AECOM

ANNUAL GROUNDWATER MONITORING AND REMEDIAL PROGRESS REPORT

FORMER TRW MICROWAVE SITE
825 STEWART DRIVE
SUNNYVALE, CALIFORNIA

FEBRUARY 2015

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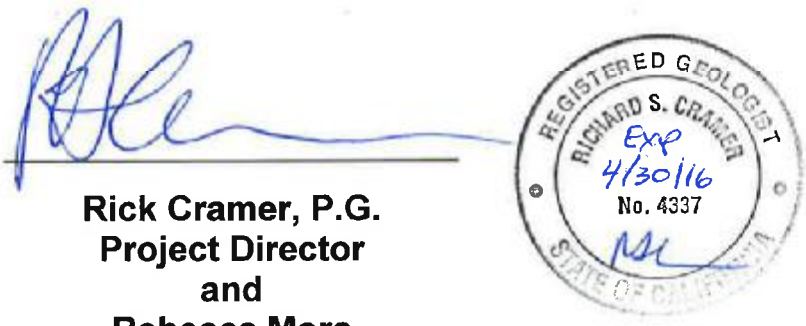

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1.0 INTRODUCTION

This Annual Groundwater Monitoring and Remedial Progress Report (report) presents the results of the groundwater monitoring program and summarizes the remedial activities conducted by Northrop Grumman Systems Corporation (Northrop Grumman) in 2014 at the former TRW Microwave Site (the "Site") in Sunnyvale, California (Figure 1). The groundwater monitoring program includes 1) annual monitoring activities to fulfill the requirements of the California Regional Water Quality Control Board - San Francisco Bay Region (Water Board, 1999) including a Non-Pumping Conditions (NPC) evaluation and 2) semi-annual monitoring performed as part of the Enhanced Anaerobic Bioremediation (EAB) program, in accordance with the Water Board's February 17, 2004 letter (Water Board, 2004a).

Two significant changes have occurred for the Site during the current 2014 monitoring period. First, the lead regulatory agency for the Site has been transferred from the Water Board to the United States Environmental Protection Agency (USEPA), per notification from USEPA in a letter dated August, 7, 2014 (USEPA, 2014). Second, the property changed ownership in early 2014 from Pacific Landmark LLC to 825 Stewart Acquisition Partners LLC. The new owner started property redevelopment activities in late 2014 that will be ongoing into the first quarter of 2015.

1.1 Groundwater Monitoring Well Network

Forty-two (42) wells and the Eductor (a groundwater extraction pipe installed within the former underground storage tank [UST] gravel backfill pit) have been completed at the Site in four depth intervals, designated as Zones A, B1, B2, and B4 (Table 1). These zones consist of permeable sediments, ranging from silty sand to sand and gravel, and are vertically separated by laterally continuous lower permeability clay and silt intervals.

In 2004, wells T-1A and T-1B were abandoned with permission from the Water Board. Figure 2 shows the Site layout and existing well locations (as of October 2014). As later discussed in Section 2.3.5, four wells (T-2A, T-2B, T-2C, and T-3A) and the Eductor, all located inside the building, were destroyed in October and November 2014.

1.2 Groundwater Monitoring Program

The groundwater monitoring program at the Site includes two components: 1) evaluation of NPC and 2) evaluation of the EAB program. The NPC evaluation was initiated in April 2001 and involves the evaluation of volatile organic compound (VOC) concentration trends after complete suspension of groundwater extraction at the Site. Section 2.1 discusses the groundwater extraction and treatment (GWET) system that was previously operated at the Site. The EAB program was initiated in October 2000 in order to more aggressively remediate the former Site source area (the former UST area) and was expanded to the area immediately downgradient of the former Site source area starting in August 2005. The EAB program is discussed in Section 2.2.

Selected wells are monitored on a semi-annual basis as part of the EAB program and/or NPC evaluation. For the 2014 calendar year, Northrop Grumman followed the approved monitoring schedule submitted to the Water Board and USEPA in 2007 (Water Board, 2007).

All groundwater samples were analyzed for VOCs using USEPA Test Method 8260B. As part of the EAB program, select samples were also analyzed for geochemical parameters, electron acceptors, and metabolic by-products using USEPA test methods or other standard methods, and dechlorinating microbes using polymerase chain reaction methods. A detailed discussion of the relevance of the individual EAB analyses was presented in the *Evaluation of Natural Attenuation and Chemical Oxidation Report* (CDM, 2000a). A detailed discussion of the EAB process and groundwater oxidizing and reducing conditions was presented in the work plan for the initial EAB program (CDM, 2000b). In addition to these analyses, selected wells have periodically (including the 2014 annual event) been sampled and analyzed for compound specific isotope analysis (CSIA) to evaluate off-site and source area contaminant contributions and the effectiveness of the EAB program.

2.0 SITE REMEDIAL ACTIVITIES

This section presents a discussion of the GWET system (which was removed in 2012), the EAB program, and 2014 remedial activities at the Site. Figure 3 illustrates soil and groundwater remediation activities performed at the Site through 2014.

2.1 Groundwater Extraction and Treatment System

The GWET system operated from 1985 to April 2001. The GWET system consisted of seven extraction wells (completed at three cluster locations), the Eductor, transmission pipelines, and a treatment system. Although groundwater extraction no longer occurs, the following extraction wells and Eductor were used for groundwater monitoring in October 2014.

- The T-2 cluster: Wells T-2A, T-2B, and T-2C, completed in Zones A, B1, and B2, respectively. These wells were destroyed in November 2014.
- The T-8 cluster: Wells T-8A and T-8B, completed in Zones A and B1, respectively.
- The T-9 cluster: Wells T-9A and T-9B, completed in Zones A and B1, respectively.
- The Eductor consisted of a perforated PVC pipe within a gravel-backfilled excavation (Site source area), completed in Zone A at a location adjacent to and immediately up gradient of the T-2 cluster. The Eductor was destroyed in October 2014.

Extracted groundwater was treated at the Site via an air stripper to remove VOCs, under a Bay Area Air Quality Management District permit. Treated groundwater was discharged to the storm drain under a National Pollutant Discharge Elimination System permit. A total of approximately 92.5 million gallons of groundwater were extracted prior to suspension in 2001, from which approximately 3,100 pounds of trichloroethene (TCE) were removed.

Pumps in extraction wells at and near the former Site source area (T-2A, T-2B, T-2C, T-8A, T-8B, and the Eductor) were turned off prior to, or shortly after, the initiation of the EAB program (Water Board, 2000). In April 2001, pumps in the remaining two extraction wells, located near the northern property boundary (T-9A and T-9B), were turned off to allow the property owner to conduct Site redevelopment activities (Water Board, 2001a). Subsequently, approval from the Water Board was received for the continued suspension of groundwater extraction based on

changes in VOC concentrations after suspension (CDM, 2001 and Water Board, 2001b). As a result of continued improvements in groundwater VOC concentrations across the Site, the Water Board approved suspension of groundwater extraction and recommended suspension be continued in their Five-Year Review report to USEPA (Water Board, 2004a and 2004b). USEPA approved the Water Board's Five-Year Review report (USEPA, 2004). Since April 2001, groundwater extraction at the Site has not occurred. The GWET system was dismantled and removed from the Site in November 2012 because it had deteriorated beyond repair.

2.2 Enhanced Anaerobic Bioremediation Program

Following completion of CDM's *Evaluation of Natural Attenuation and Chemical Oxidation Report* (CDM, 2000a) and approval from the Water Board (Water Board, 2000), Northrop Grumman (then TRW Inc.) implemented the EAB program at the Site. The following presents the chronology of the implementation and progress of the EAB program:

Date	Report/Letter/Event
March 2000	CDM's report on the evaluation of natural attenuation and chemical oxidation recommended that in situ remediation via EAB be implemented for Zone B1 (CDM, 2000a).
August 2000	CDM submitted a work plan to implement an EAB pilot program in Zone B1 at the former Site source area (CDM, 2000b).
October 2000	After verbal approval from the Water Board, CDM implemented the EAB pilot program by injecting polylactate ester (via Regenesis' Hydrogen Release Compound [HRC] products) into Zone B1 in and around the former Site source area (see Figure 3).
April 2001	Based on the periodic monitoring of Zone A wells within the EAB treatment area, CDM determined that the limited amount of the HRC product that was injected into Zone A during the injection into Zone B1 had significantly changed conditions in Zone A to support EAB. CDM submitted an addendum to the EAB work plan to inject electron donor into Zone A. The Water Board approved the addendum. (CDM, 2001 and Water Board, 2001b)
June 2001	CDM injected slow-releasing HRC to target Zone A. In addition, injections within the footprint of the former treatment system, which was not possible during October 2000 injection, were advanced into Zone B1.
December 2003, January 2004, and February 2005	Effectiveness monitoring showed that the EAB application increased the rate of chlorinated VOC biodegradation occurring within the former Site source area and accelerated VOC attenuation rates across the downgradient portions of the Site.
August 2005	Subsequent to Water Board approval (Water Board, 2005), the EAB pilot program was expanded to include groundwater immediately downgradient of the former Site source area in Zone A and Zone B1 (CDM, 2005) (see Figure 3).
April 2006	CDM submitted the Revised Proposed Plan to USEPA in order to change the groundwater remedy from GWET to in situ bioremediation (CDM,

Date	Report/Letter/Event
	2006).
July 2006	Water Board issued a letter to USEPA in which they concurred with conclusions of the Revised Proposed Plan and recommended to USEPA to change the groundwater remedy for the Site from GWET to in situ bioremediation (Water Board, 2006).
January 2007	EAB performance monitoring showed that EAB continues to improve the groundwater quality and enhance VOC degradation in and around the former Site source area; however, VOC degradation has slowed at downgradient portions of the plume due to competing electron acceptors (Northrop Grumman, 2007).
June 2007	CDM submitted work plan for additional Zone A EAB remedial activities, which proposed to conduct four quarterly cheese whey injections in the expanded portion of Zone A downgradient of the former Site source area (CDM, 2007).
August 2007	Subsequent to Water Board approval (Water Board, 2007), CDM installed seven injection wells and one monitoring well as part of the downgradient Zone A EAB treatment area.
September 2007	Tamalpais Environmental Consultants (TEC), under CDM's oversight, performed the first of four quarterly cheese whey injection events into wells T-13A, T-14A, and T-18A through T-24A.
November 2007	CDM performed a one-time bioaugmentation event into wells T-13A, T-14A, and T-18A through T-24A, using groundwater from Eductor well.
December 2007	TEC, under CDM's oversight, performed the second of four quarterly cheese whey injection events into wells T-13A, T-14A, and T-18A through T-24A.
March 2008	TEC, under CDM's oversight, performed the third of four quarterly cheese whey injection events into wells T-13A, T-14A, and T-18A through T-24A.
June 2008	TEC, under CDM's oversight, performed the last of four quarterly cheese whey injection events into wells T-13A, T-14A, and T-18A through T-24A.
January 2010	EAB performance monitoring showed depletion of electron donor (cheese whey) and initial rebound of competing electron acceptors in the expanded EAB treatment area (Northrop Grumman, 2010).
October 2010	AECOM submitted a work plan for additional Zone A EAB remedial activities, which proposed to conduct one emulsified vegetable oil (EVO) injection and one neat vegetable oil injection in the former Site source area.
October 2010	AECOM injected EVO into the Eductor, located in Zone A within the former Site source area excavation.
November 2010	Vironex, under AECOM oversight, injected neat vegetable oil into the Eductor, located in Zone A within the former Site source area excavation.

