Triple Site – Stratigraphic Evaluation of the OOU

Background

Numerous residences show elevated indoor air TCE concentrations that are currently not associated with shallow (A-Aquifer) TCE-impacted groundwater (Figure 1) as depicted by Locus (2019, 2020, and 2021). This variance suggests that the migratory pathways transporting elevated dissolved TCE emanating from sources at the Signetics Site are not reflected in the isocontours prepared by Locus (Figure 2). The focus of this screening is to evaluate the effect of A-Aquifer stratigraphy on the distribution of observed exceedances of TCE in indoor residential air.

The subsurface at the Signetics Site (and the OOU in general) is composed of highly permeable coarse-grained sand channels encased in low permeability fine-grained silt and clay floodplain deposits. Dissolved contaminants migrate downgradient predominantly along the localized sand channels. Sand channels have been identified beneath the Signetics Site but not traced downgradient. Early work at the Signetics Site by EMCON (1996) identified a major sand channel between 5 and 25 feet below grade trending slightly northwest leaving the central portion of the Signetics Site (Figure 3). EPA (2017) identified multiple A-Aquifer coarse-grained hydrostratigraphic units (HSUs) in the northeastern portion of the Signetics Site in the Environmental Sequence Stratigraphy (ESS) study of the TRW Site published in *Best Practices for Environmental Site Management a Practical Guide for Applying Environmental Sequence Stratigraphy to Improve Conceptual Site Models* (EPA, 2017). These A-Aquifer coarse-grained HSUs are shown on Figure 4. Coarse-grained HSUs are the preferred pathways for contaminant transport and the coarse-grained HSUs emanating from the Signetics Site have not been traced downgradient into the OOU. Identification of these coarse-grained HSUs within the OOU are a requirement to understand the distribution of indoor air exceedances in residences in the OOU footprint.

<u>Duane Ave.</u>

A simple ESS evaluation of the A-Aquifer along Duane Ave. is presented on Figure 5. Permeable sand and gravel units are shown as orange, moderately permeable silty sand units are shown as yellow, and relative impermeable silt and clay units are shown as grey. Note that the silty sand units are generally depositionally associated with sand and gravel units and that sand and gravel units may be adjacent to these yellow silty sands that are not depicted on the figure. The upper 10 feet of the A-Aquifer along Duane Ave. between San Luisito Way and Britton Ave. is characterized by coarse-grained HSUs between about 6 feet and 20 feet below grade. These HSUs are likely pathways of contaminant transport from the Signetics Site downgradient into the OOU. Relatively impermeable silt and clay units generally characterize the shallow subsurface east of San Luisito Way, suggesting little contaminant migration east of San Luisito Ave at Duane Ave.

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Carmel Ave.

Only one well (COM01A) characterizes A-Aquifer groundwater conditions for the 1,500-foot long, 900-foot-wide area between Duane Ave. and Alvarado Ave. that contains numerous residences with indoor air TCE exceedances (Figure 2). Groundwater reports between at least 1989 and 2010 indicated the primary TCE plume (>100 µg/L) west of COM01A. In fact, the 1989 isocontour for TCE by HLA positioned the plume west of COM01A to account for the 1,800 µg/L detected in COM06A along the western portion of Alvarado Ave as compared to the 460 µg/L TCE detected in COM01A (Figure 6). TCE concentrations greater downgradient than that found at COM01A indicate that COM01A did not intercept the historical primary downgradient pathway through the Carmel Ave. area. In 2011, the reported primary TCE plume was shifted east of COM01A, but no supporting data were presented to justify this change. In addition, up until 2018 the primary TCE plume was shown as a continuous plume encompassing all wells indicating >100 µg/L between the Signetics Site and Alvarado Ave. In 2018, plume contours change to encompass small areas about wells that exceeded 100 µg/L (Figure 1).

To provide information on likely A-Aquifer pathways of TCE-impacted groundwater through the Carmel Ave. area, a preliminary ESS is presented on Figure 7 that uses stratigraphy from well borings in the B1-, B2-, and B3-Aquifers. Four of the five stratigraphic locations along Carmel Ave. show little relatively impermeable material in the upper A-Aquifer and all five locations show shallow coarse-grained HSUs. Interestingly, the eastern most boring (COM53B2) shows no impermeable material in the upper A-Aquifer that may be indicative of the upper A-Aquifer along San Luisito Way. The lack of impermeable materials in the upper A-Aquifer in this area may explain the elevated indoor air TCE concentrations along San Luisito Way. Vapors from dissolved contaminant transport in the coarse-grained HSUs between 10 and 20 feet below grade would not be impeded from migrating upward. The lack of an impermeable vapor barrier in the upper A-Aquifer may extend as far south as San Justo Ct. that could explain the TCE exceedances in indoor air along San Luisito Way.

