

The logo for CTEH, featuring the letters 'CTEH' in a bold, white, sans-serif font with a registered trademark symbol (®) to the upper right. The text is set against a dark blue rectangular background.

CTEH[®]

THE SCIENCE OF READYSM

VALERO ENERGY

BENICIA REFINERY PARTICULATE

RELEASE

Benicia, CA

March 27, 2019

Project #111391

1.0 Introduction

On March 23, 2019 Valero Energy requested that CTEH® conduct air monitoring in the surrounding community after a release of particulate matter from the Benicia Refinery in Benicia California. CTEH® arrived on-site on March 24, 2019 and began air monitoring operations. Activities were comprised of real-time air monitoring and analytical air sampling.

This report summarizes air monitoring data collected from March 26, 2019 06:00 PDT to March 27, 2019 06:00 PDT.

2.0 Air Monitoring and Sampling Methods

CTEH® developed and implemented an air sampling and analysis work plan (SAP) to document and quantify the release of fugitive emissions from the flue gas scrubber. All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as, carbon monoxide (CO), nitrogen dioxide (NO₂), 2.5-micron particulate matter (PM_{2.5}), and 10-micron particulate matter (PM₁₀), sulfur dioxide (SO₂), and volatile organic compounds (VOCs) using handheld instruments such as RAE Systems MultiRAEs, TSI SidePak™ AM510/AM520 Aerosol Monitors, TSI DustTrak™ Aerosol Monitors, and Gastec GV-100 pumps with chemical-specific colorimetric detection tubes.

Hand-held air monitoring consisted of roaming air monitoring in the surrounding community. All hand-held air monitoring was conducted in the breathing zone.

Analytical air samples were deployed for evaluation of Volatile Organic Compounds using USEPA TO-15 **Figure 9** in **Attachment A** depicts these analytical air sampling locations.

3.0 Air Monitoring Results

Figures 1 – 8 in **Attachment A** depicts the site location and hand-held monitoring locations for this reporting period.

Table 1 summarizes the results for community hand-held air monitoring readings.

Table 1: Community Hand-Held Real-Time Air Monitoring Results

Analyte	Instrument	# Readings	# Detections	Range
CO	MultiRAE	82	0	< 1 ppm
NO ₂	Gastec #9I/MultiRAE	82	0	< 0.1 ppm
PM ₁₀	AM510/AM520/DustTrak	48	48	0.004 - 0.017 mg/m ³
PM _{2.5}	AM510/AM520/DustTrak	48	48	0.001 - 0.016 mg/m ³
SO ₂	MultiRAE	62	0	<0.1 ppm
VOCs	MultiRAE	80	0	< 0.1 ppm

¹Maximum detections preceded by the “<” symbol are considered non-detections below the limit of detection (LoD) value to the right.

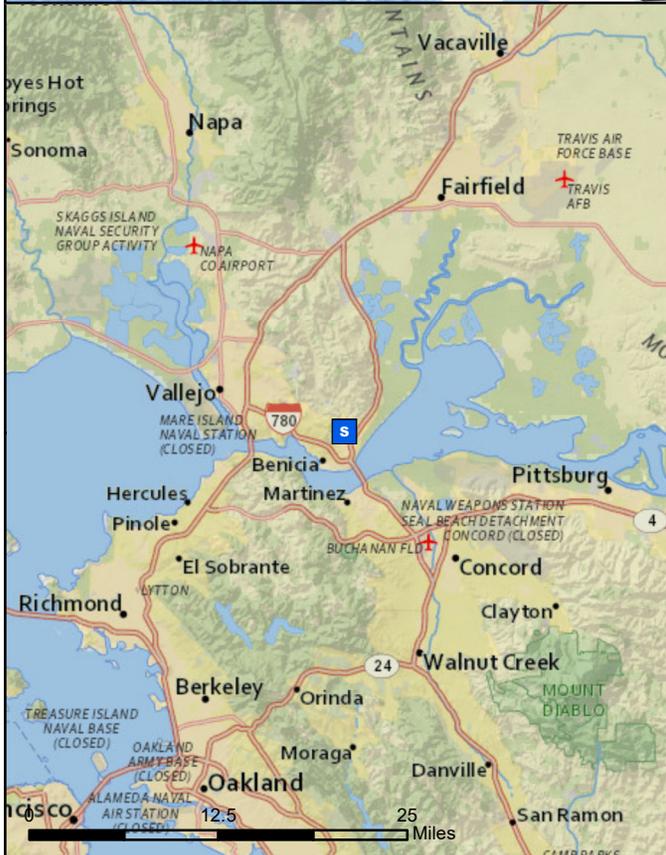
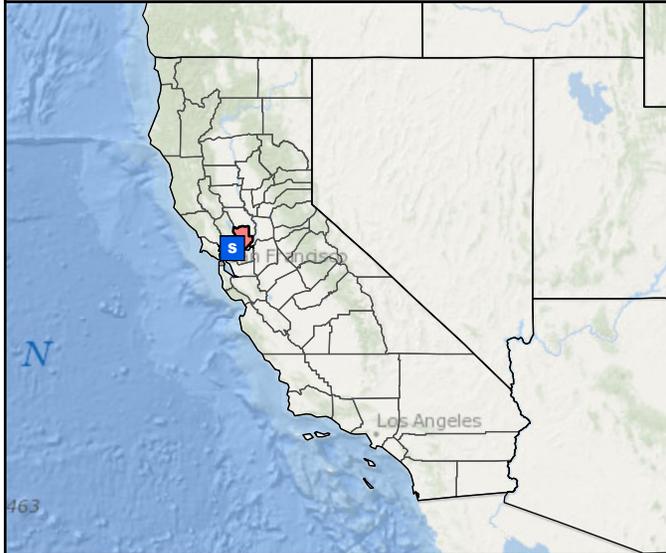
Additionally, at the request of public health officials, particulate matter (PM_{2.5} and PM₁₀) data have been grouped by downwind direction and averaged over a 24-hour period for comparison to AQI category equivalents. Wind-rose maps are provided for the corresponding time periods (**Appendix B**). It is notable that the USEPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS. Comparisons to AQI category equivalents are provided for illustration purposes only.

4.0 Weather Conditions

Figure 12 in attachment C contains meteorological data and a wind rose depicting wind speed and direction for this reporting period. Data was acquired from California Irrigation Management System (CIMIS) meteorological station #170 located in Concord to the southeast of the Benicia Refinery.

