FINAL CLOSE OUT REPORT

Intel Santa Clara 3 Superfund Site

Santa Clara, California

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ABBREVIATIONS

5YR	five-year review
bgs	below ground surface
EPA	United States Environmental Protection Agency
GMP	Groundwater Management Plan
GWTS	groundwater extraction and treatment system
IC	institutional control
ISCO	in-situ chemical oxidation
MCL	maximum contaminant limit
µg/L	micrograms per liter
MNA	monitored natural attenuation
O&M	operation and maintenance
PS	PlumeStop®
QA/QC	quality assurance/quality control
RWQCB	San Francisco Bay Regional Water Quality Control Board
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SCVWD	Santa Clara Valley Water District
TCE	trichloroethene
UCL	upper confidence limit
VOC	volatile organic compound

I. Introduction

All response actions under the Comprehensive Environmental Response, Compensation, and Liability Act for the Intel Santa Clara 3 Superfund Site have been successfully completed. The purpose of the response actions, as described in the 1990 Record of Decision (ROD) and 2010 ROD Amendment, were to prevent any further migration of contaminants in the groundwater, prevent any future exposure to the public of contaminated groundwater, and to restore the A-zone groundwater to drinking water quality. California and federal drinking water standards at the Site have been achieved.

II. Summary of Site Conditions

Background

The Site is located at 2880 Northwestern Parkway in the City of Santa Clara in Santa Clara County, California, southwest of the intersection of San Tomas Expressway and Interstate Highway 101, as shown on Figure 1. The Site is approximately one acre in size and contains a low-rise building, landscaping, and parking areas (Figure 2). The Site is currently part of Vantage Data Center's (Vantage's) 18-acre Santa Clara campus, which is under redevelopment.

The topography of the area is flat, sloping approximately 10 feet per mile towards the San Francisco Bay, located approximately 3.5 miles to the north of the Site. San Tomas Aquina Creek, located 0.2 miles east of the Site, flows north in a generally unlined channel to the San Francisco Bay.

Geologic investigations indicate that the depositional sediments at the Site consist of heterogeneous alluvial deposits that are a mixture of sand and gravel (stream channel deposits with high to very high relative permeability) interbedded with silts and clays (originating from episodes of flooding and overbank deposition) and exhibit abrupt changes in grain size both horizontally and vertically (Stellar Environmental, 2018a). An extensive silt and clay layer is present from approximately 100 to 150 feet below ground surface (bgs), below which sand and gravel interbeds again appear (Weiss, 1990).

Two water-bearing layers, designated the A and B zones, have been identified at the Site. The shallowest, or A-zone, has its upper boundary at approximately 10 to 18 feet bgs and lower boundary at approximately 25 to 27 feet bgs. Since 1990, depth to first groundwater in A-zone wells has generally been approximately 7 to 12 feet bgs, or roughly 30 feet above mean sea level, indicating that this zone is confined or partially confined. The B-zone is found from approximately 30 to 43 feet bgs and is separated from the A-zone by an aquitard 5 to 10 feet thick. A higher hydraulic head in the B-zone compared with that in the A-zone indicates that the

aquitard is a continuous confining layer (Weiss, 1990). Because groundwater contaminants were detected only in the A-zone, investigations did not extend deeper than the B-zone. Groundwater in both shallow zones flow northerly towards the San Francisco Bay, most likely the point of discharge. Natural recharge occurs at the base of the hills to the south/southwest.

Groundwater extracted from below the regional aquitard provides about half of the water used in Santa Clara County (SCVWD, 2018). Screened intervals for supply wells typically begin at 250 feet bgs or deeper (Weiss, 1990). The closest water supply wells downgradient of the Site are about two miles away on the north side of Interstate Highway 101 (Weiss, 1990).

The 1-acre Site is in the heart of Silicon Valley and is zoned for industrial use. Land use in the immediately surrounding area is light industrial and office/research facilities. There are residential subdivisions to the south of the Site, approximately 1,500 feet away. Intel operated a facility that performed quality control of chemicals and electrical testing of semiconductors from 1976 to 2008. Solvent product was stored indoors and waste solvent was stored outdoors in a small above-ground double-contained facility with a maximum capacity of five drums. An acid waste neutralization system was used to treat waste water. Both the drum storage area and neutralization system were located outside on the west side of the building (Weiss, 1990). Intel sold the property to Vantage in 2010. The Site is now part of the 18-acre Vantage campus, which is fenced with security gates at all entrances.

