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THE SCIENCE OF READY℠

VALERO ENERGY

BENICIA REFINERY STARTUP

Benicia, CA

May 4, 2019

Project #111560

1.0 Introduction

On May 1, 2019 Valero Energy requested that CTEH® initiate air monitoring prior to startup of the Benicia Refinery in Benicia, CA to collect background air quality data in the surrounding community. CTEH will continue to conduct air monitoring to evaluate potential emissions, if any, during the startup of the refinery. Air monitoring activities consist of roaming hand-held real-time and analytical sampling in the surrounding community.

This report summarizes air monitoring data collected from May 3, 2019 06:30 PDT to May 4, 2019 06:30 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 coker unit (if any). All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as benzene, carbon monoxide (CO), hydrogen sulfide (H_2S), nitrogen dioxide (NO_2), particulate matter at 2.5-microns ($PM_{2.5}$), sulfur dioxide (SO_2), toluene, volatile organic compounds (VOCs), and xylene using handheld instruments such as RAE Systems MultiRAEs and UltraRAEs, RKI Instruments Eagles, Arizona Instrument Jerome 631-Xs, TSI SidePak™ AM510/AM520 Aerosol Monitors, and Gastec GV-100 pumps with chemical-specific colorimetric detection tubes.

3.0 Air Monitoring Results

Figures 1 – 11 in **Attachment A** depict 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: Preliminary Community Real-Time Air Monitoring Summary

May 3, 2019 06:30 PDT to May 4, 2019 06:30 PDT

Analyte	Instrument	# Readings	# Detections	Range
Benzene	UltraRAE	110	0	< 0.025 ppm
Carbon Monoxide	MultiRAE	109	3	3 - 9 ppm
H_2S	Jerome 613-X	46	2	0.003 ppm
	MultiRAE	75	0	< 0.1 ppm
	Eagle	11	0	< 0.5 ppm
NO_2	MultiRAE	107	0	< 0.1 ppm
$PM_{2.5}$	AM510/AM520/DustTrak	108	108	0.006 - 0.085 mg/m^3
SO_2	MultiRAE	108	0	< 0.1 ppm
Toluene	Gastec #122	13	0	< 1 ppm
	Gastec #122L	35	0	< 0.5 ppm
VOCs	MultiRAE	112	0	< 0.1 ppm
Xylene	Gastec #123	47	0	< 1 ppm

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

4.0 Weather Conditions

Figure 8 in **Attachment B** 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

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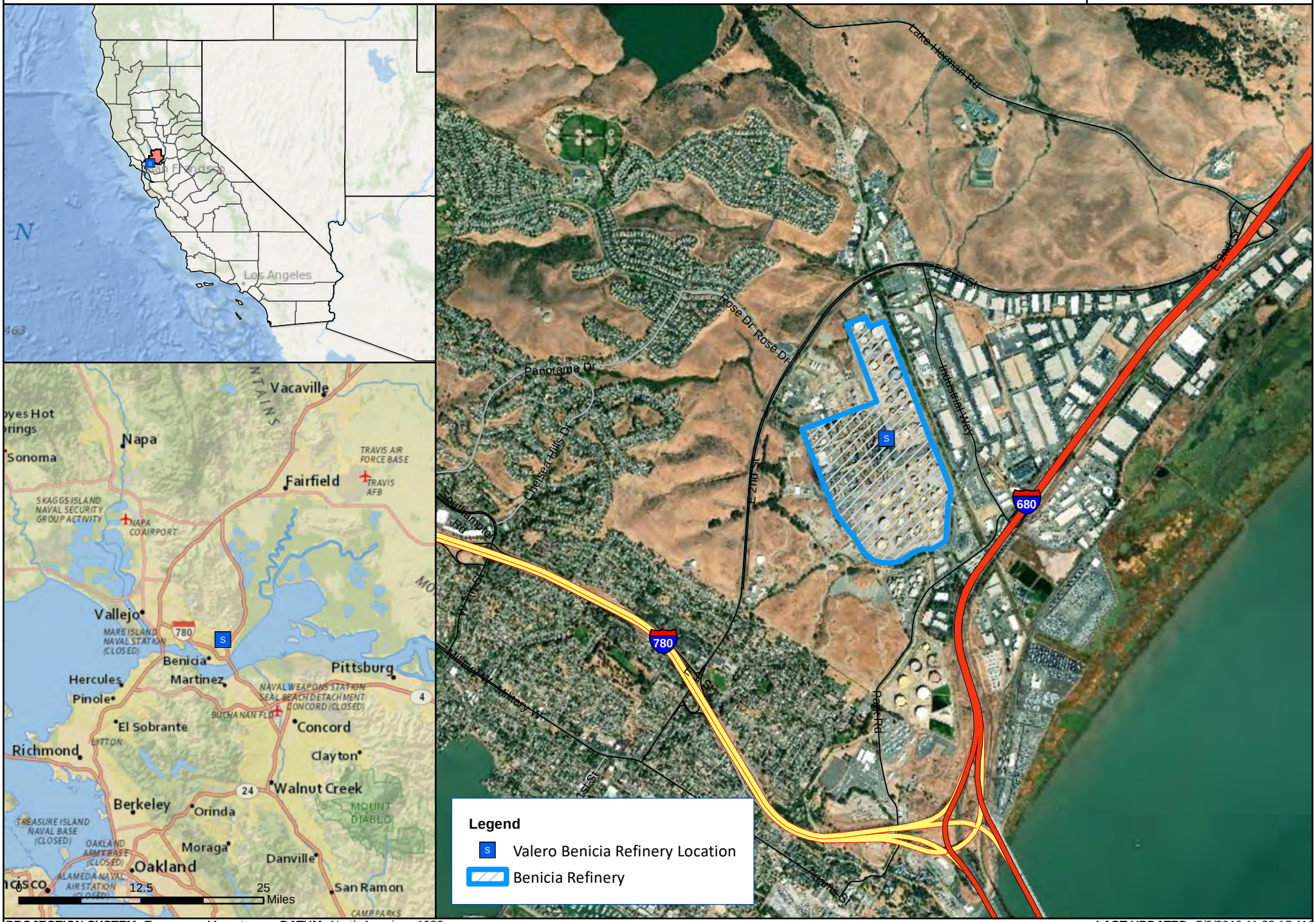
Figure 1: Incident Location

Benicia Refinery Startup

0 0.25 0.5 1 Miles

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



PROJECTION SYSTEM: *Transverse Mercator* **DATUM:** *North American 1983* **LAST UPDATED:** *5/2/2019 11:38:15 AM*