Date	Report/Letter/Event
November 2011	AECOM submitted a work plan for additional EAB remedial activities, which proposed to inject EHC-L and ABC+ downgradient of the former Site source area.
November 2011	Redox Tech, under AECOM oversight, injected EHC-L into injection wells T-13A, T-14A, and T-18A through T-24A and injected ABC+ into Zone A and Zone B1 via nine direct push locations (see Figure 3).

2.3 Remedial Activities Performed in 2014

During the current monitoring period (calendar year 2014), AECOM, on behalf of Northrop Grumman, conducted the annual groundwater monitoring event and continued semi-annual groundwater monitoring of selected Site wells for the EAB program and NPC evaluation. Several additional remedial activities were performed at the Site this year, most occurring after the property was sold in early 2014. These activities included 1) groundwater extraction from the Eductor, 2) an expanded membrane interface probe (MIP) investigation in the former source area, 3) installation of a passive sub-slab vapor collection system, 4) source area excavation, 5) well destruction inside the building, and 6) additional EAB injection activities in the source area. A description of all 2014 Site activities is provided below.

2.3.1 Groundwater Monitoring

Groundwater samples were collected from 13 wells and the Eductor as part of the semi-annual EAB evaluation on April 14 and 15, 2014. Groundwater levels were measured in all accessible Site wells on October 13, 2014 in conjunction with the annual groundwater monitoring events at adjacent operable units and the off-site operable unit. For the annual monitoring event, groundwater samples were collected from 32 monitoring wells and the Eductor from October 13 to 16, 2014 as part of the NPC evaluation and/or the EAB evaluation. Note, that AECOM collected groundwater samples from the wells located in the building (wells T-2A, T-2B, T-2C, and T-3A) and the Eductor on September 24 and 25, 2014, because those wells were scheduled for destruction prior to the October sampling event. Standard field procedures utilized for groundwater sampling and the low-flow sampling logs for each well are included in Appendix A.

2.3.2 Groundwater Extraction from the Eductor

On March 14, 2014, a vacuum truck was used to extract groundwater from the Eductor and surrounding former excavation. The purpose of this event was to remove groundwater containing high concentrations of VOCs, which were consistently detected in samples collected from the Eductor despite the EAB injections in 2010. A total of 1,180 gallons were extracted and transported to an off-site disposal facility.

2.3.2 Additional MIP Investigation

In July 2014, an expanded MIP investigation was performed in accordance with the Water Board approved *Work Plan for Additional Membrane Interface Probe (MIP) Investigation* (AECOM, 2014a) to supplement a previous MIP investigation conducted in 2013. The goal of the investigation was to identify the location of elevated-concentration material to later guide

excavation efforts. Results of the MIP investigation indicated that elevated concentration VOC-impacted material remained within the original excavation, southwest of the Eductor. A complete description of the MIP investigation results was included in the *Well Destruction and Source Removal Work Plan* (AECOM, 2014b).

2.3.3 Installation of Sub-Slab Vapor Collection System

In August and September 2014, a passive sub-slab vapor collection (SVC) system was installed beneath the concrete floor of the entire building in accordance with the *Work Plan for Passive Sub-Slab Vapor Collection System Installation* (AECOM, 2014c). The purpose of the SVC system is to passively collect sub-slab vapors below the building and vent them to the atmosphere as a protective measure against vapor intrusion. A complete set of the system record drawings as well as photographs of system installation are included in Appendix B.

2.3.4 Source Area Excavation

In October and November 2014, a targeted excavation of the source area was performed in accordance with the *Well Destruction and Source Removal Work Plan* (AECOM, 2014b). The excavation was performed using large-diameter augers to remove contaminated material. The extent of the excavation was guided by the results of the MIP investigation as well as additional confirmation soil borings. Based on the results of confirmation soil borings, the extent of the excavation was expanded, as explained in the *Work Plan Addendum for Source Area Removal Activities* (AECOM, 2014d). A figure showing the final excavation area and photographs of the excavation activities are included in Appendix C. A total of approximately 590 tons of soil and semi-solids and approximately 9,000 gallons of water were removed from the source area. A detailed description of excavation activities at the Site will be provided in the *Source Area Removal Summary Report* (Orion Environmental Inc., in prep).

2.3.5 Well Destruction

Concurrently with source area excavation activities, all wells within the building (T-2A, T-2B, T-2C, and T-3A) and the Eductor were destroyed via overdrilling per the *Well Destruction and Source Removal Work Plan* (AECOM, 2014b). These wells were removed to prevent them from serving as a potential vapor intrusion pathway once the building is occupied following redevelopment activities being conducted by the new owner.

2.3.6 Additional EAB Injection Activities

Following source area excavation, and in accordance with the *Work Plan for Additional Source Area Injection Activities* (AECOM, 2014e), EAB injections were used to address remaining contamination that was not accessible during excavation. A majority of the injection activities targeted the area under the building footing, immediately east of the former Eductor, where excavation was not possible. A directional injection tool was used to focus distribution of EAB amendments (EVO, buffer, bioaugmentation culture, and anoxic water) under the footing. In addition, EAB amendments were injected below the excavation in an area southwest of the former Eductor. This area had been excavated to approximately 20 feet bgs with the large-diameter augers and backfilled; however, a grab groundwater sample collected after excavation

activities from between 28 feet and 30 feet bgs contained elevated concentrations of VOCs. Injection logs and photographs from the EAB injection activities are included in Appendix D.

3.0 RESULTS

This section presents a discussion of the water-level elevations and groundwater analytical results for the April 2014 EAB groundwater monitoring event and the October 2014 annual groundwater monitoring event.

3.1 Water-Level Elevations

The October 2014 water-level elevation data for the Site wells and the Eductor are presented in Table 2 and historic water-level data are presented in Appendix E. The historic data include measured depths to groundwater and the calculated water-level elevations recorded for each well since 1986. Potentiometric surface contours generated for Zones A, B1, and B2 using the October 2014 water-level elevation data are presented on Figures 4, 5, and 6, respectively. There is only one well screened in Zone B4, and therefore a potentiometric surface cannot be contoured for that zone. Hydrographs of water-level elevations versus (vs.) time in selected Site wells, including three in Zone A (T-1A, T-7A, and T-8A), three in Zone B1 (T-1B, T-7B, and T-8B), and two in Zone B2 (T-2C and T-11C) are presented on Figure 7. For wells T-8A, T-8B, and T-2C, the hydrographs begin in year 2000, when groundwater extraction was suspended at these wells. For wells T-1A and T-1B, the hydrographs end in year 2004, when the wells were destroyed.

Depth to water, as measured in October 2014, indicates that the static depth to the water table in Zone A ranged from approximately 6.34 feet to 8.2 feet bgs. The regional and local direction of groundwater movement in Zone A is to the north at an average horizontal gradient of 0.005 horizontal foot per vertical foot, consistent with previous monitoring events. The general horizontal groundwater gradient in Zone B1 is to the north. Locally the groundwater movement is influenced by channelized flow related to stream deposits. Groundwater movement in Zone B2 is to the northwest. Water levels and groundwater movement in Zones B1 and B2 have historically been, and continue to be, affected by groundwater extraction at the Philips sites (located to the west at 815 Stewart Avenue and 440 Wolfe Road).

Water levels in Zone A wells observed during the October 2014 monitoring event increased in elevation by 0.1 foot to 1.1 feet compared to the October 2013 measurements and continue to be near the high end of the historic range. Hydraulic heads in Zone B1 wells during October 2014 ranged from approximately 0.1 foot lower to 0.7 foot higher than October 2013. Hydraulic heads in Zone B2 wells during October 2014 ranged from approximately 0.1 foot lower to 0.9 foot higher than October 2013, with the exception of well T-2C (in which the water level increased by 1.5 feet). Note that well T-2C was gauged on a different day than other Site wells due to its impending destruction and was in close proximity to excavation activities, which were underway at the time.

Vertical hydraulic gradients are relatively neutral or downward between the Zone B1 and Zone B2 intervals. The vertical hydraulic gradient between Zone B4 and the overlying zones is upward. Hydraulic head values measured in October 2014 under NPC indicate that the vertical head difference between Zones A and B1 is:

- Fairly neutral in the central Site area (between T-2A and T-2B, T-8A and T-8B, and T-16A and T-10B) and at the southern property boundary (between T-7A and T-7B); and
- Approximately 0.1 feet downward at the southwestern property boundary (between 37S and T-5B), at the northern property boundary (between T-9A and T-9B), and at the western property boundary (between 38S and T-4B).

Based on historical Site information, these vertical gradients between Zone A and Zone B1 are due to the influence of pumping within Zone B1 at the nearby Philips site.

3.2 Groundwater Analytical Results

VOCs detected during the April and October 2014 groundwater sampling event are summarized in Table 3. The historic results for previous monitoring events performed since 1990, including monitoring events for the EAB program and the NPC evaluation, are presented in Appendix F. Historically, low concentrations of other VOCs (not listed in Table 3 or in Appendix F) have occasionally been detected. These VOCs are not listed as they are not associated with Site operations and have not been detected above their Site cleanup requirements (SCRs) (e.g., California Maximum Contaminant Levels [MCLs] or action levels, federal MCLs, or risk-based levels).

