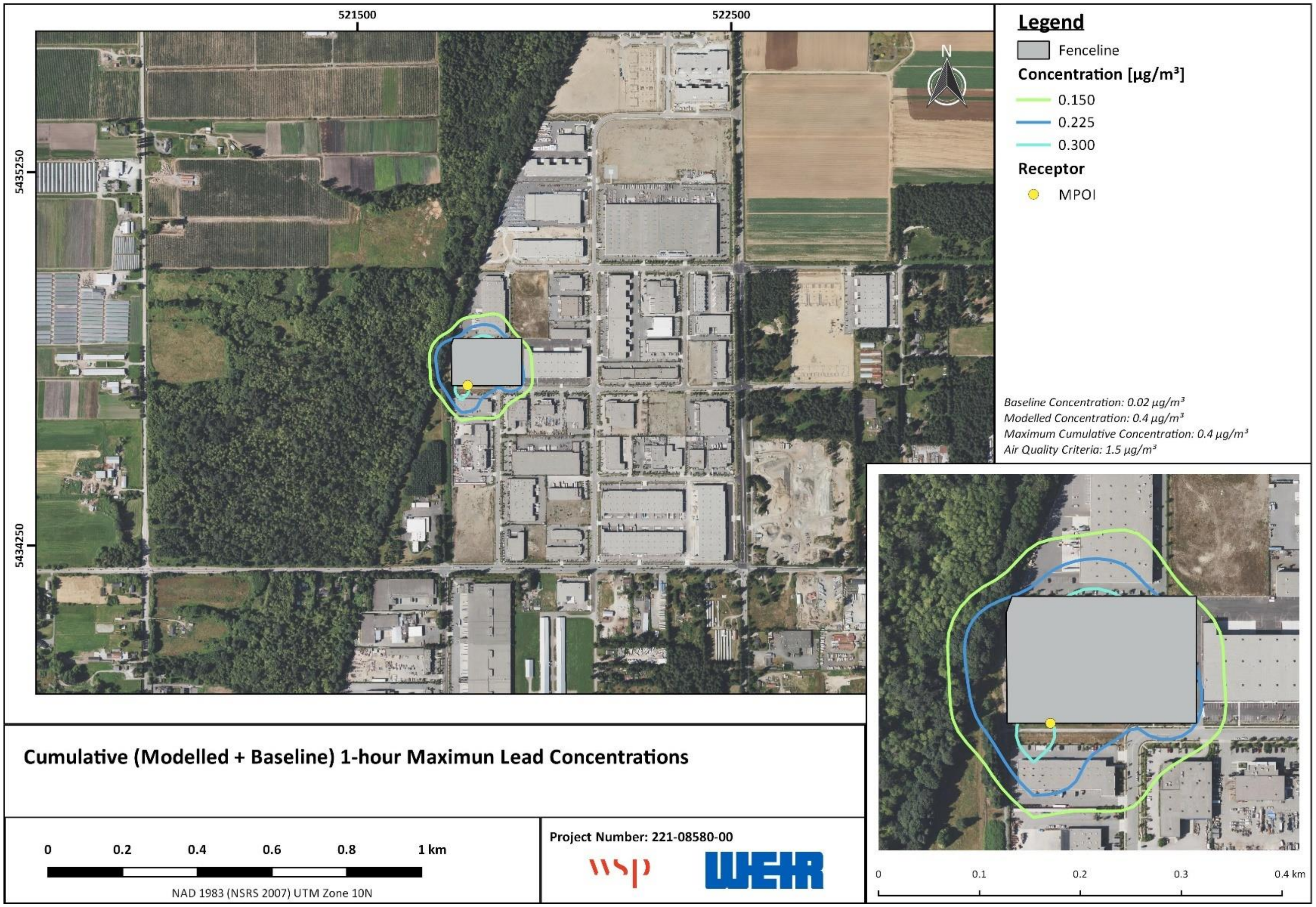
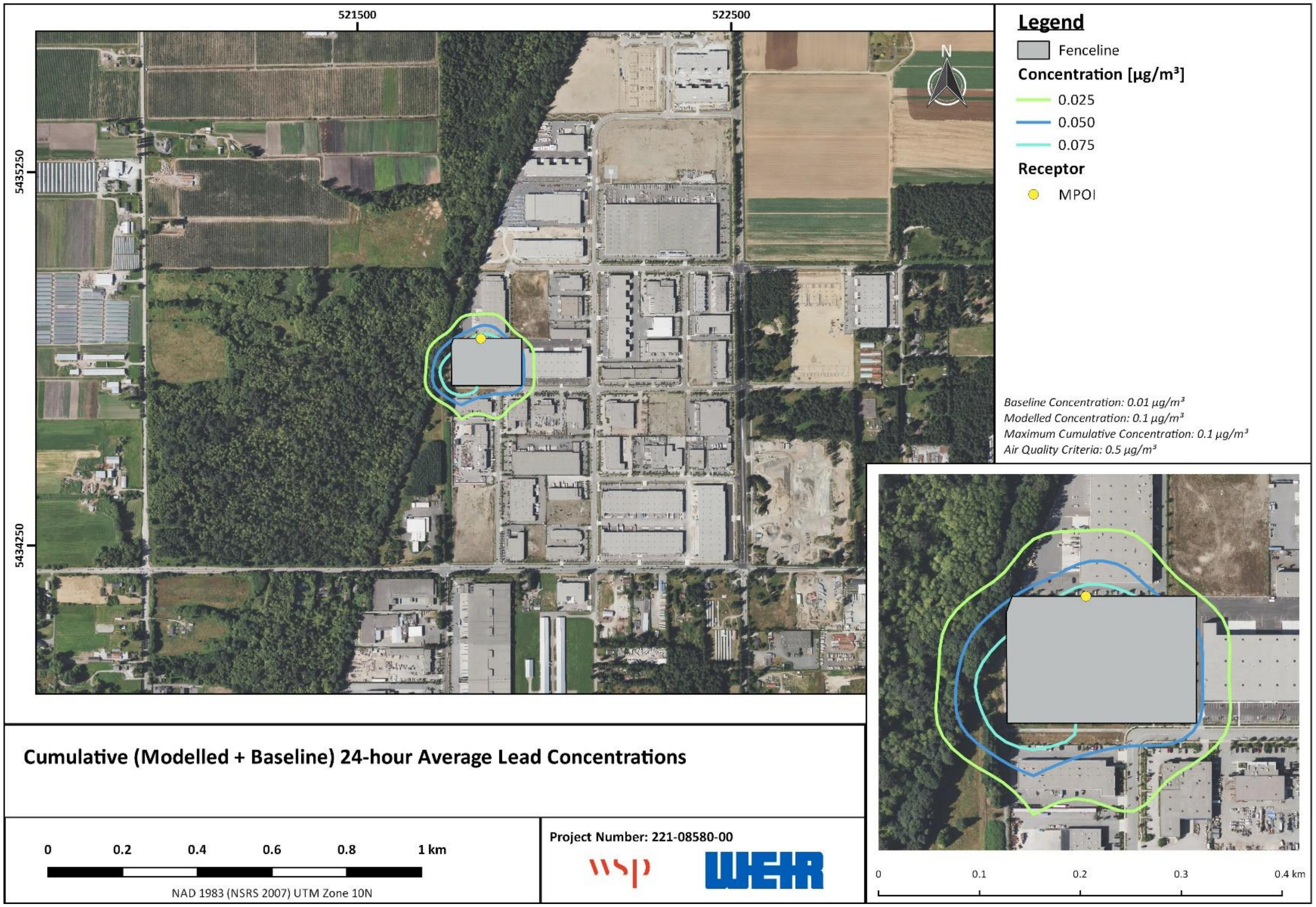


