RO2438 MacArthur St, Oakland
Vapor Mitigation Comments/ Response

Meeting Notes:

- *Pat Cullen and the State are still reviewing the need of a VMS required. ACDEH will be returning to the state to discuss the VMS.*
- *Public comment for the CAP (spot excavation and VMS during redevelopment): Ends August 2.*
- *ACDEH to request Property owner provide copy of building permits to ACDEH and Chevron by end of comment period*
- *Comments on VMS design to Chevron and Alex by July 31, 2018. Revise and submit the building permits and plans. SGMP, SMP, LUC as deliverables*
- *Corrective action Implementation Plan to be submitted by Alex and Consultant*
- *Chevron to document the installation of the VMS post installation. CQA by Chevron.*

RO454/RO3272 Center St, Oakland
Lead case

1. Review the cleanup goals for a commercial/industrial (320 mg/kg) vacant lot
2. Discuss the use of an amendment to stabile the soil rather than excavation
3. City of Oakland engagement? - *ACDEH to issue NOR*

Meeting Notes:

- *Prop 65 notice for site by August 30 2018*
- *Request for Extension to include*

1. *Request to include need for additional soil data and treatability study for amendments used to stabilize lead in soil*
2. *Upload Lead presentation to Geotracker*
3. *Provide EPA study to ACDEH*

- *Lead soil sampling and treatability study work plan proposed due date September 15*
- *ACDEH to review Geotracker SGMP to see if adequate*

UST case update and discussion

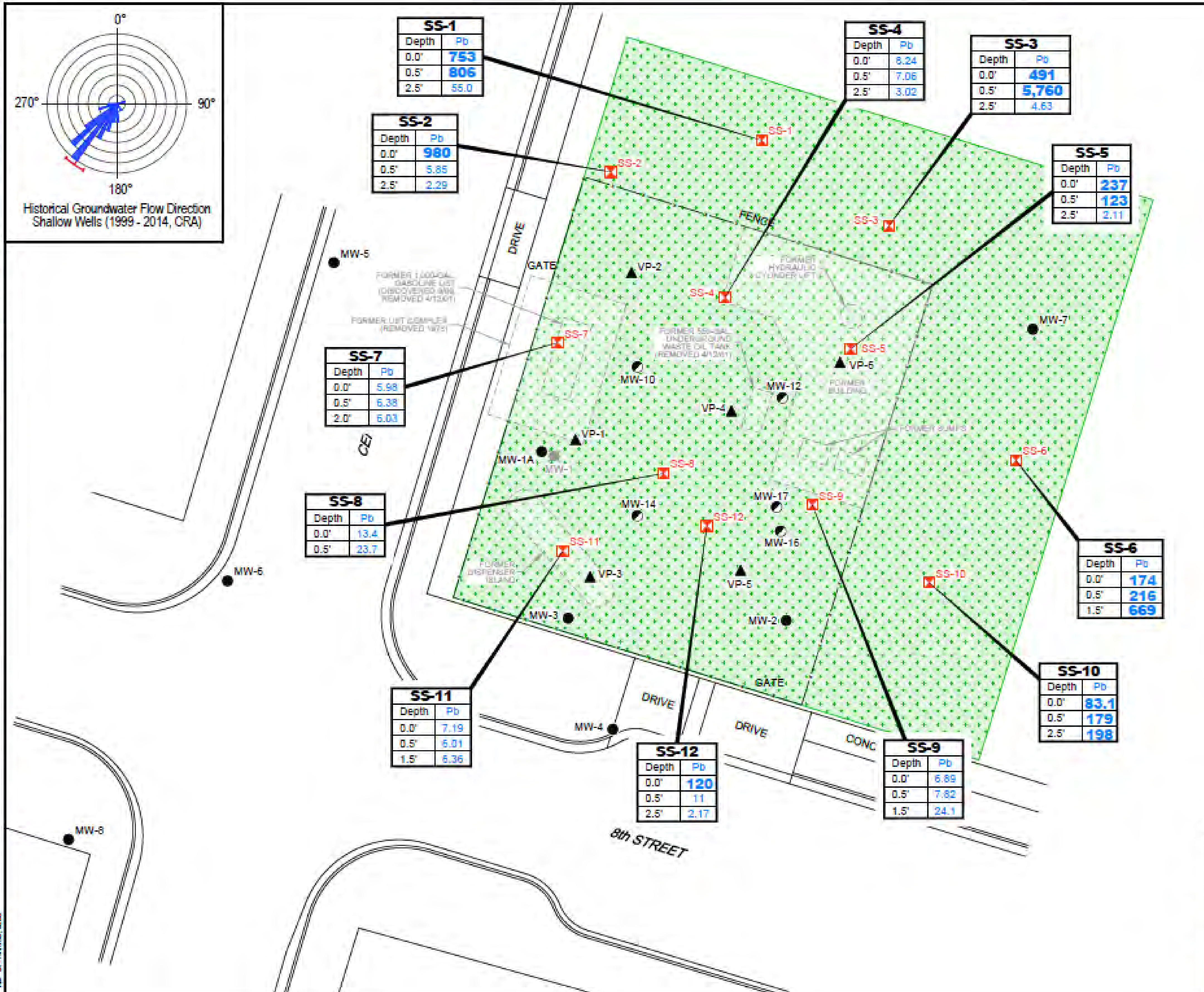
1. Instead of an IRAP complete a soil boring sampling event to evaluate ethylbenzene (314 mg/kg LTC Policy for Utility Worker and 134 mg/kg for volatilization to outdoor air) in the 5 to 10 foot zone. When we last discussed the site, there was a discussion the water level is as shallow as 2 feet below ground surface (once in 1999) recently 5 feet bgs (2017) and these detections may be submerged samples. Submerged soils would be addressed with a SGMP when site is redeveloped to protect utility workers and do not pose a risk to volatilization to outdoor air.

Meeting Notes:
ACDEH to issue request for work plan for shallow soil impacts. Evaluate submerged verses vadose and differences. Evaluate spot treatment of impacted soil and groundwater in the area of the 2014 confirmation soil borings as limited exceedances.

REGIONAL BACKGROUND LEAD

West Oakland Area Surrounding Site 206145

7/20/2018



SS-1	
Depth	Pb
0.0'	**753**
0.5'	**806**
2.5'	55.0

SS-2	
Depth	Pb
0.0'	**980**
0.5'	5.85
2.5'	2.29

SS-3	
Depth	Pb
0.0'	**491**
0.5'	**5,760**
2.5'	4.63

SS-4	
Depth	Pb
0.0'	6.24
0.5'	7.06
2.5'	3.02

SS-5	
Depth	Pb
0.0'	**237**
0.5'	**123**
2.5'	2.11

SS-6	
Depth	Pb
0.0'	**174**
0.5'	**216**
1.5'	**669**

SS-7	
Depth	Pb
0.0'	5.98
0.5'	6.38
2.0'	6.03

SS-8	
Depth	Pb
0.0'	13.4
0.5'	23.7

SS-9	
Depth	Pb
0.0'	6.89
0.5'	7.82
1.5'	24.1

SS-10	
Depth	Pb
0.0'	**83.1**
0.5'	**179**
2.5'	**198**

SS-11	
Depth	Pb
0.0'	7.19
0.5'	6.01
1.5'	6.36

SS-12	
Depth	Pb
0.0'	**120**
0.5'	11
2.5'	2.17

LEGEND

- MW-3 ● SHALLOW MONITORING WELL
- MW-12 DEEP MONITORING WELL
- MW-1 DESTROYED WELL
- VP-3 ▲ VAPOR PROBE
- SS-1 SURFICIAL SOIL SAMPLE
- VEGETATED AREA

SS-10 — SAMPLE ID
Pb ANALYZED BY EPA METHOD 6010B (mg/kg)
SAMPLE DEPTH IN FEET BELOW GROUND SURFACE

EPA	ENVIRONMENTAL PROTECTION AGENCY
Pb	LEAD
mg/kg	MILLIGRAMS PER KILOGRAM
BOLD	CONCENTRATION EXCEEDS ENVIRONMENTAL SCREENING LEVEL (SEE NOTE 2)

NOTES:

1. BASE MAP PROVIDED BY CRA, DATED 1/27/2017.
2. ENVIRONMENTAL SCREENING LEVEL FOR LEAD IS 80 mg/kg FOR DIRECT SOIL EXPOSURE IN A RESIDENTIAL SETTING AND 320 mg/kg IN A COMMERCIAL SETTING (FROM THE ENVIRONMENTAL SCREENING LEVEL WORKBOOK PREPARED BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD - SAN FRANCISCO BAY REGION, REVISED FEBRUARY 2016).

0 20' 40'
GRAPHIC SCALE

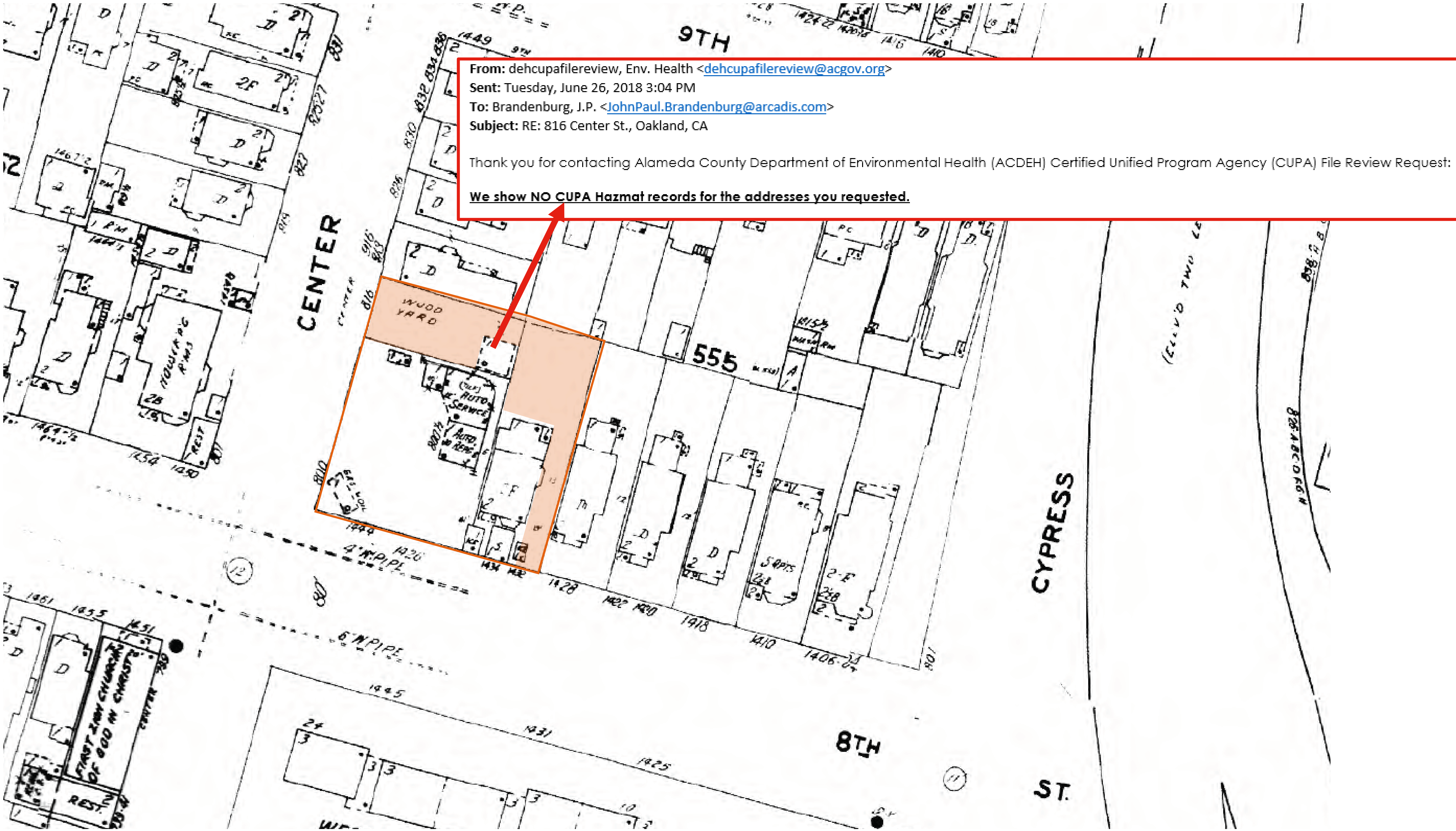
SITE NO. 206145
800 CENTER STREET
OAKLAND, CALIFORNIA