Figures 8 through 10 present the analytical results for TCE, cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC) for each of the zones (A, B1, and B2). Graphs of TCE and cDCE concentrations vs. time for representative wells located on Site, including seven wells in Zone A (T-2A, T-7A, T-8A, T-9A, T-13A, T-15A, and T-16A) and seven wells in Zone B1 (T-2B, T-4B, T-7B, T-8B, T-9B, T-10B, and T-17B), are presented on Figures 11 through 14. Figure 15 presents TCE concentrations vs. time for representative on-site Zone B2 wells (T-2C, T-9C, T-10C, T-11C, and T-12C).

Graphs of concentrations of tetrachloroethene (PCE), TCE, cDCE, trans-1,2-dichloroethene (tDCE), and VC for October 2014 at select wells along the general groundwater flow direction in Zone A and Zone B1 across the Site are presented on Figures 16 and 17, respectively. CSIA results for TCE, cDCE, and VC are also plotted on Figure 16 and are discussed in Section 3.2.6.

This section also presents a discussion of the other EAB program results, such as geochemical parameters, electron acceptors, metabolic by-products, electron donor indicators such as total organic carbon (TOC), and dechlorinating microbes. Results of the April 2014 and October 2014 groundwater EAB analyses are summarized in Tables 4, 5, and 6. These results represent groundwater conditions after the 2010 EVO and neat vegetable oil injections and the November 2011 EHC-L and ABC+ injections. The historical analytical results for pre- and post-EAB monitoring events performed since 2000 are presented in Appendix F.

VOC and EAB (if relevant) analytical results for each part of the Site are discussed as follows: upgradient Zone A and Zone B1 wells (Section 3.2.1), former source area Zone A and Zone B1 wells (Section 3.2.2), downgradient Zone A and Zone B1 wells (Section 3.2.3), Zone B2 wells (Section 3.2.4), and off-site VOC concentrations (Section 3.2.5). A separate discussion is provided for CSIA results in Section 3.2.6.

A copy of the laboratory analytical reports and chain-of-custody forms for the 2014 groundwater monitoring events are contained in Appendix G. For selected Site wells, trend plots of chlorinated ethene concentrations prior to and after suspension of groundwater extraction are presented in Appendices H and I.

3.2.1 Site Zone A and Zone B1 Upgradient Wells

Impacts to the Site from off-site sources continue to be apparent for Zones A and B1. Groundwater analytical results from Zone A wells 36S, 36D, T-7A, and 37S, located along the upgradient Site boundary, indicate migration of VOCs, primarily TCE and cDCE, onto the Site. Concentrations of TCE migrating onto the Site (particularly from areas around well T-7A) are similar to or greater than those present for wells downgradient of the former Site source area in Zone A (see Figure 16).

- Zone A wells 36D and 37S, located along the upgradient Site boundary, have had TCE concentrations ranging from 29 µg/L to 95 µg/L and cDCE concentrations ranging from 1.6 µg/L to 34 µg/L over the last 5 years.

- TCE and cDCE concentrations for T-7A, located approximately 175 feet upgradient of the former Site source area, have varied from 56 µg/L to 250 µg/L and 51 µg/L to 230 µg/L, respectively, over the same time period. In October 2014, the concentrations of TCE and cDCE in T-7A were 230 µg/L and 75 µg/L, respectively.

Groundwater analytical results from Zone B1 wells T-5B and T-7B along the upgradient Site boundary also indicate substantial VOC migration onto the Site, primarily due to pumping-induced groundwater flow towards the Philips 815 extraction system.

- TCE was detected in well T-5B at concentrations greater than most other wells within the former Site source area (1,600 µg/L in 2014) (see Table 3). Between 2006 and 2011, TCE, cDCE, and Freon 113 concentrations for Zone B1 well T-5B exhibited fluctuations due to periodic shutdown of the Philips 815 groundwater extraction system, which allowed migration of impacted groundwater from upgradient, off-site source areas onto the Site. Concentrations have remained relatively unchanged since 2011. In 2014, concentrations of TCE, cDCE, and Freon 113 detected in groundwater in well T-5B were 1,600 µg/L, 64 µg/L, and 160 µg/L, respectively.

- Since 2007, TCE concentrations for Zone B1 well T-7B have ranged from 130 µg/L to 200 µg/L.

In Zone B1, the historical presence of Freon 113, a VOC which has not been attributed to the former Site source area, was previously demonstrated to be related to off-site sources. Historical and/or current Freon 113 concentration data (Appendix F) from Site Zone B1 wells T-5B, T-7B, T-17B, and T-19B indicate impact from off-site sources. One Zone B1 well, T-5B, exhibited a decreasing trend in Freon 113 between October 2008 and October 2011 and concentrations have remained generally similar between 2011 and 2014 with slight decreases. This finding further supports the benefit of continued shutdown of on-site extraction in order to prevent further migration of VOCs from off-site sources onto the Site.

3.2.2 Site Zone A and Zone B1 Former Source Area Wells

VOC Concentrations

From the start of the EAB program in 2000, monitoring data have shown that the program has had a beneficial impact on groundwater quality in the former Site source area, as indicated by the decrease in TCE concentrations observed (see concentration trend plots for the Eductor and wells T-2A, and T-2B in Appendices H and I). Historically, these decreases were generally accompanied by temporary increases in cDCE and VC, the intermediary products generated during the complete biodegradation/dechlorination of PCE and TCE to ethene and/or ethane endpoints.

In 2008, 7 years after the 2001 EAB injections in the former source area, TCE concentrations in the Eductor rebounded to 100,000 µg/L, similar to the concentration detected in 1993. In 2009 and 2010, TCE concentrations decreased due to on-going attenuation processes to non-detect and 2,100 µg/L, respectively, with an increase in concentrations of daughter products cDCE and VC. The 2008 increase in VOC concentrations in the Eductor was attributed to (1) enhanced mass transfer of VOCs into the aqueous phase, and/or (2) increased solubility of VOCs resulting from the presence of metabolic acids).

As noted in Section 2.2, injection of emulsified and neat vegetable oil were performed in the former source area (Zone A) in October 2010 and resulted in VOC sequestration and significant decreases in VOCs (including TCE, cDCE, and VC) in the Eductor by October 2011. Between October 2011 and October 2012, concentrations of TCE and cDCE in the Eductor increased by one to two orders of magnitude and the concentration of VC was approximately four times higher.

Since October 2013, groundwater samples have been collected from two discrete depths within the screen interval of the Eductor (11 feet bgs and 15 feet bgs) based on past observation of vertical stratification of VOC concentrations in the Eductor.

As mentioned in Section 2.3.2, approximately 1,180 gallons of groundwater were extracted from the Eductor in March 2014 to remove groundwater containing elevated concentrations of VOCs. In groundwater samples collected from the Eductor in April 2014, TCE was not detected above the reporting limit at either sampling depth, cDCE was detected at 20,000 µg/L (11 ft bgs) and 50,000 µg/L (15 ft bgs), and VC was detected at 1,600 µg/L (11 ft bgs) and 2,400 µg/L (15 ft bgs). These results indicated that the March 2014 groundwater extraction event temporarily reduced the vertical stratification of VOC concentrations in the Eductor and decreased contaminant concentrations in the lower sampling interval. In September 2014, TCE was still not detected at either sampling depth, cDCE was detected at 43,000 µg/L (11 ft bgs) and 120,000 µg/L (15 ft bgs), and VC was detected at 2,900 µg/L (11 ft bgs) and 5,700 µg/L (15 ft bgs), indicating the return of vertical stratification of VOC concentrations, a 2-fold increase in concentrations from April 2014, and the likely presence of residual source material in the immediate vicinity.

The significant impacts of the 2010 EVO and neat vegetable oil injections observed in the Eductor were also observed in wells T-2A and T-2B, located immediately downgradient of the former Site source area. Following the October 2010 injections, cDCE and VC concentrations decreased by at least three orders of magnitude in T-2A by March 2011 and were reduced approximately 50 percent in T-2B, even though Zone B1 was not targeted for treatment. While both wells have shown some increases more recently, October 2014 cDCE and VC concentrations in T-2A were still one to two orders of magnitude lower than pre-injection concentrations. In September 2014, concentrations of cDCE in wells T-2A and T-2B were 190 µg/L and 26 µg/L, respectively, and concentrations of VC were 590 µg/L and 60 µg/L, respectively. TCE concentrations have been below SCRs for wells T-2A and T-2B since 2007.

EAB Parameters

Geochemical conditions near wells T-2A and T-2B in September 2014 remained conducive to EAB, with a dissolved oxygen concentration less than 1 milligram per liter (mg/L) (with the exception of September 2014 for T-2B), a negative ORP value, neutral pH, and an elevated methane concentration. Geochemical conditions were less favorable for EAB in the Eductor due to a depressed pH related to previous injections, but are still reducing as indicated by low ORP values, low dissolved oxygen concentrations, and elevated methane concentrations. Continuing detections of ethene in the Eductor and wells T-2A and T-2B (Appendix F) suggest that EAB is ongoing in this area.

The TOC concentration trends in wells T-2A, and T-2B and the Eductor are generally in line with VOC trends in these wells. In the Eductor, TOC increased from 280 mg/L in October 2010 prior to injection to 3,600 mg/L following the EVO and neat vegetable oil injections and then decreased steadily to 634 mg/L in April 2014, with the exception of low concentrations detected in October 2011 and October 2012. Decreasing TOC concentrations indicate utilization of the carbon source to enhance degradation processes. In Well T-2A, TOC concentration trends were similar to the Eductor as TOC increased from 4.8 mg/L in October 2010 to 180 mg/L following the EVO and neat vegetable oil injections followed by a decrease to 4.8 mg/L in October 2011 as robust degradation occurred. TOC concentrations have remained generally unchanged (less than 10 mg/L) since October 2011, suggesting that the vegetable oil remained within the former source area excavation. In Well T-2B, TOC concentrations increased from non-detect to 27 mg/L following injection of the less viscous and more mobile EVO, but following the neat vegetable oil injection, TOC concentrations were 1.9 mg/L or less through April 2014.