Data on subsurface conditions along the western portion of Carmel Ave. are lacking; however, indoor VI data indicate indoor air exceedances of TCE both north and south of Carmel Ave. Historically (up until 2011), the greater than 100 µg/L plume of TCE in A-Aquifer groundwater was positioned west of COM56B3 and the isoconcentration plume moved to east of COM56B3 in 2011 with no supporting data. Again, recent isoconcentration maps by Locus (2021) depict low dissolved TCE concentrations along the eastern portion of Carmel Ave. Stratigraphic and indoor VI data suggest contaminant migration pathways through the western portion of Carmel Ave. that have yet to be identified.

Alvarado Ave.

Few well developed coarse-grained HSUs are present along Alvarado Ave. (Figure 8). The upper portion of the A-Aquifer along the central eastern portion of the Alvarado Ave. area appears to be characterized by relatively impermeable materials that would act to prevent upward vapor migration into residences. The detection of TCE in indoor air at the residence on the northeastern corner of Alvarado Ave. and San Junipero Dr. (residences 334 & 336) is not reflected in the ESS evaluation; however, the coarse-grained HSU in COM37A at between 7 and 12 feet below grade may be the source of this TCE. Along the eastern portion of Alvarado Ave., specifically at COM60B2, the upper A-Aquifer is characterized by a coarse-grained HSU. Not surprising, the

HSU is associated with residences that contain TCE in indoor air above 0.48 $\mu g/m^3$; not coincidently, these TCE detections in indoor air are aligned in a downgradient direction.

Summary

The cursory ESS evaluation of the OOU appears to confirm that migratory pathways emanating from the Signetics Site are associated with coarse-grained HSUs and that these pathways are generally associated with detections of TCE in residential indoor air. The pump and treat remedy has operated for over 30 years and has removed a significant mass from HSUs that intersect extraction wells. However, there appear to be HSUs that are not in direct communication with extraction wells that have inhibited cleanup of the OOU and prolonged the exposure of VU concerns. An effort should be initiated to identify these HSUs, and this effort should be concentrated in the area north and south of Carmel Ave.

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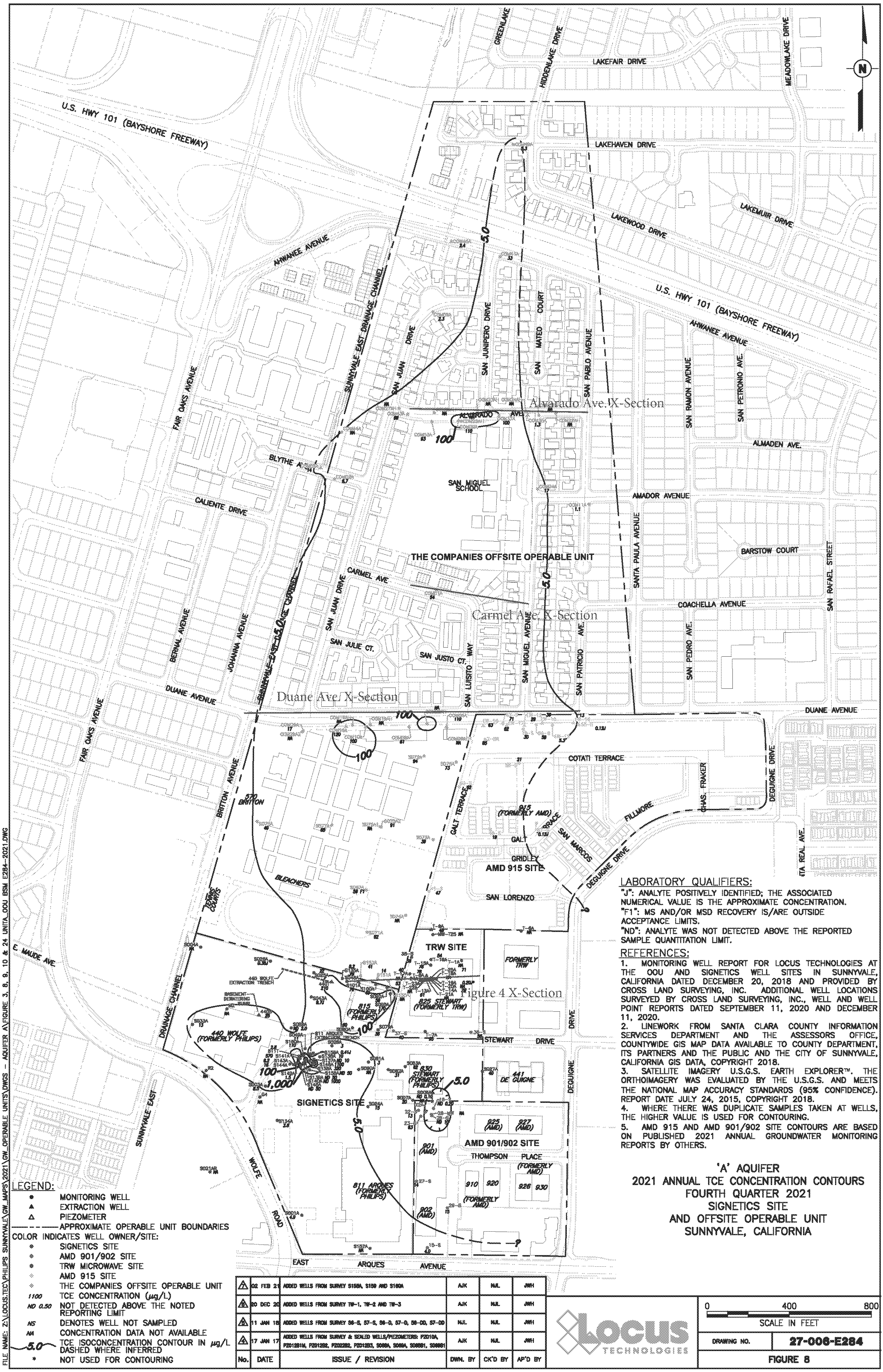