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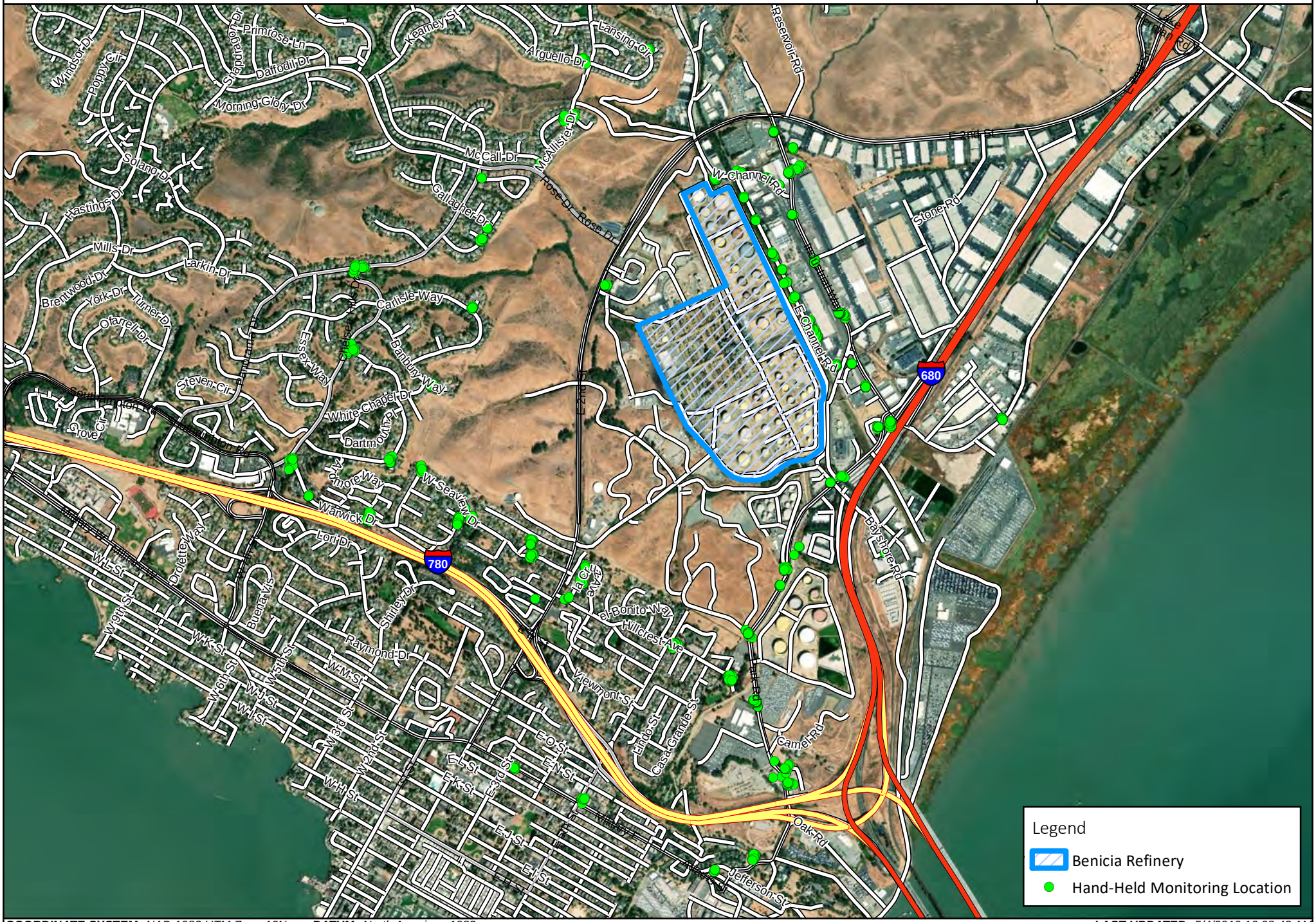
Figure 2: Hand-Held Real-Time Monitoring Locations

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



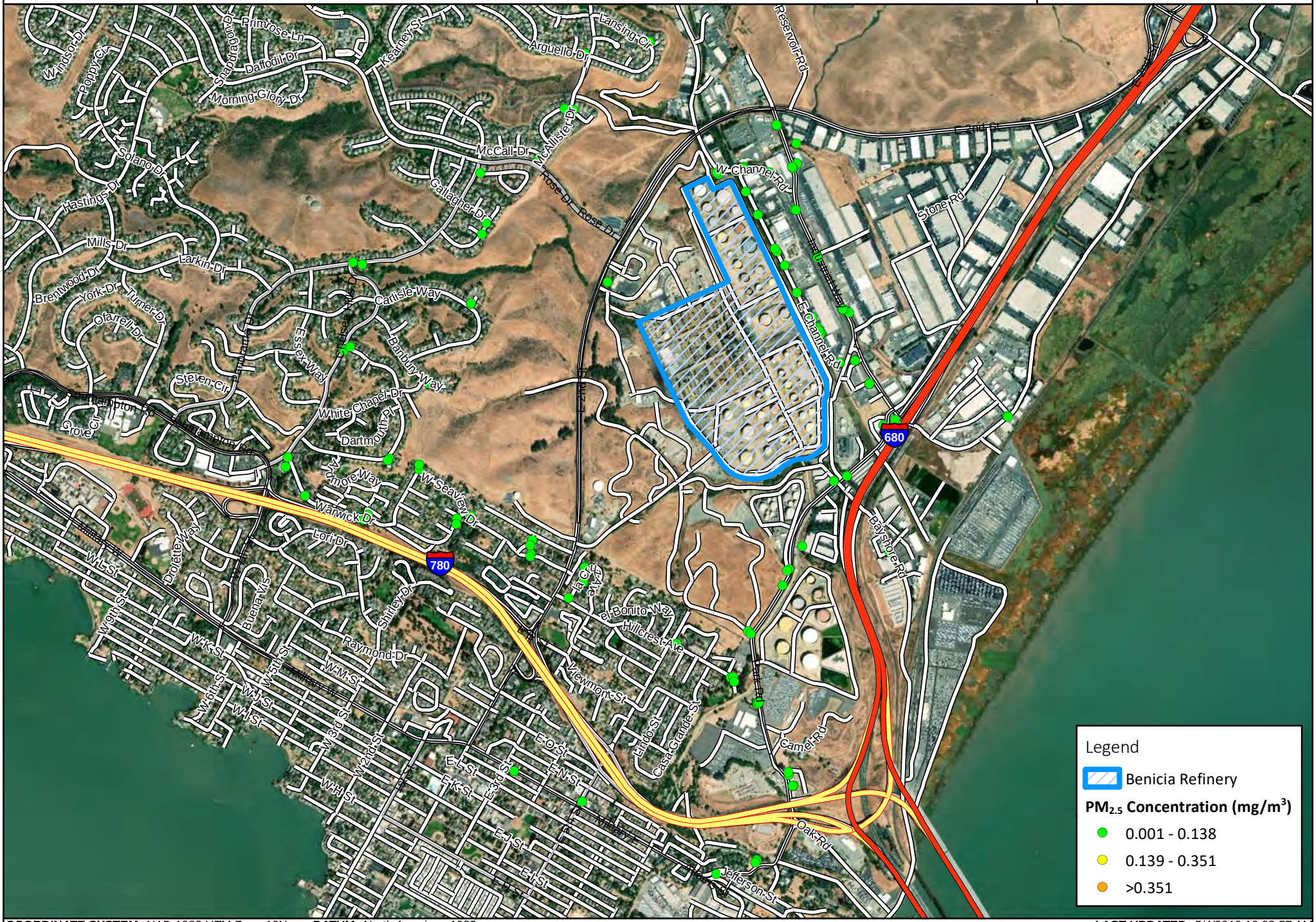
COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:08:43 AM*