Attachment A

CTEH Air Sampling and Monitoring Locations

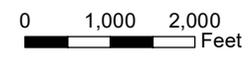


Legend

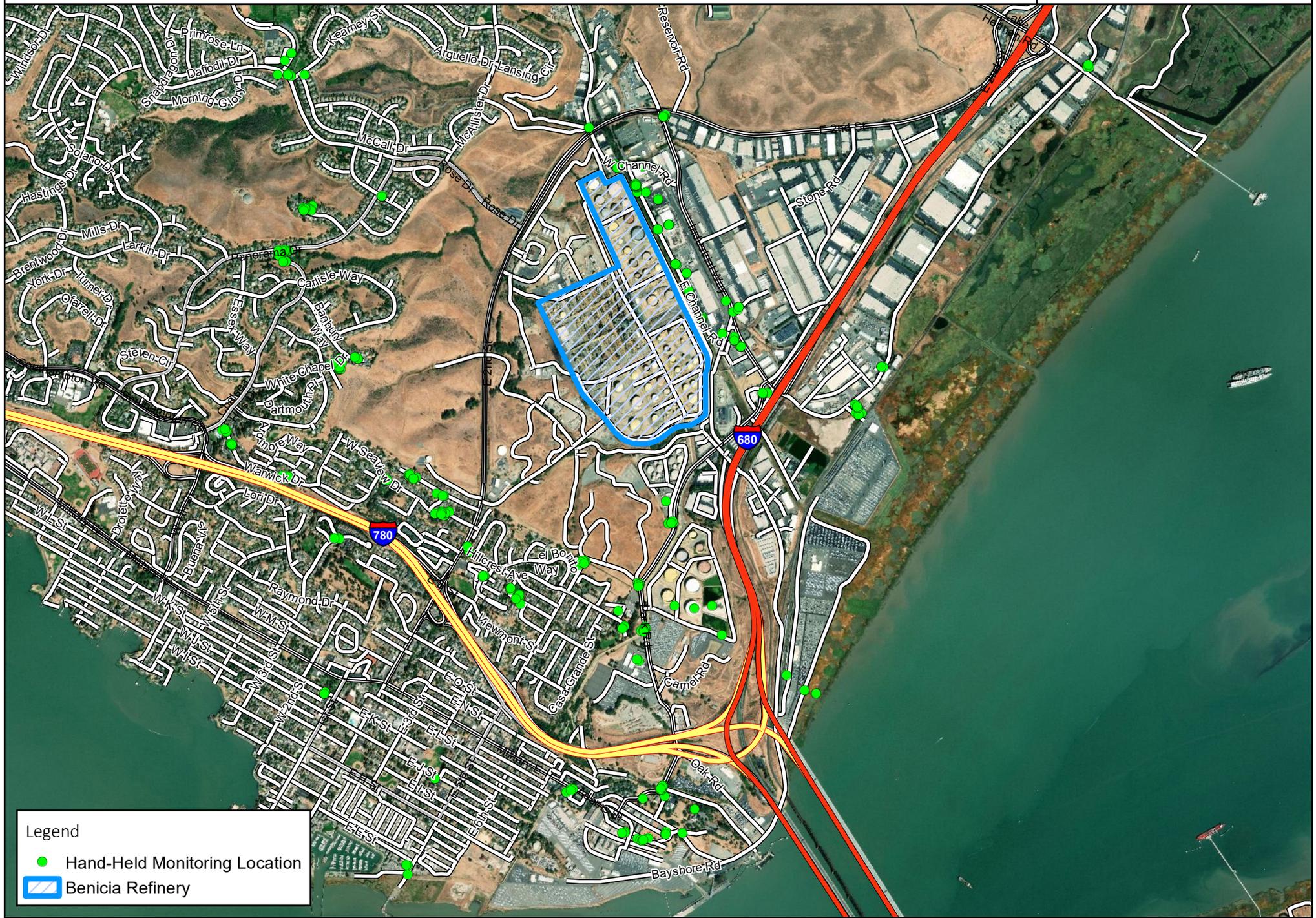
- Valero Benicia Refinery Location
- Benicia Refinery



Figure 2: Hand-Held Real-Time Monitoring Locations
Benicia Refinery Particulate Release