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
3	02 FEB 21	ADDED WELLS FROM SURVEY S158A, S159 AND S160A	AJK	NJL	JWH
2	20 DEC 20	ADDED WELLS FROM SURVEY TW-1, TW-2 AND TW-3	AJK	NJL	JWH
1	11 JAN 18	ADDED WELLS FROM SURVEY 56-S, 57-S, 56-D, 57-D, 56-DD, 57-DD	NJL	NJL	JWH
0	17 JAN 17	ADDED WELLS FROM SURVEY & SEALED WELLS/PIEZOMETERS: P2010A, P201291M, P201292, P202282, P201293, S069A, S069A, S06991, S06991	AJK	NJL	JWH

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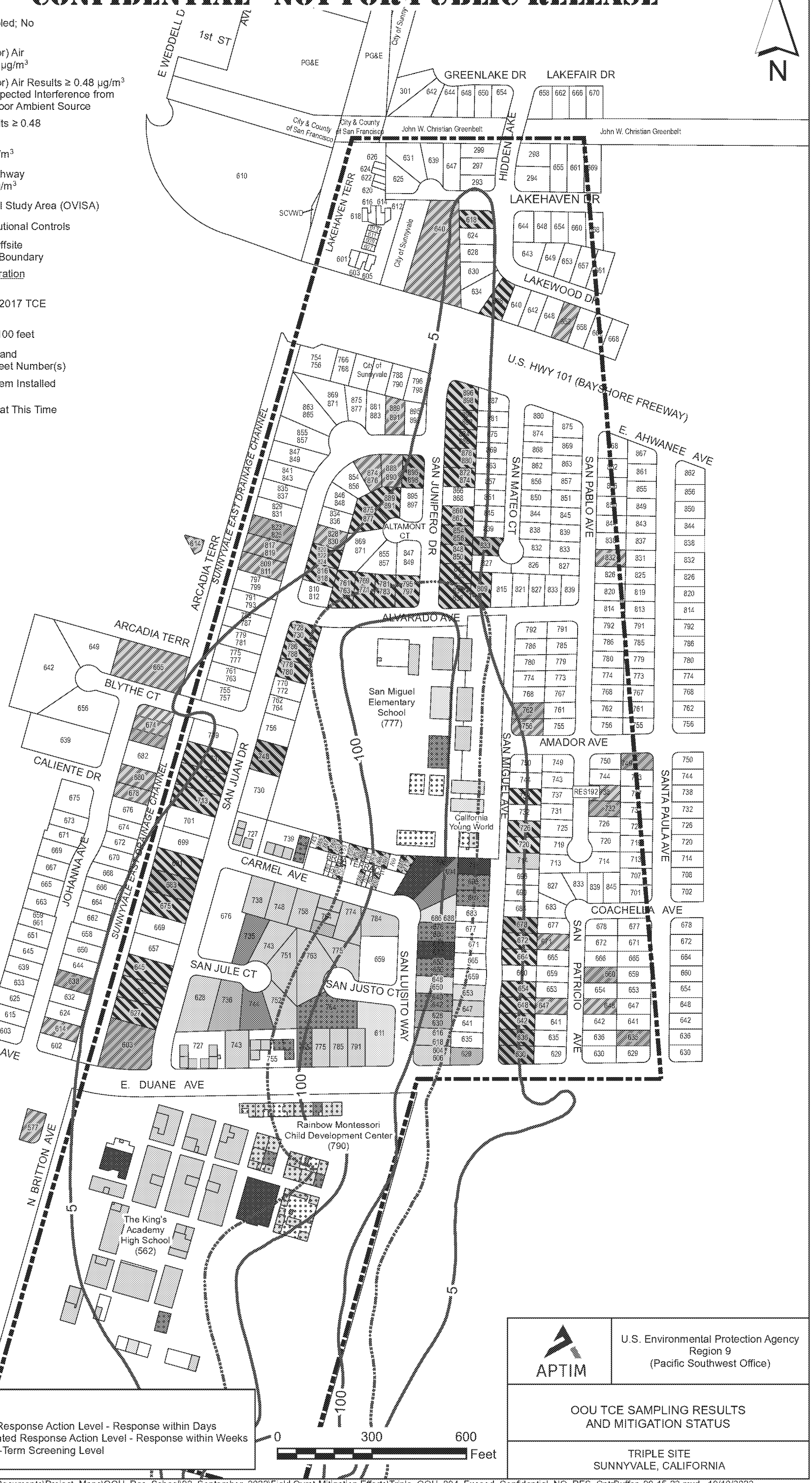
Legend