Figure 3: Hand-Held Real-Time Monitoring Locations ($PM_{2.5}$)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



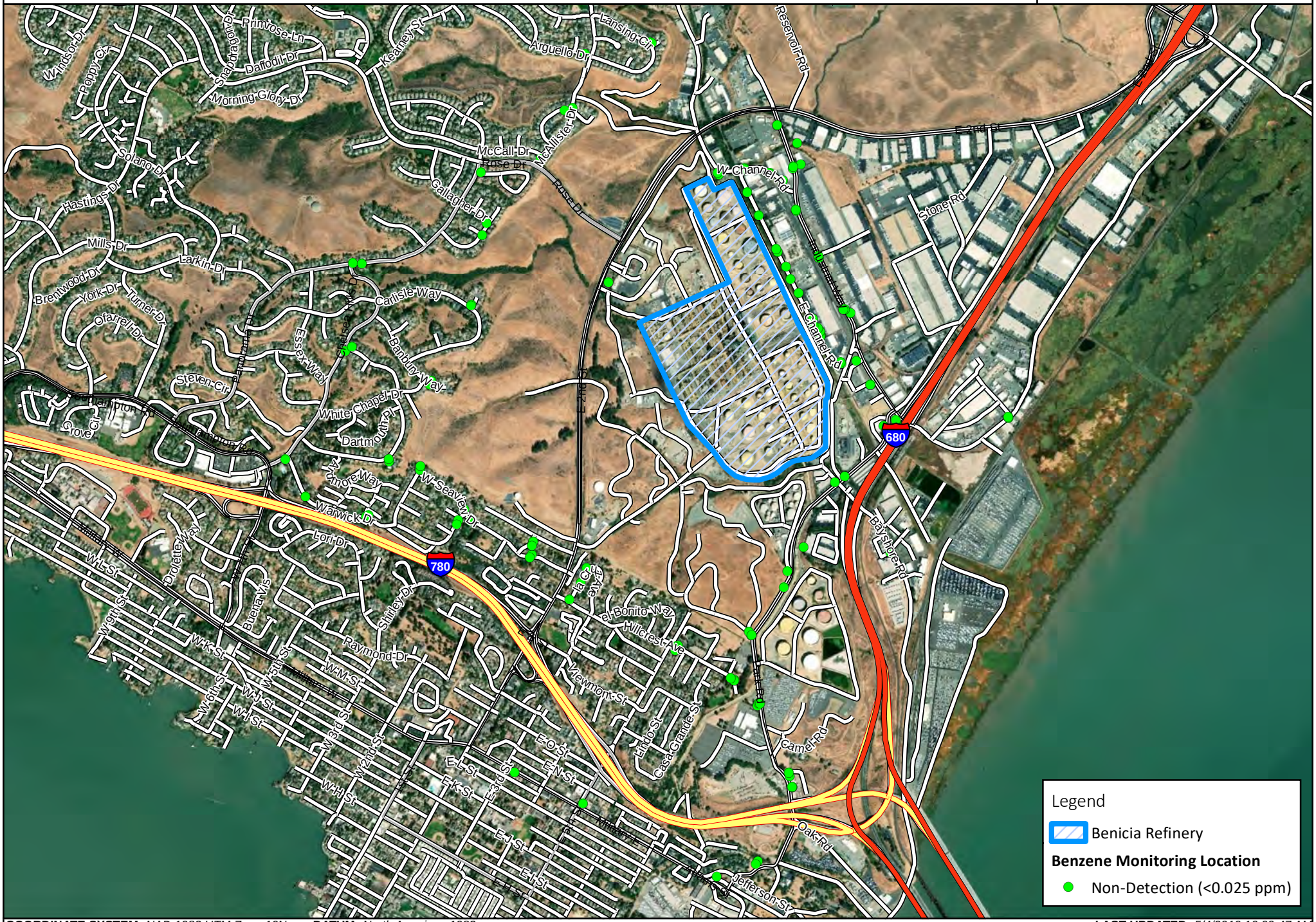
COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:08:57 AM*

Figure 4: Hand-Held Real-Time Monitoring Locations (Benzene)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:09:47 AM*

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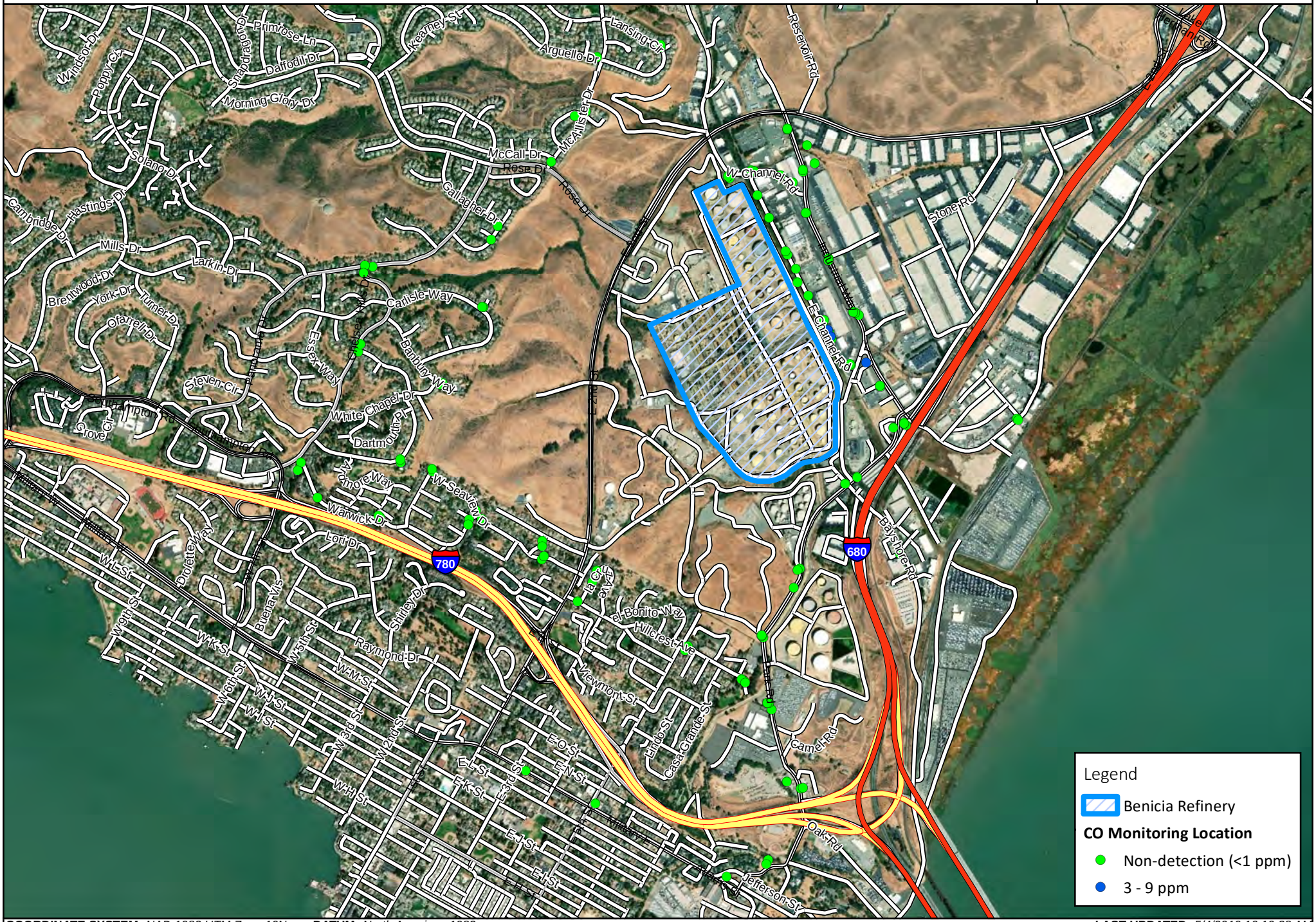
Figure 5: Hand-Held Real-Time Monitoring Locations (CO)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