The population count of *Dehalococcoides* (Dhc) type microbes for the Eductor decreased following the 2010 EVO and neat vegetable oil injections from 2.78E+06 cells per milliliter (cells/mL) in October 2010 to 8.35E+01 cells/mL in October 2011. Between October 2012 and April 2014 the Dhc population has fluctuated between 1.47E+01 cells/mL and 3.41E+03 cells/mL, possibly due to low pH conditions in the Eductor. The Dhc population in well T-2A increased following vegetable oil injections from 1.10E+03 cells/mL in October 2010 to 2.67E+05 cells/mL in October 2011. Since 2011, the Dhc population has generally decreased and was 4.16E+03 cells/mL in April 2014. Low VOC and TOC concentrations since October 2012 could be contributing to the overall decrease in Dhc population. However, the Dhc population is still within/near the range that has been shown to correspond with efficient reductive dechlorination (greater than 1E+03 cells/mL,

ITRC 2013). The Dhc concentration trends over time for the Eductor and selected Zone A wells within the expanded EAB treatment area are presented in Figure 18.

As described in Section 2.3.5, the Eductor and wells T-2A and T-2B, were removed during the recent source area excavation at the Site in October/November 2014.

3.2.3 Site Zone A and Zone B1 Downgradient Wells

Downgradient of the former source area, the influence of the EAB program has been more pronounced for Zone B1 than Zone A, consistent with better hydraulic connection and greater transmissivity in the deeper zones due to more laterally continuous permeable zones. As described in Section 2.2, EAB remedial activities, consisting of cheese whey injections, were conducted in downgradient Zone A wells (T-13A, T-14A, and T-18A through T-24A) in September 2007, December 2007, March 2008, and June 2008. In November 2011, EHC-L was injected into the same downgradient Zone A wells and ABC+ was injected in direct push points downgradient of the source area in Zones A and B1.

VOC Concentrations

In downgradient Zone A monitoring wells, the observed trends since the initiation of the EAB program, including the expansion to encompass areas around well T-8A, are perhaps not directly attributable to the EAB program. The EAB process has removed considerable VOC mass from the former Site source area and immediate vicinity. This has reduced the VOC mass migrating to the downgradient Site areas. The cessation of groundwater extraction has enhanced conditions by returning the groundwater gradient to its natural condition, allowing for longer residence times between T-8A and T-9A, and hence, higher attenuation potential within these areas. TCE concentrations for well T-9A are consistently lower than the upgradient property boundary well T-7A and total chlorinated ethene concentrations for T-13A, T-14A, T-8A, T-15A, T-16A, and T-9A (listed from upgradient to downgradient) are less than those for upgradient property boundary well T-7A (see Figure 16 and Appendices F and H).

Following cheese whey injection in late September 2007, decreases in TCE concentrations and increases in cDCE concentrations were observed in the injection wells. Starting in April 2010, TCE concentrations in these wells started rebounding, indicating depletion of cheese whey. Injection of additional electron donor (EHC-L) into the same wells was performed in November 2011, after which concentrations of TCE decreased in all of the injection wells to below SCRs, with the exception of well T-23A. Concentrations of cDCE also decreased in all of the wells with limited VC increases, with the exception of well T-23A.

Until October 2007, decreases in TCE and cDCE concentrations were observed in well T-8A without detectable concentrations of VC. After cheese whey injections began in September 2007 immediately upgradient of well T-8A, decreases in TCE and cDCE concentrations and increases in VC concentrations were observed in well T-8A. After 2009, TCE and cDCE concentrations slowly rebounded and VC concentrations decreased in well T-8A, indicating depletion of the cheese whey in the upgradient injection wells. In November 2011, EHC-L was injected into wells T-13A, T-14A, and T-18A through T-24A (the same wells used for cheese whey injection). Concentrations of TCE, cDCE, and VC detected in well T-8A

have remained roughly equivalent to concentrations prior to the EHC-L injections, indicating that the effects of the EHC-L injections did not reach this location.

In Zone B1, downgradient monitoring well T-8B total chlorinated ethene concentrations decreased by more than 50 percent (%) following initiation of Zone B1 EAB activities in 2000 (see Appendix F). TCE concentrations rebounded from October 2007 to October 2013 (from 7.5 µg/L to 36 µg/L) and then decreased to 10 µg/L in October 2014. Concentrations of daughter product cDCE increased in this well from 39 µg/L in 2009 to 450 µg/L in October 2013 and 270 µg/L in October 2014. This elevated concentration may be attributable to migration of cDCE from the former Site source area and/or related to cDCE migrating onto and through the Site from off-site sources.

In Zone B1 well T-4B, located near the western property boundary, TCE concentrations were below the SCR of 5 µg/L in October 2006 and have since fluctuated between 2.5 µg/L and 9.2 µg/L. Concentrations of cDCE have been consistently higher than TCE since 2000, and have fluctuated between 360 µg/L and 600 µg/L since 2007, with one exception of 830 µg/L in 2013. These elevated cDCE concentrations for well T-4B (and also for T-17B and T-9B) since 2006/2007 may be attributable to migration of EAB dechlorination products (cDCE, VC, and ethene) in groundwater from the former Site source area (although VC has not been detected in wells T-4B or T-17B since 2007) and/or related to cDCE migrating onto and through the Site from off-site sources.

It is suspected that well T-9B was impacted by an off-site source, and that pumping from T-9B induced the migration of VOCs onto the Site in Zone B1 from this off-site source (CDM, 1999 and 2000c). This conclusion is supported by the historical substantially higher TCE concentrations for T-9B compared to upgradient Zone B1 wells T-8B and T-10B and the historical presence of Freon 113 in T-9B which is not attributed to the Site. Based on October 2014 data, TCE concentrations are still significantly higher in well T-9B (390 µg/L) than upgradient wells T-8B (10 µg/L) and T-10B (45 µg/L). The decrease in TCE concentrations following the suspension of groundwater extraction at T-9B, in addition to the different contaminant profile from upgradient on-site wells, supports the conclusion that groundwater around T-9B is impacted by historical pumping-induced migration of the Philips plume onto the Site.

EAB Parameters

TOC concentrations for the EHC-L injection wells increased up to 34 mg/L in April 2012 following EHC-L injection, decreased to below 10 mg/L in all of the wells by October 2012, and remained below 10 mg/L through October 2014. These decreases in TOC concentrations, corresponding decreases in contaminant concentrations, and increased production of daughter products (VC) suggest that electron donor is being utilized to facilitate degradation of VOCs. This is supported by geochemical data indicating that reducing conditions conducive to EAB are still present in the EHC-L injection wells with low ORP values, low dissolved oxygen concentrations, and elevated methane concentrations. In addition, Dhc was detected in the EHC-L injection wells in October 2014, at population counts up to 2.68E+04 cells/mL (T-13A).

3.2.4 Site Zone B2 Wells

VOC concentrations for Zone B2 in the central Site area decreased an order of magnitude following suspension of groundwater extraction from Site well T-2C in November 2000. In September 2014, the TCE concentration in well T-2C was 280 µg/L. Concentrations in well T-2C have historically been elevated relative to Zone B1 and have resulted solely from off-Site sources, as substantiated by a differing suite of VOCs with differing VOC ratios for Zone B2 relative to overlying Zone B1 (e.g., the presence of Freon 113 in Zone B2, which is not attributed to the Site) and the absence of VOCs common to the former Site source area (PCE). Groundwater extraction from T-2C in the past is suspected to have contributed to the migration of VOCs onto the Site. Since the suspension of groundwater extraction from this well, TCE concentrations have decreased more than 90% and Freon 113 concentrations have ranged from non-detect to 1.3 µg/L since October 2012. These decreases are attributed to capture of a significant portion of the plume in Zone B2 by the Philips 815 site extraction system.

3.2.5 Off-site Groundwater Analytical Data

VOC results for the October 2014 monitoring events conducted on the nearby Philips and AMD properties were provided to Northrop Grumman and reviewed during the preparation of this annual report. These data indicate that the neighboring Philips sites continue to demonstrate substantial VOC impact in groundwater with maximum October 2014 concentrations of TCE and cDCE of 18,000 µg/L and 6,400 µg/L, respectively. Note, the maximum TCE and cDCE concentrations in June 2014 were 42,000 µg/L and 26,000 µg/L, following a brief (2-3 day) shutdown of the Philips extraction system.

VOC data for the AMD 901/902 site, located upgradient of the Site, indicate a maximum TCE concentration of 280 µg/L for Zone A. TCE concentrations on the AMD 915 site, located downgradient of the Site, indicate a maximum of 170 µg/L for Zone A. The VOC concentrations observed for Site Zone A wells 36S, 36D, and T-7A located along the upgradient Site boundary are attributed to the migration of contamination from upgradient properties such as Mohawk Laboratories and AMD.

3.2.6 Compound-Specific Isotope Analysis

In order to better understand and quantify allocation of upgradient off-site plume and former Site source area contributions to current Site plume configuration, as well as evaluate the effectiveness of past and ongoing EAB processes, monitoring of CSIA of TCE and cDCE was initiated in 2007. Carbon isotopes present in TCE and cDCE include ^{13}C and ^{12}C, with ^{13}C being the much less naturally abundant isotope. During anaerobic microbial reductive dechlorination of chlorinated compounds, the light (^{12}C) versus the heavy isotope (^{13}C) bonds are preferentially broken, resulting in isotopic enrichment of the residual contaminant in ^{13}C and a change in the isotopic ratio of $^{13}C/^{12}C$, also known as $\delta^{13}C$. CSIA measures the $\delta^{13}C$ in a groundwater sample (with units of $^{0}/_{00}$) using the following equation:

$$\delta^{13}C \text{ in } ‰ = \frac{(^{13}C/\,^{12}C_{\text{ sample}} - {}^{13}C/\,^{12}C_{\text{standard}})}{{}^{13}C/\,^{12}C_{\text{ standard}}} \times 1000$$

For chlorinated compounds, $\delta^{13}C$ is typically a negative number that increases, or becomes less negative, as the compound is degraded and becomes enriched with ^{13}C (heavier).

Samples from selected Site wells for CSIA have been collected since July 2007 and results are summarized in Appendix F. In October 2014, groundwater samples were collected from Zone A wells across the Site in the direction of groundwater flow and results are plotted on Figure 16 along with VOC concentrations. Groundwater samples were also collected from select Zone B1 wells in October 2014 to compile a CSIA dataset for Zone B1. Zone B1 results are included in Appendix F but will not be discussed or interpreted until additional rounds of CSIA sampling are performed.