Figure 5-5 **Cumulative (Modelled + Baseline) 1-hour Lead Concentrations**



Baseline Concentration: 0.01 µg/m³
Modelled Concentration: 0.1 µg/m³
Maximum Cumulative Concentration: 0.1 µg/m³
Air Quality Criteria: 0.5 µg/m³

Figure 5-6 Cumulative (Modelled + Baseline) 24-hour Average Lead Concentrations

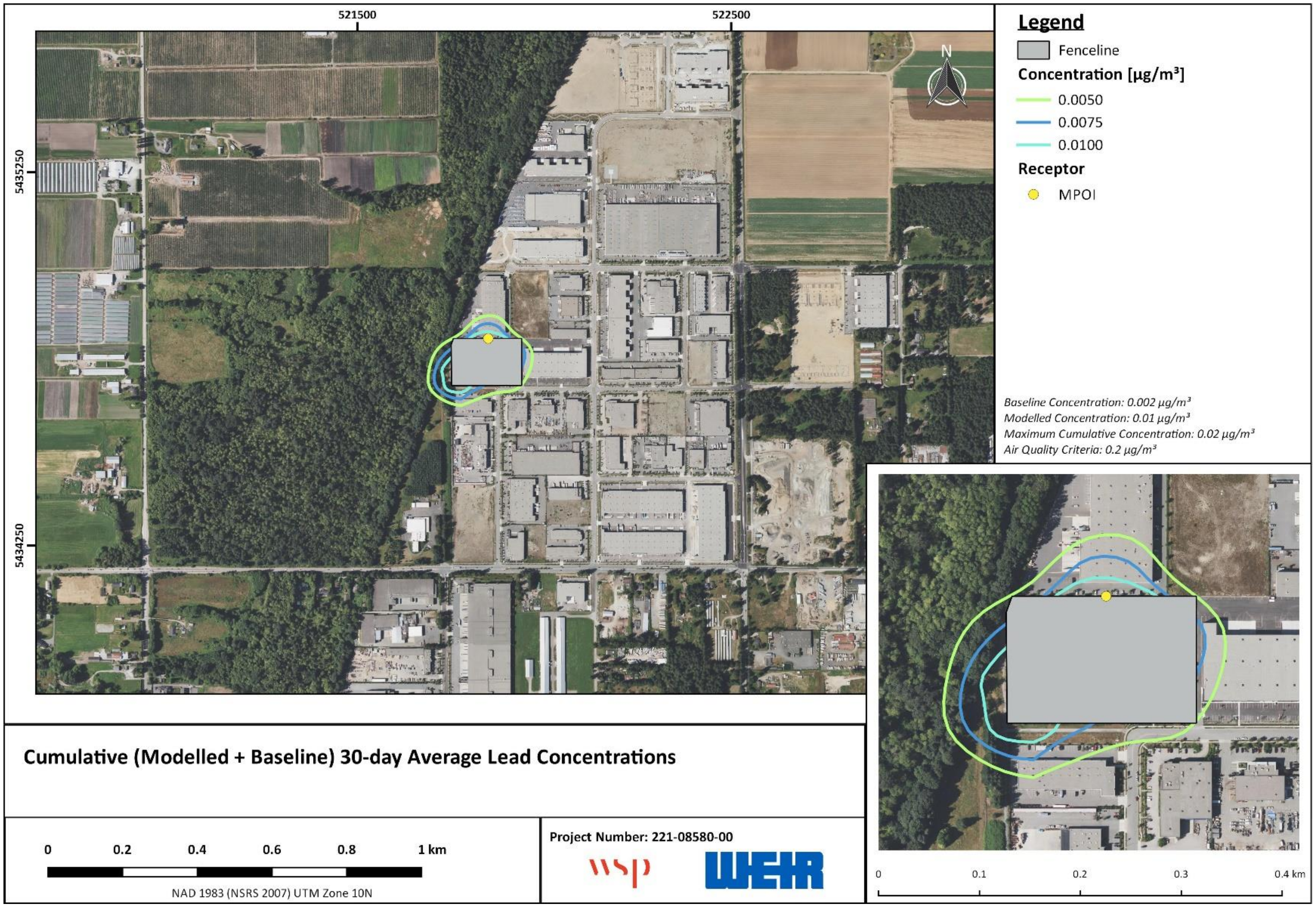


Figure 5-7 Cumulative (Modelled + Baseline) 30-Day Average Lead Concentrations

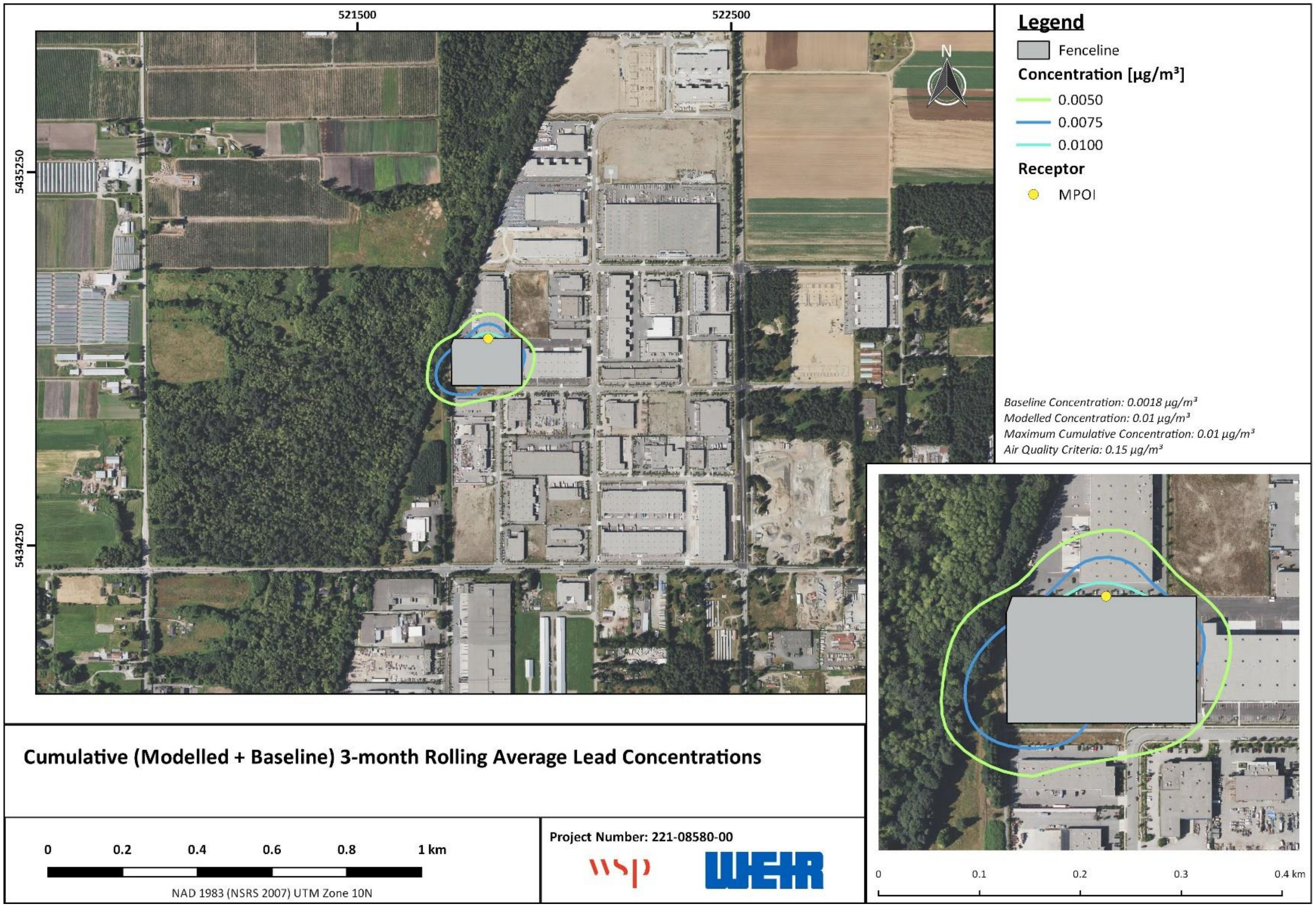


Figure 5-8 Cumulative (Modelled + Baseline) Rolling 3-month Average Lead Concentrations