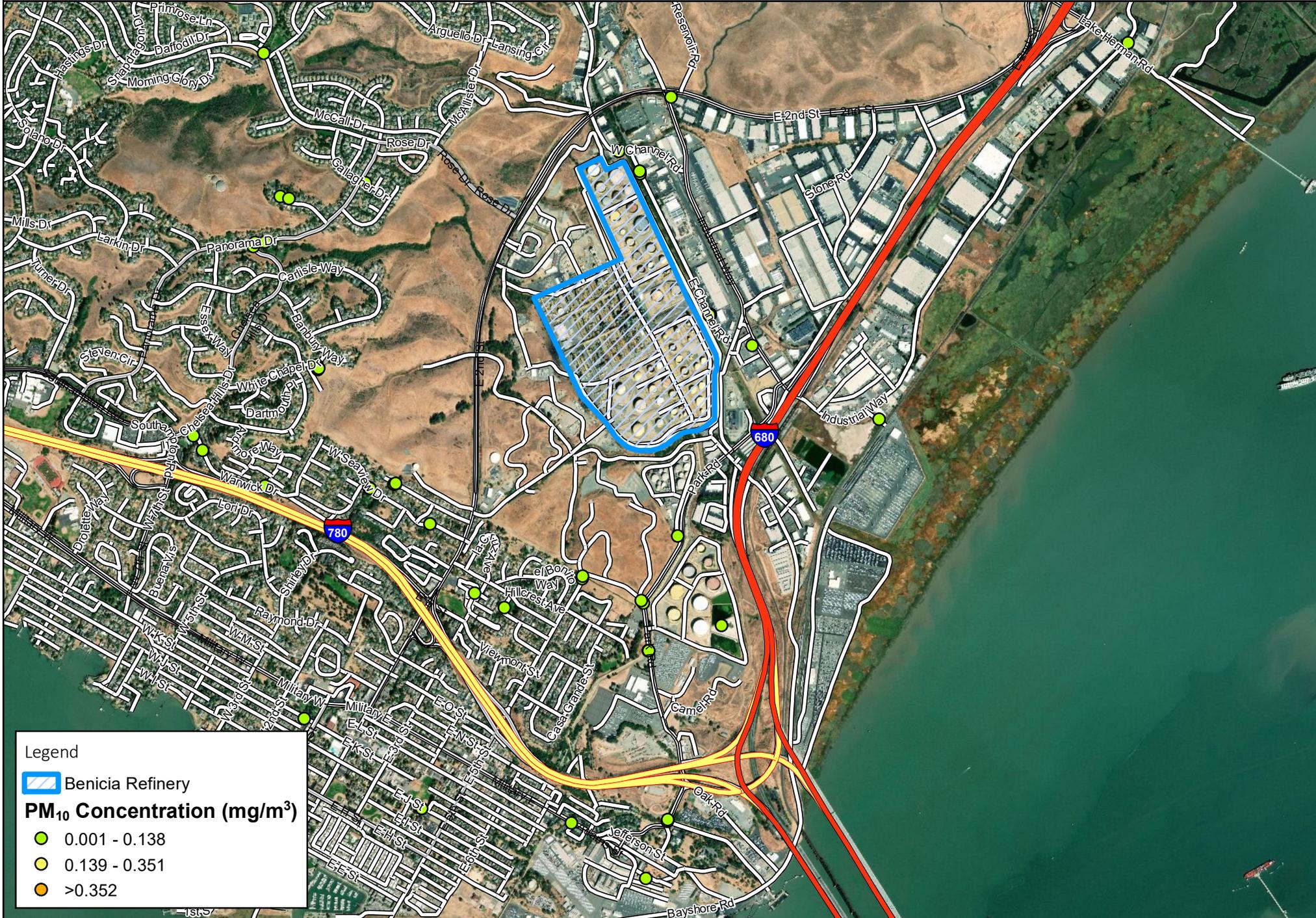


Project: 111391
Client: Valero Energy
City: Benicia, AR
County: Solano



Legend

- Hand-Held Monitoring Location
- Benicia Refinery

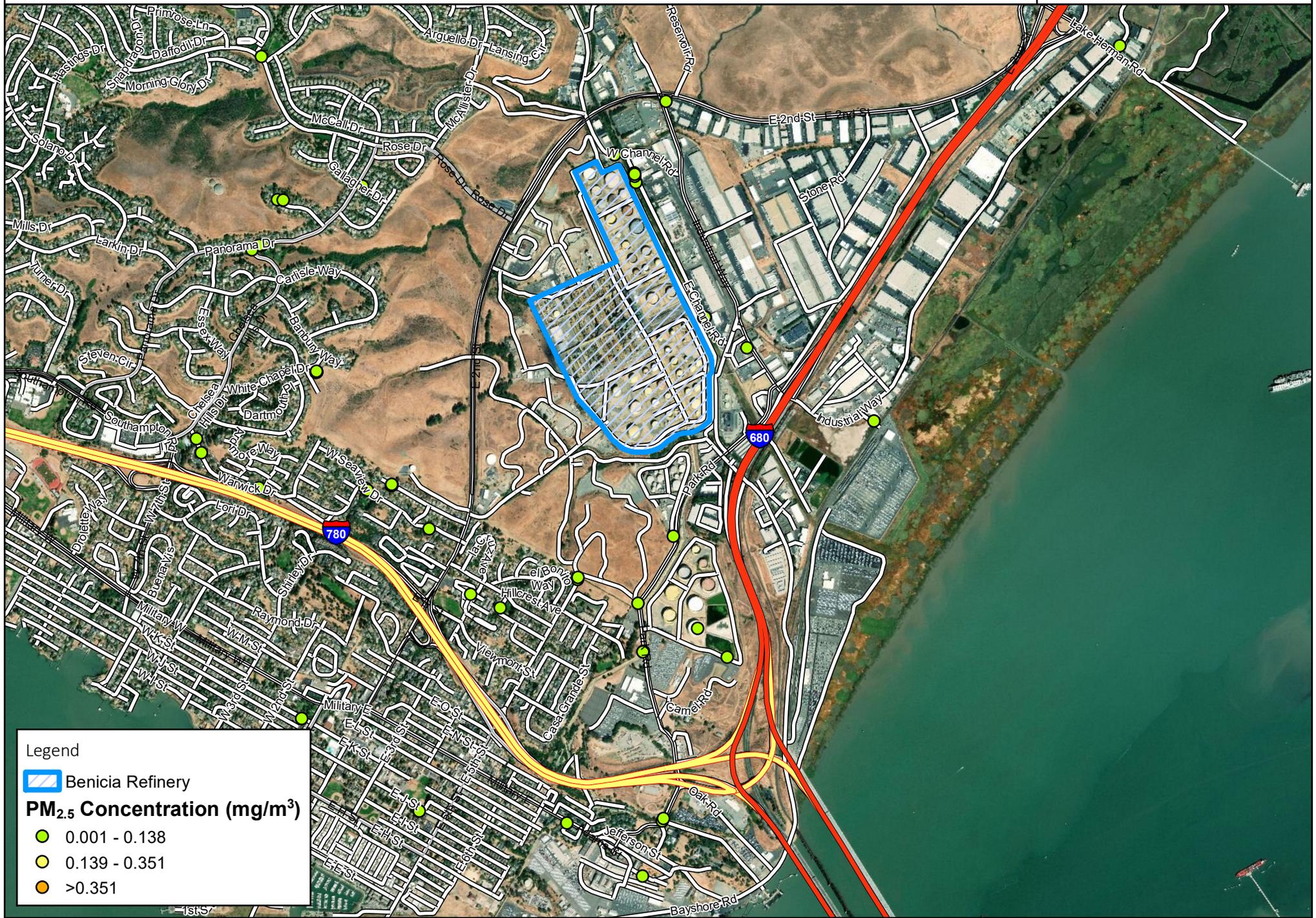


Legend

Benicia Refinery

PM₁₀ Concentration (mg/m³)