The Zone A CSIA data were collected in order to further evaluate the following conclusions:

- Even though TCE concentrations are higher for the former Site source area (Eductor) than in upgradient well T-7A, the degree of TCE biodegradation (i.e., TCE dechlorination to cDCE, VC, and ethene) is higher for former Site source area groundwater compared to that migrating on to the Site from the upgradient off-site plume. This can be demonstrated by showing that the groundwater migrating onto the Site from the upgradient off-site plume (T-7A) is lighter (more negative $\delta^{13}C$) than former Site source area groundwater (Eductor) with respect to the stable isotope ratio $\delta^{13}C$ for parent compound TCE. CSIA data continue to support this conclusion. In April 2014, $\delta^{13}C$ values for TCE and cDCE indicate that the compounds continue to be more degraded in the vicinity of the former Site source area (i.e., well T-2A) compared to groundwater migrating on to the Site (i.e. well T-7A) (Figure 16). Note that with the destruction of the Eductor and well T-2A, in October/November 2014, a direct comparison between the CSIA data for the source area and the upgradient plume will no longer be possible.

- Even though TCE fluctuations in the Eductor have occurred periodically since 2003, biodegradation processes in the immediate vicinity of the Eductor are sufficient to prevent further downgradient migration of TCE. This can be demonstrated by comparing the CSIA data of the Eductor and well T-2A, located immediately downgradient of the Eductor. CSIA data collected to date strongly support this conclusion with TCE and cDCE in well T-2A being significantly more degraded than TCE and cDCE in the Eductor since April 2008 (Appendix F). Also of note, the $\delta^{13}C$ values for cDCE and VC in EHC-L injection well T-13A (located directly downgradient from the Eductor and well T-2A) increased significantly between October 2011 and October 2012 (from -15.39 $^{0}/_{00}$ to 9.45 $^{0}/_{00}$ and from -25.31 $^{0}/_{00}$ to -0.93 $^{0}/_{00}$, respectively) indicating that the cDCE and VC detected in this well were highly degraded due to the EHC-L injection. In October 2014, the $\delta^{13}C$ value for cDCE in this well decreased to –4.25 $^{0}/_{00}$ indicating less degradation than in 2012, but still highly degraded cDCE compared to pre-injection values.

- EAB processes have been sufficient to ensure that contaminant mass from the former Site source area is not contributing to the off-site groundwater plume. This can be demonstrated by showing that the groundwater migrating downgradient from the Site is similar or heavier for $\delta^{13}C$ for TCE and cDCE than that migrating onto the Site from the upgradient off-site plume, as shown on Figure 16. According to available guidance on CSIA data interpretation (USEPA, 2008), differences in $\delta^{13}C$ values must be at a minimum greater than $1^{0}/_{00}$ to be considered real and greater than $2\ ^{0}/_{00}$ for positive identification of degradation. Therefore, since $\delta^{13}C$ values for downgradient wells T-8A and T-9A continue to be similar to (within $1^{0}/_{00}$) or less negative (by at least $2\ ^{0}/_{00}$) than $\delta^{13}C$ values for wells located outside the influence of the former Site source area (e.g., T-7A), EAB processes have been considered sufficient to limit contribution of contamination from the former Site source area to the off-site groundwater plume.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Groundwater monitoring data collected through 2014 support the following conclusions:

- Impact to the Site from off-site sources continues to be apparent in Zones A, B1, and B2. Impacts in Zone B2 are solely from off-site sources. Continued migration of VOC-impacted groundwater onto the Site complicates long-term Site groundwater remediation.

- The EAB program has increased the rate of VOC biodegradation occurring within the former Site source area.

- The EAB program has significantly reduced, if not eliminated contribution from the former Site source area to the off-site groundwater plume (Figure 16).

- EAB processes are ongoing based on VOC, dissolved gases, and Dhc data; however, continued monitoring is needed to assess the longevity of these processes.

- Suspension of groundwater extraction at wells T-9A, T-9B, and T-2C has halted pumping-induced migration of the Philips 815 plume toward the Site.

Based on these conclusions, the following actions are recommended:

- Continue suspension of groundwater extraction at the Site and initiate regulatory process for changing the Site remedy (current GWET based on the 1991 Record of Decision).

- Continue downgradient EAB monitoring in 2015 to assess whether degradation processes are continuing. Source area monitoring locations (the Eductor and wells T-2A and T-2B) no longer exist and therefore cannot be monitored going forward.

- Continue the annual Site groundwater monitoring program to 1) evaluate the effects of the November 2014 source area excavation activities, 2) monitor the impacts from off-site sources, and 3) assess the need for additional remedial activities.

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TABLES

Table 1
Well Completion and Sampling Information
Former TRW Microwave Site
825 Stewart Drive, Sunnyvale, California

Well Number	Zone	Screen Interval (feet bgs)	Total Depth (feet bgs)	Top of Casing Elevation (feet, MSL)	Sampling Schedule (annual quarters)	U.S. EPA Test Method
EDUCTOR	A	8-16	16.5	42.24	4TH	8260B
T-1A	A	10-20	20	41.16	Well Abandoned in 2004	
T-1B	B1	28-38	38	41.72	Well Abandoned in 2004	
T-2A	A	10-20	20	42.16	4TH	8260B
T-2B	B1	23-33	33	42.23	4TH	8260B
T-2C	B2	51-59	59	41.38	4TH	8260B
T-3A	A	10-20	20	41.74	4TH	8260B
T-4B	B1	31.5-41.5	42	40.93	4TH	8260B
T-5B	B1	34.5-44.5	45	42.45	4TH	8260B
T-6A	A	10-20	20	39.92	4TH	8260B
T-7A	A	8-20	20	42.09	4TH	8260B
T-7B	B1	34-41	41	42.01	4TH	8260B
T-8A	A	8-19	19	40.38	4TH	8260B
T-8B	B1	24-36	36	40.33	4TH	8260B
T-8D	B4	90-102	102	40.35	Sampling Suspended in 2002	
T-9A	A	7-19	19	39.22	4TH	8260B
T-9B	B1	28-37	37	38.89	4TH	8260B
T-9C	B2	55-65	65	38.81	4TH	8260B
T-10B	B1	23-32	32	40.09	4TH	8260B
T-10C	B2	49-59	60	39.76	4TH	8260B
T-11C	B2	46-56	56	38.65	4TH	8260B
T-12C	B2	45.5-55.5	56	40.74	4TH	8260B
T-13A	A	10-20	20	40.76	4TH	8260B
T-14A	A	10-20	20	40.62	4TH	8260B
T-15A	A	10-20	20	40.11	4TH	8260B
T-16A	A	10-20	20	40.02	4TH	8260B
T-17A	A	10-20	20	38.23	4TH	8260B
T-17B	B1	25-35	35	40.61	4TH	8260B
T-18A	A	12-22	22	TBD	4TH	8260B
T-18B	B1	41-46	46	38.78	4TH	8260B
T-19A	A	10-20	22	TBD	4TH	8260B
T-19B	B1	29-39	39	38.72	4TH	8260B
T-20A	A	7-17	20	TBD	4TH	8260B
T-21A	A	10-20	20	TBD	4TH	8260B
T-22A	A	10-20	20	TBD	4TH	8260B
T-23A	A	10-20	20	TBD	4TH	8260B
T-24A	A	10-20	20	TBD	4TH	8260B
T-25A	A	10-20	20	TBD	4TH	8260B
36S	A	10-16	16	41.46	4TH	+
36D	A	15-20	20	41.26	4TH	+
36DD	B2	51.5-61.5	61.5	41.58	4TH	+
37S	A	9-15	15	42.06	4TH	+
38S	A	9-15	15	41.05	4TH	8260B

Notes:
+ = Sample collected and analyzed by AMD.
MSL = mean sea level
TBD = To be determined; well casing elevations have not been surveyed.
U.S. EPA = United States Environmental Protection Agency
Top of casing elevations presented in NAVD88 (North American Vertical Datum 1988).
Eductor screen interval and total depth revised based on September 2010 well videolog

Table 2
Water-Level Elevation Measurements - October 2014
Former TRW Microwave Site
825 Stewart Drive, Sunnyvale, California

Well Number	Zone	Date Measured	Depth to Water (feet, BTOC)	Updated Top of Casing Elevation (feet, MSL NAVD88)	Updated Water-Level Elevation (feet, MSL NAVD88)
T-1A	A	Destroyed			
T-2A	A	9/24/14	8.08	42.16	34.08
T-3A	A	9/24/14	7.68	41.74	34.06
T-6A	A	--	NM	39.92	--
T-7A	A	10/13/14	6.89	42.09	35.20
T-8A	A	10/13/14	6.67	40.38	33.71
T-9A	A	10/13/14	6.60	39.22	32.62
T-13A	A	10/13/14	7.01	40.76	33.75
T-14A	A	10/13/14	6.92	40.62	33.70
T-15A	A	10/13/14	6.72	40.11	33.39
T-16A	A	10/13/14	6.77	40.02	33.25
T-17A	A	10/13/14	7.19	38.23	31.04
T-18A	A	10/13/14	7.41	NA	--
T-19A	A	10/13/14	7.18	NA	--
T-20A	A	10/13/14	7.01	NA	--
T-21A	A	10/13/14	7.28	NA	--
T-22A	A	10/13/14	7.29	NA	--
T-23A	A	10/13/14	7.48	NA	--
T-24A	A	10/13/14	7.28	NA	--
T-25A	A	10/13/14	6.44	NA	--
36S	A	10/13/14	6.59	41.46	34.87
36D	A	10/13/14	6.34	41.26	34.92
37S	A	10/13/14	6.79	42.06	35.27
38S	A	10/13/14	7.86	41.05	33.19
EDUCTOR*	A	9/24/14	8.20	42.24	34.04
T-1B	B1	Destroyed			
T-2B	B1	9/24/14	8.18	42.23	34.05
T-4B	B1	10/13/14	9.00	40.93	31.93
T-5B	B1	10/13/14	9.62	42.45	32.83
T-7B	B1	10/13/14	6.64	42.01	35.37
T-8B	B1	10/13/14	6.67	40.33	33.66
T-9B	B1	10/13/14	7.91	38.89	30.98
T-10B	B1	10/13/14	6.81	40.09	33.28
T-17B	B1	10/13/14	7.30	40.61	33.31
T-18B	B1	10/13/14	6.34	38.78	32.44
T-19B	B1	10/13/14	7.38	38.72	31.34
T-2C	B2	9/24/14	7.50	41.38	33.88
T-9C	B2	10/13/14	8.21	38.81	30.60
T-10C	B2	10/13/14	10.16	39.76	29.60
T-11C	B2	10/13/14	8.03	38.65	30.62
T-12C	B2	10/13/14	7.54	40.74	33.20
36DD	B2	10/13/14	6.20	41.58	35.38
T-8D	B4	10/13/14	3.54	40.35	36.81