SITE PLAN SHOWING LEAD DETECTIONS JANUARY 27, 2010

ARCADIS

FIGURE 3

1967



From: dehcupafilereview, Env. Health <dehcupafilereview@acgov.org>
Sent: Tuesday, June 26, 2018 3:04 PM
To: Brandenburg, J.P. <JohnPaul.Brandenburg@arcadis.com>
Subject: RE: 816 Center St., Oakland, CA
Thank you for contacting Alameda County Department of Environmental Health (ACDEH) Certified Unified Program Agency (CUPA) File Review Request:
We show NO CUPA Hazmat records for the addresses you requested.
9TH
CENTER
WOOD YARD
555
CYPRESS
8TH
ST.

1961

Design & Consultancy for natural and built assets

1958


9TH
ST.
CENTER
555
CYPRESS
8TH
ST
THE FIRST CHURCH OF GOD IN CHRIST

1957

ARCADIS Design & Consultancy for natural and built assets

1952

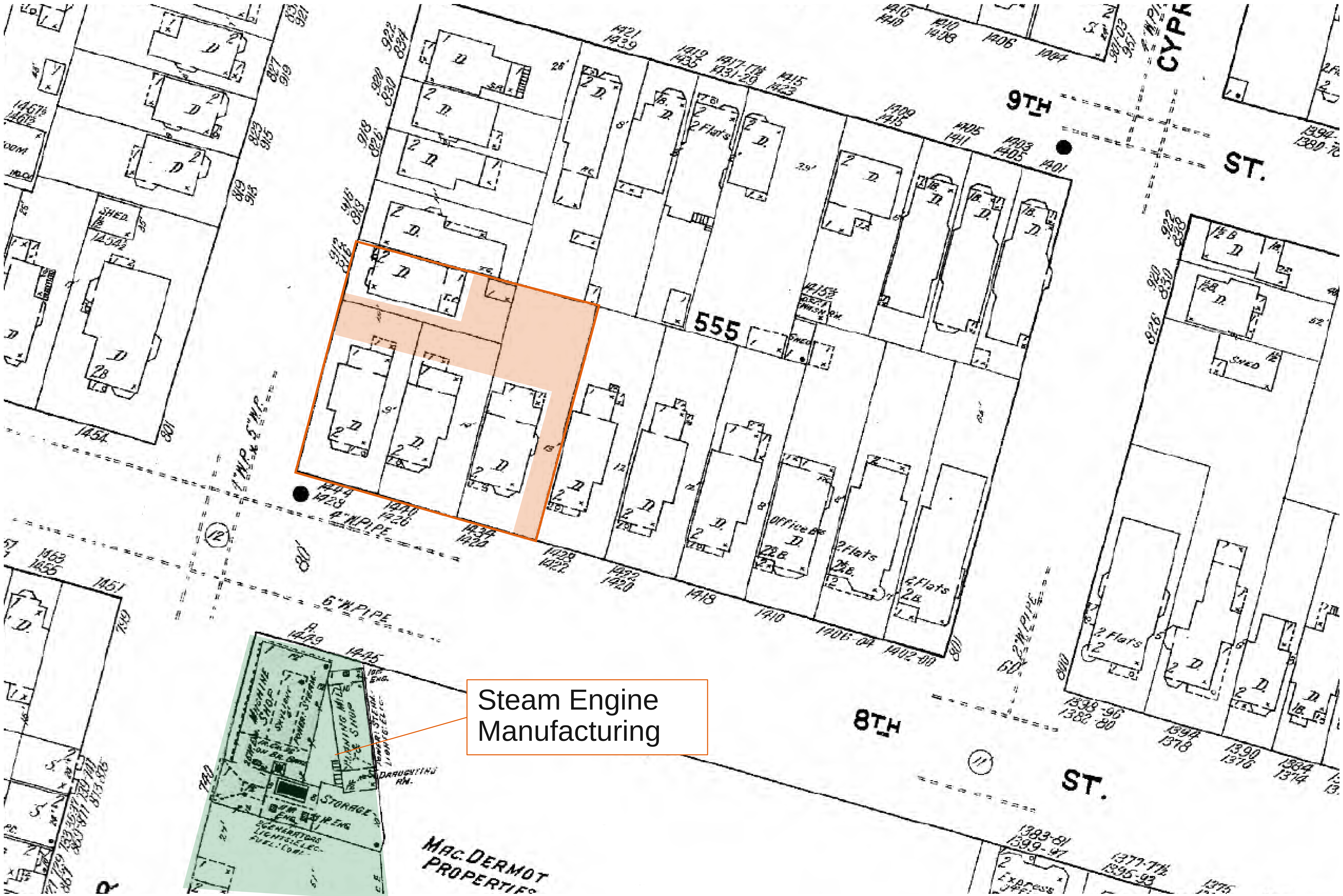

CENTER
CYPRESS
9TH
ST.
8TH
ST.
555
2 Flats
The First Church of God in Christ

1951

Design & Consultancy
for natural and
built assets

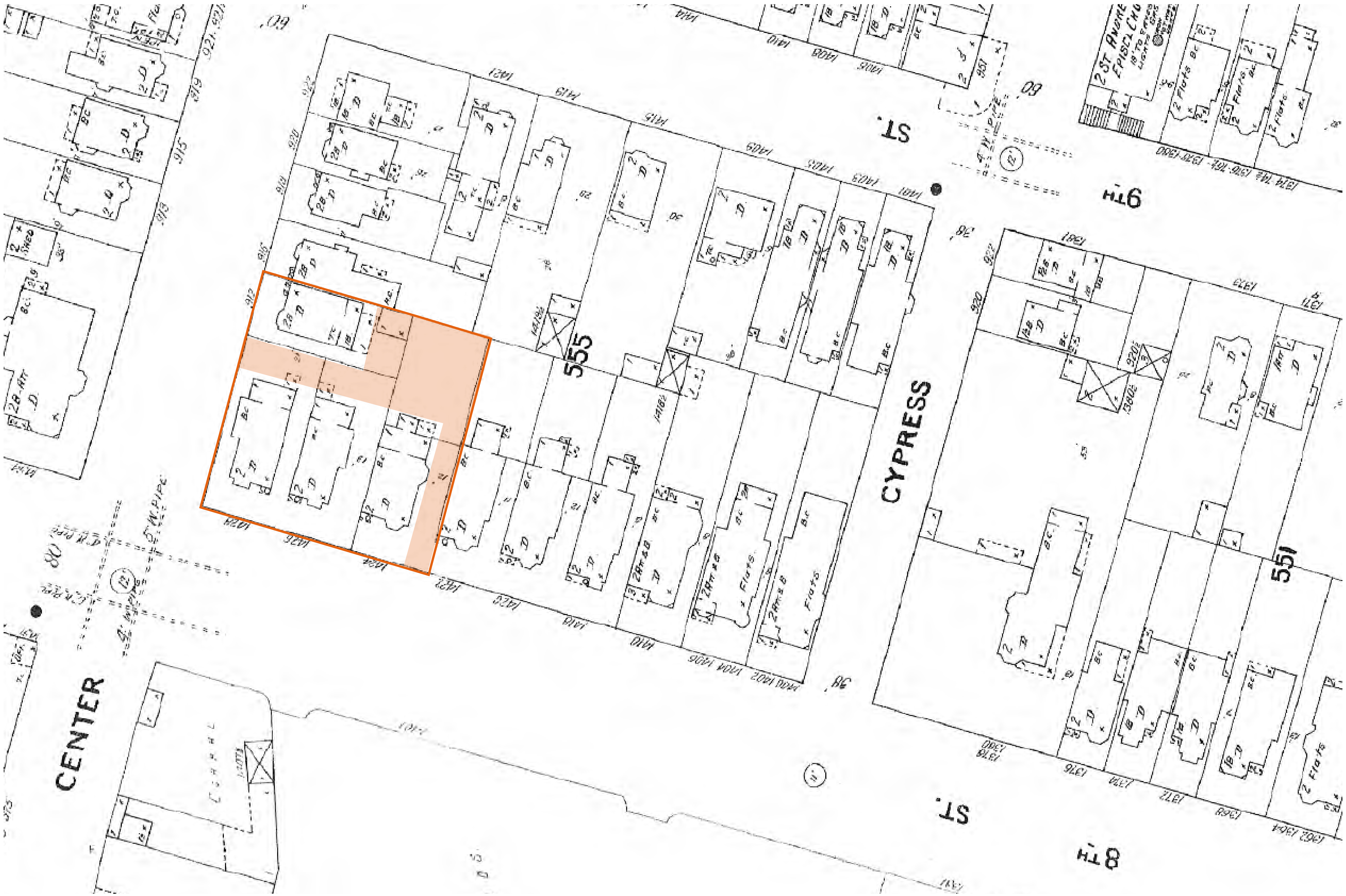
1912

Design & Consultancy for natural and built assets



1902

ARCADIS Design & Consultancy for natural and built assets



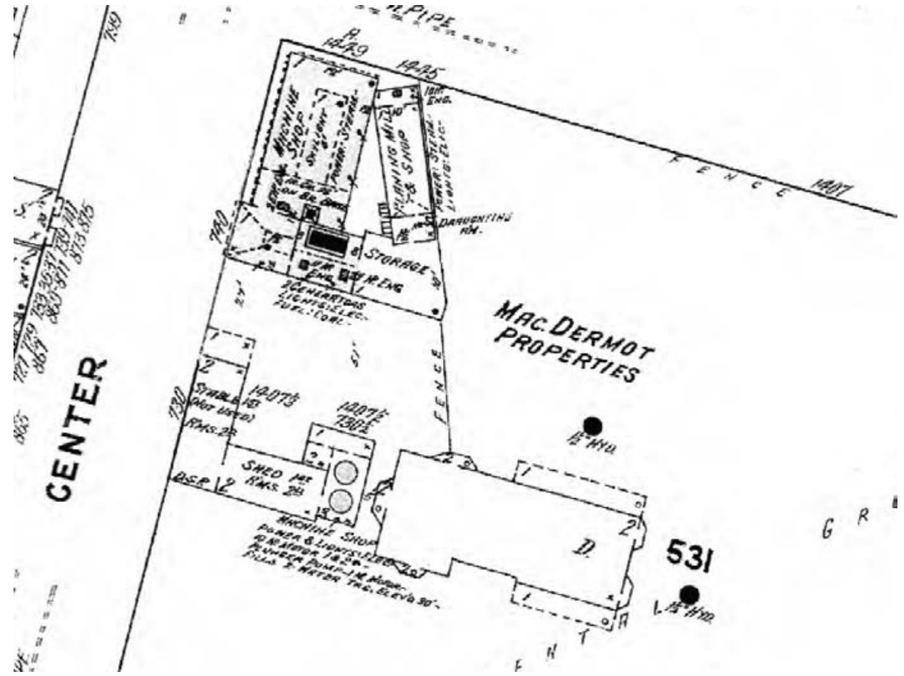
1889

Across 8th from site in 1912

https://localwiki.org/oakland/MacDermot_Mansion

http://web.sonoma.edu/asc/cypress/finalreport/chapter02.pdf

http://www.sfmuseum.net/hist9/overfair.html



Locomotive from Overfair Railway

https://sprr.calpoly.edu/making-swanton-pacific-railroad

ARCADIS Design & Consultancy for natural and built assets

LEGEND

☆ SITE LOCATION

● IDENTIFIED LOCATION

0 1500' 3000'