- 0.001 - 0.138
- 0.139 - 0.351
- >0.352



Legend

Benicia Refinery

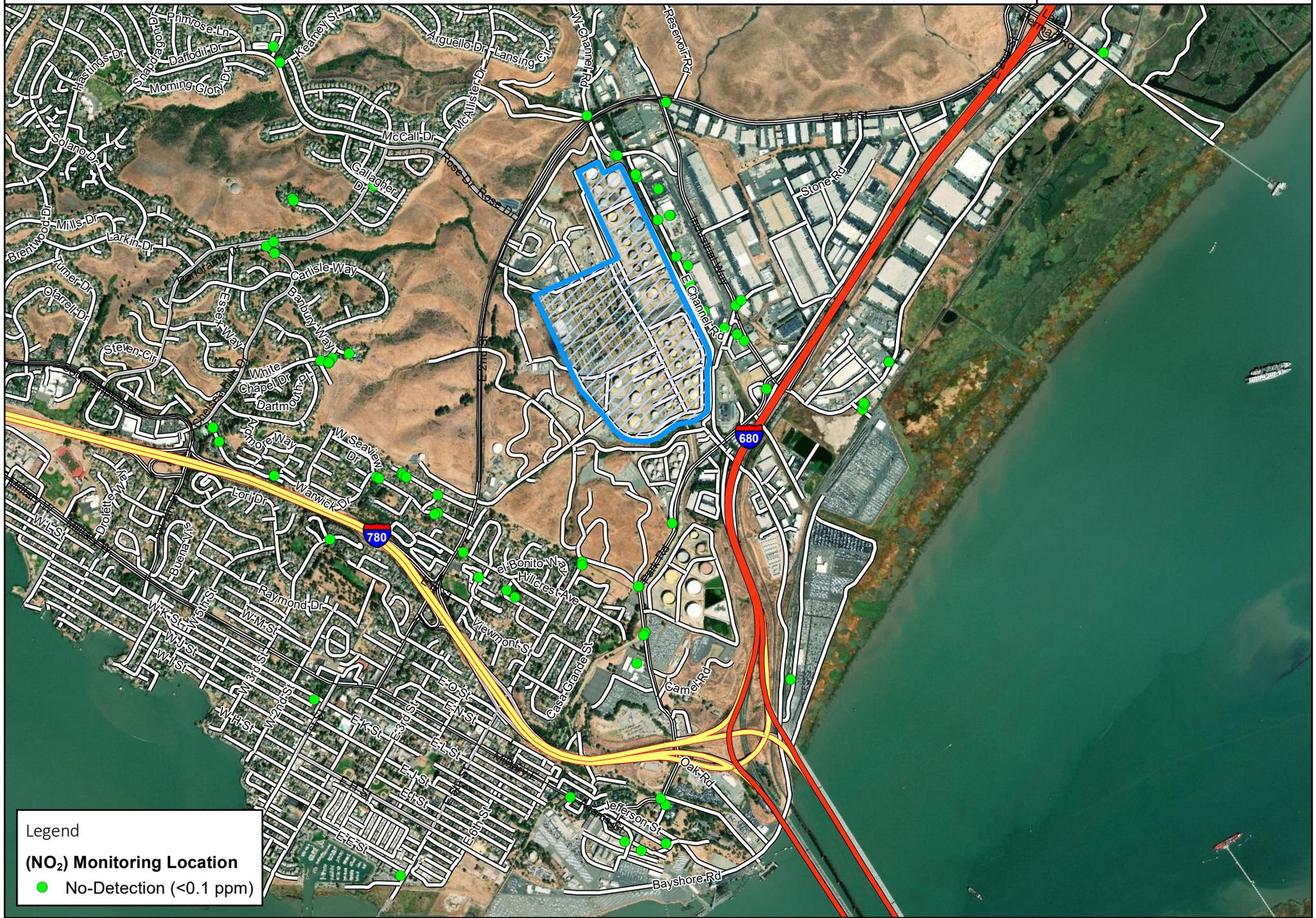
PM_{2.5} Concentration (mg/m³)

- 0.001 - 0.138
- 0.139 - 0.351
- >0.351



Legend

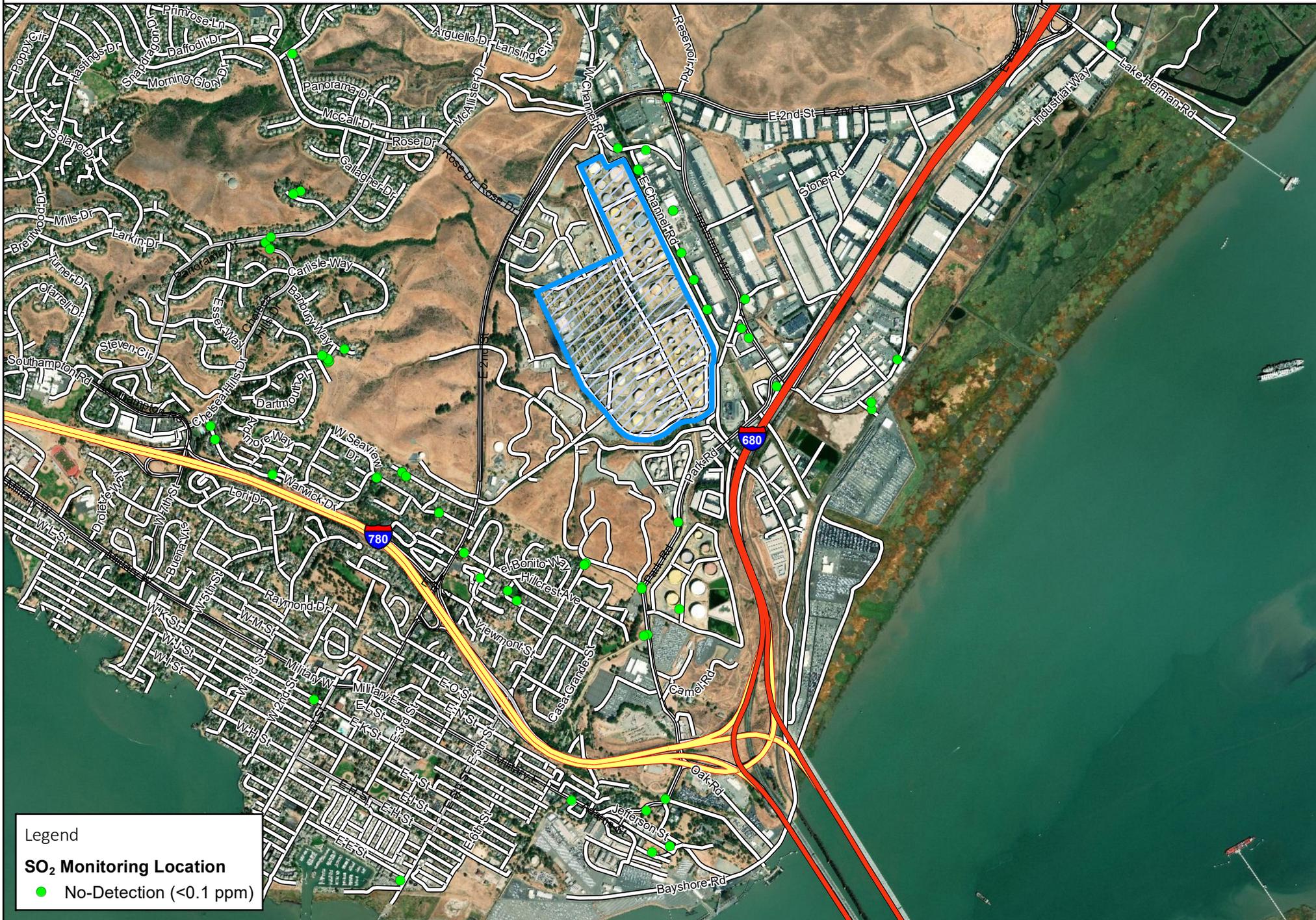
- CO Monitoring Locations
- No-Detection (<1 ppm)
- Benicia Refinery