5.2.2 FUGITIVE AIR CONTAMINANTS

The dispersion modelling results for the HVAC-Only and the HVAC and Stacks emissions scenarios are summarized in Table 5-2 and Table 5-3 below. The HVAC-Only scenario reflects release of fugitive air contaminants through 14 vents of the HVAC system, while the HVAC and Stacks scenario represents the release of fugitive emissions from a combination of HVAC vents and stacks as described in Section 4.2.2.

Modelled and cumulative (modelled + baseline) concentrations of all fugitive air contaminants included in this assessment are low to negligible falling well below the ambient air quality critiera for all averaging periods and at all receptors over the entire modelling period for both the HVAC-Only as well as the HVAC and Stacks scenario.

An example of the spatial distribution of fugitive emissions for both scenarios is provided in form of isopleths of predicted Xylene concentrations. Figure 5-9 through Figure 5-11 show cumulative (modelled + baseline) Xylene concentrations for the 1-hour, 24-hour, and annual averaging periods for the HVAC-Only scenario and Figure 5-12 through Figure 5-14 illustrate predicted concentrations for the HVAC and Stacks scenario.

Table 5-2 Summary of Predicted Concentrations for Fugitive Air Contaminants – HVAC-Only Scenario

Description of Standard						Modelled Concentration (µg/m^3)				Percentage of Criteria (%)
Air Contaminant	**Averaging Period**	**Statistical Form**	**Jurisdiction**	**Criteria (µg/m^3)**	**Baseline Concentration (µg/m^3)**	**2018**	**2019**	**2020**	**Cumulative (Modelled + Baseline)**	
Ethylbenzene	1-hour	Maximum	Texas	26,000	2.2	17.3	16.1	**20.9**	23.1	0.1
	24-hour	Maximum	Ontario	1,000	0.9	**6.1**	6.0	6.0	7.0	0.7
	Annual	Maximum	Texas	570	0.3	1.5	1.3	**1.5**	1.8	0.3
Ethyl acetate	1-hour	Maximum	Texas	3,100	-	7.7	7.2	**9.3**	9.3	0.3
	Annual	Maximum	Texas	1,440	-	0.64	0.59	**0.68**	0.68	0.05
Ethyl Alcohol / Ethanol	1-hour	Maximum	Texas	18,800	-	0.19	0.18	**0.23**	0.23	0.001
	Annual	Maximum	Texas	1,880	-	0.02	0.01	**0.02**	0.02	0.001
Methyl Ethyl Ketone [MEK]	1-hour	Maximum	Texas	18,000	1.6	5.5	5.2	**6.7**	8.3	0.05
	24-hour	Maximum	Ontario	1,000	0.4	**2.0**	1.9	1.9	2.6	0.3
	Annual	Maximum	Texas	2,600	0.2	0.46	0.43	**0.49**	0.74	0.03
Methyl Isobutyl Ketone [MIBK]	1-hour	Maximum	Texas	820	0.4	21.5	20.0	**26.0**	26.3	3.2
	Annual	Maximum	Texas	82	0.1	1.8	1.7	**1.9**	2.0	2.4
Tetrachloroethylene	1-hour	Maximum	Texas	2,000	0.9	5.5	5.2	**6.7**	7.6	0.4
	24-hour	Maximum	Ontario	360	0.4	**2.0**	1.9	1.9	2.3	0.6
	Annual	Maximum	Texas	26	0.1	0.46	0.43	**0.49**	0.60	2.3
Toluene	1-hour	Maximum	Texas	4,500	12.3	19.4	18.1	**23.5**	35.8	0.8
	Annual	Maximum	Texas	1,200	1.6	1.6	1.5	**1.7**	3.3	0.3
Xylene	1-hour	Maximum	Texas	2,200	8.8	254.1	236.6	**307.4**	316.2	14
	24-hour	Maximum	Ontario	730	3.6	**89.8**	87.3	88.7	93.4	13
	Annual	Maximum	Texas	180	1.1	21.3	19.6	**22.5**	23.6	13

Note: The maximum concentration over the 3-year modelling period is highlighted in **bold**.

Table 5-3 Summary of Predicted Concentrations for Fugitive Air Contaminants – HVAC and Stacks Scenario

Description of Standard						Modelled Concentration (µg/m^3)				Percentage of Criteria (%)
Air Contaminant	**Averaging Period**	**Statistical Form**	**Jurisdiction**	**Criteria (µg/m^3)**	**Baseline Concentration (µg/m^3)**	**2018**	**2019**	**2020**	**Cumulative (Modelled + Baseline)**	
Ethylbenzene	1-hour	Maximum	Texas	26,000	2.2	13.0	12.6	**18.8**	21.0	0.1
	24-hour	Maximum	Ontario	1,000	0.9	4.7	4.7	**4.9**	5.8	0.6
	Annual	Maximum	Texas	570	0.3	0.9	0.9	**1.0**	1.3	0.2
Ethyl acetate	1-hour	Maximum	Texas	3,100	-	5.8	5.6	**8.4**	8.4	0.3
	Annual	Maximum	Texas	1,440	-	0.42	0.38	**0.44**	0.44	0.03
Ethyl Alcohol / Ethanol	1-hour	Maximum	Texas	18,800	-	0.14	0.14	**0.21**	0.21	0.001
	Annual	Maximum	Texas	1,880	-	0.01	0.01	**0.01**	0.01	0.001
Methyl Ethyl Ketone [MEK]	1-hour	Maximum	Texas	18,000	1.6	4.1	4.0	**6.0**	7.6	0.04
	24-hour	Maximum	Ontario	1,000	0.4	1.5	1.5	**1.6**	2.2	0.2
	Annual	Maximum	Texas	2,600	0.2	0.30	0.27	**0.32**	0.56	0.02
Methyl Isobutyl Ketone [MIBK]	1-hour	Maximum	Texas	820	0.4	16.1	15.6	**23.3**	23.7	2.9
	Annual	Maximum	Texas	82	0.1	1.2	1.1	**1.2**	1.3	1.6
Tetrachloroethylene	1-hour	Maximum	Texas	2,000	0.9	4.1	4.0	**6.0**	6.9	0.3
	24-hour	Maximum	Ontario	360	0.4	1.5	1.5	**1.6**	1.9	0.5
	Annual	Maximum	Texas	26	0.1	0.30	0.27	**0.32**	0.43	1.6
Toluene	1-hour	Maximum	Texas	4,500	12.3	14.5	14.1	**21.1**	33.4	0.7
	Annual	Maximum	Texas	1,200	1.6	1.0	1.0	**1.1**	2.7	0.2
Xylene	1-hour	Maximum	Texas	2,200	8.8	190.2	184.5	**276.1**	284.9	13
	24-hour	Maximum	Ontario	730	3.6	68.5	68.7	**71.6**	75.2	10
	Annual	Maximum	Texas	180	1.1	13.7	12.6	**14.6**	15.6	8.7

Note: The maximum concentration over the 3-year modelling period is highlighted in **bold**.