GRAPHIC SCALE

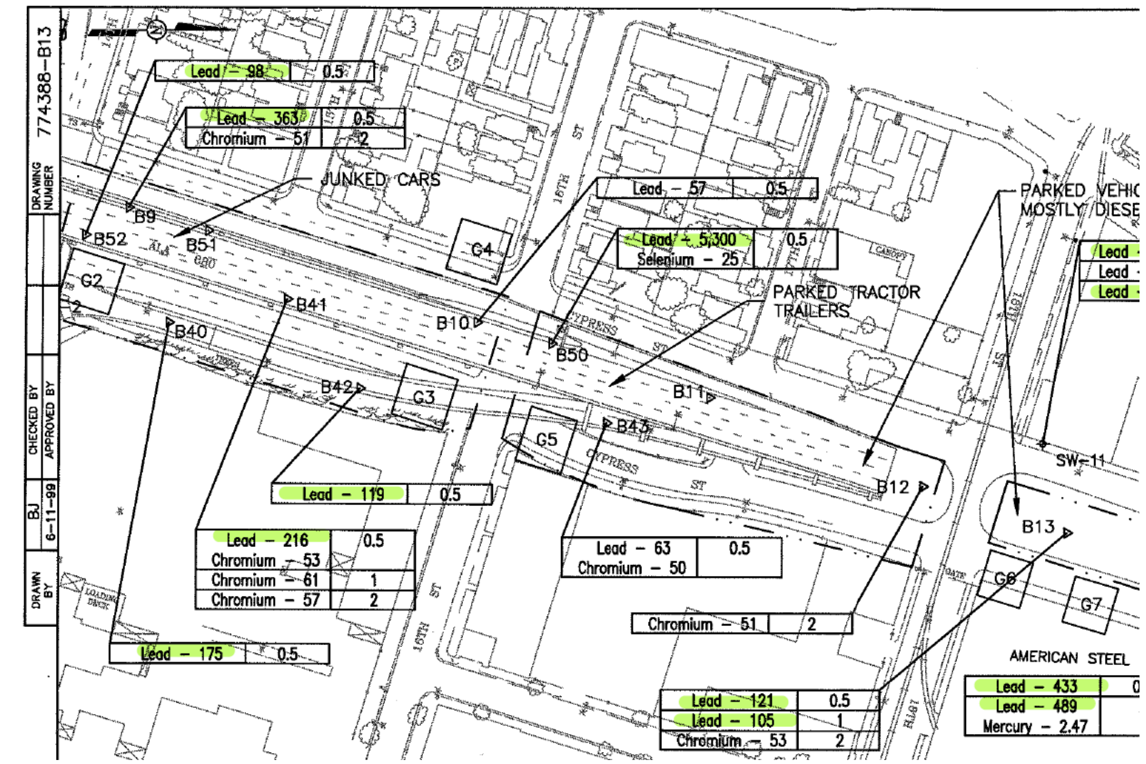
SITE NO. 206145
800 CENTER STREET
OAKLAND, CALIFORNIA

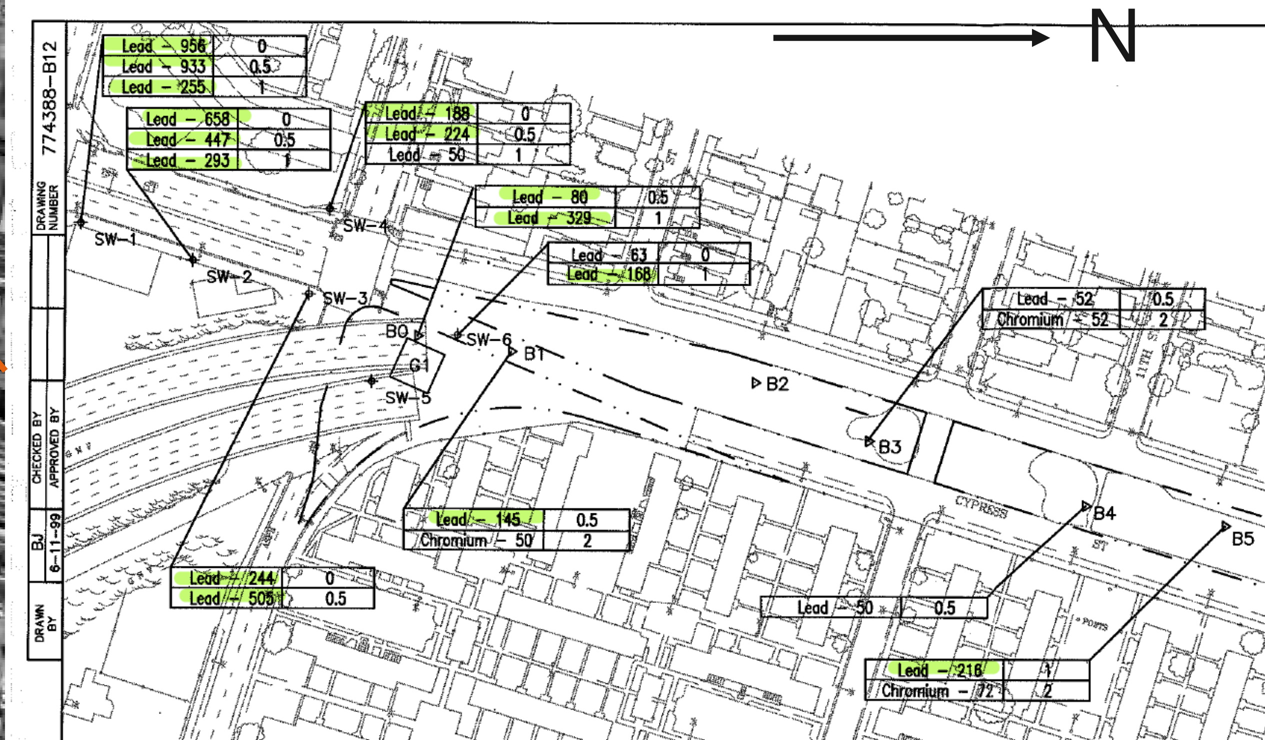
OFFSITE Pb CASES

ARCADIS

FIGURE 2

Mandela Parkway Corridor





MANDELA PARKWAY CORRIDOR (01410118)

SIGN UP FOR EMAIL ALERTS

MANDELA PARKWAY BETWEEN 34TH AND 8TH STS
OAKLAND, CA 94607
ALAMEDA COUNTY
SITE TYPE: VOLUNTARY CLEANUP

SUPERVISOR: MARK PIROS
OFFICE: CLEANUP BERKELEY
CENSUS TRACT: 6001410500
CALENVIROSCREEN PERCENTILE SCORE: 81-85%

Summary | Activities | Community Involvement | Site/Facility Docs | Map | Related Sites | CalEnviroScreen

Site Information

CLEANUP STATUS
CERTIFIED AS OF 6/28/2007

SITE TYPE: VOLUNTARY CLEANUP
NATIONAL PRIORITIES LIST: NO
ACRES: 10.3 ACRES
APN: NONE SPECIFIED
CLEANUP OVERSIGHT AGENCIES:
DTSC - SITE CLEANUP PROGRAM - LEAD AGENCY

ENVIROSTOR ID: 01410118
SITE CODE: 201078
SPECIAL PROGRAM: VOLUNTARY CLEANUP PROGRAM
FUNDING: SITE PROPONENT
ASSEMBLY DISTRICT: 18
SENATE DISTRICT: 09

Regulatory Profile

PAST USE(S) THAT CAUSED CONTAMINATION
HIGHWAY RIGHT-OF-WAY

POTENTIAL CONTAMINANTS OF CONCERN
LEAD
TPH-MOTOR OIL

POTENTIAL MEDIA AFFECTED
SOIL

Site History

The site is the Mandela Parkway (formerly Cypress Street) median area and other features associated with the former Cypress Freeway located between 8th and 34th Streets. The properties were acquired by Caltrans between 1934 and 1936. After acquisition, a double-deck freeway (Cypress Structure) was constructed in 1957. The area below the Cypress Structure was composed of both paved and unpaved surfaces and was leased to businesses primarily for equipment storage. During the 1989 Loma Prieta earthquake, the structure was damaged and subsequently demolished. The City of Oakland has proposed landscape improvements, and pedestrian and bicycle trails.

Mandela Parkway Corridor - Remedial Investigation

Soil samples collected from the site were reported to contain antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, vanadium, zinc, and cyanide. Only antimony, lead, and mercury were reported in soil samples at concentrations that exceeded their respective U.S. EPA, Region 9, residential soil PRGs. The source for the lead is likely accumulations of leaded gasoline emissions. Some of the lead may also be associated with the TPHmo present in the soil from waste oil releases. Heavy metal concentrations were compared to total threshold limit concentrations (TTLC), soluble threshold limit concentrations (STLC), and toxicity characteristic leaching procedure (TCLP) values to evaluate whether the soil would, should it become a waste, be considered a hazardous waste. Only lead was reported to exceed TTLC, STLC, and TCLP values.

Heavy Metal	10 Times STLC (mg/l)	Number Samples at or Exceeding 10 Times STLC	TTLC (mg/kg)	Number Samples Exceeding TTLC	Concentration Range (mg/kg)
Lead	50	102	1,000	6	<1.0 to 5,730
Copper	250	2	2,500	0	<2.0 to 730
Mercury	2	3	20	1	<0.010 to 33.9
Selenium	10	1	100	0	<10 to 25

Heavy Metals

Heavy metal analyses were conducted on 273 soil samples. This included analysis for the 17 CAM Metals in 159 soil samples and lead in 114 soil samples. The soil samples were reported to contain antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, vanadium, and zinc (Table 6). Lead was reported in certain soil samples at concentrations that exceeded the U.S. EPA, Region 9, residential soil PRG of 400 mg/kg (EPA, 1998). Lead concentrations ranged from less than 1.0 mg/kg to 5,730 mg/kg. Antimony and mercury were reported at concentrations in excess of their respective U.S. EPA, Region 9, residential soil PRGs in borings B-48 (antimony at 56 mg/kg) and B-44 (mercury at 33.9 mg/kg) (Table 6). The residential soil PRGs for antimony and mercury are 30 and 22 mg/kg, respectively. Hexavalent chromium analyses were conducted on 10 soil samples. Hexavalent chromium was not detected at concentrations exceeding the method reporting limit.