Legend

(NO₂) Monitoring Location

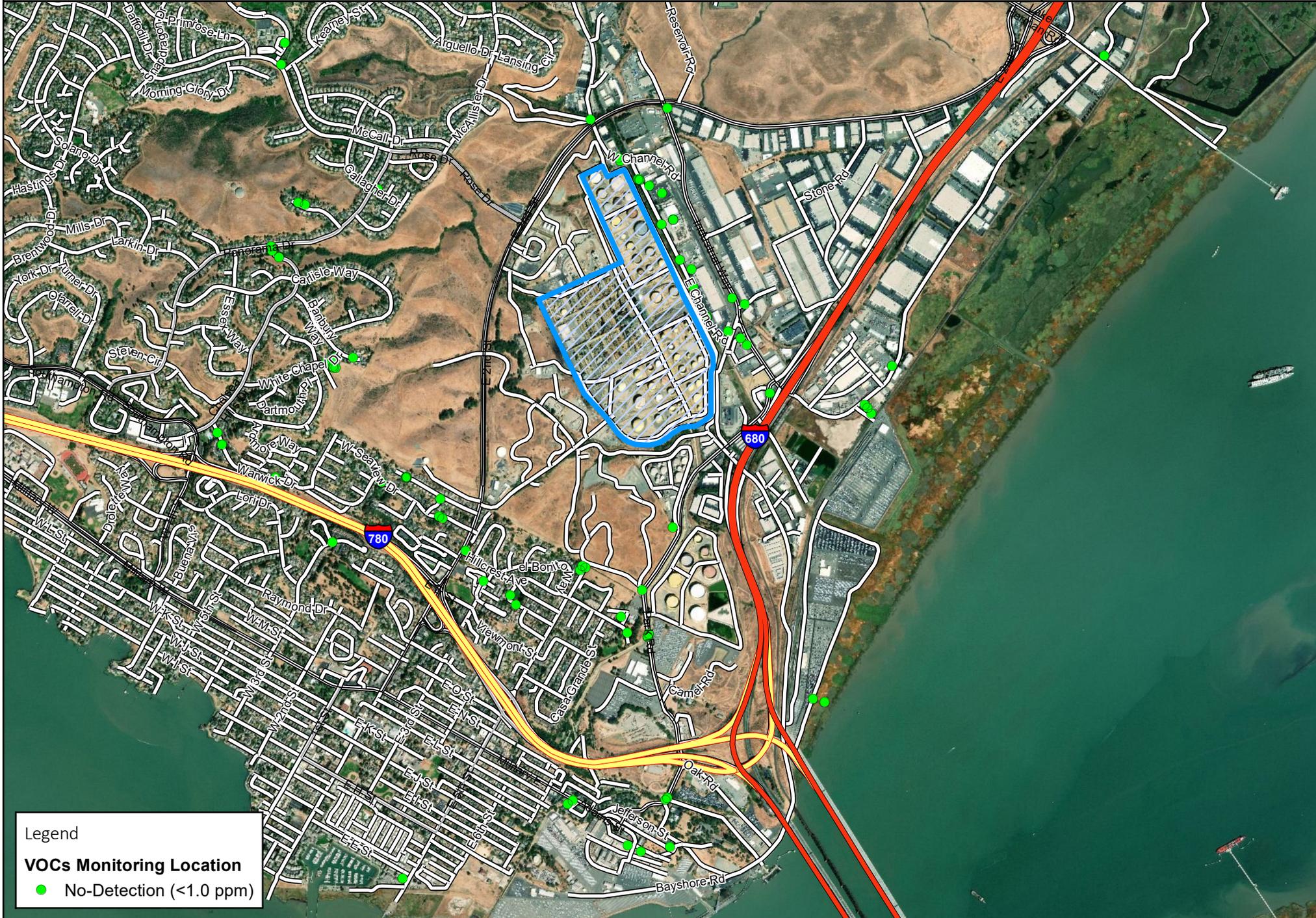
- No-Detection (<0.1 ppm)