- Property Sampled; No Exceedances
- Ambient (Indoor) Air Results ≥ 0.48 µg/m³
- Ambient (Indoor) Air Results ≥ 0.48 µg/m³ but not VI; Suspected Interference from Indoor or Outdoor Ambient Source
- Pathway Results ≥ 0.48 µg/m³
- Results ≥ 2 µg/m³
- Ambient or Pathway Results ≥ 6 µg/m³
- NFA Outside VI Study Area (OVISA)
- NFA with Institutional Controls
- Approximate Offsite Operable Unit Boundary

Approximate Isoconcentration Contour

- Fouth Quarter 2017 TCE Contour
- 100 ug/L plus 100 feet
- Parcel Outline and Associated Street Number(s)
- Mitigation System Installed

NFA = No Further Action at This Time



Notes:
TCE Screening Levels:
6 µg/m³ – EPA's Urgent Response Action Level - Response within Days
2 µg/m³ – EPA's Accelerated Response Action Level - Response within Weeks
0.48 µg/m³ – EPA's Long-Term Screening Level

APTIM

U.S. Environmental Protection Agency
Region 9
(Pacific Southwest Office)

OOU TCE SAMPLING RESULTS AND MITIGATION STATUS

TRIPLE SITE
SUNNYVALE, CALIFORNIA