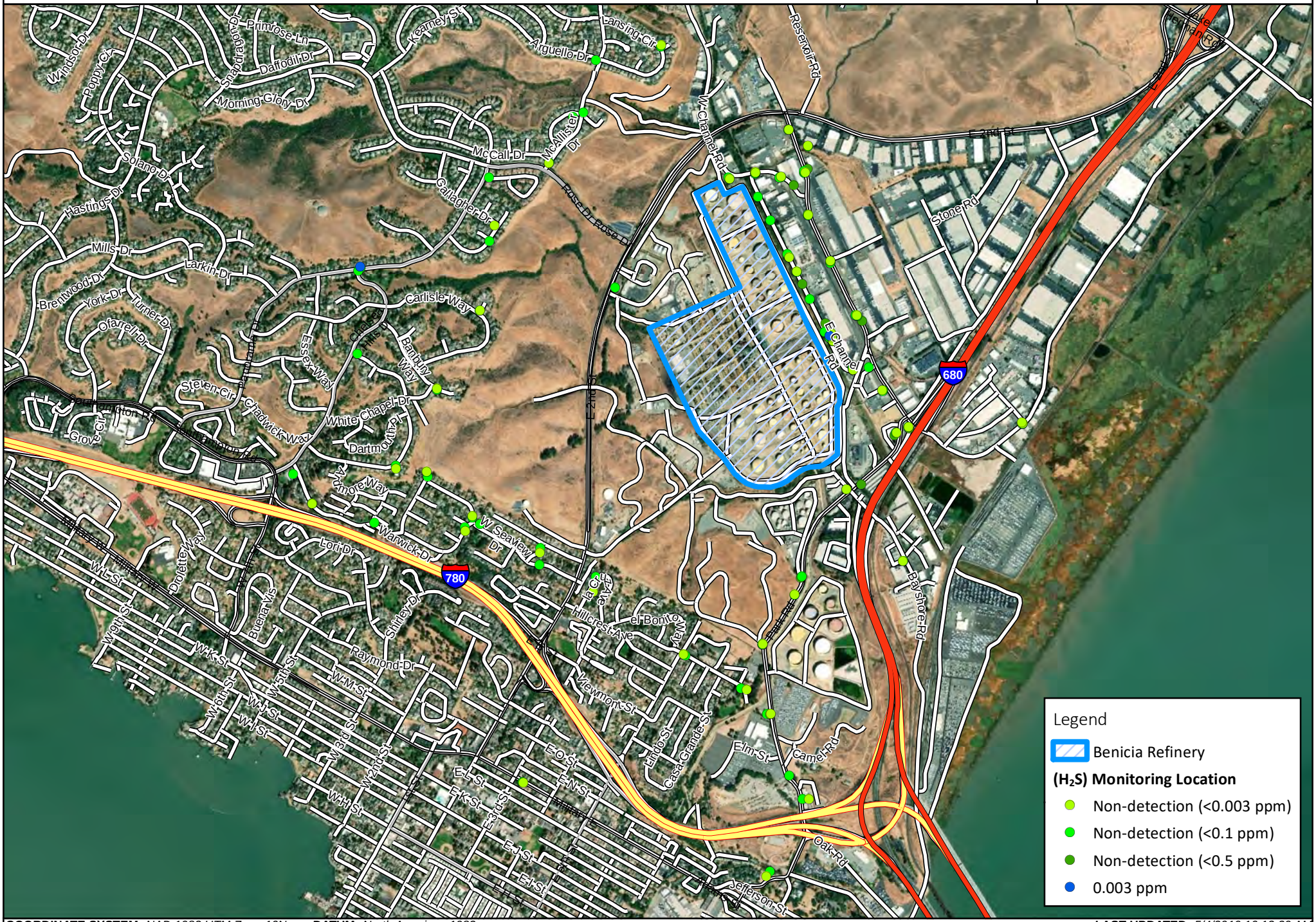
COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:10:38 AM*

Figure 6: Hand-Held Real-Time Monitoring Locations (H_2S)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:13:39 AM*