Legend

SO₂ Monitoring Location

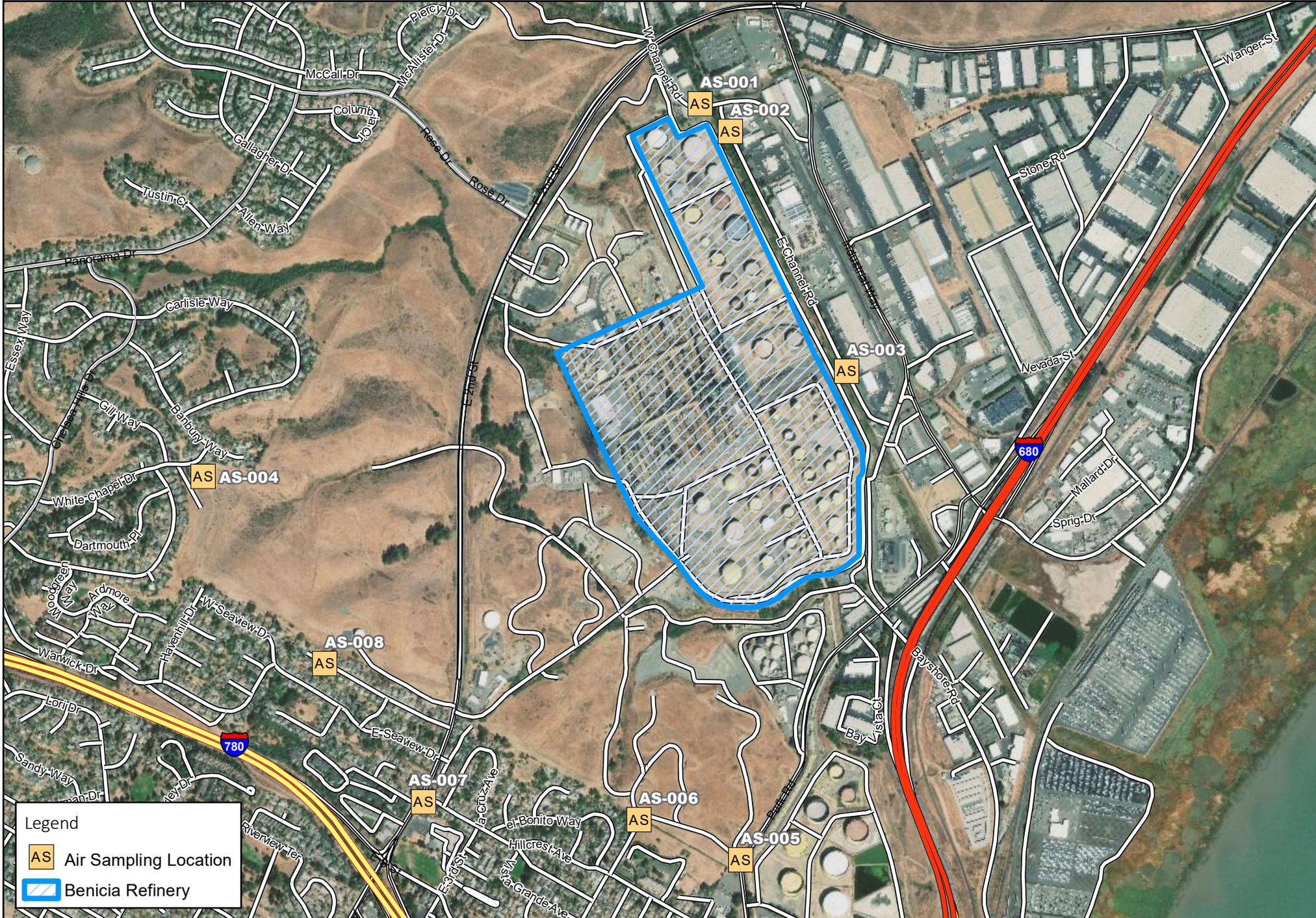
- No-Detection (<0.1 ppm)



Legend

VOCs Monitoring Location

- No-Detection (<1.0 ppm)



Attachment B

Directional Averages



PM₁₀ Directional Averages
Benicia Refinery Particulate Release

PM₁₀ Avg. for 24 Hour Period
March 26 06:00 - March 27 06:00¹

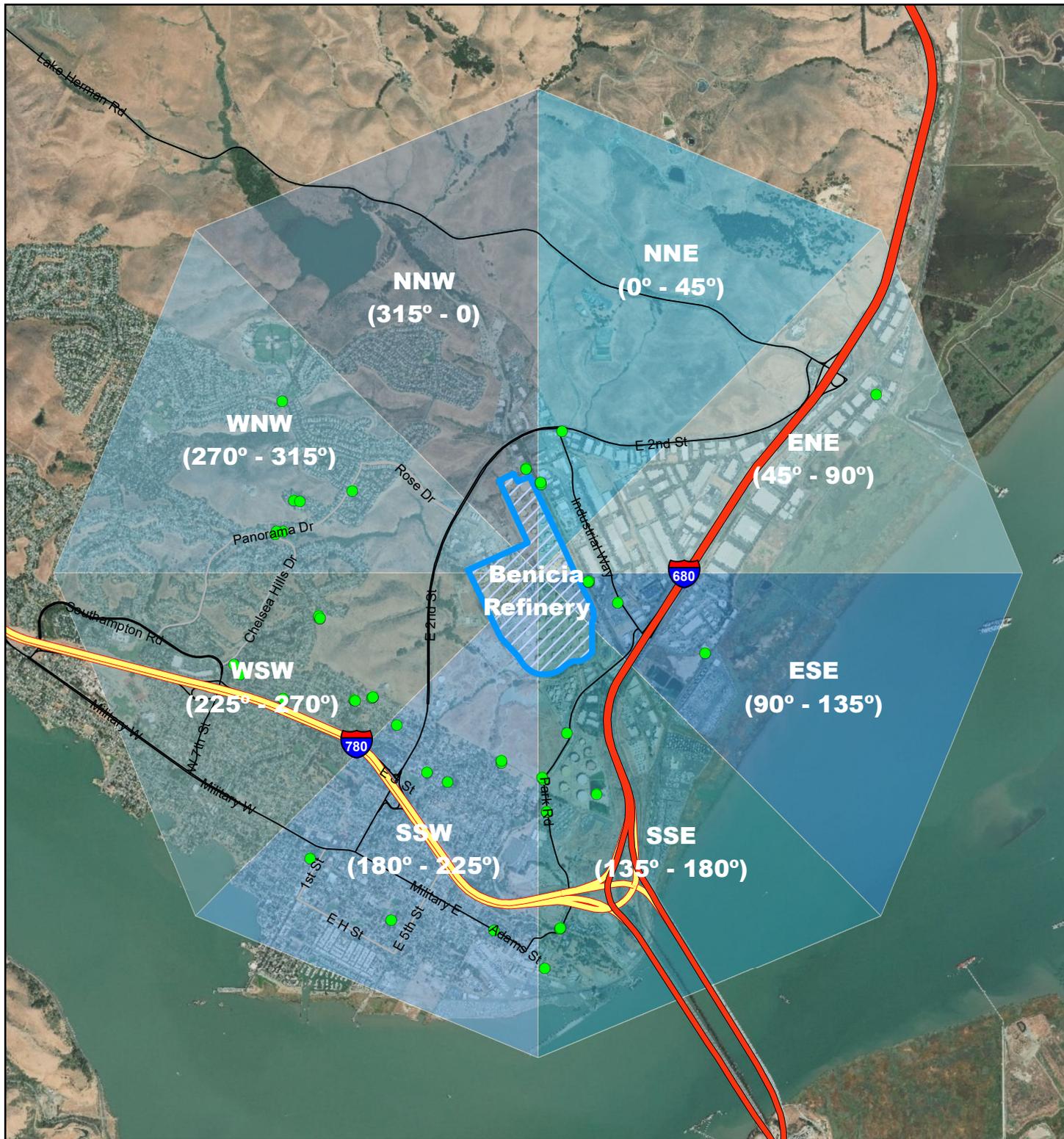
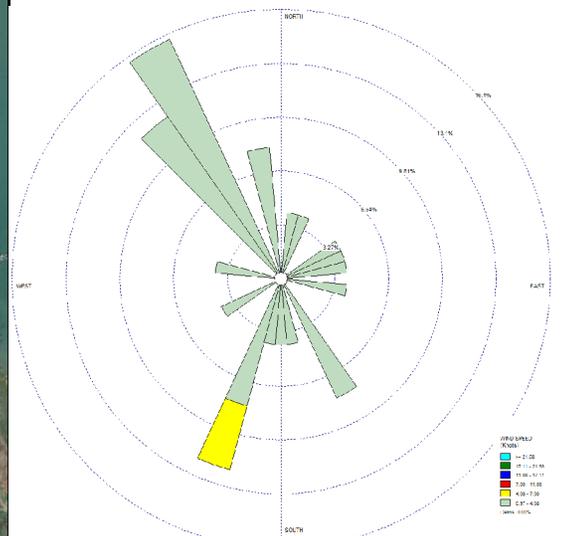
Direction	# Readings	# Detections	Avg (mg/m ³)	Range (mg/m ³)	AQI Category Equivalent
ENE	1	1	0.007	0.007	Good
ESE	5	5	0.0084	0.007 - 0.009	Good
NNE	5	5	0.0078	0.006 - 0.009	Good
NNW	2	2	0.007	0.007 - 0.007	Good
SSE	9	9	0.00911	0.005 - 0.014	Good
SSW	8	8	0.00725	0.005 - 0.011	Good
WNW	7	7	0.006	0.004 - 0.011	Good
WSW	11	11	0.00909	0.006 - 0.017	Good