Notes:
BTOC - below top of casing
CDTW - corrected depth to water
MSL - mean sea level
NA - Not available. While depth to water measurements were collected in all wells, only selected former injection wells were surveyed for top of casing.
NAVD88 - North American Vertical Datum 1988
NM - not measured
*CDTW = measured depth to water - [(density soybean oil/density of water) x (thickness of soybean oil)]
= 8.80 feet -[(0.9/1) x (0.39 feet)] = 8.45 feet

Table 3
2014 Groundwater Volatile Organic Compound Results
Former TRW Microwave Site
825 Stewart Drive, Sunnyvale, California

Well	Zone	Sample Name	Sample Date	PCE (µg/L)	TCE (µg/L)	cDCE (µg/L)	tDCE (µg/L)	VC (µg/L)	1,1,1-TCA (µg/L)	1,1-DCE (µg/L)	1,1-DCA (µg/L)	Freon 113 (µg/L)	1,2-DCB (µg/L)	1,4-DCB (µg/L)	CBN (µg/L)
T-1A	A	Destroyed													
T-2A	A	J6038-T2A-041514-1	4/15/14	<5.0	<5.0	<5.0	57	670	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	120
T-2A Dup	A	J6038-T2A-041514-2	4/15/14	<5.0	<5.0	<5.0	51	540	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	110
T-2A	A	J6038-T2A-092414	9/24/14	<5.0	<5.0	190	50	590.0	<5.0	<5.0	<5.0	<5.0	19	<5.0	150
T-3A	A	J6038-T3A-041414	4/14/14	1.3	140	51	1.6	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-3A	A	J6038-T3A-092414	9/24/14	1.2	130	65	1.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-7A	A	J6038-T7A-101514-1	10/15/14	<2.5	230	75	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
T-7A Dup	A	J6038-T7A-101514-2	10/15/14	<2.5	170	64	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
T-8A	A	J6038-T8A-041414	4/14/14	<2.5	130	63	2.8	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
T-8A	A	J6038-T8A-101314	10/13/14	1.7	110	56	2.6	<0.50	<0.50	0.55	<0.50	<0.50	<0.50	<0.50	<0.50
T-9A	A	J6038-T9A-101414	10/14/14	1.2	70	91	3.4	<0.50	<0.50	0.71	0.51	<0.50	3.4	<0.50	<0.50
T-13A	A	J6038-T13A-041414-1	4/14/14	<0.50	1.8	49	4.4	19	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-13A Dup	A	J6038-T13A-041414-2	4/14/14	<0.50	1.4	50	5.5	20	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-13A	A	J6038-T13A-101414-1	10/14/14	<0.50	1.4	76	4.6	33.0	<0.50	<0.50	0.56	<0.50	<0.50	<0.50	<0.50
T-14A	A	J6038-T14A-041414	4/14/14	<0.50	4.1	43	4.2	22	<0.50	<0.50	0.53	<0.50	1.5	<0.50	<0.50
T-14A	A	J6038-14A-101414	10/14/14	<0.50	3.6	62	5.1	29.0	<0.50	<0.50	0.7	<0.50	2	<0.50	<0.50
T-15A	A	J6038-T15A-041414	4/14/14	1.9	100	49	2.7	<0.50	<0.50	0.59	<0.50	<0.50	1.1	<0.50	<0.50
T-15A	A	J6038-T15A-101514	10/15/14	2.2	140	51	3.4	<0.50	<0.50	0.83	0.54	<0.50	1.5	<0.50	<0.50
T-16A	A	J6038-T16A-101414	10/14/14	1.7	97	78	3.7	2.5	<0.50	0.7	0.58	<0.50	1.7	<0.50	<0.50
T-17A	A	J6038-T17A-041414	4/14/14	0.87	57	16	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-17A	A	J6038-T17A-101414	10/14/14	0.88	62	30	0.57	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-18A	A	Not sampled by AECOM - Not part of sampling and analysis plan													
T-19A	A	J6038-T19A-041414	4/14/14	<0.50	<0.50	3.7	1.4	3.1	<0.50	<0.50	<0.50	<0.50	0.75	<0.50	1.3
T-19A	A	J6038-T19A-101414	10/14/14	<0.50	<0.50	15.0	1.9	11.0	<0.50	<0.50	<0.50	<0.50	0.9	<0.50	1.8
T-20A	A	Not sampled by AECOM - Not part of sampling and analysis plan													
T-21A	A	Not sampled by AECOM - Not part of sampling and analysis plan													
T-22A	A	Not sampled by AECOM - Not part of sampling and analysis plan													
T-23A	A	J6038-T23A-041414	4/14/14	<0.50	45	60	6.0	7.1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-23A	A	J6038-T23A-101414	10/14/14	<0.50	32.0	51.0	3.3	6.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-25A	A	J6038-T25A-041414	4/14/14	<0.50	0.50	32	4.0	35	<0.50	<0.50	0.59	<0.50	2.0	<0.50	<0.50
T-25A	A	J6038-T25A-101414	10/14/14	<0.50	4.0	39.0	4.1	35.0	<0.50	<0.50	0.6	<0.50	2.3	<0.50	<0.50
36S[1]	A	--	10/22/14	2.2	73	13.0	0.8	1.7	0.6	0.6	<0.5	<2.0	<0.5	-	-
36D[1]	A	-	10/21/14	1.8	56	23	0.9	<0.5	<0.5	0.6	<0.5	<2.0	<0.5	-	-
38-S	A	J6038-38S-101514	10/15/14	<0.50	45	200	2.3	12.0	<0.50	0.9	<0.50	1.3	<0.50	<0.50	<0.50
Eductor (11 feet)[2]	A	J6038-EDUCTOR-11-041514	4/15/14	<500	<500	20000	<500	1600	<500	<500	<500	<500	<500	<500	<500
Eductor (11 feet)[2]	A	J6038-Eductor-11-092514	9/25/14	<500	<500	43,000	<500	2,900	<500	<500	<500	<500	530	<500	<500
Eductor (15 feet)[2]	A	J6038-EDUCTOR-15-041514	4/15/14	<1000	<1000	50000	<1000	2400	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Eductor (15 feet)[2]	A	J6038-Eductor-15-092514	9/25/14	<1,000	<1,000	120,000	<1,000	5,700	<1,000	<1,000	<1,000	<1,000	1,400	<1,000	1,600
T-1B	B1	Destroyed													
T-2B	B1	J6038-T2B-041514	4/15/14	<2.5	<2.5	12	<2.5	40	<2.5	<2.5	<2.5	<2.5	16	<2.5	58
T-2B	B1	J6038-T2B-092414	9/24/14	<2.5	<2.5	26	<2.5	60.0	<2.5	<2.5	<2.5	<2.5	9.3	<2.5	28
T-4B	B1	J6038-T4B-101514	10/15/14	<5.0	5.2	500	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
T-5B	B1	J6038-T5B-101614-1	10/16/14	<10	1900	58	<10	<10	<10	<10	<10	140	<10	<10	<10
T-5B Dup	B1	J6038-T5B-101614-2	10/16/14	<25	1600	64	<25	<25	<25	<25	<25	160	<25	<25	<25
T-7B	B1	J6038-T7B-101514-1	10/15/14	0.74	170	11	0.78	<0.50	<0.50	0.61	<0.50	3.2	2.1	<0.50	<0.50
T-7B Dup	B1	J6038-T7B-101514-2	10/15/14	0.84	170	12	0.97	<0.50	0.5	0.74	0.57	4.4	2.4	<0.50	<0.50
T-8B	B1	J6038-T8B-101514	10/15/14	<0.50	10	270	7.3	16	<0.50	1.8	0.90	<0.50	7.5	<0.50	<0.50
T-9B	B1	J6038-T9B-101614	10/16/14	<5.0	390	210	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
T-10B	B1	J6038-T10B-101314	10/13/14	2.1	45	180	3.3	16	<0.50	1.1	0.82	<0.50	4.8	<0.50	<0.50
T-17B	B1	J6038-T17B-041514	4/15/14	<5.0	55	370	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
T-17B	B1	J6038-T17B-101614	10/16/14	<5.0	75	400	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
T-18B	B1	J6038-T18B-101314	10/13/14	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-19B	B1	J6038-T19B-101314	10/13/14	<0.50	52	2.2	<0.50	<0.50	<0.50	<0.50	<0.50	1.2	<0.50	<0.50	<0.50
T-2C	B2	J6038-T2C-041514	4/15/14	<0.50	150	48	0.80	0.59	<0.50	0.65	<0.50	0.94	<0.50	<0.50	<0.50
T-2C	B2	J6038-T2C-092514	9/25/14	<0.50	280	120	1.6	8.5	<0.50	0.97	<0.50	1.3	<0.50	<0.50	<0.50
T-9C	B2	J6038-T9C-101414	10/14/14	<0.50	<0.50	0.54	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
T-10C	B2	J6038-T10C-101614	10/16/14	<10	1300	76	<10	<10	<10	<10	<10	170	<10	<10	<10
T-11C	B2	J6038-T11C-101514	10/15/14	<2.5	310	23	<2.5	3.6	<2.5	<2.5	<2.5	15	<2.5	<2.5	<2.5
T-12C	B2	J6038-12C-101514	10/15/14	<1.0	140	5.1	<1.0	<1.0	<1.0	1.2	<1.0	1.8	<1.0	<1.0	<1.0
36DD[3]	B2	--	10/21/14	<0.5	<0.5	7.1	1.0	<0.5	<0.5	<0.5	<0.5	<2.0	<0.5	-	-
T-8D	B4	Not sampled by AECOM - Water Board approval to discontinue sampling requirement for well													

Notes:

(1) Groundwater analytical data provided by AMD.

(2) The Eductor was sampled at two discrete intervals, 11 feet below ground surface and 15 feet below ground surface.