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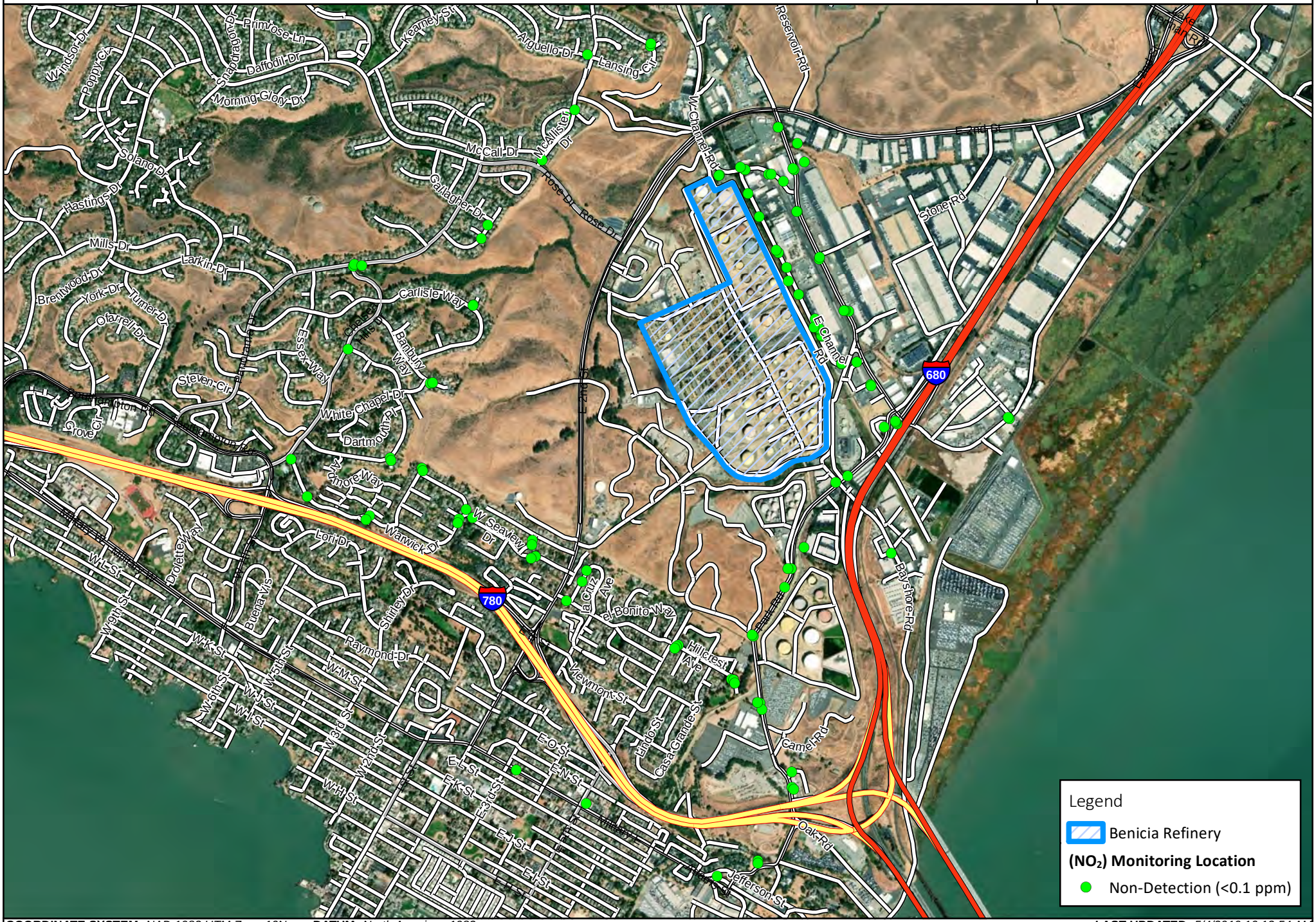
Figure 7: Hand-Held Real-Time Monitoring Locations (NO_2)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

- Benicia Refinery
- **(NO_2) Monitoring Location**
- Non-Detection (<0.1 ppm)

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:13:54 AM*

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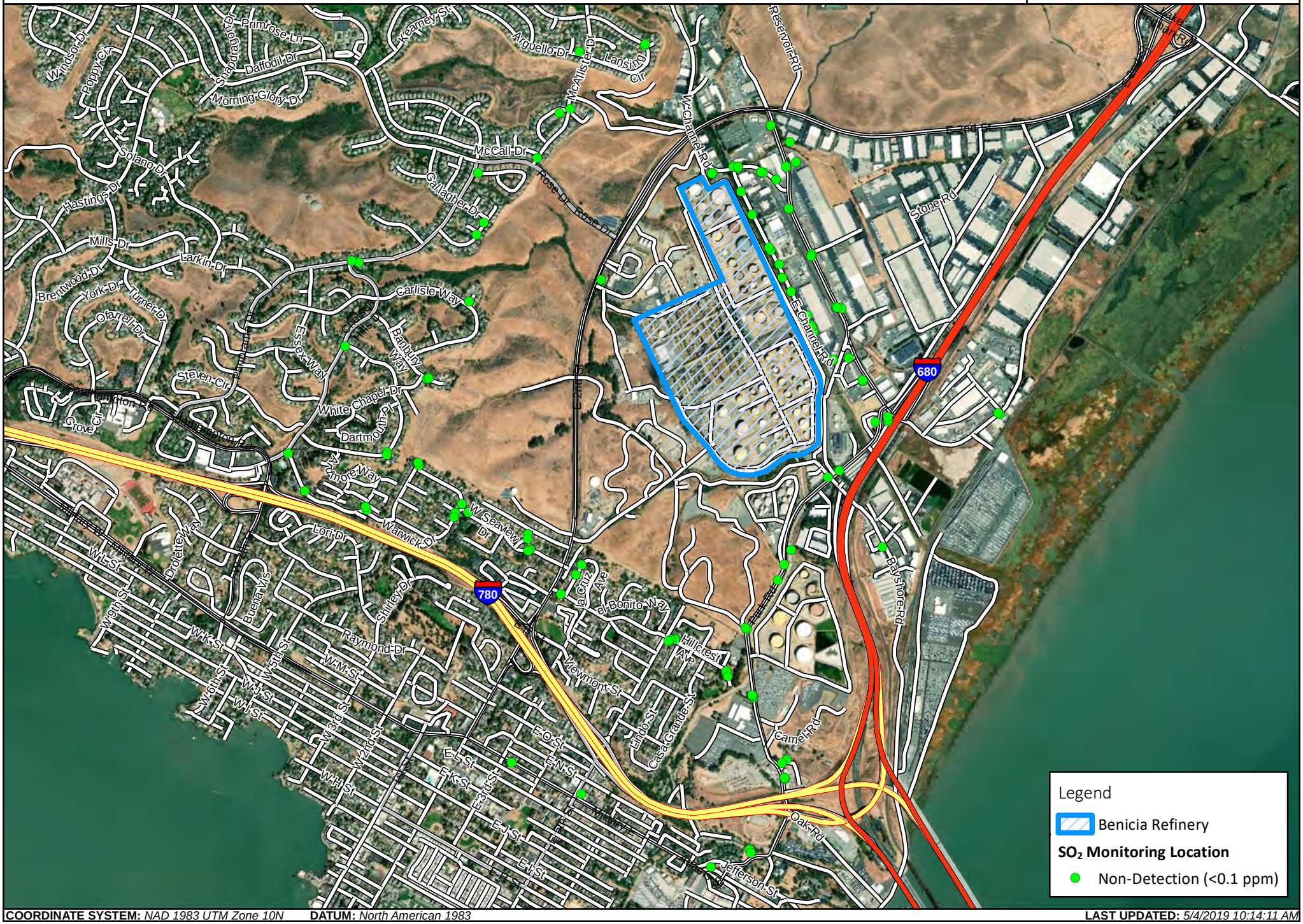
Figure 8: Hand-Held Real-Time Monitoring Locations (SO_2)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