Early Investigations and Removal Actions

In July 1982, Intel found low concentrations of volatile organic compounds (VOCs) in the groundwater beneath the Site. Over the next several years, Intel conducted groundwater and soil investigations to determine the source and extent of the VOC contamination. No source was identified and groundwater contamination was found to be confined to the shallow A-zone groundwater. In February 1985, a groundwater extraction and treatment system (GWTS) began operation. This GWTS consisted of two extraction wells, with granular activated carbon treatment and discharge of treated groundwater at the Site to San Tomas Aquino Creek via the storm water sewer under a National Pollution Discharge Elimination System permit.

The Site was added to the National Priorities list in 1986 and EPA designated the San Francisco Regional Water Quality Control Board (RWQCB) as the lead agency to oversee cleanup.

Final Investigations and Remedies Selected

Additional groundwater monitoring wells were installed in 1987 to define the extent of groundwater contamination and a soil gas investigation was conducted in 1988 to identify potential VOC sources. No VOC sources were identified. The Remedial Investigation/ Feasibility Study (RI/FS) and baseline risk assessment were completed in 1990.

The ROD summary of site risks indicated an excess lifetime cancer risk based on use of on-site contaminated groundwater for drinking water of $7x10^{-5}$ (7 people out of 100,000 people), based on the maximum VOC concentrations detected in groundwater in 1989. The non-carcinogenic risk estimate for contaminated groundwater indicated that no adverse non-carcinogenic health effects were expected.

The ecological assessment summarized in the ROD concluded that there is no probable pathway for exposure to critical habitats or endangered species. The Site is in a commercial-light industrial setting and no parks or surface water features are nearby. Over 90% of the Site is covered with pavement or building slab.

Based on the risk assessment and beneficial uses for groundwater specified in the Basin Plan (RWQCB, 2017), the remedial action objective was to restore groundwater to its beneficial use as drinking water. On July 18, 1990, the RWQCB adopted Order No. 90-105, Final Site Cleanup Requirements, which included addition of a third extraction well and pulsed pumping trials for the GWTS, continued carbon treatment, permitted discharge for the extracted groundwater, continued groundwater monitoring, and implementation of a deed restriction for shallow groundwater use. The ROD, which mirrored the RWQCB Order, was issued on September 20, 1990 (EPA, 1990). Although the ROD listed maximum contaminant level (MCL) cleanup criteria for nine different VOCs, only trichloroethene (TCE) remained above the MCL when the ROD was issued (Table 1). At that time, the maximum TCE concentration detected in groundwater was approximately 100 micrograms per liter (µg/L); the MCL for TCE is 5 µg/L. In 1993, Intel and EPA signed an Administrative Consent Order establishing liability for cost of cleanup at the Site.

A ROD Amendment was signed on September 7, 2010, modifying the previously selected remedy for the Site, but leaving intact the 1990 ROD's remedial action objective of restoring groundwater to its beneficial use as drinking water (EPA, 2010). The evaluations leading to the ROD Amendment are described in the following section. The new remedy selected in the 2010 ROD Amendment included the following elements (EPA, 2010):

- The deed restriction already recorded for the Site;
- Ongoing groundwater monitoring; and
- Monitored natural attenuation (MNA) to achieve groundwater clean-up standards

Remedial Actions

The deed restriction requirement of the 1990 ROD was recorded with Santa Clara County on September 11, 1991, specifying that no groundwater production well could be installed at the Site without RWQCB approval (RWQCB, 1991). The new third extraction well was installed in 1990 and pulsed pumping trials were conducted from 1991 through 1993. The RWQCB then concluded that neither pulsed nor continuous groundwater extraction was effective at further reduction of groundwater TCE concentrations and, in 1994 the RWQCB approved closure of the

groundwater extraction system. The maximum groundwater TCE concentration at the Site at that time was approximately 50 µg/L. On August 18, 1992, EPA issued the Preliminary Close-Out Report for the Site, documenting that all remedy construction activities had been completed in accordance with the ROD and Regional Board Order No. 90-105 (EPA, 1992).

In the 12 years that followed, several additional pilot test remedies were implemented in attempts to bring the TCE concentrations of groundwater in all wells below the MCL. In 2005, an in-situ chemical oxidation (ISCO) pilot test was implemented using the Regenesis product RegenOx. The ISCO remedy did not achieve the MCL in all wells, resulting in Intel's request for a technical impracticability waiver (Stellar Environmental, 2007). EPA determined that the site conditions did not meet the waiver criteria.

In January 2008, a new and expanded deed restriction was recorded with Santa Clara County (Regional Board, 2008). In addition to restricting extraction of groundwater, the new deed restriction included specifications that no residences, hospitals, schools, or daycare centers could be built at the Site and that no excavations greater than 3 feet bgs were allowed without RWQCB approval.