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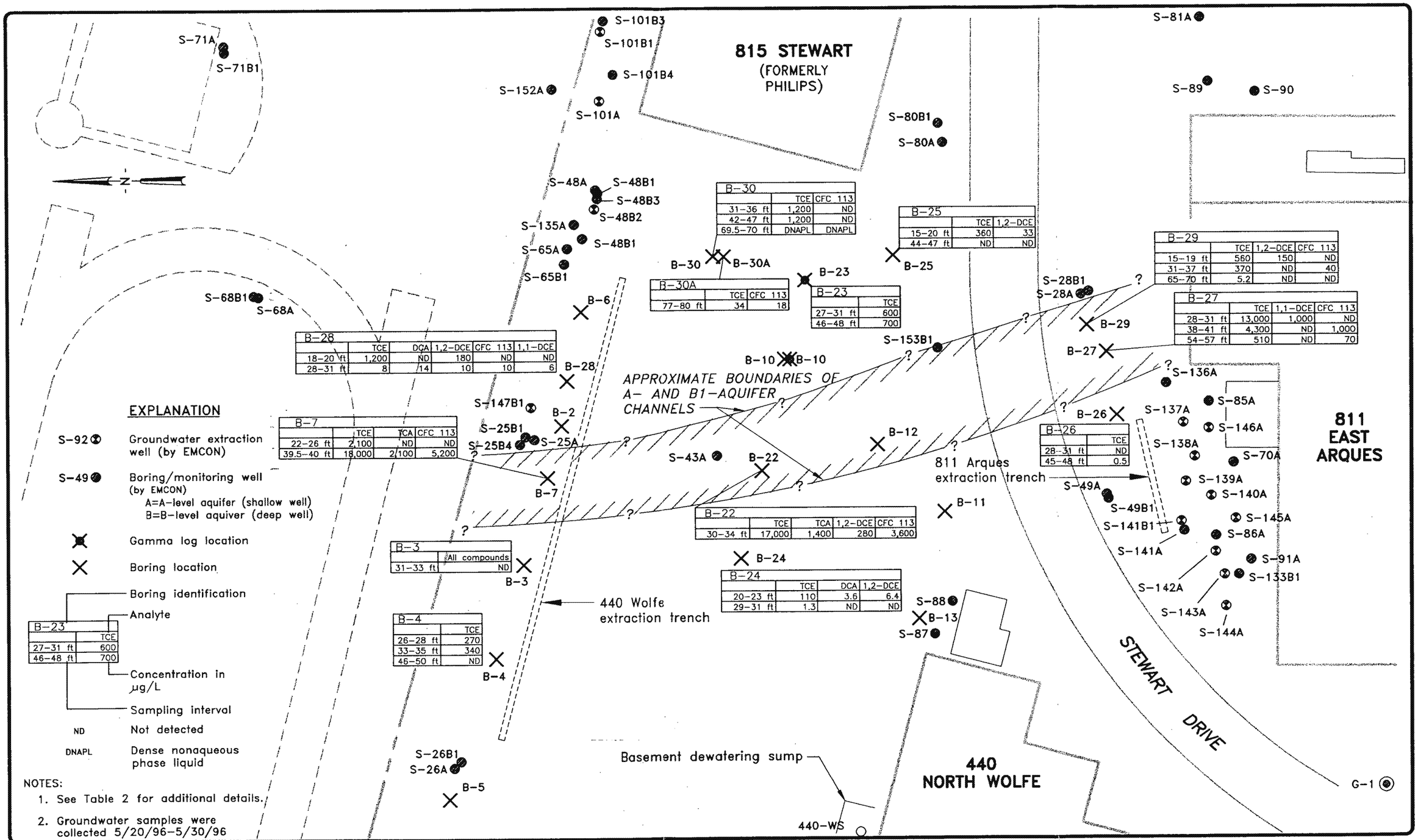

B-30	TCE	CFC 113
31-36 ft	1,200	ND
42-47 ft	1,200	ND
69.5-70 ft	DNAPL	DNAPL

B-30A	TCE	CFC 113
77-80 ft	34	18

B-23	TCE
27-31 ft	600
46-48 ft	700

B-25	TCE	1,2-DCE
15-20 ft	360	33
44-47 ft	ND	ND

B-29	TCE	1,2-DCE	CFC 113
15-19 ft	560	150	ND
31-37 ft	370	ND	40
65-70 ft	5.2	ND	ND

B-27	TCE	1,1-DCE	CFC 113
28-31 ft	13,000	1,000	ND
38-41 ft	4,300	ND	1,000
54-57 ft	510	ND	70

B-28	TCE	DCA	1,2-DCE	CFC 113	1,1-DCE
18-20 ft	1,200	ND	180	ND	ND
28-31 ft	8	14	10	10	6

B-7	TCE	TCA	CFC 113
22-26 ft	2,100	ND	ND
39.5-40 ft	18,000	2,100	5,200

B-26	TCE
28-31 ft	ND
45-48 ft	0.5

B-22	TCE	TCA	1,2-DCE	CFC 113
30-34 ft	17,000	1,400	280	3,600

B-3	All compounds
31-33 ft	ND

B-24	TCE	DCA	1,2-DCE
20-23 ft	110	3.6	6.4
29-31 ft	1.3	ND	ND

B-4	TCE
26-28 ft	270
33-35 ft	340
46-50 ft	ND

EMCON

PHILIPS SEMICONDUCTORS
SUBSURFACE INVESTIGATION REPORT
440 NORTH WOLFE ROAD AND 811 EAST ARQUES AVENUE FACILITIES
SUNNYVALE, CALIFORNIA