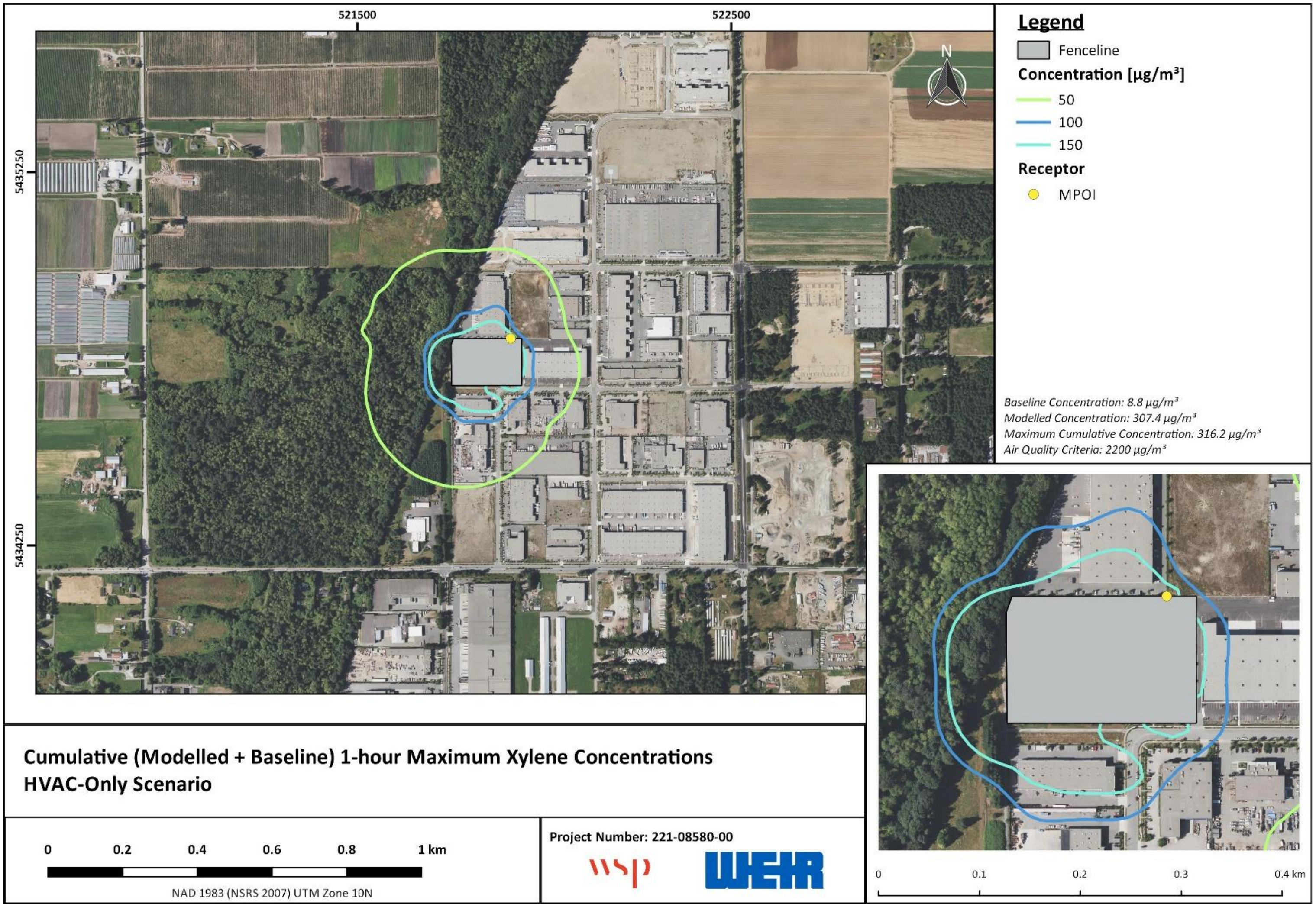


Figure 5-9 **Cumulative (Modelled + Baseline) 1-hour Xylene Concentrations (HVAC-Only Scenario)**

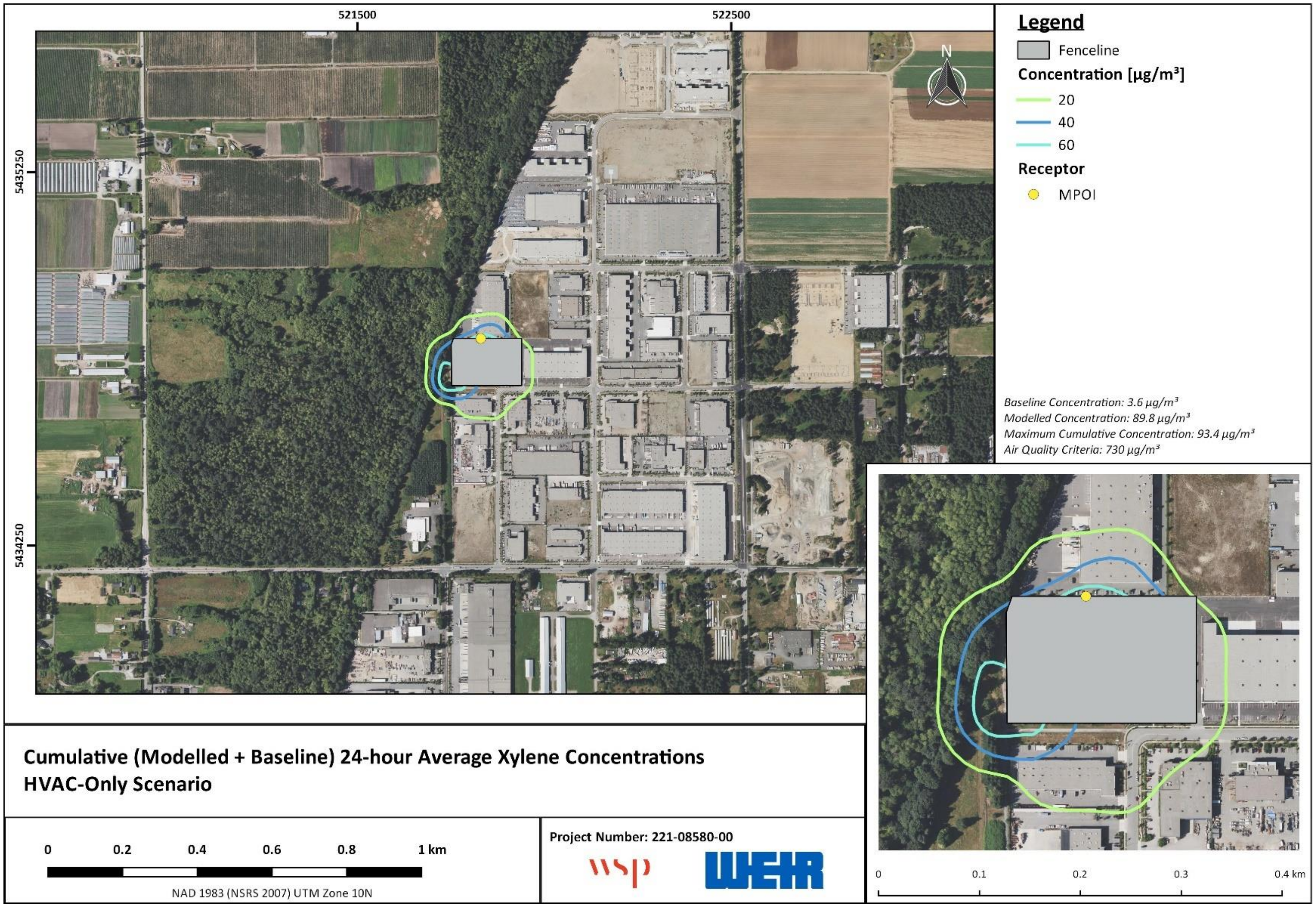


Figure 5-10 Cumulative (Modelled + Baseline) 24-hour Average Xylene Concentrations (HVAC-Only Scenario)