¹The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.

Benicia Refinery

Monitoring Direction

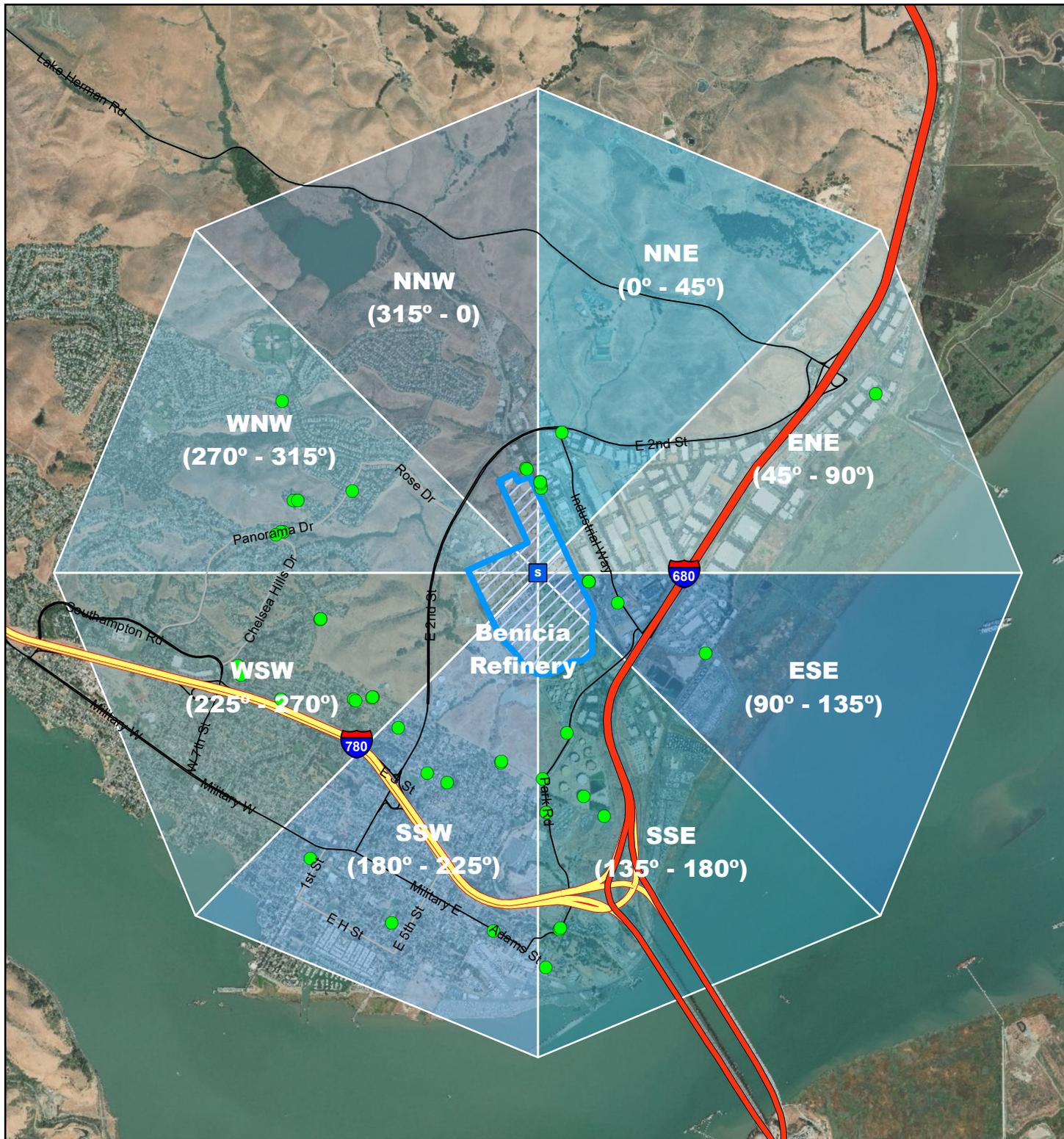
- ENE
- NNW
- WNW
- ESE
- SSE
- WSW
- NNE
- SSW