Benicia Refinery

SO_2 Monitoring Location

Non-Detection (<0.1 ppm)

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:14:11 AM*

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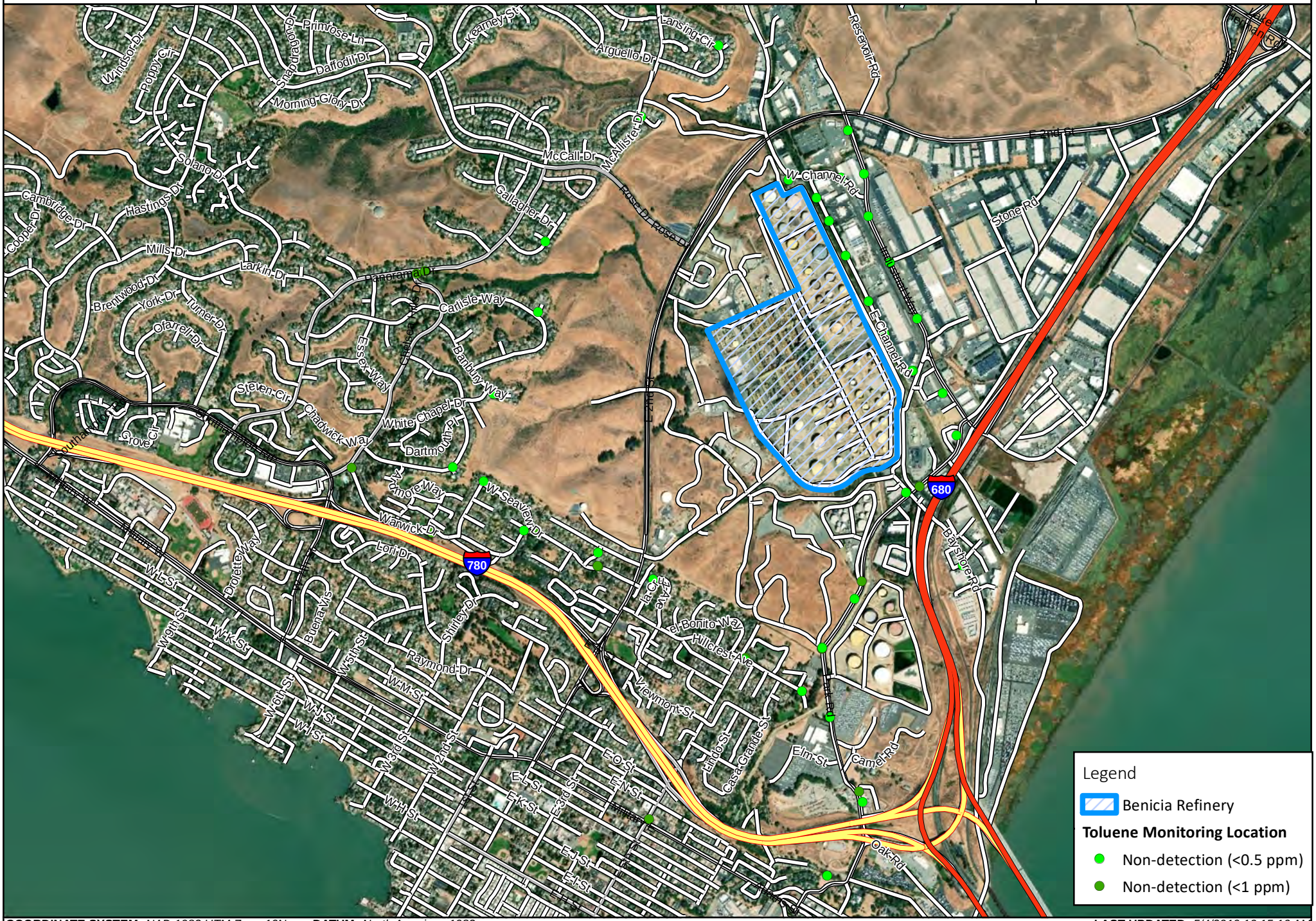
Figure 9: Hand-Held Real-Time Monitoring Locations (Toluene)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

- Benicia Refinery

Toluene Monitoring Location

- Non-detection (<0.5 ppm)
- Non-detection (<1 ppm)

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:15:16 AM*

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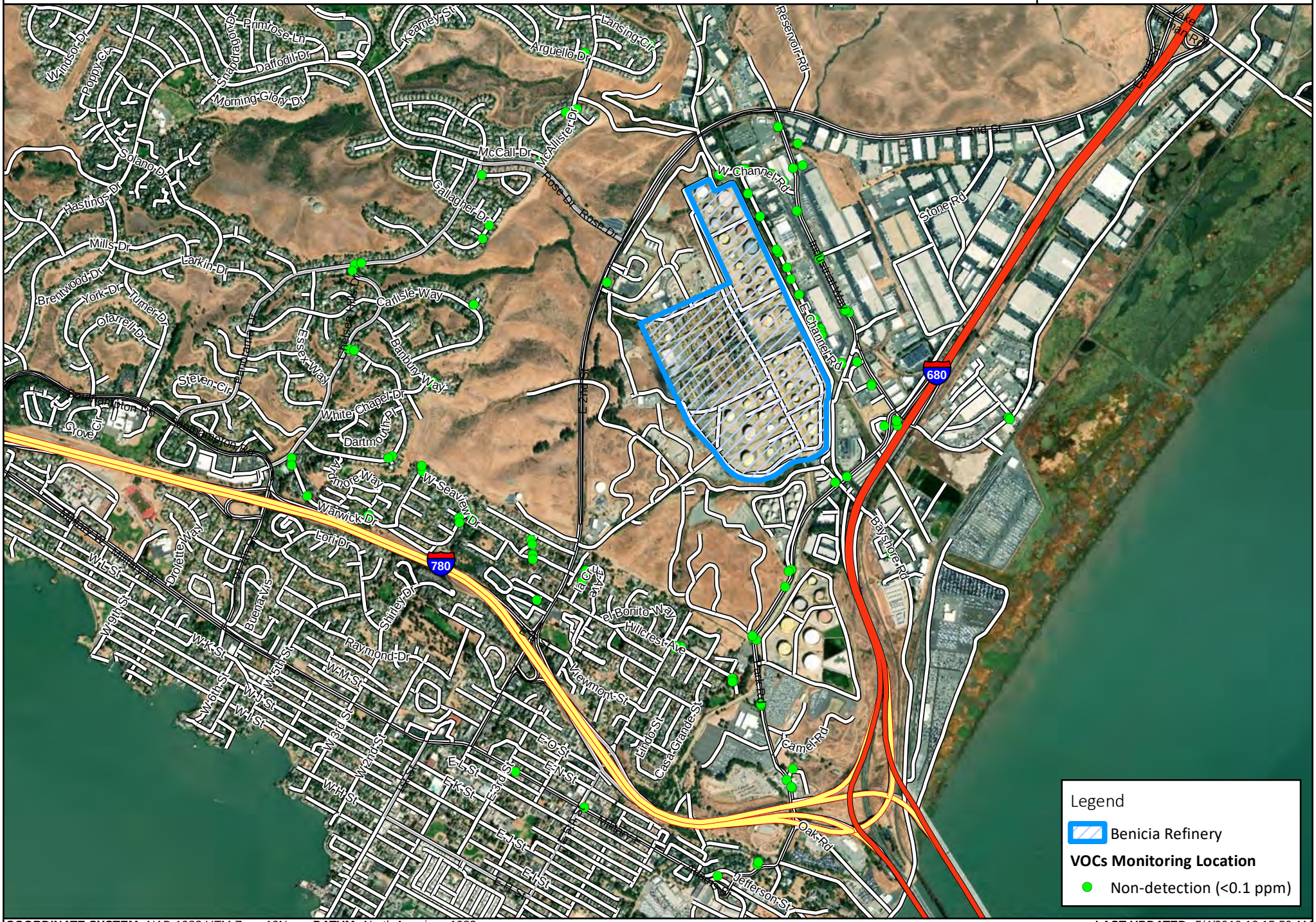
Figure 10: Hand-Held Real-Time Monitoring Locations (VOCs)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