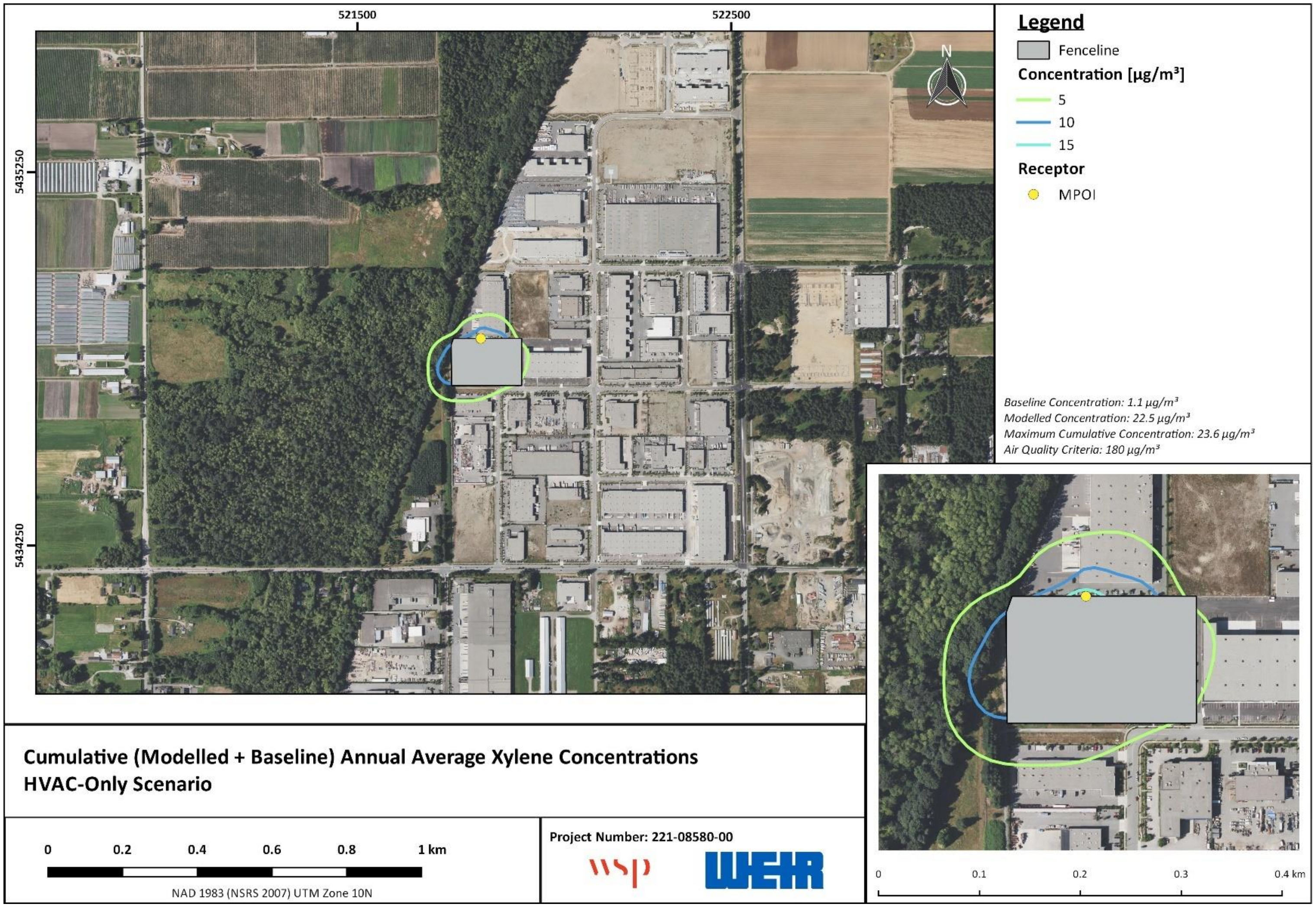
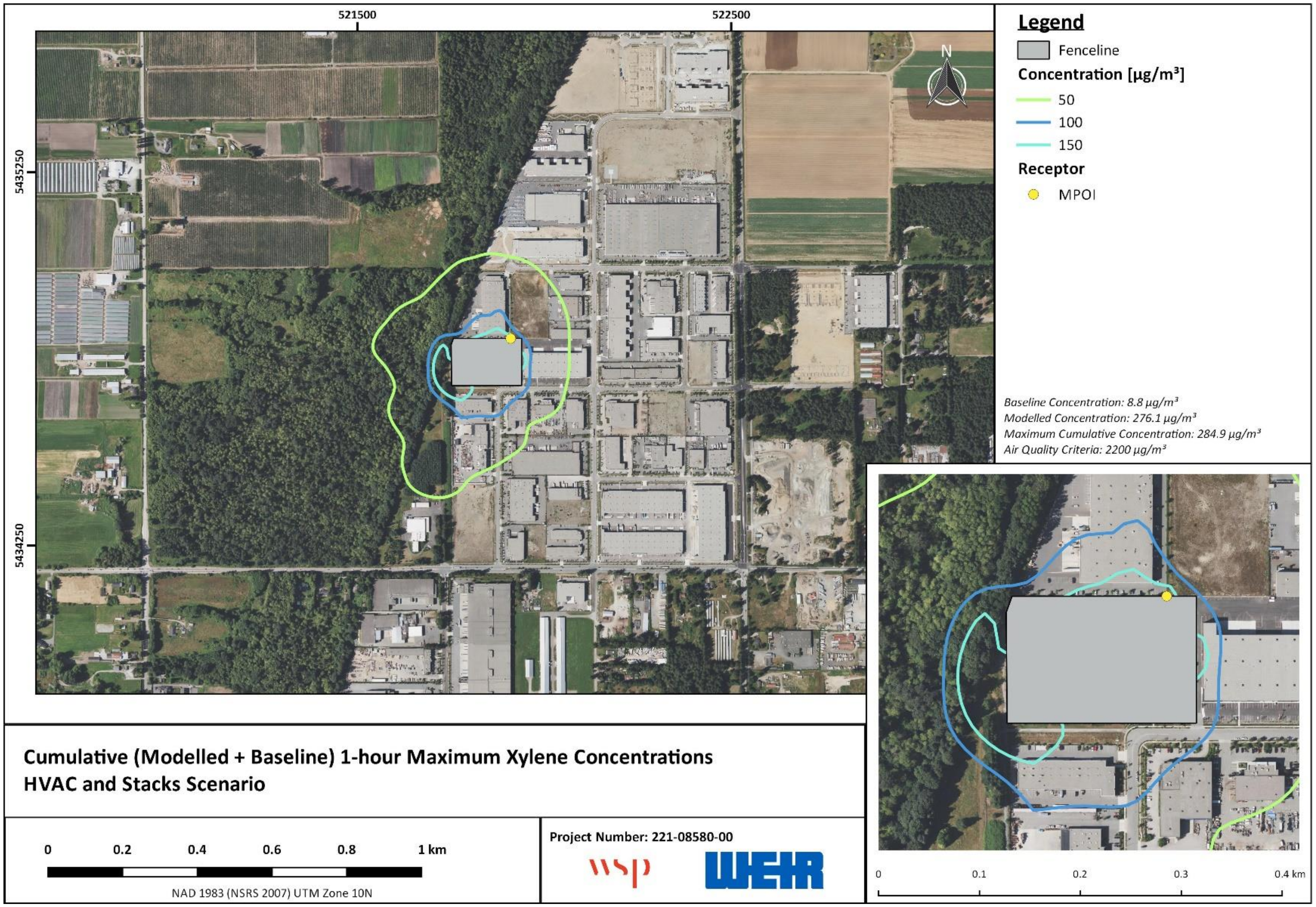