INORGANIC RESULTS - SOIL

Caltrans - Mandela Parkway Median Investigation

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Boring Number	Sample Depth (m)	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Cyanide
B-0	0.5	1.6	ND	ND	226	0.39	ND	30		17	62	**80**	0.165	ND	45	ND	ND	ND	46	101	
	1	3.3	ND	ND	173	ND	ND	34		6.1	44	**329**	0.255	ND	26	ND	ND	ND	28	192	
	2	6.6	ND	ND	69	0.30	ND	48		8.2	18	10	0.028	ND	42	ND	ND	ND	35	33	
	3	9.8																			
B-1	0.5	1.6	ND	ND	126	ND	ND	28		7.9	44	**145**	0.132	ND	28	ND	ND	ND	43	105	
	1	3.3	ND	ND	335	0.59	ND	21		11	92	33	0.11	ND	36	ND	ND	ND	71	118	
	2	6.6	ND	ND	37	0.34	ND	50		12	16	5.4	0.031	ND	45	ND	ND	ND	37	29	
	3	9.8																			
	ER		ND	ND	ND	ND	ND	ND		ND	ND	ND	0.00027	ND	ND	ND	ND	ND	ND	ND	
B-2	0.5	1.6	ND	ND	78	0.36	ND	40		6.8	29	31	0.057	ND	38	ND	ND	ND	33	80	ND
	1	3.3	ND	ND	79	ND	ND	36		7.0	32	36	0.137	ND	35	ND	ND	ND	29	75	ND
	2	6.6	ND	ND	65	ND	ND	44		6.2	22	4.1	0.022	ND	4.4	ND	ND	ND	31	32	ND
	3	9.8																			ND
B-3	0.5	1.6	ND	ND	137	0.39	ND	20		5.5	30	**52**	0.195	ND	20	ND	ND	ND	18	59	
	1	3.3	ND	ND	36	ND	ND	31		ND	11	2.7	0.027	ND	21	ND	ND	ND	20	41	
	2	6.6	ND	ND	63	0.33	ND	52		8.8	14	3.9	0.029	ND	48	ND	ND	ND	38	29	
	3	9.8																			
B-4	0.5	1.6	ND	ND	73	ND	ND	29		ND	20	**50**	0.093	ND	20	ND	ND	ND	21	87	ND
	1	3.3	ND	ND	78	ND	ND	32		5.7	18	48	0.056	ND	22	ND	ND	ND	25	106	ND
	2	6.6	ND	ND	62	0.31	ND	45		6.4	12	4.7	0.023	ND	47	ND	ND	ND	32	26	ND
	3	9.8																			ND
B-5	0.5	1.6	ND	ND	30	ND	ND	7.4		ND	18	27	0.111	ND	11	ND	ND	ND	18	25	
	1	3.3	ND	ND	143	ND	ND	26		ND	53	**216**	0.194	ND	18	ND	ND	ND	18	269	
	2	6.6	ND	ND	41	0.32	ND	72		5.2	21	5.6	0.030	ND	53	ND	ND	ND	33	29	
	3	9.8																			
B-6	0.5	1.6	ND	ND	11	ND	ND	30		ND	8.0	1.7	0.080	ND	26	ND	ND	ND	21	15	ND
	1	3.3	ND	ND	23	ND	ND	31		ND	10	3.3	0.024	ND	25	ND	ND	ND	22	19	ND
	2	6.6	ND	ND	55	ND	ND	40		5.5	15	4.5	0.021	ND	42	ND	ND	ND	28	26	ND
	3	9.8																			ND
B-7	0.5	1.6	ND	ND	ND	ND	ND	1.2		5.1	19	1.1	0.174	ND	5.1	ND	ND	ND	21	50	ND
	1	3.3	ND	ND	78	ND	ND	28		ND	13	16	0.065	ND	17	ND	ND	ND	20	27	ND
	2	6.6	ND	ND	42	0.32	ND	39		11	18	5.4	0.028	ND	40	ND	ND	ND	30	24	ND
	3	9.8																			ND
B-8	0.5	1.6	ND	ND	128	ND	ND	29		5.7	23	**79**	0.167	ND	22	ND	ND	ND	24	53	ND
	1	3.3	ND	ND	31	ND	ND	25		ND	9.2	3.2	0.023	ND	14	ND	ND	ND	18	13	ND
	2	6.6	ND	ND	41	ND	ND	44		ND	13.0	5.4	0.020	ND	31	ND	ND	ND	24	21	ND
	3	9.8																			ND
B-9	0.5	1.6	ND	ND	325	0.62	ND	26		7.7	86	**363**	0.158	ND	35	ND	ND	ND	33	250	ND
	1	3.3	ND	ND	66	0.33	ND	48		5.2	7.4	5.0	0.058	ND	36	ND	ND	ND	34	22	ND
	2	6.6	ND	ND	81	ND	ND	51		7.2	8.8	4.4	0.043	ND	47	ND	ND	ND	32	25	ND
	3	9.8																			ND
B-10	0.5	1.6	ND	ND	50	0.31	ND	15		ND	20	**57**	0.440	ND	18	ND	ND	ND	20	55	
	1	3.3	ND	ND	25	ND	ND	32		ND	4.1	2.8	0.024	ND	26	ND	ND	ND	25	16	
	2	6.6	ND	ND	55	ND	ND	28		ND	4.6	4.7	0.026	ND	24	ND	ND	ND	22	17	
	3	9.8																			
B-11	0.5	1.6	ND	ND	62	0.78	ND	36		7.5	13	10	0.654	ND	31	ND	ND	ND	33	43	ND
	1	3.3	ND	ND	58	0.36	ND	40		7.4	20	4.7	0.032	ND	43	ND	ND	ND	31	30	ND
	2	6.6	ND	ND	58	ND	ND	38		7.4	8.9	4.3	0.034	ND	40	ND	ND	ND	32	25	ND
	3	9.8																			ND
B-12	0.5	1.6	ND	ND	76	ND	ND	39		5.3	7.9	4.1	0.945	ND	22	ND	ND	ND	29	19	
	1	3.3	ND	ND	70	ND	ND	36		ND	6.6	3.6	0.032	ND	19	ND	ND	ND	24	16	
	2	6.6	ND	ND	60	ND	ND	51		ND	6.6	4.2	0.045	ND	31	ND	ND	ND	28	23	
	3	9.8																			
B-13	0.5	1.6	ND	ND	66	ND	1.2	31		6.4	23	**121**	0.219	ND	32	ND	ND	ND	27	124	ND
	1	3.3	ND	ND	128	0.34	ND	30		6.8	23	**105**	0.184	ND	20	ND	ND	ND	26	56	ND
	2	6.6	ND	ND	79	0.30	ND	53		5.6	9.5	4.0	0.035	ND	24	ND	ND	ND	31	19	ND
	3	9.8																			ND
B-14	0.5	1.6	ND	11	203	0.40	0.88	30		8.8	89	**433**	1.32	ND	34	ND	ND	ND	32	307	
	1	3.3	ND	ND	12	ND	ND	24		ND	4.3	5.3	0.061	ND	14	ND	ND	ND	16	15	
	2	6.6	ND	15	134	ND	ND	39		7.6	46	**489**	**2.47**	ND	32	ND	ND	ND	32	147	
	3	9.8																			
B-15	0.5	1.6	ND	ND	67	0.55	ND	27		6.0	20	14	0.365	ND	27	ND	ND	ND	24	49	ND
	1	3.3	ND	ND	11	ND	ND	30		ND	6.0	2.8	0.024	ND	20	ND	ND	ND	23	27	ND
	2	6.6	ND	ND	23	ND	ND	28		6.7	7.4	2.9	0.023	ND	30	ND	ND	ND	21	27	ND
	3	9.8																			ND
B-16	0.5	1.6	ND	ND	99	ND	ND	28		7.2	38	**69**	0.063	ND	32	ND	ND	ND	30	108	
	1	3.3	ND	ND	20	ND	ND	36		5.0	15	3.6	0.016	ND	27	ND	ND	ND	29	55	
	2	6.6	ND	ND	109	0.49	ND	12		ND	8.8	**91**	0.074	ND	13	ND	ND	ND	17	26	
	3	9.8																			
	ER		ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