In September 2010 EPA issued a ROD Amendment, changing the remedy from extraction and treatment to MNA.

By August 2010, the former Intel facility was in the process of redevelopment by the new owner, Vantage Data Systems. The redevelopment did not entail changes to the footprint of the building or require deep excavations into the small area of the residual plume footprint. However, part of the redevelopment necessitated the closure and replacement of several A-zone monitoring wells and the closure of two B-zone wells. These monitoring well closures and replacements were approved by EPA.

On May 4, 2011, EPA issued a Unilateral Administrative Order (UAO) with its associated Statement of Work for a Site Groundwater Monitoring Plan (GMP). The GMP specified groundwater monitoring on an annual basis. The RWQCB officially rescinded the Site Cleanup Requirements for the Intel SC3 Site (Order R2-2014-0016) on May 1, 2014.

By 2014, only samples collected from well SC3-3Rep consistently reported TCE analytical sampling result concentrations above the ROD cleanup level of 5.0 µg/L. Of the five other wells that were monitored, SC3-7ARep had reported no detections (< 0.5 µg/L) of TCE concentrations since the well replacement occurred in early 2011; well SC3-1Rep reported TCE concentrations below the MCL for 7 years (until 2016, when a concentration of 5.2 µg/L was measured); and, wells SC3-2, SC3-5A/SC3-5ARep, and SC3-6 had reported no detectable TCE concentrations for at least 10 years.

In another effort to overcome the TCE matrix diffusion occurring around well SC3-3Rep, a pilot test was conducted to determine if pumping at that well could reduce TCE to below 5 µg/L. The temporary groundwater extraction with discharge, under a permit with the San Jose/Santa Clara Water Pollution Control Plant, operated from August 7, 2014, to April 22, 2015. This groundwater extraction did not result in any statistically significant decrease in groundwater TCE concentrations at well SC3-3Rep.

Intel, with EPA approval, then conducted a pilot test using PlumeStop (PS), a Regenesis product consisting of injectable emulsified micro-sized activated carbon, to reduce the TCE at wells SC3-3Rep and SC3-1Rep (Stellar Environmental, 2016). The PS pilot test was implemented in September 2016, with follow-up injections around well SC3-1Rep in September 2017 due to concentration rebound in this area after the first injection. The post-injection groundwater monitoring data for wells SC3-1Rep and SC3-3Rep were analyzed with EPA tools for evaluating completion of groundwater restoration (EPA, 2014a-c). The two criteria to determine if MCLs had been attained were:

1) The 95 percent upper confidence limit (UCL) on the mean of all attainment period TCE concentrations for each well is 5 µg/L or less. The "EPA Groundwater Statistics Tool" (EPA, 2014c) was used to evaluate the data distribution and calculate an appropriate 95 percent UCL.

2) Trend analysis for attainment period TCE concentrations over time indicates steady state or decreasing concentrations. Trend analysis was conducted as specified in the EPA guidance referenced above.

The groundwater sampling results and statistical analyses for these post-injection monitoring events are discussed in more detail in Sections III and IV.

Institutional Controls

As described above, the remedy specified in the 1990 ROD included a deed restriction on use of groundwater from the A zone; this deed restriction was recorded in 1991. In 2008, this deed restriction was replaced with an expanded deed restriction that also included specifications that no residences, hospitals, schools, or daycare centers could be built at the Site and that no excavations greater than 3 feet bgs were allowed without RWQCB approval. The 2010 ROD Amendment that changes the remedy to MNA also specified that the deed restriction remain in place until MCLs are achieved. Now that MCLs are achieved, the deed restriction is no longer needed. In accordance with the deed restriction language, it has now been terminated with review and written approval by both the RWQCB and EPA (Regional Board, 2018; EPA, 2018).

III. Monitoring Results

Groundwater monitoring at the Site began in 1982. By 1990 TCE was the only VOC remaining above its MCL, and after 2011 the only wells with TCE detected above the MCL were SC3-1Rep and SC3-3Rep. Figure 2 presents the former monitoring well locations, the estimated extent of TCE above-the MCL in 1995 and 2016, and the reported concentrations of TCE in select wells from 1995, 2016, and 2018.