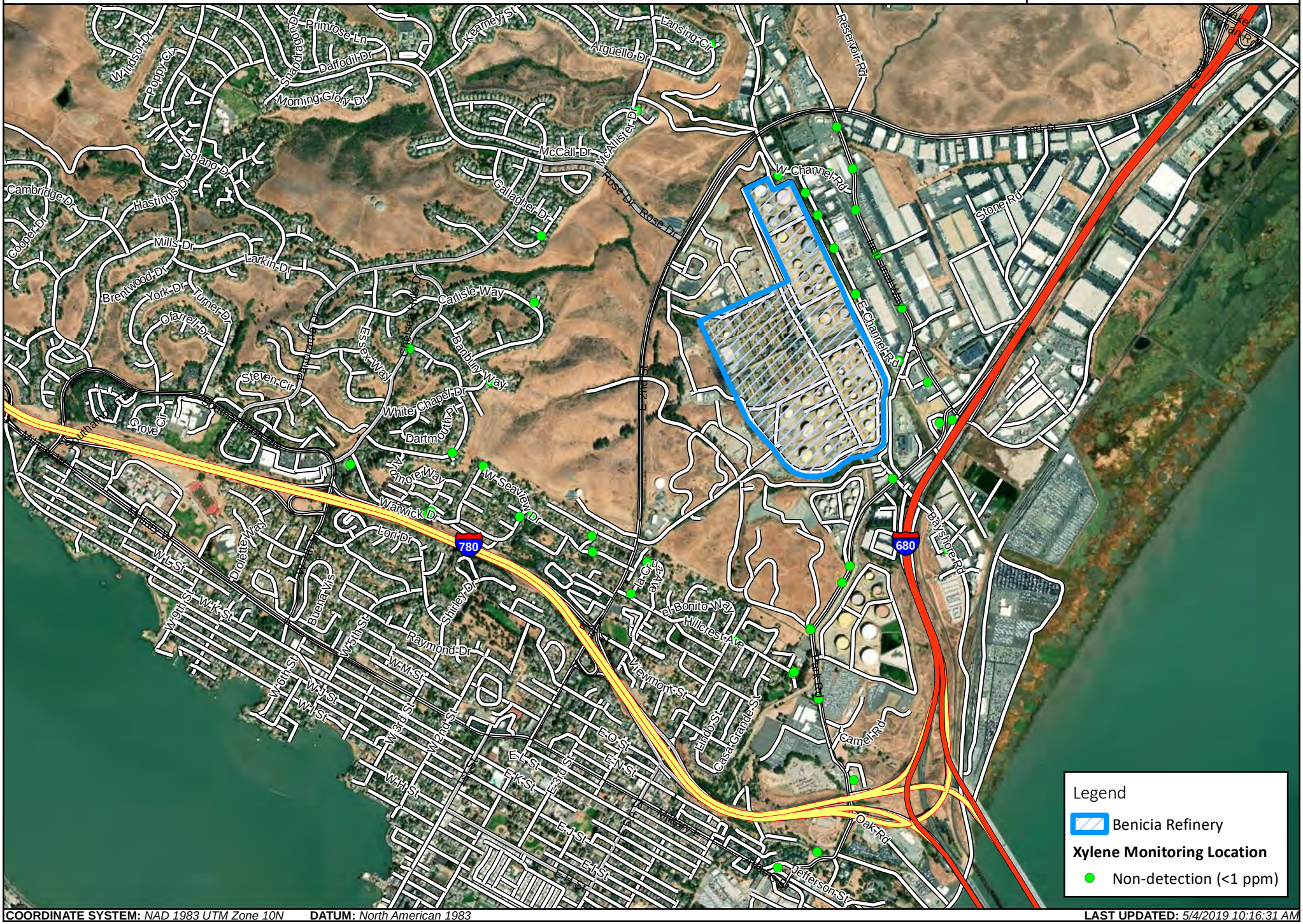
COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:15:50 AM*

Figure 11: Hand-Held Real-Time Monitoring Locations (Xylene)