<	Not detected at or above the detection limit shown
µg/L	micrograms per liter
1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCB	1,2-Dichlorobenzene
1,4-DCB	1,4-Dichlorobenze
CBN	Chlorobenzene
cDCE	cis-1,2-Dichloroethene
Dup	Duplicate sample
J	Estimated concentration. Compound detected between the detection limit and the reporting limit.
PCE	Tetrachloroethene
tDCE	trans-1,2-Dichloroethene
TCE	Trichloroethene
Freon 113	Trifluorotrichloroethane
VC	Vinyl Chloride

Table 4
2014 Groundwater General Environmental Parameter Results
Former TRW Microwave Site
825 Stewart Drive, Sunnyvale, California

Well	Date		Temperature (°C)	pH (SU)	Conductivity (µS/cm)	Turbidity (NTU)	Oxidation-Reduction Potential (mV)	Total Organic Carbon (mg/L)
Zone A Aquifer Wells								
EDUCTOR (11 feet)	4/15/14		18.8	5.59	1,616		-24	634
EDUCTOR (11 feet)	9/25/14		20.44	5.62	2,460	0	14	--
EDUCTOR (15 feet)	4/15/14		19	5.68	2,015		-34	656
EDUCTOR (15 feet)	9/25/14		19.93	5.84	3,130	0	-35	--
T-2A	4/15/14		19.2	6.79	2,112		-84	6.4
T-2A	4/15/14	dup	19.2	6.79	2,112		-84	6.5
T-2A	9/24/14		20.44	6.84	2,370	0	-151	--
T-3A	4/14/14		19.6	6.98	1,376	-20	1.99	--
T-3A	9/24/14		20.46	7.15	1,430	0	152	--
T-7A	10/15/14		21.7	7	1,301	1	68.1	--
T-8A	4/14/14		19	6.9	1,377	-28	0.27	1
T-8A	10/13/14		22.5	6.9	1,314	1	65.3	1
T-9A	10/14/14		23.8	6.92	1,329	1	56.5	--
T-13A	4/14/14		19.6	6.9	1,309	-90	0.49	1.6
T-13A	4/14/14	dup	19.6	6.9	1,309	-90	0.49	1.7
T-13A	10/14/14		20.6	6.93	1,332	4	-59.4	2.1
T-14A	4/14/14		18.5	6.9	1,338	-92.5	0.35	1.2
T-14A	10/14/14		19.5	6.91	1,256	2	-68.6	1.2
T-15A	4/14/14		20.5	6.88	1,358	-33	0.4	<1
T-15A	10/15/14		21.2	6.91	1,277	1	93.6	--
T-16A	10/14/14		22.4	6.92	1,293	6	79.8	--
T-17A	4/14/14		19.6	7.02	1,258	-42	0.29	<1
T-17A	10/14/14		21.1	7.23	1,286	4	-47.1	1.1
T-19A	4/14/14		16	6.86	1,024	-96	0.34	3.6
T-19A	10/14/14		21.6	6.82	1,346	4	-119.1	3.2
T-23A	4/14/14		18.1	6.89	1,390	-123	0.24	1.7
T-23A	10/14/14		20.4	6.94	1,350	9	-99	3.5
T-25A	4/14/14		19.2	6.91	1,341	-97	0.23	1
T-25A	10/14/14		20.9	6.95	1,266	2	-67.2	1.2
38S	10/15/14		21.7	6.98	1,251	5	-40.1	1.8
Zone B1 Aquifer Wells								
T-2B	4/15/14		19.4	6.77	1,723	-122	0.9	1.9
T-2B	9/24/14		19.91	7.01	1,770	0	-125	--
T-4B	10/15/14		21.6	7.29	1,306	2	-53.3	--
T-5B	10/16/14		20.7	7.25	1,107	1	149.8	--
T-7B	10/15/14		20.7	7.19	1,017	1	83	--
T-8B	10/15/14		20.8	7.02	1,339	1	-64.4	--
T-9B	10/16/14		19.9	7.09	1,403	1	234	--
T-10B	10/13/14		22.8	6.94	1,322	1	1.4	--
T-17B	4/14/14		18.4	7.21	1,248	-55	0.57	<1
T-17B	10/16/14		20	7.29	1,206	4	7.4	1.3
T-18B	10/13/14		23.4	7.63	846	24	-76.8	--
T-19B	10/13/14		22.7	7.26	1,001	102	90.2	--
Zone B2 Aquifer Wells								
T-2C	4/15/14		19.5	5.62	831	121	2.23	--
T-2C	9/25/14		19.77	7.84	910	0	110	--
T-9C	10/14/14		23.1	7.85	723	2	14.3	--
T-10C	10/16/14		20.7	7.68	756	5	77.7	--
T-11C	10/15/14		22.2	7.39	903	1	37.4	--
T-12C	10/15/14		20.3	7.5	827	29	96.3	--

Notes:
°C = degree Celsius
SU = standard units
µS/cm = micro Siemens per centimeter
NTU = Nephelometric Turbidity Unit
mV = millivolts
mg/L = milligram per liter
-- = not analyzed/measured

Table 5
2014 Groundwater Electron Acceptor/Metabolic By-Product Results
Former TRW Microwave Site
825 Stewart Drive, Sunnyvale, California

Well	Date		Electron Acceptors		Metabolic By-Products		
			Dissolved Oxygen (mg/L)	Sulfate (mg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)
Zone A Aquifer Wells							
EDUCTOR (11 feet)	4/15/14		0.15	40	2700	14	450
EDUCTOR (11 feet)	9/25/14		0.66	--	--	--	--
EDUCTOR (15 feet)	4/15/14		0.21	27	3100	17	740
EDUCTOR (15 feet)	9/25/14		1.26	--	--	--	--
T-2A	4/15/14		0.19	56	7700	240	110
T-2A	4/15/14	dup	0.19	58	7400	230	110
T-2A	9/24/14		0.85	--	--	--	--
T-3A	4/14/14		1.99	--	--	--	--
T-3A	9/24/14		1.41	--	--	--	--
T-7A	10/15/14		0.15	--	--	--	--
T-8A	4/14/14		0.27	170	6.2	0.038	0.018 J
T-8A	10/13/14		0.13	170	11	0.043	0.019 J
T-9A	10/14/14		0.13	--	--	--	--
T-13A	4/14/14		0.49	170	2900	1.2	2.2
T-13A	4/14/14	dup	0.49	150	2900	1.2	2.3
T-13A	10/14/14		0.15	320	4100	2.2	3.1
T-14A	4/14/14		0.35	160	770	0.79	6.6
T-14A	10/14/14		0.21	150	350	0.49	7.3
T-15A	4/14/14		0.4	170	1.8	0.28	0.84
T-15A	10/15/14		0.14	--	--	--	--
T-16A	10/14/14		0.1	--	--	--	--
T-17A	4/14/14		0.29	130	840	0.54	0.31
T-17A	10/14/14		0.15	130	960	0.39	0.43
T-19A	4/14/14		0.34	36	6300	3.5	2.7
T-19A	10/14/14		0.17	180	6400	3.5	5.6
T-23A	4/14/14		0.24	140	2400	1.2	0.77
T-23A	10/14/14		0.18	260	4200	2.5	0.97
T-25A	4/14/14		0.23	160	45	0.15	7.2
T-25A	10/14/14		0.12	150	12	0.079	5.8
38S	10/15/14		0.16	120	--	--	--
Zone B1 Aquifer Wells							
T-2B	4/15/14		0.9	120	13000	110	25
T-2B	9/24/14		3.09	--	--	--	--
T-4B	10/15/14		0.2	--	--	--	--
T-5B	10/16/14		0.26	--	--	--	--
T-7B	10/15/14		0.2	--	--	--	--
T-8B	10/15/14		0.16	--	--	--	--
T-9B	10/16/14		0.35	--	--	--	--
T-10B	10/13/14		0.15	--	--	--	--
T-17B	4/15/14		0.57	160	100	0.96	0.22
T-17B	10/16/14		0.2	150	140	1.2	0.87
T-18B	10/13/14		0.43	--	--	--	--
T-19B	10/13/14		0.35	--	--	--	--
Zone B2 Aquifer Wells							
T-2C	4/15/14		2.23	--	--	--	--
T-2C	9/25/14		12	--	--	--	--
T-9C	10/14/14		0.34	--	--	--	--
T-10C	10/16/14		0.22	--	--	--	--
T-11C	10/15/14		0.15	--	--	--	--
T-12C	10/15/14		0.24	--	--	--	--

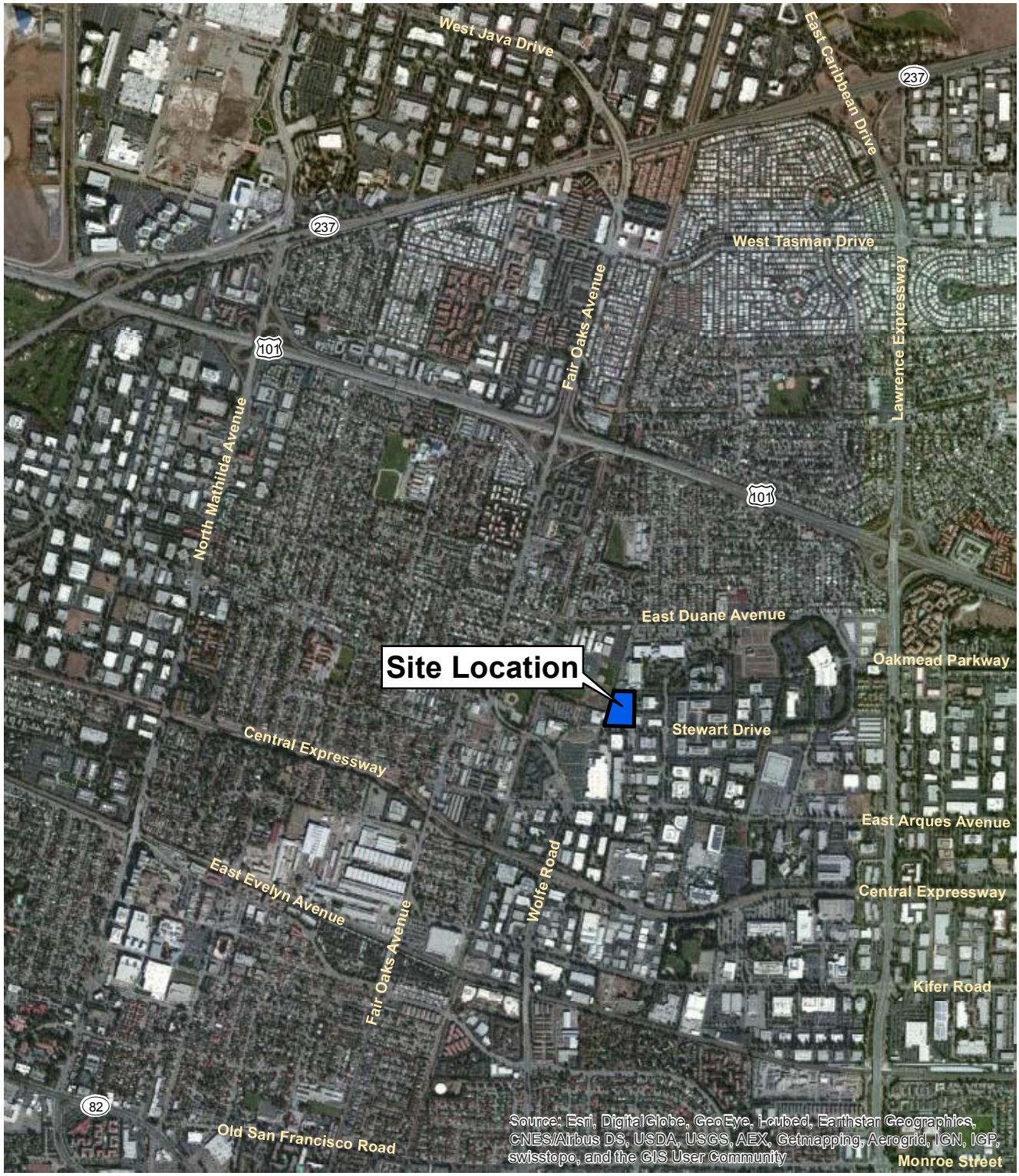
Notes:
mg/L = milligram per liter
µg/L = microgram per liter
-- = not analyzed/measured