EPA's assessment of Site groundwater monitoring data through 2016 indicates that VOC concentrations in all monitoring wells had been below MCLs for at least 5 years except for those in wells SC3-1Rep and SC3-3Rep. Only these two wells required ongoing monitoring and the areas around these two wells are where the PS injections were performed. A post-injection monitoring plan and criteria for evaluating groundwater restoration were presented in the PS Work Plan (Stellar Environmental, 2016), which EPA approved (EPA, 2017). The monitoring plan included monthly sampling of the two wells, with data evaluation using EPA guidance and tools, as described above.

Following the first round of PS injections in September 2016, TCE concentrations in well SC3-1Rep were initially reduced to below the MCL but then rebounded to slightly above the MCL (Figure 3). Therefore, a second round of PS injections was performed in September 2017. Following this second round of injections, TCE in well SC3-1Rep was consistently not detected above its MCL of 5.0 µg/L for 7 consecutive monthly monitoring events: 2.5 µg/L for the first monthly event in October 2017 and non-detect (<0.5 µg/L reporting limit) for all six subsequent monthly sampling events. As shown on Figure 3, all 18 post-injection results for well SC3-3Rep were non-detect (<0.5 µg/L) for TCE.

IV. Attainment of Groundwater Restoration Clean-up Levels

As described above, the areas around wells SC3-1Rep and SC3-3Rep were the only locations with TCE concentrations above the MCL, and therefore were targeted for TCE reduction by the PS injections in 2016 and 2017. These two injections successfully reduced TCE to below its MCL.

The first EPA attainment criterion (noted in Section II), calculating the 95 percent UCL, could not be calculated using post-injection TCE concentrations because all TCE results were non-detect. Instead, the 95%UCL was calculated using the laboratory detection limit of 0.5 µg/L. This produced a 95 percent UCL of 2.03 µg/L.

For the second EPA attainment criterion, trend analysis, EPA determined that because there was no variation in concentration, there was no concentration trend over time. Based on this analysis of post-injection TCE monitoring, groundwater restoration in the area of wells SC3-

1Rep and SC3-3Rep is complete. Because these were the only areas at the Site that were above the TCE MCL, site-wide groundwater restoration is now complete.

V. Summary of Operation and Maintenance Required

No operation and maintenance (O&M) activities are required at this site. All clean-up goals have been met and no further remedial actions are required. ICs are no longer required.

VI. Demonstration of Clean-up Activity Quality Assurance/Quality Control

Construction QA/QC

The remedial actions selected by the 2010 ROD Amendment did not require any additional construction activities. The remedial actions consisted of MNA and ICs. The MNA utilized existing wells for ongoing monitoring, therefore no construction QA/QC plan was prepared for the remedial action.

Operation and Maintenance QA/QC

The O&M activity associated with the MNA remedy consisted of annual groundwater monitoring. No O&M activities were necessary or conducted relating to the IC remedy component.

Annual groundwater monitoring was conducted according to the EPA-approved Groundwater Monitoring Plan (GMP; Stellar Environmental, 2011). Seven A-zone monitoring wells remained at the Site in 2011 and were subject to this GMP. One of the seven wells, downgradient well SC3-9A (Figure 2), which had never shown detectable TCE concentrations in over 20 years of monitoring, was paved over in 2013 by the Site owner. The well was properly closed under an SCVWD well destruction permit on September 18, 2015. As the well had not shown detectable VOCs, EPA agreed that it did not need to be replaced.

As specified in the GMP, the seven (then six) wells were purged using low-flow/micropurge bladder pumps with new Teflon® tubing. During purging, field measurements for temperature, pH, conductivity dissolved oxygen and turbidity were taken using a calibrated YSI, Horiba U-22, or equivalent meter. After the well had been purged until stable (three successive readings within ±0.1 for pH, ±3% for conductivity, ±10 mv for oxidation-reduction potential, and ±10% for turbidity and dissolved oxygen), the samples were collected from the tubing into new HCL-preserved 40-ml glass VOC-certified containers supplied by the analytical laboratory.

Labeled samples were stored in an ice-cooled chest and transported under chain-of-custody protocol to the analytical laboratory. The groundwater samples were submitted to Curtis & Tompkins, Ltd. (now Enthalpy Analytical), a California-certified laboratory, for analysis of

VOCs by EPA Method 8260B (using an EPA Method 8010 analyte list extended to include Freon 113 based on its historical presence at the Site).

Data validation reporting was not required by the GMP. At the time the GMP was established, the data set did not require validation because none of the previous data were flagged and there were many "non-detect" data points.

VII. Five-Year Review

No further five-year reviews will be conducted because they are no longer required. No waste was left in place above an unlimited use, unrestricted exposure level. To date, five five-year reviews have been conducted. These reviews were conducted because contaminant levels in the groundwater exceeded the ROD clean-up levels. The groundwater has since attained all clean-up levels.