TABLE 6

INORGANIC RESULTS - SOIL
Caltrans - Mandela Parkway Median Investigation

Boring Number	Sample Depth (m)	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Cyanide
B-17	0.5	1.6	ND	ND	80	ND	ND	32		6.7	40	44	0.038	ND	37	ND	ND	ND	29	83	
	1	3.3	9.6	ND	39	0.31	ND	42		6.2	82	412	0.029	ND	38	ND	ND	ND	35	177	
	2	6.6	ND	ND	7.8	ND	ND	16		ND	2.2	2.5	0.0085	ND	9.3	ND	ND	ND	10	10	
	3	9.8																			
B-18	0.5	1.6	7.9	18	110	0.38	0.60	36		15	89	1,170	0.23	ND	64	ND	ND	ND	34	616	
	1	3.3	ND	ND	38	ND	ND	42		ND	86	18	0.057	ND	28	ND	ND	ND	39	55	
	2	6.6	ND	ND	28	0.34	ND	44		7.9	16	7.3	0.038	ND	45	ND	ND	ND	37	41	
	3	9.8																			
B-19	0.5	1.6	ND	ND	60	0.62	ND	22		6.8	20	10	0.56	ND	29	ND	ND	ND	25	44	
	1	3.3	ND	ND	206	0.48	ND	30		7.8	48	288	0.015	ND	36	ND	ND	ND	30	131	
	2	6.6	ND	ND	112	0.39	ND	34		8.8	28	7.2	0.026	ND	48	ND	ND	ND	31	54	
	3	9.8																			
B-20	0.5	1.6	ND	ND	63	0.69	ND	22		6.9	22	10	1.45	ND	24	ND	ND	ND	22	33	ND
	1	3.3	ND	ND	13	ND	ND	2.0		6.4	27	2.6	0.021	ND	5.7	ND	ND	ND	18	17	ND
	2	6.6	ND	12	430	0.57	ND	7.7		2.6	132	326	0.5	ND	7.7	ND	ND	ND	30	228	ND
	3	9.8																			ND
B-21	0.5	1.6	ND	12	749	0.36	ND	29		7.9	81	162	0.48	ND	34	ND	ND	ND	32	176	
	1	3.3	ND	ND	693	0.79	0.78	18		6.3	122	849	1.6	ND	21	ND	ND	ND	38	455	
	2	6.6	ND	17	598	0.59	ND	11		ND	51	340	1.4	ND	12	ND	ND	ND	22	133	
	3	9.8																			
B-22	0.5	1.6	ND	ND	88	ND	ND	27		9.6	61	149	0.23	ND	24	ND	ND	ND	28	121	
	1	3.3	ND	ND	281	0.36	0.82	27		6.7	88	619	0.47	ND	36	ND	ND	ND	26	477	
	2	6.6	ND	13	779	1.0	ND	14		ND	267	848	0.67	ND	15	ND	ND	ND	29	284	
	3	9.8																			
B-22S	0.5	1.6							ND												
	1	3.3							ND												
B-23	0.5	1.6	ND	ND	72	0.54	ND	26		7.2	28	44	0.83	ND	30	ND	ND	ND	23	64	ND
	1	3.3	ND	ND	46	ND	ND	40		6.3	20	12	0.10	ND	36	ND	ND	ND	25	50	ND
	2	6.6	ND	ND	25	0.36	ND	49		9.2	34	5.4	0.023	ND	54	ND	ND	ND	44	48	ND
	3	9.8																			ND
B-23S	0.5	1.6							ND												
	1	3.3							ND												
B-24	0.5	1.6	ND	ND	81	1.1	ND	31		10	12	11	0.720	ND	34	ND	ND	ND	32	52	
	1	3.3	ND	ND	118	0.39	ND	29		6.3	16	89	0.510	ND	25	ND	ND	ND	22	78	
	2	6.6	ND	13	23	ND	ND	33		ND	16	4.1	0.029	ND	24	ND	ND	ND	28	22	
	3	9.8																			
B-25	0.5	1.6	ND	ND	40	0.33	ND	42		7.3	14	5.0	0.190	ND	43	ND	ND	ND	34	40	
	1	3.3	ND	ND	223	ND	0.72	29		5.6	179	653	0.060	ND	28	ND	ND	ND	28	396	
	2	6.5	ND	ND	209	0.36	1.4	28		6.6	135	276	0.160	ND	30	ND	ND	ND	30	415	
	3	9.8																			
B-26	0.5	1.6	ND	ND	77	0.62	ND	28		8.1	12	14	0.750	ND	29	ND	ND	ND	28	42	ND
	1	3.3	ND	ND	95	ND	ND	30		ND	8.6	34	0.055	ND	16	ND	ND	ND	21	29	ND
	2	6.6	ND	ND	42	ND	ND	38		6.4	8.3	5.3	0.015	ND	33	ND	ND	ND	23	23	ND
	3	9.8																			ND
B-27	0.5	1.6	ND	ND	70	0.69	ND	36		7.6	20	18	0.89	ND	45	ND	ND	ND	23	40	
	1	3.3	ND	ND	200	0.35	ND	18		5.3	40	124	0.28	ND	30	ND	ND	ND	44	104	
	2	6.6	ND	ND	36	0.38	ND	51		9.2	32	8.6	0.035	ND	52	ND	ND	ND	44	46	
	3	9.8																			
B-28	0.5	1.6	ND	ND	62	0.43	ND	23		6.0	40	496	0.0043	ND	27	ND	ND	ND	23	0.25	
	1	3.3	ND	ND	36	ND	ND	23		ND	14	2.1	0.0072	ND	17	ND	ND	ND	17	12	
	2	6.5	ND	ND	31	0.43	ND	57		8.7	39	5.9	0.021	ND	54	ND	ND	ND	55	48	
	3	9.8																			
	ER		ND	ND	ND	ND	ND	ND		ND	ND	ND	0.0033	ND	ND	ND	ND	ND	ND	ND	
B-28S	0.5	1.6							ND												
	1	3.3							ND												
B-29	0.5	1.6	ND	ND	145	0.35	0.84	36		9.1	36	67	0.57	ND	37	ND	ND	ND	33	109	ND
	1	3.3	ND	ND	14	ND	ND	12		ND	9.0	3.6	0.013	ND	11	ND	ND	ND	10	13	ND
	2	6.6	ND	ND	30	0.38	ND	50		9.2	34	7.0	0.038	ND	51	ND	ND	ND	50	45	ND
	3	9.8																			ND
B-30	0.5	1.6	ND	ND	141	0.32	ND	31		12	43	85	0.51	ND	37	ND	ND	ND	35	87	
	1	3.3	ND	ND	200	ND	ND	28		ND	21	811	0.19	ND	16	ND	ND	ND	22	194	
	2	6.6	ND	ND	121	0.47	0.74	34		5.3	35	11	0.024	ND	35	ND	ND	ND	42	68	
	3	9.8																			
B-30S	0.5	1.6							ND												
	1	3.3							ND												
B-31	0.5	1.6	ND	ND	116	ND	ND	32		ND	15	172	0.152	ND	22	ND	ND	ND	24	152	0.143
	1	3.3	ND	ND	33	ND	ND	26		3.6	5.1	2.0	0.019	ND	17	ND	ND	ND	20	12	ND
	2	6.6	ND	ND	52	ND	ND	40		7.2	10	4.6	0.080	ND	41	ND	ND	ND	28	24	ND
	3	9.8																			ND

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TABLE 6

INORGANIC RESULTS - SOIL

Caltrans - Mandela Parkway Median Investigation

Boring Number	Sample Depth (m)	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Cyanide
B-32	0.5	1.6	ND	ND	130	0.30	ND	27		5.4	122	**180**	0.314	ND	21	ND	ND	ND	23	152	0.121
	1	3.3	ND	ND	48	0.35	ND	48		6.5	17	4.2	0.035	ND	40	ND	ND	ND	34	26	ND
	2	6.6	ND	ND	62	ND	ND	40		6.5	15	3.1	0.022	ND	42	ND	ND	ND	30	25	ND
	3	9.8																			ND
B-33	0.5	1.6	ND	ND	73	ND	ND	33		ND	15	17	0.054	ND	21	ND	ND	ND	24	40	ND
	1	3.3	ND	ND	65	0.35	ND	49		5.3	21	3.9	0.033	ND	39	ND	ND	ND	33	27	ND
	2	6.6	ND	ND	560	ND	ND	41		6.4	12	3.2	0.026	ND	41	ND	ND	ND	23	25	ND
	3	9.8																			ND
B-34	0.5	1.6	ND	ND	108	ND	ND	31		5.2	26	69	0.121	ND	20	ND	ND	ND	22	87	ND
	1	3.3	ND	ND	64	0.31	ND	45		ND	16	3.2	0.043	ND	36	ND	ND	ND	34	27	ND
	2	6.6	ND	ND	74	0.31	ND	40		7.0	16	3.5	0.024	ND	46	ND	ND	ND	30	27	ND
	3	9.8																			ND
B-35	0.5	1.6	ND	ND	81	ND	ND	41		7.5	20	25	0.083	ND	44	ND	ND	ND	31	56	0.176
	1	3.3	ND	ND	64	0.38	ND	53		ND	14	3.7	0.038	ND	36	ND	ND	ND	32	23	ND
	2	6.6	ND	ND	68	0.31	ND	44		8.3	16	2.6	0.024	ND	47	ND	ND	ND	32	24	ND
	3	9.8																			ND
B-36	0.5	1.6	ND	ND	181	0.33	ND	32		8.4	50	**256**	0.166	ND	29	ND	ND	ND	27	206	
	1	3.3	ND	ND	216	0.50	ND	36		8.2	30	8.6	0.031	ND	26	ND	ND	ND	38	41	
	2	6.6	ND	ND	106	0.41	ND	28		7.9	16	3.9	0.026	ND	17	ND	ND	ND	26	23	
	3	9.8																			
B-37	0.5	1.6	ND	ND	93	ND	ND	29		11	49	14	0.026	ND	28	ND	ND	ND	23	69	
	1	3.3	ND	ND	132	ND	1.2	33		6.9	141	**171**	0.184	ND	41	ND	ND	ND	120	5.2	
	2	6.6	ND	ND	114	0.49	ND	37		6.9	26	5.7	0.030	ND	33	ND	ND	ND	36	43	
	3	9.8																			
B-38	0.5	1.6	ND	ND	181	0.65	ND	28		14	56	14	0.080	ND	46	ND	ND	ND	31	81	ND
	1	3.3	ND	ND	123	0.47	ND	34		9.3	29	32	0.179	ND	40	ND	ND	ND	41	53	ND
	2	6.6	ND	ND	69	0.47	ND	36		5.8	24	4.8	0.033	ND	30	ND	ND	ND	32	36	ND
	3	9.8																			ND
	ER		ND	ND	ND	ND	ND	ND		ND	ND	ND	0.00027	ND	ND	ND	ND	ND	ND	ND	
B-39	0.5	1.6	ND	ND	59	ND	ND	38		6.5	41	20	0.058	ND	30	ND	ND	ND	30	57	ND
	1	3.3	ND	ND	184	0.54	ND	41		9.1	32	7.5	0.033	ND	36	ND	ND	ND	40	42	ND
	2	6.6	ND	ND	90	0.49	ND	46		5.7	27	8.5	0.030	ND	55	ND	ND	ND	45	48	ND
	3	9.8																			ND
B-40	0.5	1.6	ND	ND	94	ND	ND	29		ND	18	**175**	0.150	ND	20	ND	ND	ND	22	133	
	1	3.3	ND	ND	54	ND	ND	38		5.0	7.0	3.0	0.035	ND	35	ND	ND	ND	26	22	
	2	6.6	ND	ND	111	ND	ND	33		7.0	8.3	2.9	0.025	ND	42	ND	ND	ND	27	24	
	3	9.8																			
B-41	0.5	1.6	ND	ND	106	0.33	ND	53		7.1	22	**216**	0.224	ND	29	ND	ND	ND	46	221	
	1	3.3	ND	ND	77	0.41	ND	61		ND	13	6.9	0.046	ND	47	ND	ND	ND	41	27	
	2	6.6	ND	ND	49	ND	ND	57		ND	9.3	4.4	0.028	ND	42	ND	ND	ND	30	23	
	3	9.8																			
B-42	0.5	1.6	ND	ND	93	ND	ND	30		ND	13	**119**	0.152	ND	18	ND	ND	ND	23	57	
	1	3.3	ND	ND	53	ND	ND	36		6.0	8.1	2.9	0.028	ND	38	ND	ND	ND	28	22	
	2	6.6	ND	ND	34	ND	ND	47		7.0	8.6	4.2	0.033	ND	42	ND	ND	ND	28	27	
	3	9.8																			
	ER		ND	ND	ND	ND	ND	ND		ND	ND	ND	0.00026	ND	ND	ND	ND	ND	ND	0.081	
B-43	0.5	1.6	ND	ND	101	0.31	0.71	50		8.4	40	63	0.301	ND	38	ND	ND	ND	36	103	
	1	3.3	ND	ND	45	0.34	ND	45		9.9	8.7	4.6	0.057	ND	44	ND	ND	ND	35	26	
	2	6.6	ND	ND	55	ND	ND	35		7.7	8.2	3.7	0.023	ND	36	ND	ND	ND	26	24	
	3	9.8																			
B-44	0.5	1.6	ND	ND	118	0.35	ND	31		5.4	34	**166**	0.200	ND	31	ND	ND	ND	34	145	
	1	3.3	ND	ND	514	0.92	2.0	17		7.8	112	**138**	33.9	ND	85	ND	ND	ND	30	581	
	2	6.6	ND	ND	338	0.50	ND	37		5.4	33	60	0.190	ND	36	ND	ND	ND	41	123	
	3	9.8																			
B-45	0.5	1.6	ND	ND	62	0.67	ND	26		6.4	25	14	0.96	ND	23	ND	ND	ND	23	38	
	1	3.3	ND	ND	251	ND	ND	29		ND	34	**244**	0.17	ND	24	ND	ND	ND	23	220	
	2	6.6	ND	12	263	0.30	ND	21		ND	54	**272**	0.34	ND	20	ND	ND	ND	24	147	
	3	9.8																			
B-46	0.5	1.6	ND	ND	141	0.43	0.53	28		7.5	47	**299**	0.17	ND	32	ND	ND	ND	28	86	
	1	3.3	ND	ND	60	0.41	ND	54		10	34	11	0.19	ND	55	ND	ND	ND	45	50	
	2	6.6	ND	ND	612	0.46	ND	17		ND	42	**233**	0.14	ND	16	ND	ND	ND	34	102	
	3	9.8																			
B-47	0.5	1.6	ND	ND	66	0.41	0.54	20		7.8	23	60	0.270	ND	28	ND	ND	ND	26	61	
	1	3.3	ND	14	573	0.69	0.55	16		ND	730	**886**	2.40	ND	18	ND	ND	ND	32	303	
	2	6.6	ND	ND	28	0.35	ND	46		7.2	13	7.6	0.033	ND	46	ND	ND	ND	40	37	
	3	9.8																			
B-47S	0.5	1.6							ND												
	1	3.3							ND												