SITE PLAN WITH GROUNDWATER ANALYTICAL RESULTS

FIGURE NO. 2

PROJECT NO. 377-021.12

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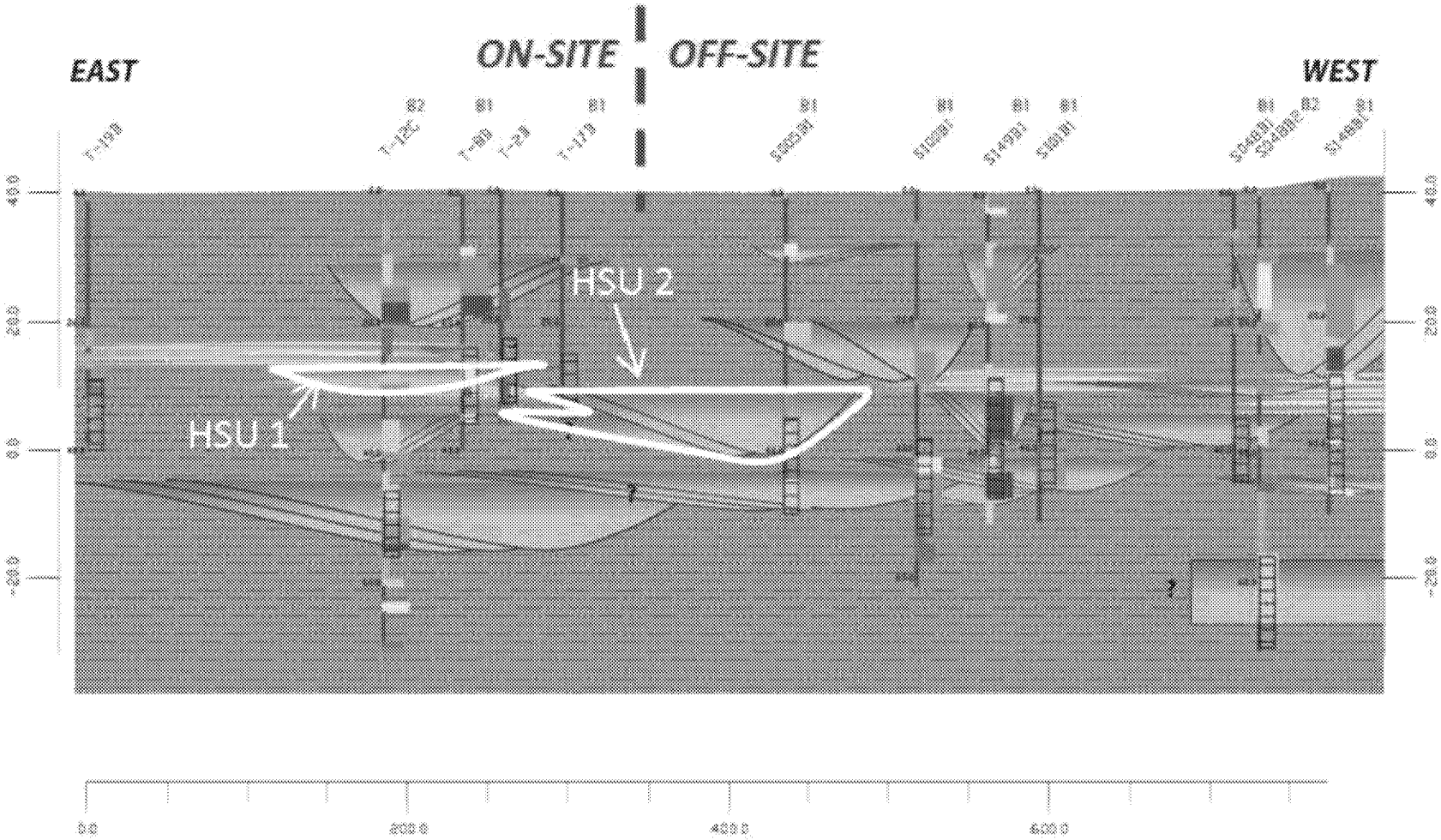
EAST
ON-SITE
OFF-SITE
WEST
HSU 2
HSU 1