Figure 5-11 Cumulative (Modelled + Baseline) Annual Average Xylene Concentrations (HVAC-Only Scenario)



Baseline Concentration: 8.8 µg/m³
Modelled Concentration: 276.1 µg/m³
Maximum Cumulative Concentration: 284.9 µg/m³
Air Quality Criteria: 2200 µg/m³

Figure 5-12 Cumulative (Modelled + Baseline) 1-hour Xylene Concentrations (HVAC and Stacks Scenario)

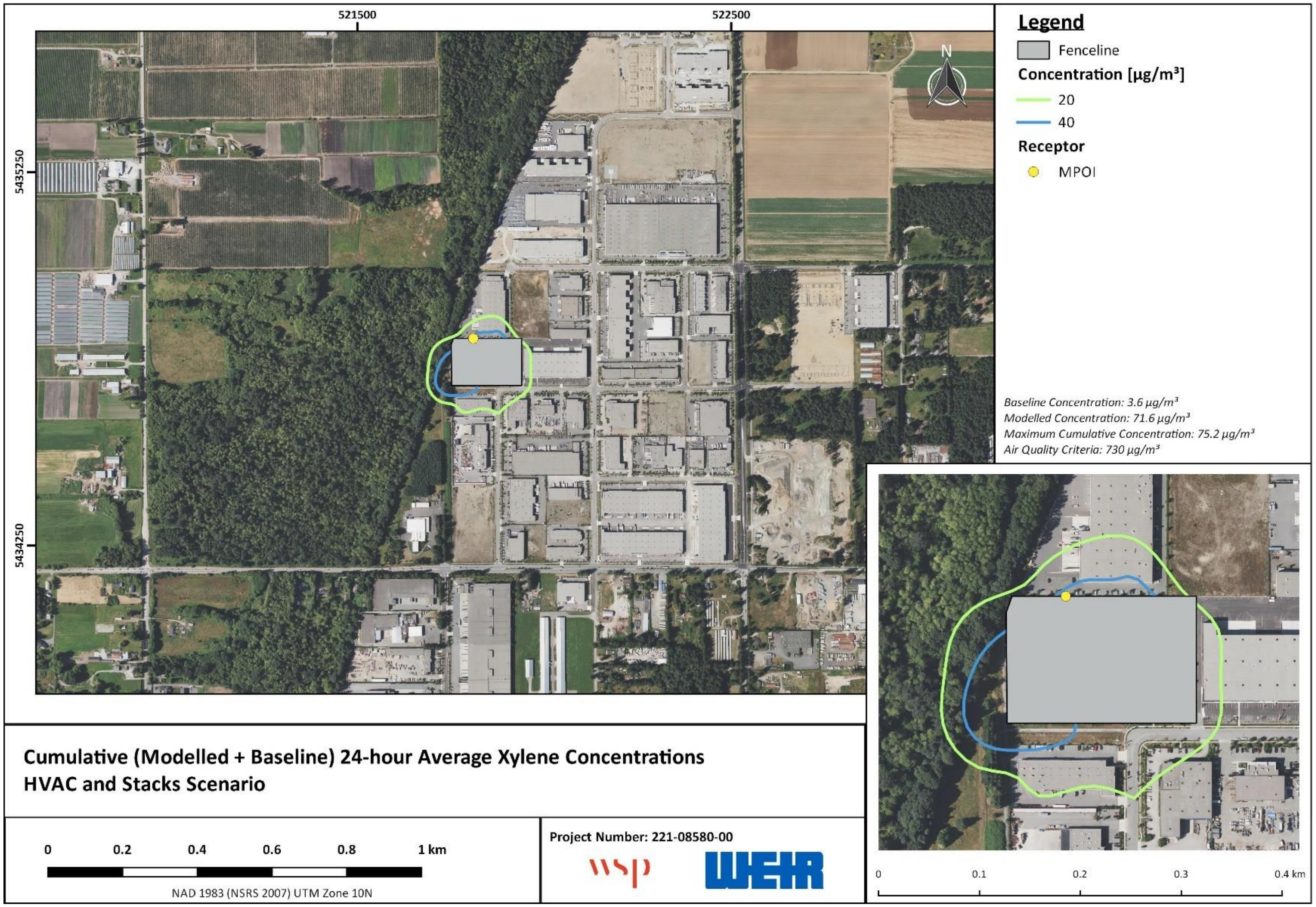


Figure 5-13 Cumulative (Modelled + Baseline) 24-hour Average Xylene Concentrations (HVAC and Stacks Scenario)