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INORGANIC RESULTS - SOIL

Caltrans - Mandela Parkway Median Investigation

Boring Number	Sample Depth (m)	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Cyanide
B-48	0.5	1.6	ND	ND	71	0.70	ND	26		6.1	9.6	8.2	0.092	ND	26	ND	ND	ND	26	36	
	1	3.3	56	ND	149	0.37	ND	35		10	84	2,400	0.0013	ND	47	ND	ND	ND	33	311	
	2	6.6	ND	ND	95	ND	ND	13		ND	13	101	0.034	ND	13	ND	ND	ND	18	48	
	3	9.8																			
B-49	0.5	1.6	ND	ND	20	ND	ND	34		ND	4.5	2.6	0.0069	ND	26	ND	ND	ND	24	16	
	1	3.3	ND	ND	21	ND	ND	30		ND	8.6	71	0.0034	ND	26	ND	ND	ND	23	26	
	2	6.6	ND	ND	26	ND	ND	32		ND	3.6	3.3	0.0049	ND	25	ND	ND	ND	22	16	
	3	9.8																			
B-50	0.5	1.6	ND	ND	92	ND	2.7	28		5.6	28	5,300	0.176	ND	ND	28	ND	ND	26	94	
	1	3.3	ND	ND	116	ND	ND	34		5.7	7.2	15	0.027	ND	26	ND	ND	ND	27	26	
	2	6.6	ND	ND	34	ND	ND	35		5.0	4.6	5.2	0.012	ND	28	ND	ND	ND	25	17	
	3	9.8																			
B-51	0.5	1.6	ND	ND	82	0.60	ND	27		7.7	23	40	0.709	ND	31	ND	ND	ND	27	75	
	1	3.3	ND	ND	50	ND	ND	28		ND	7.4	22	0.044	ND	18	ND	ND	ND	20	16	
	2	6.6	ND	ND	63	ND	ND	39		6.8	9.1	3.9	0.025	ND	42	ND	ND	ND	29	24	
	3	9.8																			
B-52	0.5	1.6	ND	ND	124	0.39	0.83	39		8.2	45	98	0.856	ND	37	ND	ND	ND	32	229	ND
	1	3.3	ND	ND	71	0.44	ND	38		13	11	3.9	0.026	ND	46	ND	ND	ND	35	24	0.139
	2	6.6	ND	ND	68	0.32	ND	38		11	8.7	3.6	0.029	ND	45	ND	ND	ND	30	24	0.107
	3	9.8																			0.185
SW-1	0	0										956									
	0.5	1.6										933									
	1	3.3										255									
SW-2	0	0										658									
	0.5	1.6										447									
	1	3.3										293									
SW-3	0	0										244									
	0.5	1.6										505									
	1	3.3										3.7									
SW-4	0	0										188									
	0.5	1.6										224									
	1	3.3										50									
SW-5	0	0										30									
	0.5	1.6										17									
	1	3.3										6.8									
SW-6	0	0										63									
	0.5	1.6										29									
	1	3.3										168									
SW-7	0	0										181									
	0.5	1.6										4.6									
	1	3.3										1.4									
SW-8	0	0										60									
	0.5	1.6										177									
	1	3.3										1.3									
SW-9	0	0										26									
	0.5	1.6										5.4									
	1	3.3										2.2									
SW-10	0	0										38									
	0.5	1.6										1.7									
	1	3.3										1.2									
SW-11	0	0										1,300									
	0.5	1.6										75									
	1	3.3										648									
SW-12	0	0										6.7									
	0.5	1.6										114									
	1	3.3										56									
SW-13	0	0										94									
	0.5	1.6										505									
	1	3.3										54									
SW-14	0	0										34									
	0.5	1.6										109									
	1	3.3										15									
SW-15	0	0										3.2									
	0.5	1.6										ND									
	1	3.3										50									
SW-16	0	0										ND									
	0.5	1.6										48									
	1	3.3										74									

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TABLE 6

INORGANIC RESULTS - SOIL
Caltrans - Mandela Parkway Median Investigation

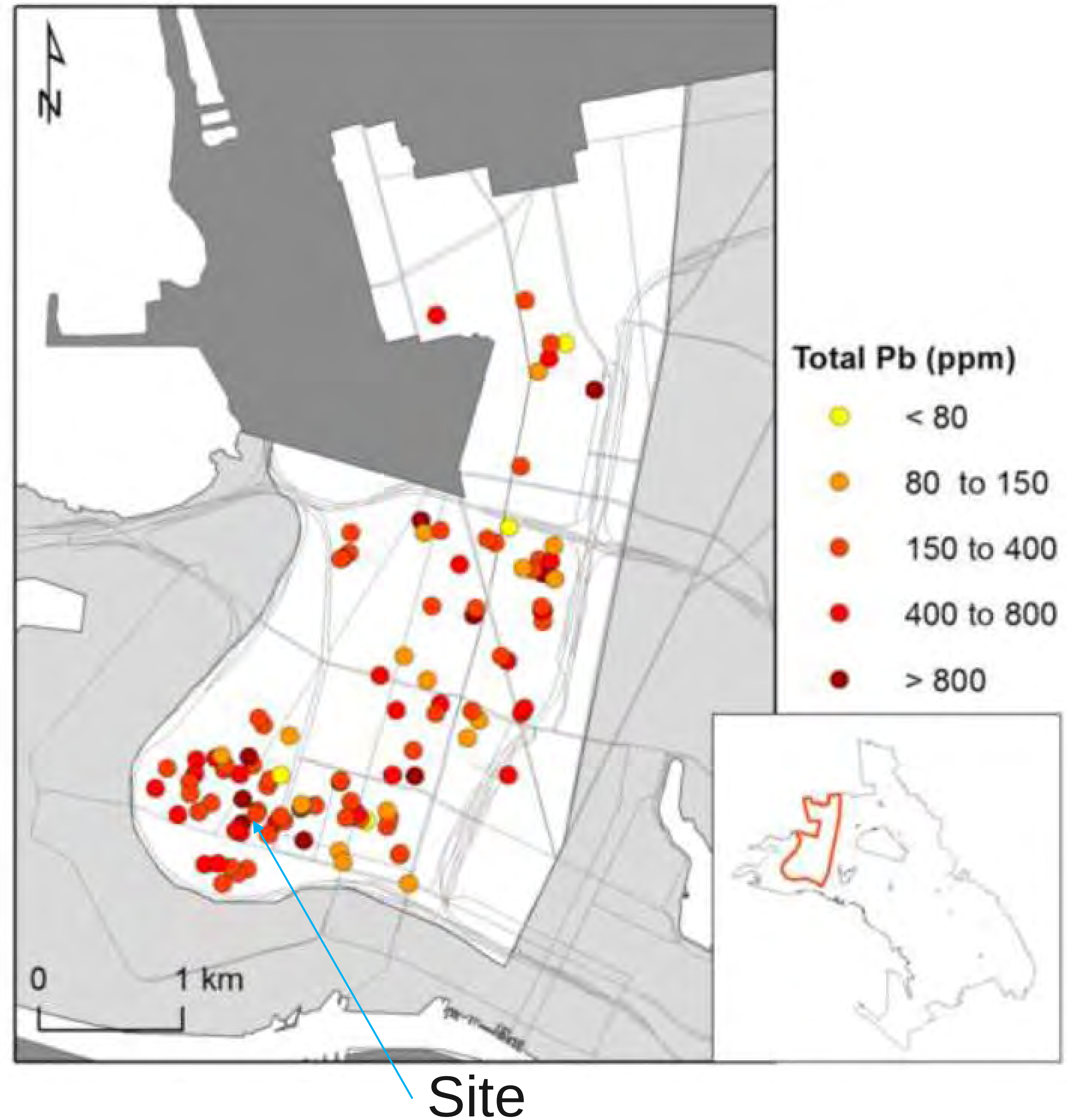
Boring Number	Sample Depth (m)	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Cyanide
SW-17	0	0										5,730									
	0.5	1.6										292									
	1	3.3										203									
SW-18	0	0										111									
	0.5	1.6										1.4									
	1	3.3										9.0									
SW-19	0	0										1.2									
	0.5	1.6										581									
	1	3.3										191									
SW-20	0	0										4.4									
	0.5	1.6										ND									
	1	3.3										6.7									
SW-21	0	0										1.4									
	0.5	1.6										5.2									
	1	3.3										16									
SW-22	0	0										2.0									
	0.5	1.6										5.7									
	1	3.3										14									
SW-23	0	0										29									
	0.5	1.6										31									
	1	3.3										27									
SW-24	0	0										13									
	0.5	1.6										1.2									
	1	3.3										4.6									
SW-25	0	0										292									
	0.5	1.6										262									
	1	3.3										59									
SW-26	0	0										362									
	0.5	1.6										599									
	1	3.3										67									
SW-27	0	0										36									
	0.5	1.6										6.6									
	1	3.3										29									
SW-28	0	0										3.7									
	0.5	1.6										3.6									
	1	3.3										1.2									
SW-29	0	0										66									
	0.5	1.6										14									
	1	3.3										2.8									
SW-30	0	0										16									
	0.5	1.6										4.0									
	1	3.3										1.6									
SW-31	0	0										121									
	0.5	1.6										99									
	1	3.3										2.6									
SW-32	0	0										1,560									
	0.5	1.6										59									
	1	3.3										1.5									
SW-33	0	0										7.8									
	0.5	1.6										32									
	1	3.3										5.0									
SW-34	0	0										9.6									
	0.5	1.6										9.1									
	1	3.3										6.3									
SW-35	0	0										173									
	0.5	1.6										23									
	1	3.3										8.8									
SW-36	0	0										13									
	0.5	1.6										2.4									
	1	3.3										3.0									

TABLE 6

INORGANIC RESULTS - SOIL
Caltrans - Mandela Parkway Median Investigation

Boring Number	Sample Depth (m)	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Cyanide
SW-37	0	0										41									
	0.5	1.6										7.4									
	1	3.3										1.9									
SW-38	0	0										**398**									
	0.5	1.6										2.0									
	1	3.3										1.4									
TTLC			500	500	10,000	75	100	2,500	500	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000	
10X STLC			150	50	1,000	7.5	10	5,600	50	800	250	50	2	3,500	200	10	50	70	240	2,500	
PRG			30	21	5,200	150	9	210	30	3,300	2,800	400	22	370	150	370	370		520	22,000	
Reporting Limit			6.0	10	2.0	0.30	0.50	1.0	0.10	5.0	2.0	1.0	0.010 to 0.30	5.0	4.0	10	1.0	10	5.0	1.5	1.0

Notes:
1. Metals analyses conducted in general accordance with U.S. Environmental Protection Agency (EPA) Methods 6010 and 7471. Cyanide analyses conducted in general accordance with EPA Method 335.
2. Sample depths reported in approximate meters (m) / feet (ft) below the ground surface.
3. Concentrations reported in milligrams per kilogram, except for equipment rinse samples for which results are reported in milligrams per liter.
4. ND = not detected in concentrations exceeding the listed reporting limit.
5. Soil samples labeled as follows: boring no.-depth-sample tube no. with 1 being from the bottom. Ex.: B1-2-2 - boring B-1, 2 meter depth, second sample tube.
6. ER = equipment rinse blank sample. Samples labeled as ER. Ex.: B1-ER.
7. TTLC = Total Threshold Limit Concentration.
8. 10X STLC = 10 times the Soluble Threshold Limit Concentration. Values listed in milligrams per liter.
9. PRG = preliminary remediation goal (1998) for residential soil. Non-cancer and PRG used for arsenic. Cadmium PRG is California-modified PRG. Cyanide PRG for free cyanide. Nickel PRG for nickel soluble salts.
10. Bold results equal or exceed 10X STLC values. Bold and italics results equal or exceed the TTLC. Underlined results equal or exceed the PRG.