Summary of Last Five-Year Review

The most recent five-year review was completed in August 2016 (EPA, 2016). The Protectiveness Statement (page 13) is:

> The remedy at the Site is protective of human health and the environment. The groundwater contamination has been reduced below drinking water standards (MCLs) in all but a very limited area. Any groundwater exposure pathway that could result in unacceptable risks is currently being controlled through the use of a land use covenant that restricts soil excavation and property development, and prohibits the drilling of groundwater wells.

No issues affecting protectiveness were identified during this FYR; therefore, no recommendations or follow-up actions were specified. As described in Section IX, the land use covenant has been terminated with EPA and RWQCB approval.

VIII. Site Completion Criteria

The implemented remedy achieves the degree of cleanup specified in the ROD and ROD Amendment for all pathways of exposure. All selected remedial action objectives and clean-up goals are consistent with agency policy and guidance. No further Superfund responses are needed to protect human health and the environment at the Site.

IX. Completion of Institutional Controls

As described in Section II, the IC specified in both the 1990 ROD and the 2010 ROD Amendment is a restrictive land use covenant to prevent exposure to the contaminated groundwater.

With the achievement of the groundwater cleanup levels, the IC is no longer needed. Both the original ROD and the ROD Amendment required that, until the cleanup levels are achieved, the deed restriction be in place to protect against inappropriate use of the contaminated groundwater. After the cleanup levels are achieved, the IC would not be needed. As documented in this report, the groundwater cleanup levels have now been achieved; therefore, the IC is no longer necessary and will be terminated (Regional Board, 2018).

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XI. Table and Figures

Table 1.
MCL Cleanup Standards and Summary of Maximum VOC Concentrations in Groundwater over Time,
Intel Santa Clara 3, Santa Clara, CA

Contaminant	MCL	Initial (1982-85)	At ROD (1989-90)	Post GWET (1993-95)	Pre-Plume Stop (2016)	Post-Plume Stop (2018)
		Maximum concentration in micrograms per liter (µg/L)				
Trichloroethene (TCE)	**5**	**490**	**140**	**76**	**6.2**	<0.5
1,1,1-trichloroethane (1,1,1-TCA)	**200**	**810**	2.1	<0.5	<0.5	<0.5
1,1-dichloroethene (1,1-DCE)	**6**	**84**	ND	<0.5	<0.5	<0.5
1,1-dichloroethane (1,1-DCA)	**5**	**8.2**[a]	ND	<0.5	<0.5	<0.5
1,2-dichloroethane (1,2-DCA)	**0.5**	**16.0**[a]	ND	<0.5	<0.5	<0.5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon-113)	**1,200**	**1,300**	35	13	2.6	<2.0

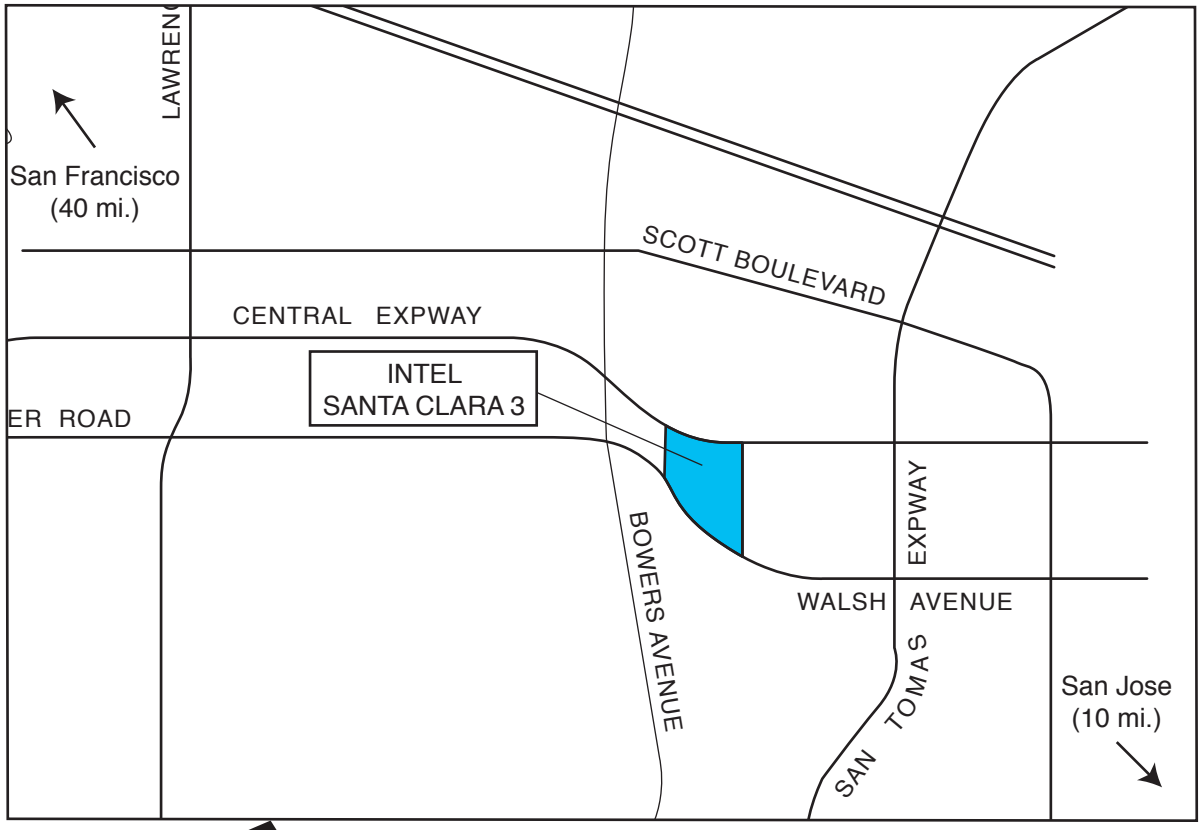
Table 1 Notes:

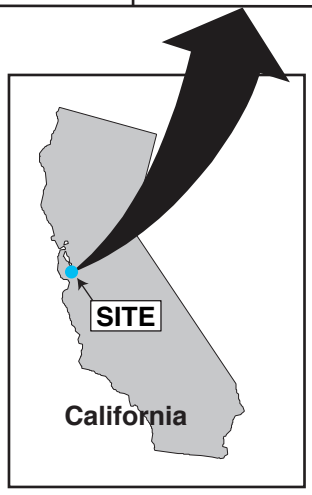
[a] Results are anomalous and suspected laboratory errors.

ND = Not detected at laboratory reporting limits ranging from 0.5 to 5 µg/L.

<0.5 = Not detected at the laboratory reporting limit of 0.5 µg/L.

<2.0 = Not detected at the laboratory reporting limit of 2.0 µg/L.





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SITE LOCATION MAP

Intel Santa Clara 3 Santa Clara, CA	By: MJC	OCTOBER 2018
	Figure 1	

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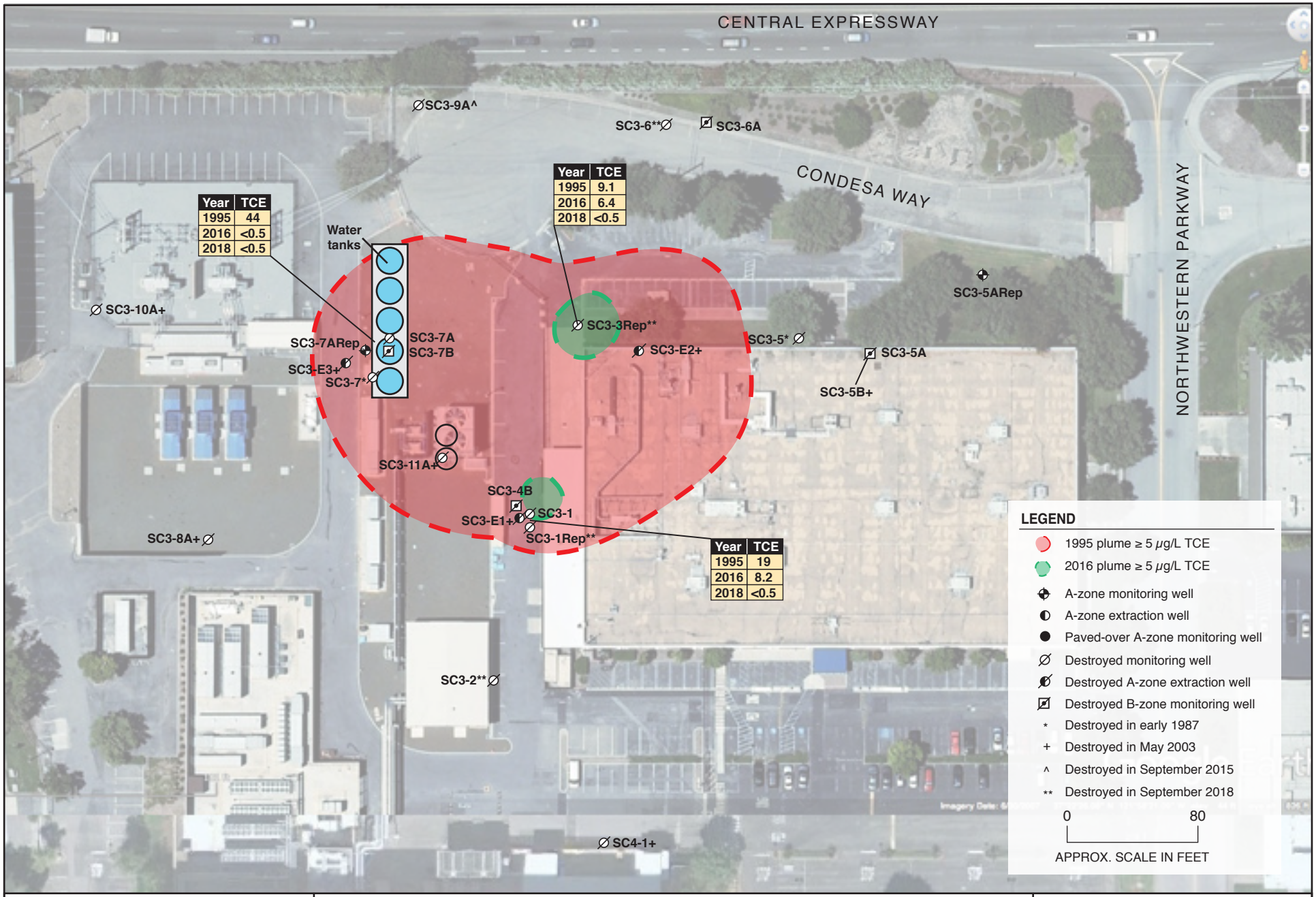
2018-01-05