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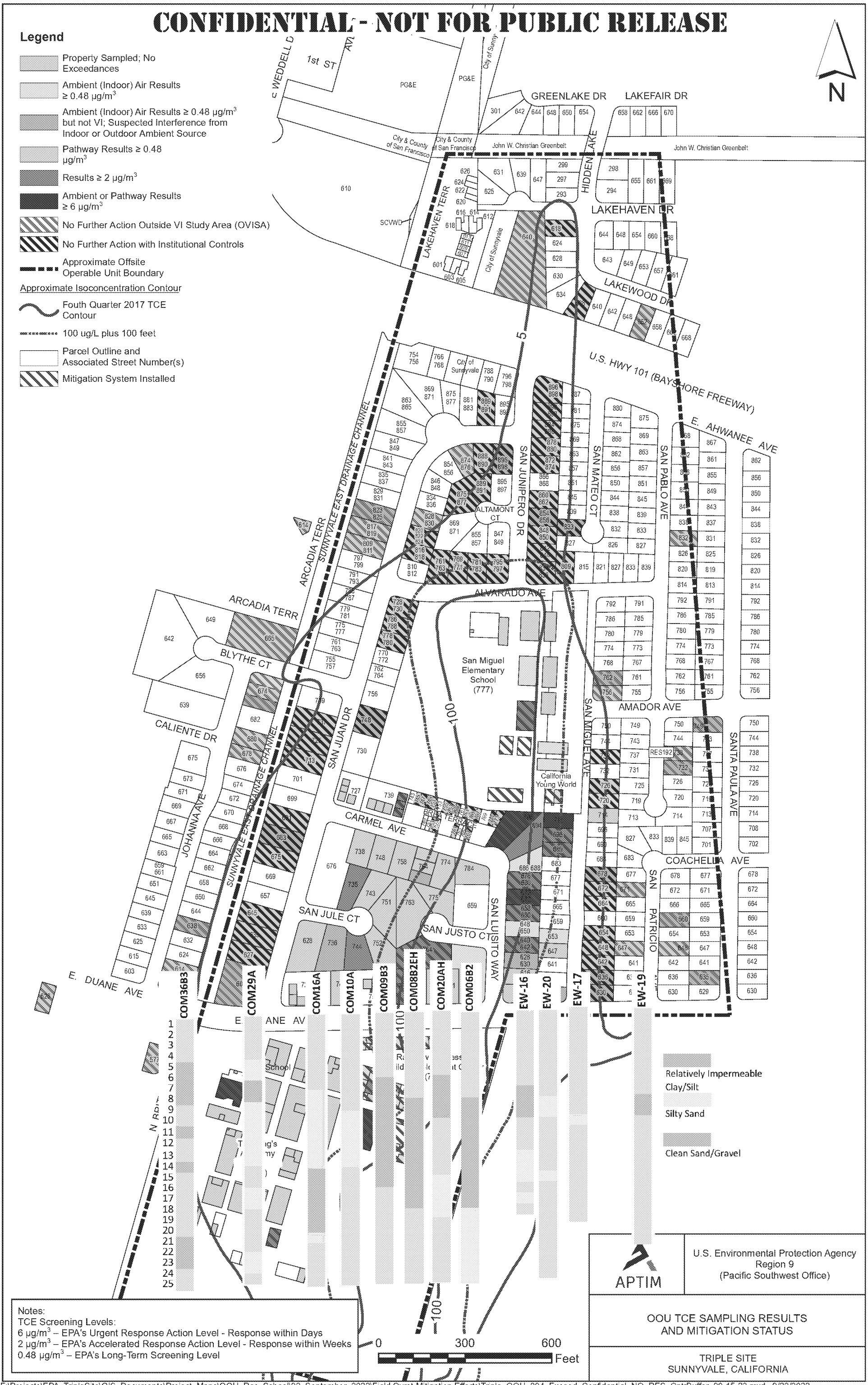

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0.48 µg/m³ – EPA's Long-Term Screening Level