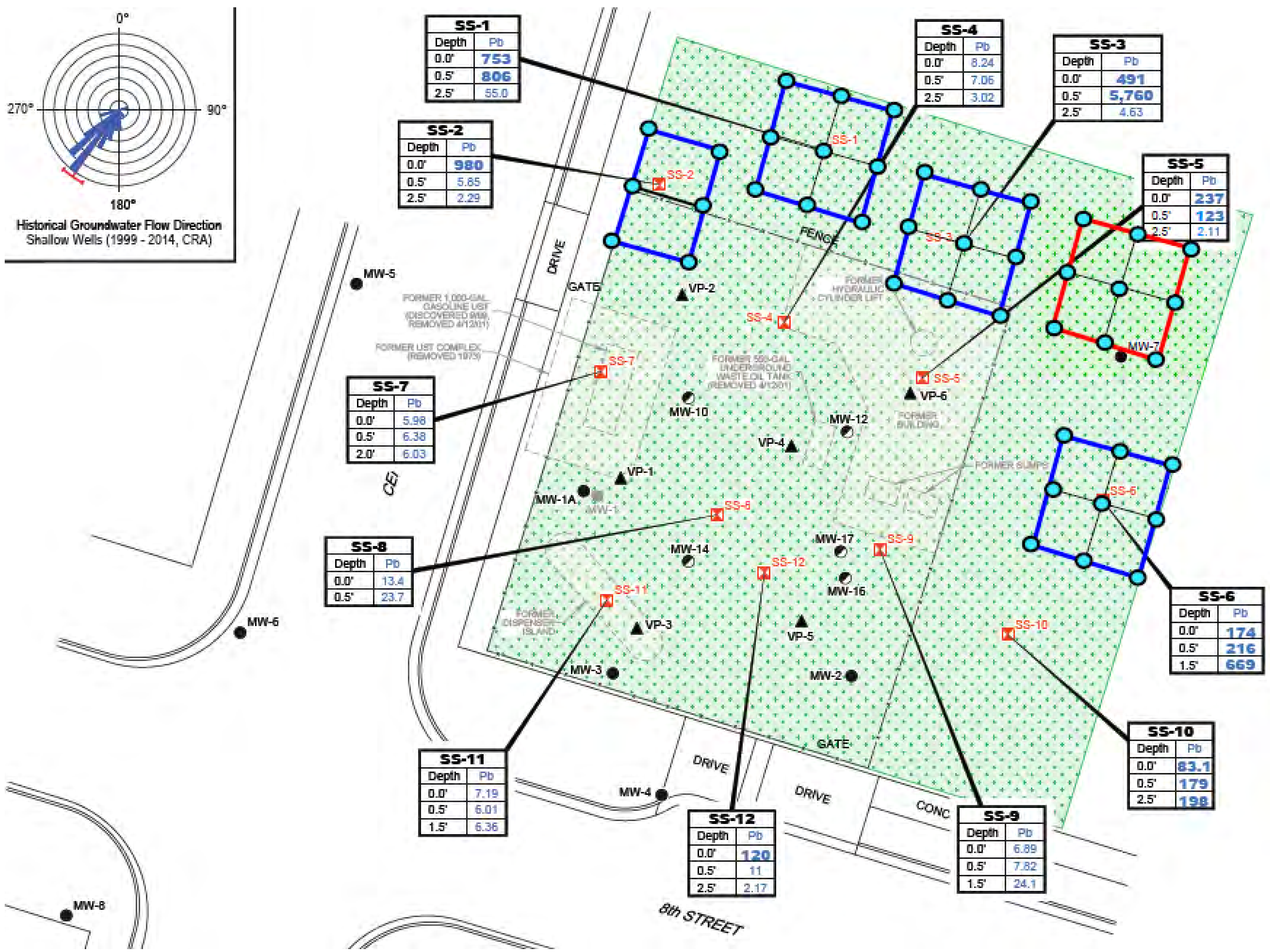


Source: McClintock, Nathan, “Assessing Soil Lead Contamination at Multiple Scales in Oakland, California: Implications for Urban Agriculture and Environmental Justice” (2012). – Provided by Chevron

Justification of 320 mg/kg Screening Level

- 320 mg/kg is the commercial/industrial screening level for lead by OEHHA of California
- Site has no future planned use or residential development, currently fenced off from the public
- The more stringent 80 mg/kg screening level in based upon continual habitation and exposure to soil - most sensitive receptors would be infants (under 2 years of age).
- The existing community garden is in raised planters and does not use soil from the site (agreement states raised beds and no use of native soils)

Proposed Confirmation Boring Locations – 320 mg/kg Screening Level



Number of confirmation borings (blue dots) = **42**

*Number of borings subject to change based upon confirmation samples using the XRF Device

Step-out approach = center of blue squares on soil borings where lead concentrations exceeded 320 mg/kg (exception SS-2 b/c property line)

Red square is for additional confirmation of lead concentrations in location where no soil borings were advanced

Phosphate Application – Lead Impacts Treatment

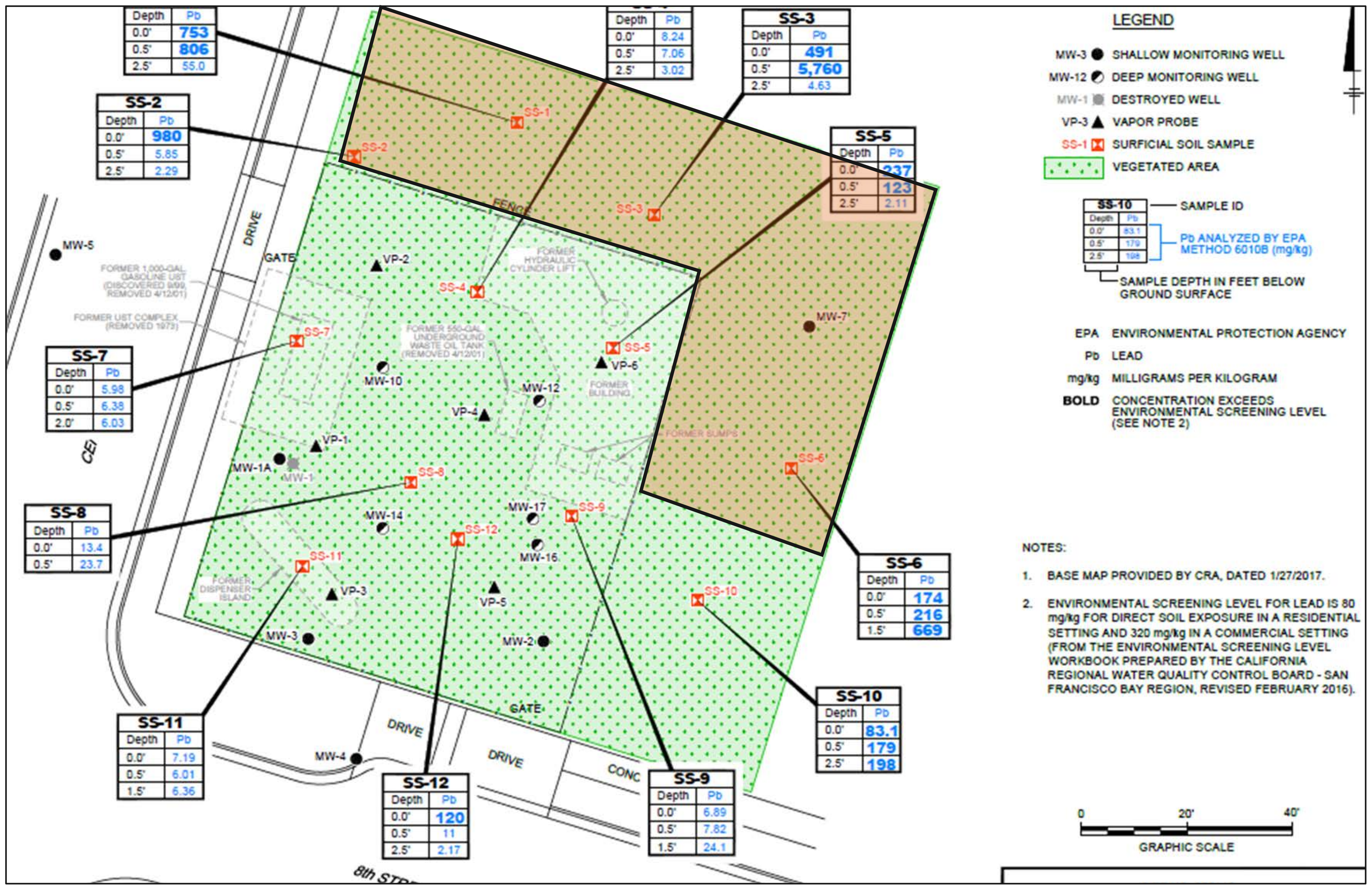
Pb presence onsite:

- Occurs only in shallow soil (0-3 ft bgs)
- Possible sources include leaded gasoline exhaust aerosols, residual lead based paint, or both
- No evidence to indicate organic lead or lead in groundwater

Prior Phosphate Applications via Technical Teams:

- Unsuccessful uses of phosphate treatment where *lead paint chips* were the known source
- In cases where lead in soil results from non-lead paint chips, there has been success with multiple reagents

Highest lead concentrations occur on the northern half of the site (the 816 parcel/ the current community garden and the top portion of 1434 & 1432 parcel/empty lot)



- Lead in gasoline emissions starts as an aerosol, combines with sulfur in the atmosphere and rains down as lead sulfide droplets
- Lead in paint chips is usually a carbonate mineral that produces white pigmentation
- A treatability test could determine what form of lead is present onsite

* Any onsite soil ingested containing PCBs or lead by chickens would occur only in the **shells** of the eggs and is not considered a risk to consumers

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LEAD IN OAKLAND SOILS

Introduction

- *Best practices in the garden*
- *Lead immobilization*

In recent years West Oakland has been turning towards urban gardening as a way to increase access to healthy, nutritious, and low cost produce that is, unfortunately, absent from the neighborhood. Oakland is home to one of the largest ports on the West Coast. It was the end point for the transcontinental railroad, as well was a location for boat and car manufacturing. As a result, Oakland's soils have been exposed to many pollutants. For people interested in gardening or who have children who play in West Oakland, understanding Oakland's industrial past and its legacy in the soil is crucial for developing safe practices that minimize risks from soil contaminants such as lead.