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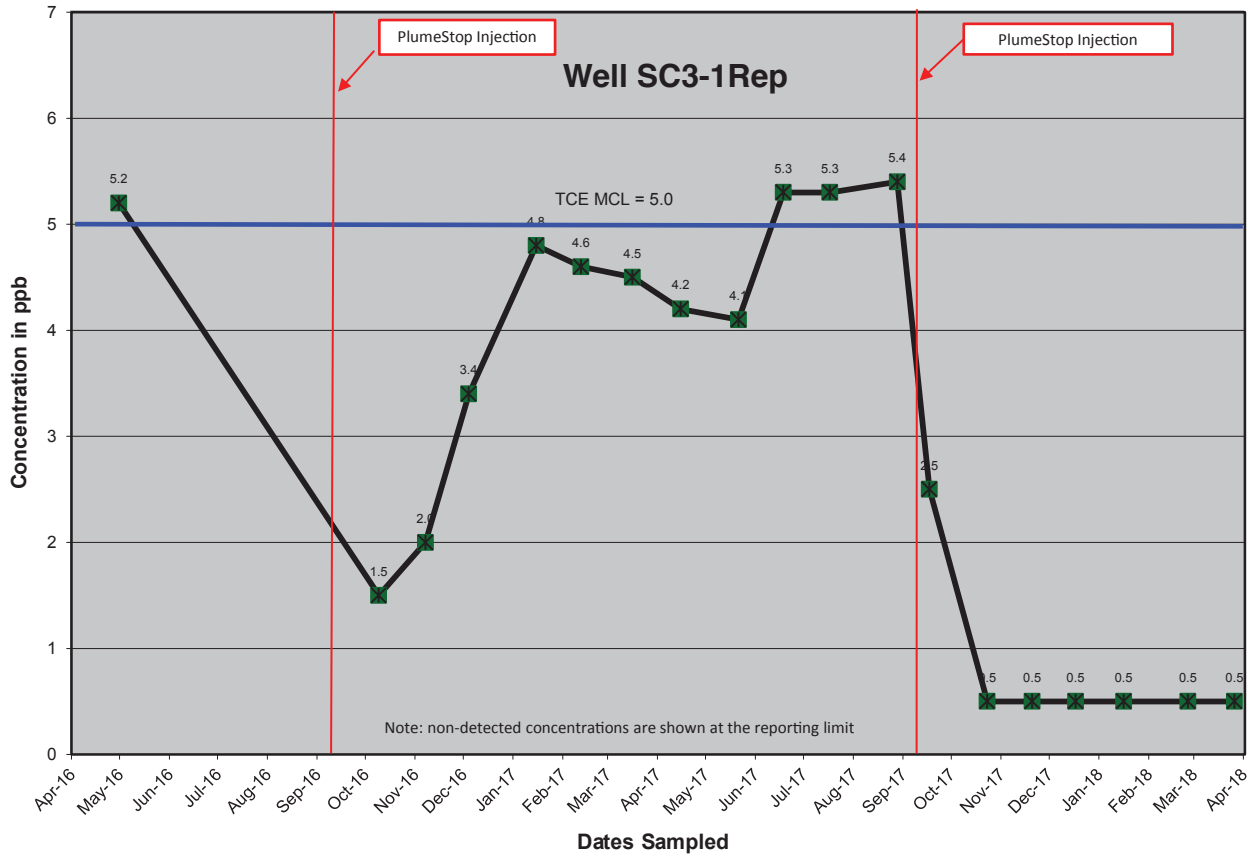
INTEL SC3 GROUNDWATER TCE PLUME OVER TIME