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



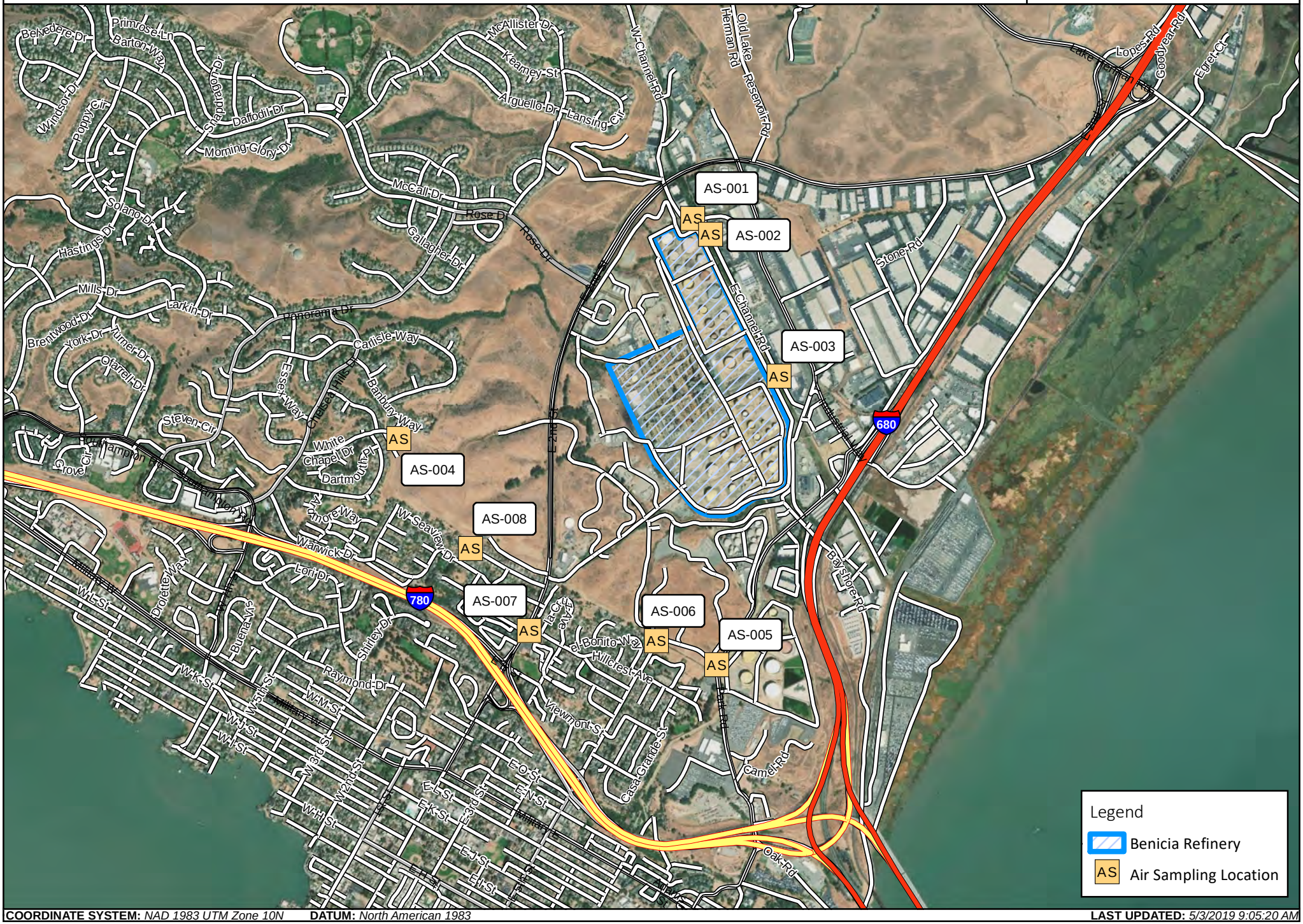
COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/4/2019 10:16:31 AM*

Figure 12: Analytical Air Sampling Locations

Benicia Refinery Startup

0 1,000 2,000 Feet

Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *5/3/2019 9:05:20 AM*

Attachment B

Meteorological Conditions

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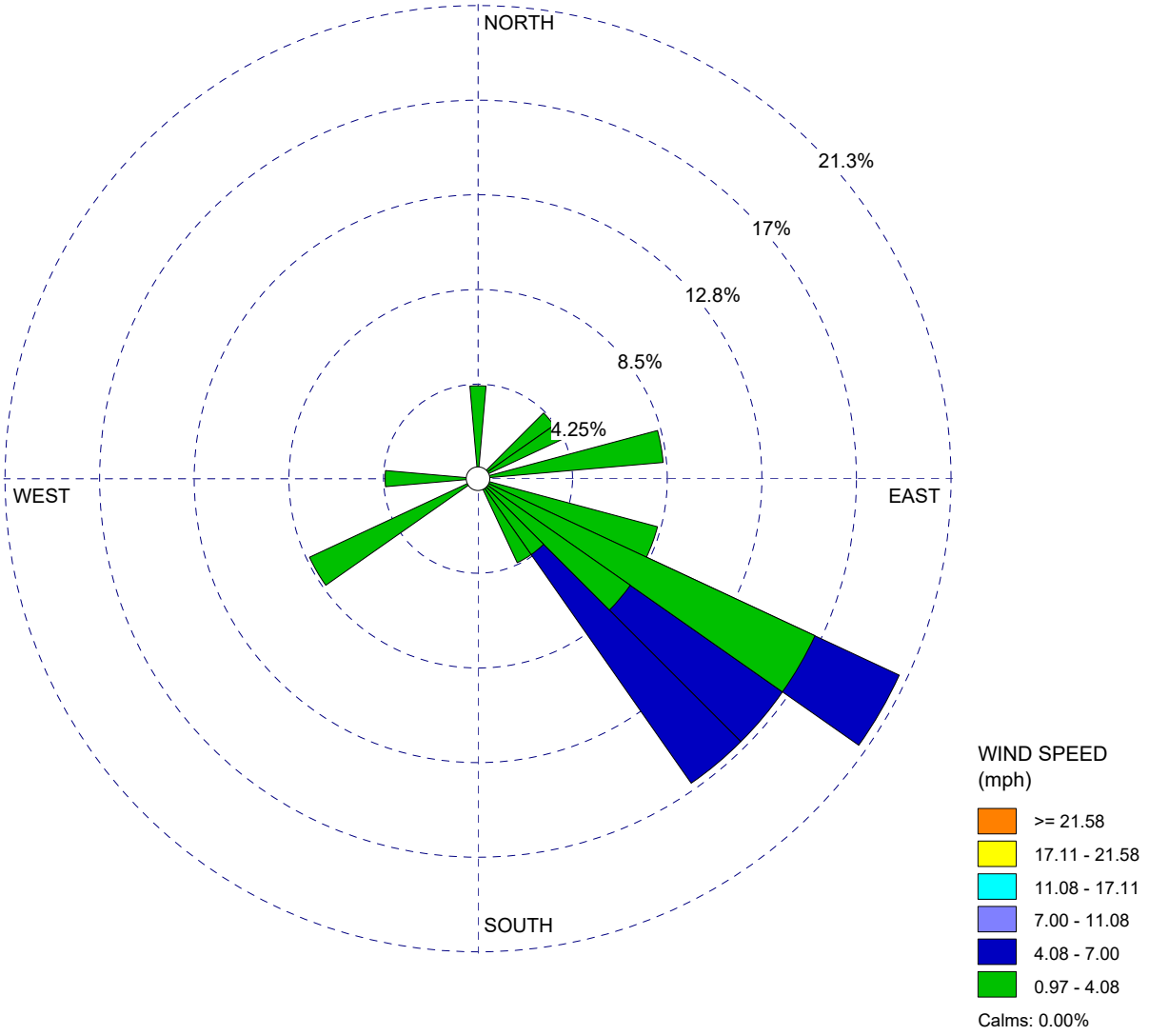
WIND ROSE PLOT:

CIMIS Meteorological Station 170 (Concord, CA)

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS:	DATA PERIOD: **Start Date: 5/3/2019 - 07:00** **End Date: 5/4/2019 - 06:00**	COMPANY NAME: **CTEH**	
		MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **24 hrs.**	
	AVG. WIND SPEED: **3.25 mph**	DATE: **5/4/2019**	PROJECT NO.: **111560**