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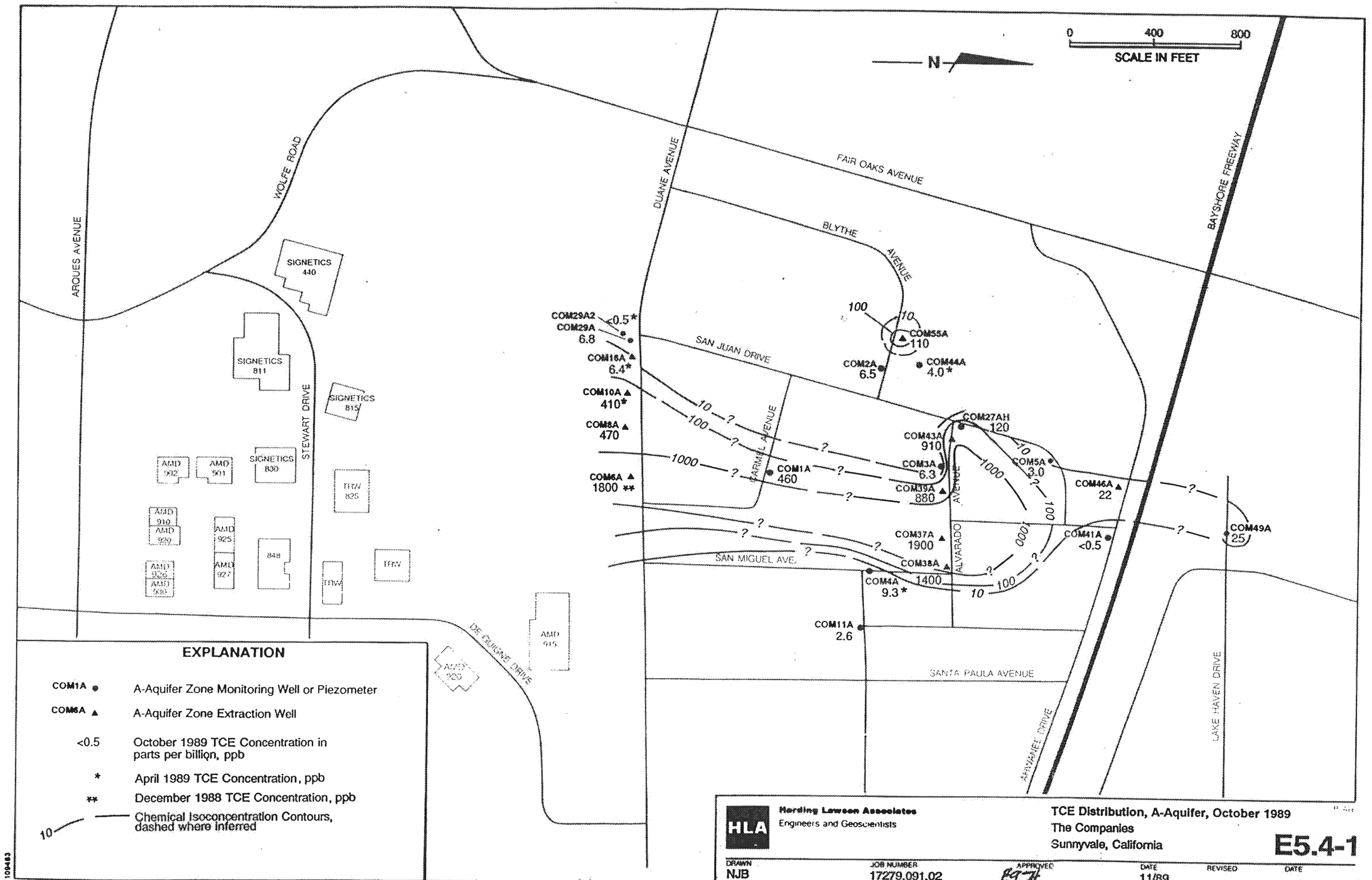

HLA Harding Lawson Associates
Engineers and Geoscientists

TCE Distribution, A-Aquifer, October 1989
The Companies
Sunnyvale, California

E5.4-1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
NJB	17279,091.02	EGH	11/89		

109483

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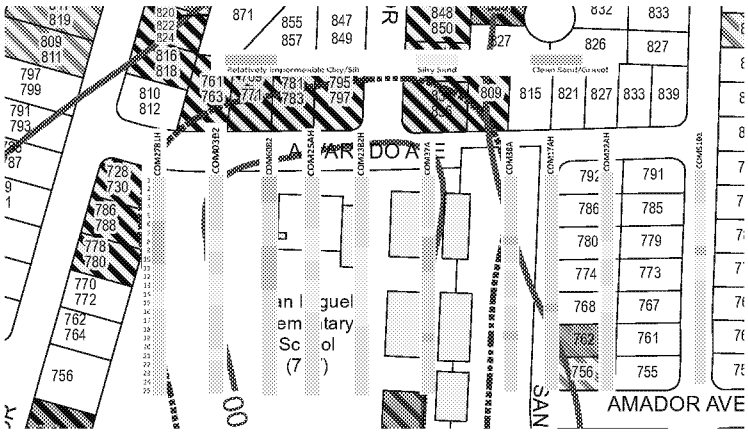
CARMEL AVE
BREATERRACE
SAN LUISITO WAY
Relatively Impermeable Clay/Silt
Silty Sand
Clean Sand/Gravel
Rainbow Montessori
100


AMADOR AVE
Relatively Impermeable Clay/Silt
Silty Sand
Clean Sand/Gravel
COM2781H
COM03B2
COM2SAH
COM2382H
COM37A
COM38A
COM17AH
COM32AH
COM51B1
871
855
857
847
849
848
850
827
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797
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