Lead is the most pervasive pollutant in Oakland soil. Lead can be a serious problem causing nervous system damage, developmental issues, and other problems for children. But lead can be effectively neutralized. Soils with high levels of lead can be used as long as the necessary precautions are taken.

The purpose of this guide is to provide reliable information regarding the risks of lead in Oakland's soil. It is intended to give homeowners options about good gardening practices and possible remediation approaches such as lead immobilization.

Left: West Oakland, Calif. (on right of ship channel), Alameda, Calif. on left

Soil

Healthy soil is essential for plants to grow in your garden. When a property has been used for industrial or commercial activities, the soil may be nutrient deficient, highly compacted and potentially contaminated. These soils can be improved and made healthy again so that your garden plants can grow and thrive. The necessary nutrients for plant growth may be absent but even more worrisome may be toxins such as lead. It is possible to get your soil screened for both nutrients and lead.

Lead Testing

A variety of environmental consulting firms can do this for you or you can do it yourself. If you choose to have a consulting firm test your soil Alameda County provides a list of inspector/risk assessors in the Bay Area at the link below. If you choose to do it yourself, sending your own soil samples to be tested at a lab is easy and safe. For more information on soil testing visit Alameda County's Website:

http://www.aclppp.org/leadpoisoning/testing.htm.

Benefits of Gardening

- *Helps to decrease the bioavailability of lead*
- *Nutritious food helps buffer the body against lead absorption*

Gardening is wonderful for many reasons, but for lead-contaminated soil, gardening is highly recommended for two reasons. First, proper care of your soil, meaning the regular addition of compost or fertilizer to support plant growth, will lock the lead up in pyromorphite crystals and decrease the bioavailability of the lead. Second, eating fruits and vegetables on a regular basis helps to buffer the body against lead absorption. For soil with moderately high levels of lead it is actually recommended to garden.

There is some concern that plants may absorb the lead and make the plants inedible. However there is little evidence to indicate this to be true. The greatest danger that lead in soil poses to humans is the residue of the soil splashed on to low growing parts of the plant. That is why it is vital to employ best management practices. Only in soil that contains 1200 ppm (parts per million) or more is it advisable not to grow produce for food.

More than anything else, gardening is highly recommended because the produce provided by a garden can help to protect the body against lead absorption. Studies show that a child who has a nutritious diet will absorb less lead then a child who does not. A well-balanced diet can do as much to help prevent lead poisoning as remediating the soil.

Bioavailability

The risks of lead in soil may also be much lower than a soil test for lead suggests because of the bioavailability of the contaminant in the soil. Bioavailability of a contaminant is the amount that can be taken up by your body. Not all forms of lead can be absorbed in to the blood stream; some just pass straight through the body. It depends on the characteristics of the site and the soil. Treatment of soil rich in lead with phosphate and compost may reduce the bioavailability of lead in soil through chemical immobilization.

Phytotechnologies & Lead

Phytoextraction, or using plants to extract heavy metals such as lead, is NOT an effective way to remove lead. Lead in soil is generally not readily available for plant uptake.

Table 1: Crops to plant and precautions for children, based on amount of lead in soil.

Amount of lead	Garden use	Child use
Below 80ppm	No restrictions	No restrictions
80-500ppm	Any crop is safe to plant, wash all crops	Use caution, encourage children to wash their hands after playing in soil and minimize contact with bare soil. Wash toys; take precautions not to track dirt into the house. Take lead blood test if possible. Ensure calcium-rich, well-balanced diet.
500-1200ppm	Don't plant lettuce, spinach, chard or herbs. But collards, kale, cabbage are OK to plant. Limit root crops (i.e., carrots). Potatoes are OK if peeled and washed well. Take extra precaution to wash all produce grown.	Use caution, encourage children to wash their hands after playing in soil and minimize contact with bare soil. Wash toys; take precautions not to track dirt into the house. County recommends lead blood test if possible. Ensure calcium-rich, well balanced diet.
Above 1200ppm	It is not advisable to grow produce for food. Do not plant leafy greens or root crops. If produce is grown take extra precaution to wash all produce grown.	Not advisable for children to play in soil. In addition to the precautions above, restrict/closely monitor children playing on exposed soil.

Best Management Practices in the Garden

These practices can help minimize exposure to lead.

- Locate garden away from old painted buildings and roads with heavy traffic.
- Use a thick layer of organic material such as compost or mulch. Place landscape fabric between areas with lead contaminated soil and new clean soil.
- Watch over small children to stop them from eating soil through hand-to-mouth play.
- Wash hands immediately after gardening and before eating to avoid eating soil.
- Wear gloves as a barrier between your hands and the soil.
- Throw away the outer leaves of greens, especially from the base or exterior of plants, before washing. Soil particles are most likely to be located on the outer leaves of leafy plants.
- Wash produce using running water.
- Peel root vegetables, which are in direct contact with soil.
- Avoid bringing contaminated soil into the home by:
    - Cleaning tools, gloves and shoes before bringing them indoors, or leave tools, gloves, and shoes outdoors.
    - Placing highly soiled clothes in a bag before bringing them indoors, and wash them promptly in a separate load.
    - Washing off excess soil from crops, especially root crops and leafy vegetables, before bringing them indoors.

Raised beds at South Prescott Fishbone Project, Oakland, CA

Raised Beds

Building raised beds and growing plants in containers is the most common way to reduce the chances of coming into contact with toxics in urban gardens known to be contaminated. The clean soil and organic matter used to build the raised bed creates a physical barrier between the gardeners/plants and possible contamination in the ground soils. Mulch walkways or maintain strong grass cover to keep soil between beds from children. For information on building raised beds check out EPA's factsheet on urban gardening at

http://cluin.org/ecotools/urbangardens.cfm

Lead Immobilization

- *Reduce bioavailability*
- *Limit exposure*

In addition to the best management practices, other steps can be taken to minimize the risk even more. Another option is lead immobilization.

The idea of lead immobilization is not to take the lead out of the soil. but to chemically change it to a form that is not bioavailable. The type of lead that was found in paint and gasoline is very toxic to humans and can be easily absorbed by the human body. However, there is a lead compound called pyromorphite which passes right through the human body without being absorbed. The goal of lead immobilization is to use phosphates to change the dangerous soil to pyromorphite. When phosphate comes into contact with lead a chemical reaction takes place that transforms the lead to pyromorphite crystals. There are many soil amendments that contain the necessary phosphate to complete the chemical reaction. The phosphate is mixed with the soil. In some cases it can be covered with sod or another ground cover to limit exposure to lead even more. Composts and fertilizers contain phosphates, so gardeners who mix these substances into their soil on a regular basis are already immobilizing lead.

This method is effective in treating lead because it addresses the two greatest risks of exposure: First, the phosphate immobilization reduces bioavailability, essentially making the lead less toxic. Second, laying down a green cap (i.e. sod) reduces direct contact with the soil, therefore reducing the potential for children to accidentally eat contaminated soil.

Artistic representation of lead immobilization at the EPA field office in West Oakland, California

Fishbones

Zero-emission vehicles used onsite

Case Study:
South Prescott Fishbone Project

In a small area of West Oakland there are high rates of lead poisoning in children as well as high rates of lead in the soil due to a history of industrial contamination. EPA decided to take action to clean up these soils. By working with the community and using the latest research in lead cleanups, EPA chose an innovative and sustainable way to clean up the soil. Instead of removing all the soil in the yards in this small neighborhood and hauling it away, EPA used phosphate immobilization to reduce the bioavailability of the lead. They mixed fishbone in to the soil to immobilize the lead. They did this in a sustainable way by using mostly zero emissions vehicles and reusing supplies. They also hired many local residents and created jobs for the community.

How to do Lead Immobilization Yourself

An individual can do lead immobilization as long as the appropriate amendments are added to the soil in sufficient quantities. Although the regular addition of phosphate through gardening is a good choice it is not always the easiest or the fastest. The process described below may only need to be done once to significantly reduce the risks of lead.

There are a variety of additives that will immobilize the lead, each with its own pros and cons. Lead immobilization is a fairly new technique and it has not yet been determined which additive is the most effective. The following are possible amendments:

- Triple Super Phosphate (TSP) is fast acting and contains no nitrogen but will still increase the acidity of the soil. This is the best option for gardeners.
- Fishbone is an organic additive, does not have nitrogen and does not generate any acidity when mixed with soil. However it is slow to react, needs higher quantities, and it is not as widely available.
- Di Ammonium Phosphate (DAP), DAP is fast acting and widely available but it will add high levels of nitrogen to the soil. Nitrogen causes excessive plant growth but inhibits seed production so it is bad for growing fruits and vegetables. DAP will also increase the acidity of the soil and limestone may be needed to neutralize it.
- Mono Ammonium Phosphate (MAP). MAP is also fast acting but has similar issues to DAP. However it contains half as much nitrogen, so half the problem.

Sandwich-board signs mark where EPA is working and keep the community informed.

Table 2: The amount of phosphate is given for a yard that has 1000ppm (parts per million) of lead. If the soil has less lead, then less phosphate should be used; if the soil has more lead, more should be used. For example a yard with 500ppm of lead should use only half as much of these amendments.

Amendments	Amount to use per sq ft for soil with 1000ppm	Where to get it	Estimated costs*
DAP	10 grams (dry weight)	Local gardening/hardware stores or online	$2.25 per lbs
MAP	9 grams (dry weight)	Local gardening/hardware stores or online	$.65 per lbs
TSP	12 grams (dry weight)	Local gardening/hardware stores or online	$3.25 per lbs
Fishbone (appetite II)	75 grams	www.pimsnw.com	$5 per lbs

**These prices are subject to change and do not include shipping and handling fees*

Steps for Lead Immobilization

1. Remove all existing vegetation and debris from the soil using a hoe, shovel, rake, or other appropriate tools.

2. Spread fishbone or spray fertilizer over the soil. TSP, DAP, and MAP are all dissolvable in water and should be mixed with water and sprayed on soil.

3. Mix in additive using a rototiler or garden fork. Make sure that the additive is mixed in 8 inches deep.

4. If you...
   - Plan to garden directly in the soil these three steps are enough.
   - Do not plan to garden, lay down sod or another sort of ground cover to limit exposure even more.
   - Use fishbone, it is also advisable to lay down sod or another ground cover because the reaction time is slower therefore additional protection is needed.

Equipment

It is worthwhile to invest in the basic gardening equipment for day-to-day work in the garden but for more specialized work, such as building a raised bed or rototilling, the Oakland Public Library provides a tool lending library. Oakland residents can rent gardening, carpentry, and other tools free of charge. For more information on the tool lending library visit them online at http://www.oaklandlibrary.org/locations/tool-lending-library or call (510) 597-5089.

The crew in West Oakland removing vegetation and debris

Conclusion

Lead in soil can be dangerous, but as long as proper precautions are taken, contaminated yards have the potential to be safe gardens or play spaces. This guide is designed to help West Oakland homeowners understand the dangers associated with lead, and learn how to effectively mitigate them.

Additional Resources:

More information on Lead hazards available at : www.aclppp.org or www.epa.gov/lead
More information on creating an urban garden is available at: www.epa.gov/brownfields/urbanag
More information on gardening in Oakland is available at: www.cityslickerfarms.org
More information on the South Prescott Fishbone Project available at: www.southprescottcommunityforum.org
Visit the EPA field office:
349 Mandela Parkway, Oakland, CA
(510) 542-4438