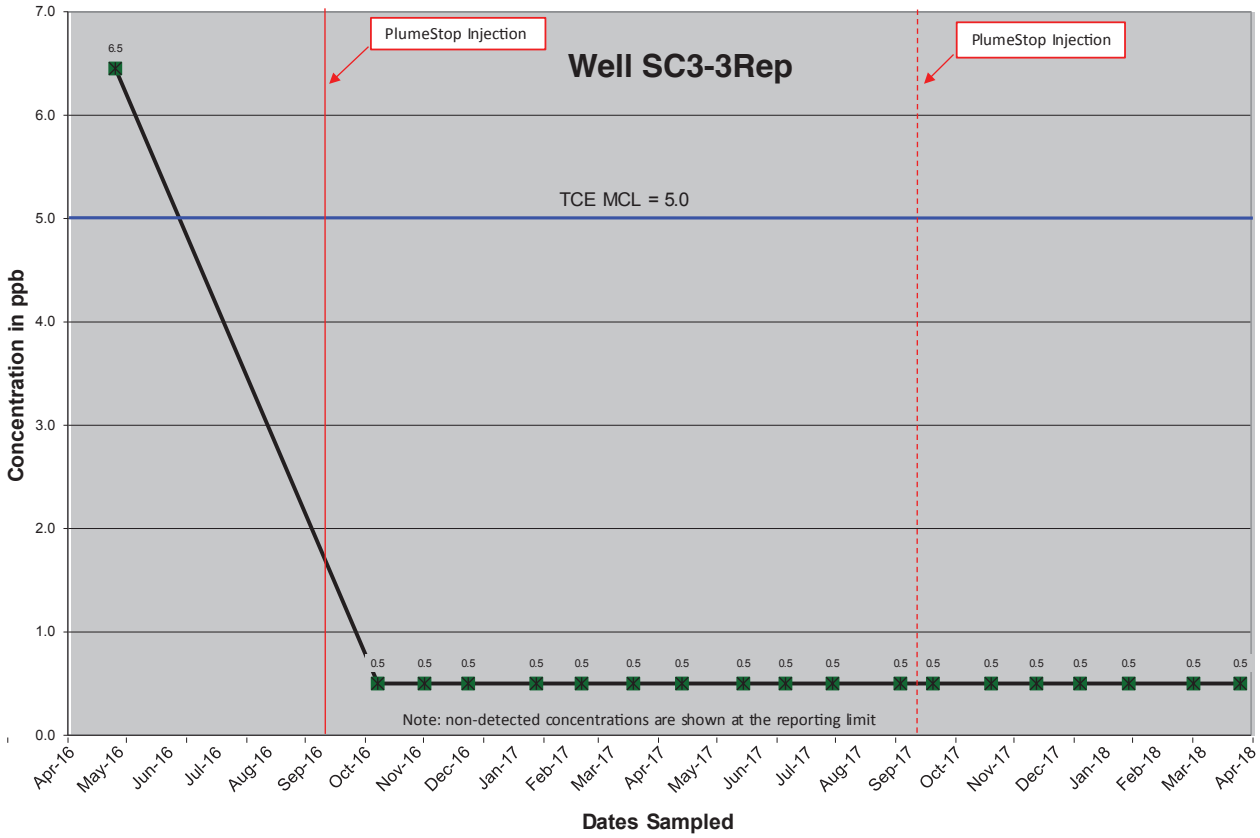
2800 Northwestern Parkway, Santa Clara, CA

Figure 2

by: MJC | OCTOBER 2018

2018-01-06





TCE MCL ATTAINMENT MONITORING DATA

Intel Santa Clara 3 2800 Northwestern Pkwy. Santa Clara, CA	By: MJC	OCTOBER 2018
	Figure 3	

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