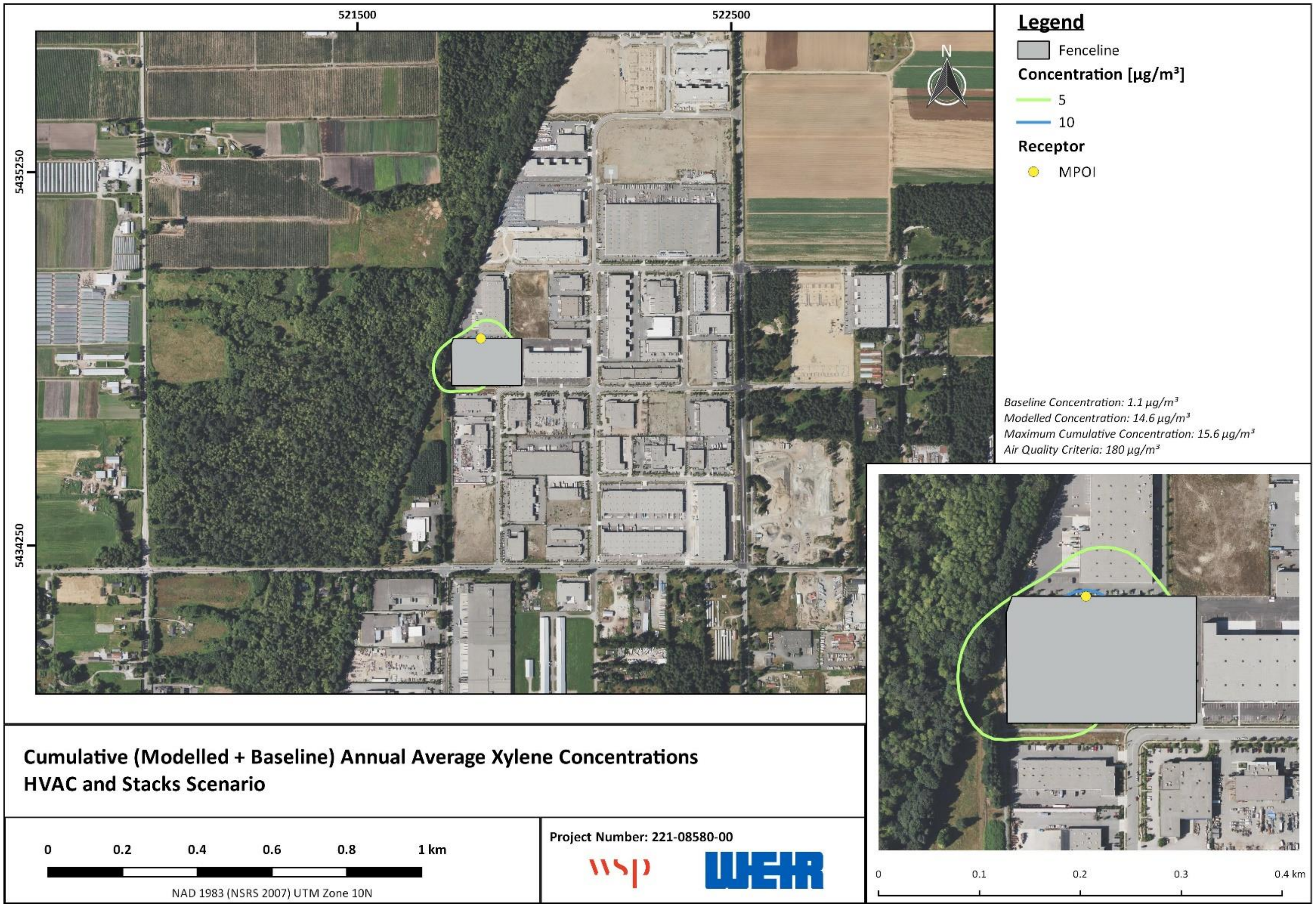


Figure 5-14 Cumulative (Modelled + Baseline) Annual Average Xylene Concentrations (HVAC and Stacks Scenario)

5.2.3 PARTICLE DEPOSITION

Notwithstanding the BC Pollution Control Objectives were rescinded, these criteria were used in this assessment as reference values to provide context for the deposition modelling results. The predicted 24-hour average deposition of lead and particulate matter (PM) are summarized in Table 5-4 below. The predicted deposition of both lead and PM is low with a maximum predicted deposition rate of lead of 0.0011 milligram (mg) per square decimeter (dm^2) per day (0.06 % of the 'residential/parkland' PCO) and a maximum of 0.085 mg/dm^2/day of PM (4.8 % of the 'residential/parkland' PCO), which equates to a predicted annual deposition of 0.04 grams per square meter (g/m^2) of lead and 3.1 g/m^2 of PM.

Deposition of lead and PM particles is localized around the Facility, with maximum predicted concentrations within 100 metres of the fenceline as shown in the deposition isopleths below in Figure 5-15 and Figure 5-16.

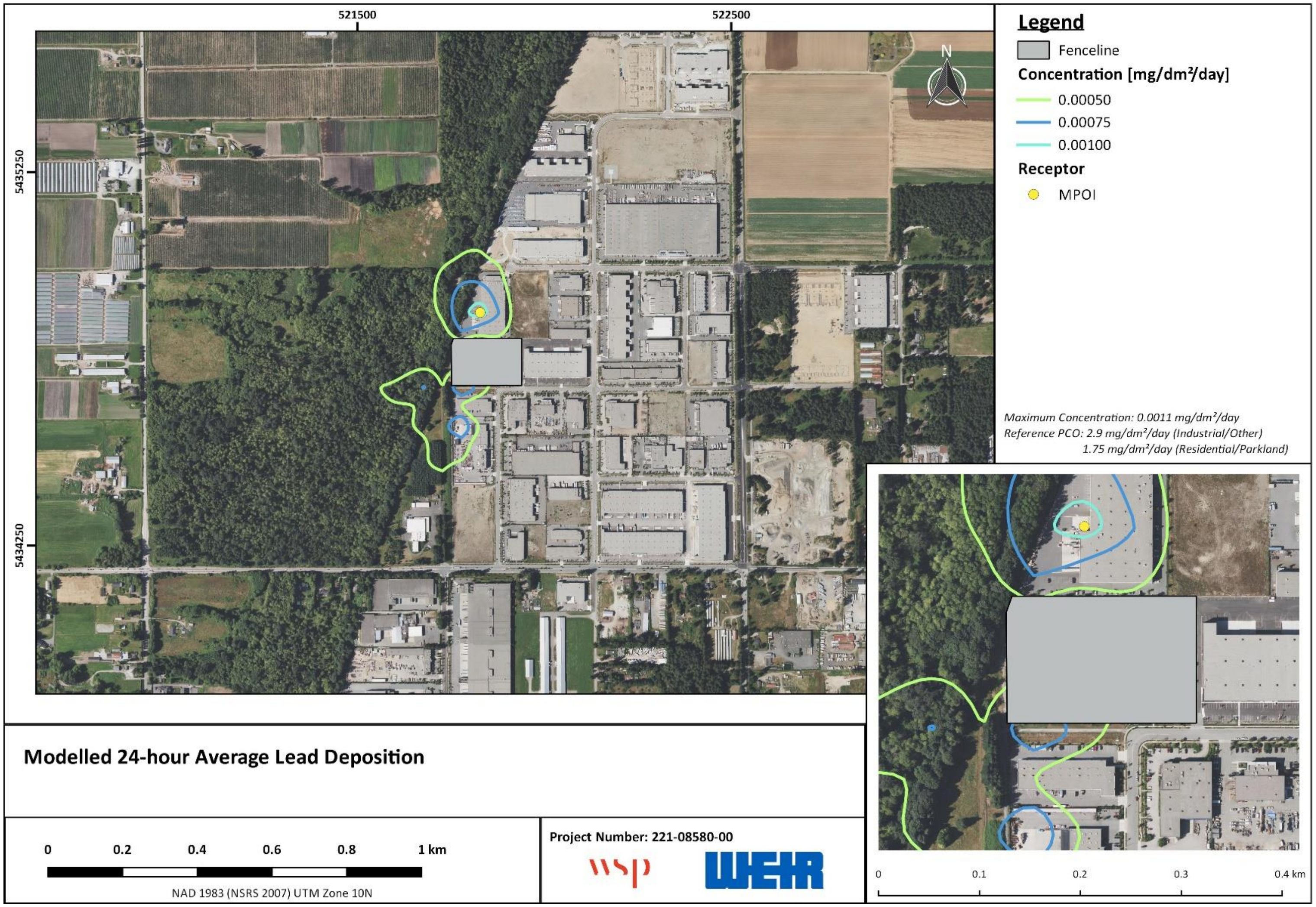
Table 5-4 Summary of Predicted Particle Deposition

Description of Standard				Modelled Deposition (mg/dm^2/day)			Percentage of Dustfall Reference (%)
Air Contaminant	**Averaging Period**	**Statistical Form**	**Dustfall Reference (mg/dm^2/day)**	**2018**	**2019**	**2020**	
Lead	24-hour	Maximum	2.9[a]	0.0009	0.0011	**0.0011**	0.04
			1.75[b]				0.06
Particulate Matter	24-hour	Maximum	2.9[a]	0.060	**0.085**	0.084	2.9
			1.75[b]				4.8

Note: The maximum concentration over the 3-year modelling period is highlighted in **bold**.