PM_{2.5} Avg. for 24 Hour Period
March 26 06:00 - March 27 06:00¹

Direction	# Readings	# Detections	Avg (mg/m ³)	Range (mg/m ³)	AQI Category Equivalent
ENE	1	1	0.007	0.007	Good
ESE	5	5	0.0046	0.001 - 0.007	Good
NNE	5	5	0.0056	0.002 - 0.007	Good
NNW	2	2	0.0065	0.005 - 0.008	Good
SSE	9	9	0.00811	0.004 - 0.016	Good
SSW	8	8	0.00612	0.003 - 0.012	Good
WNW	7	7	0.00329	0.001 - 0.007	Good
WSW	11	11	0.00582	0.002 - 0.009	Good

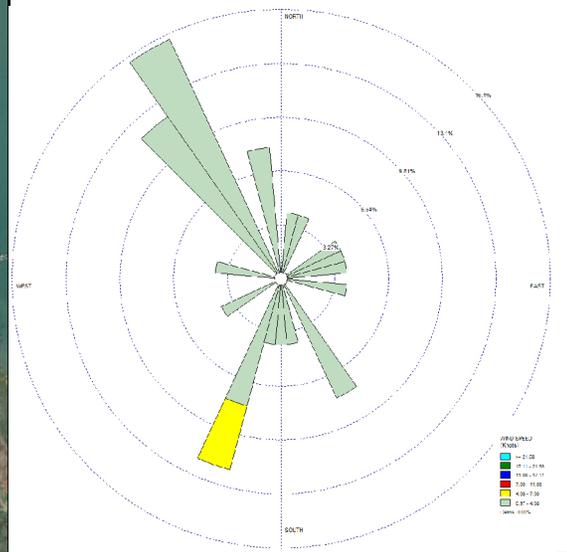
¹The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.



Benicia Refinery

Monitoring Direction

- ENE
- ESE
- NNE
- NNW
- SSW
- WNW
- WSW



INFO@CTEH2
K900
0 - 10.00
10.00 - 20.00
20.00 - 30.00
30.00 - 40.00
40.00 - 50.00
50.00 - 60.00
www.cteh.com

Attachment C

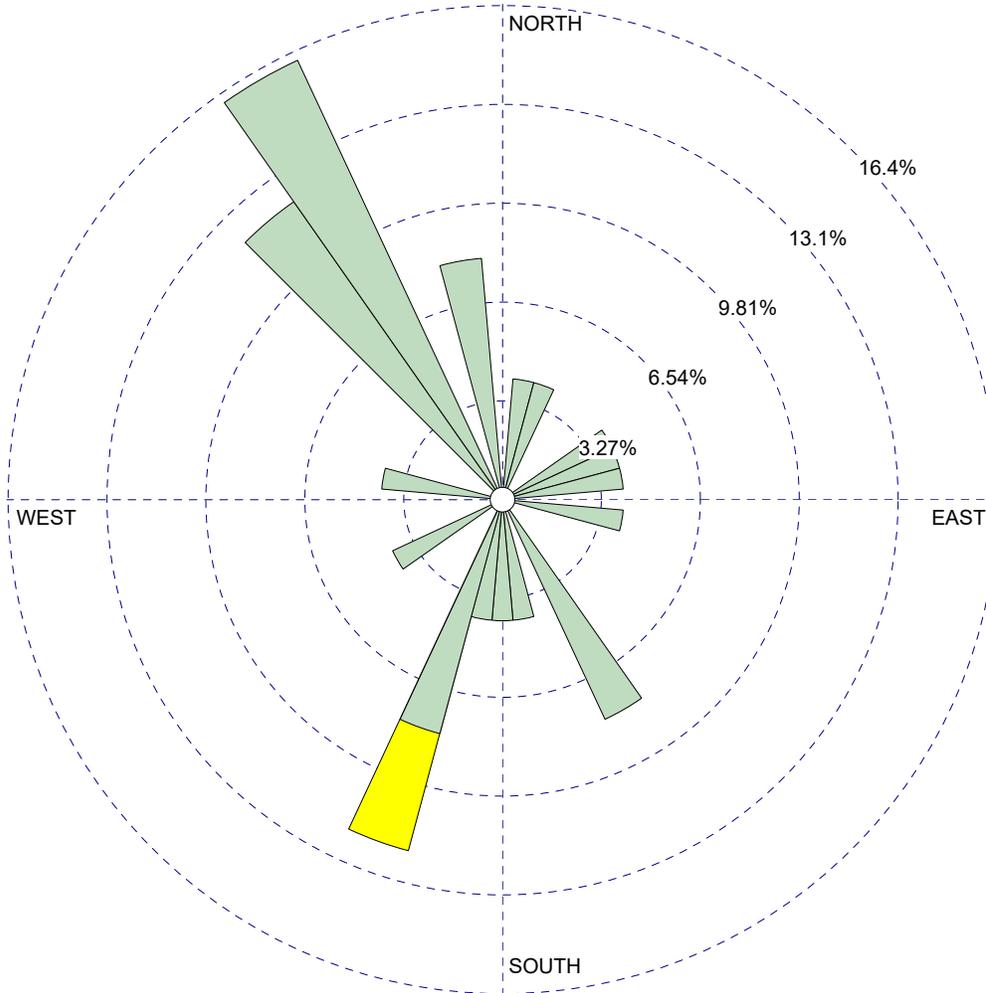
Meteorological Conditions

WIND ROSE PLOT:

Station #CIMIS

DISPLAY:

Wind Speed
Direction (blowing from)



WIND SPEED
(Knots)

- >= 21.58
- 17.11 - 21.58
- 11.08 - 17.11
- 7.00 - 11.08
- 4.08 - 7.00
- 0.97 - 4.08
- Calms: 0.00%

COMMENTS:

DATA PERIOD:

Start Date: 3/26/2019 - 06:00
End Date: 3/27/2019 - 06:00

COMPANY NAME:

MODELER:

CALM WINDS:

0.00%

TOTAL COUNT:

25 hrs.

AVG. WIND SPEED:

2.28 Knots

DATE:

3/27/2019

PROJECT NO.:

111391