[a]: Rescinded 'industrial/other' PCO.

[b]: Rescinded 'residential/parkland' PCO.



Maximum Concentration: 0.0011 mg/dm²/day
Reference PCO: 2.9 mg/dm²/day (Industrial/Other)
1.75 mg/dm²/day (Residential/Parkland)

Figure 5-15 Modelled 24-hour Average Lead Deposition

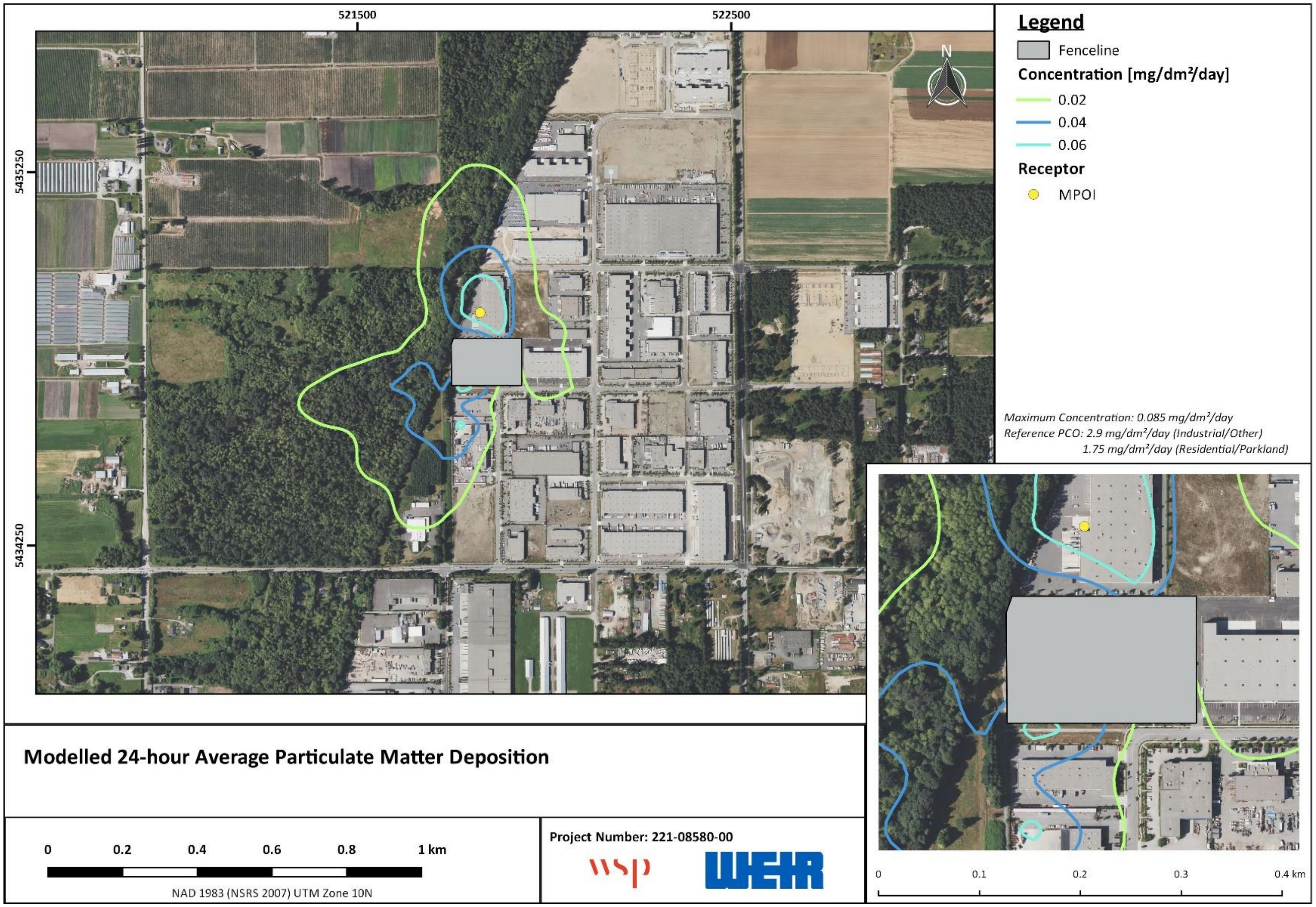


Figure 5-16 **Modelled 24-hour Average Particulate Matter Deposition**

6 SUMMARY

WSP Canada Inc. was retained by Weir Canada Inc. to conduct a dispersion modelling assessment in support of a permit amendment application to Weir's existing MVRD air permit GVA1081. The assessment evaluated potential air quality impacts from $PM_{2.5}$, PM_{10}, lead, as well as VOC and carbonyl group air contaminants resulting from Facility operations that include metal fabrication and welding, application of rubber lining to metal components as well as the application of paint.

The dispersion modelling assessment was conducted for a 20 kilometer by 20 kilometer domain using the CALPUFF modelling system. All inputs and model switches were determined based on guidance and recommendations set out in the AQDMG and the approved MVRD dispersion modelling plan and associated comment tracking table. Maximum predicted model results reflect a compound conservatism inherent in the assessment methodology, which includes conservative emissions, worst-case meteorology, and a conservative characterization of the baseline air quality.

Baseline air quality data, where available, was added to predicted air contaminant concentrations to assess potential cumulative air quality impacts. Modelling results were compared to current Metro Vancouver objectives for $PM_{2.5}$ and PM_{10}. As there are no MVRD or BC objectives for lead, 2-Butoxyethanol or the fugitive air contaminants included in this assessment, the modelling results were compared to applicable air quality criteria from other jurisdictions. Similarly, there are no objectives for evaluating particle deposition. Following British Columbia Ministry of Environment and Climate Change Strategy recommendations, deposition modelling results were compared to old BC Pollution Control Objectives for reference purposes.

Considering conservative assumptions to predict potential air quality impacts from Facility operations, the following conclusions can be drawn:

- Predicted air contaminant concentrations quickly diminish as emissions disperse away from the Facility.
- Modelled 24-hour rolling average and annual average $PM_{2.5}$ and PM_{10} concentrations are low in comparison to ambient baseline PM. Maximum cumulative (modelled + baseline) concentrations for both $PM_{2.5}$ and PM_{10} fall below MVRD air quality objectives for all averaging periods.
- Maximum cumulative (modelled + baseline) lead concentrations for all averaging periods fall well below the applicable air quality critiera.
- Maximum predicted 2-Butoxyethanol concentrations for all averaging periods are low to negligible and fall well below the applicable air quality critiera.
- Two scenarios were considered to evaluate fugitive emissions of Ethylbenzene, Ethyl Acetate, Ethyl Alcohol / Ethanol, Methyl ethyl ketone (MEK), Methyl isobutyl ketone (MIBK), Tetrachloroethylene, Toluene, and Xylene; specifically, a release of fugitive emissions from HVAC vents only as well as a release from a combination of HVAC vents and stacks. Maximum predicted concentrations plus baseline (where baseline was available) for all of these air contaminants and both emissions scenarios are low to negligible and fall below the respective air quality criteria considered in this assessment.
- Modelled deposition rates for particulate matter and lead are low and represent a fraction of the now rescinded BC pollution control objectives commonly used as a reference value to evaluate particle deposition.