Table 6
2014 Groundwater Dechlorinating Microbe Results
Former TRW Microwave Site
825 Stewart Drive, Sunnyvale, California

		Dechlorinating Microbes
		Dehalococcoides type Microbes
Well	Date	cells/mL
Eductor	4/15/2014	3.41E+03
T-2A	4/15/2014	4.16E+03
T-13A	10/14/2014	2.68E+04
T-19A	10/14/2014	2.12E+03
T-23A	10/14/2014	1.70E+04

Notes:
cells/mL = cells per milliliter

FIGURES



N

0 1,000 2,000 Feet

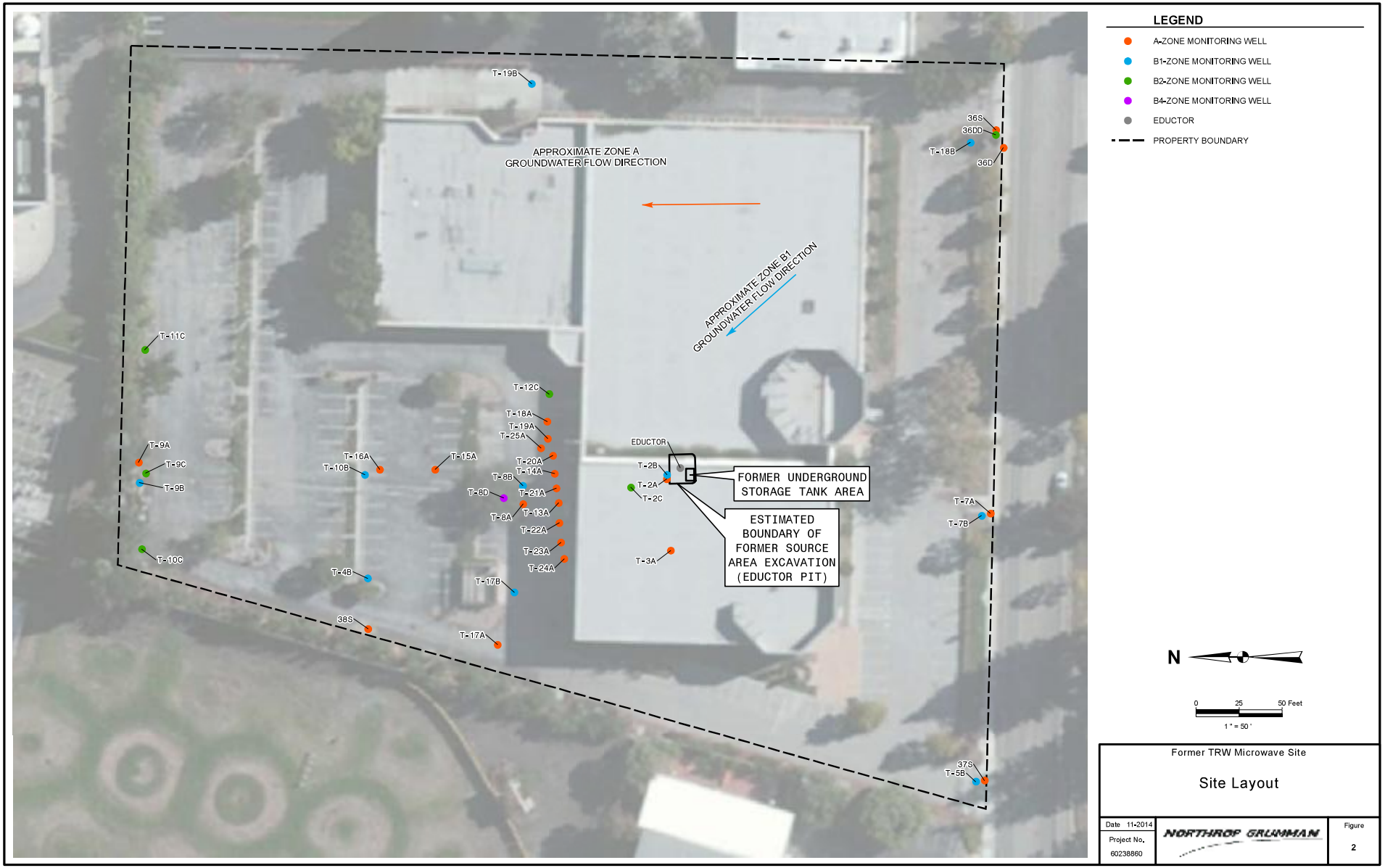
1 " = 2,000 '

Former TRW Microwave Site

Site Location

Date 09-2014	NORTHROP GRUMMAN	Figure
Project No. 60238860		1

File: W:\work\60238860_NG\GIS\Projects\Site_Location.mxd
Date: Thursday, February 05, 2015 9:04:03 AM



Former TRW Microwave Site

Site Layout

Date 11-2014	NORTHROP GRUMMAN	Figure
Project No. 60238860		2

File: W:\work\60238860_NG\GIS\Projects\Site_Layout.mxd
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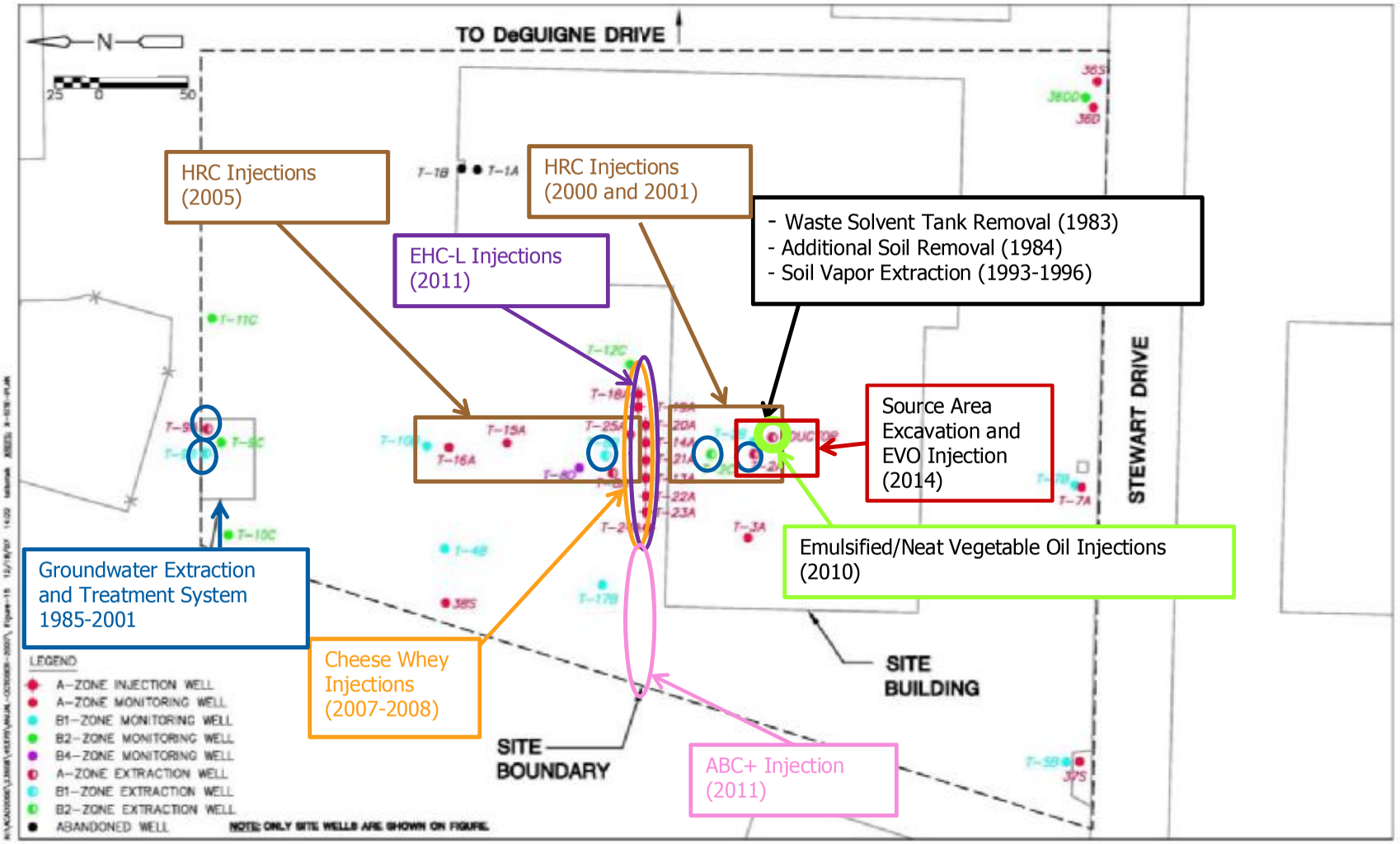
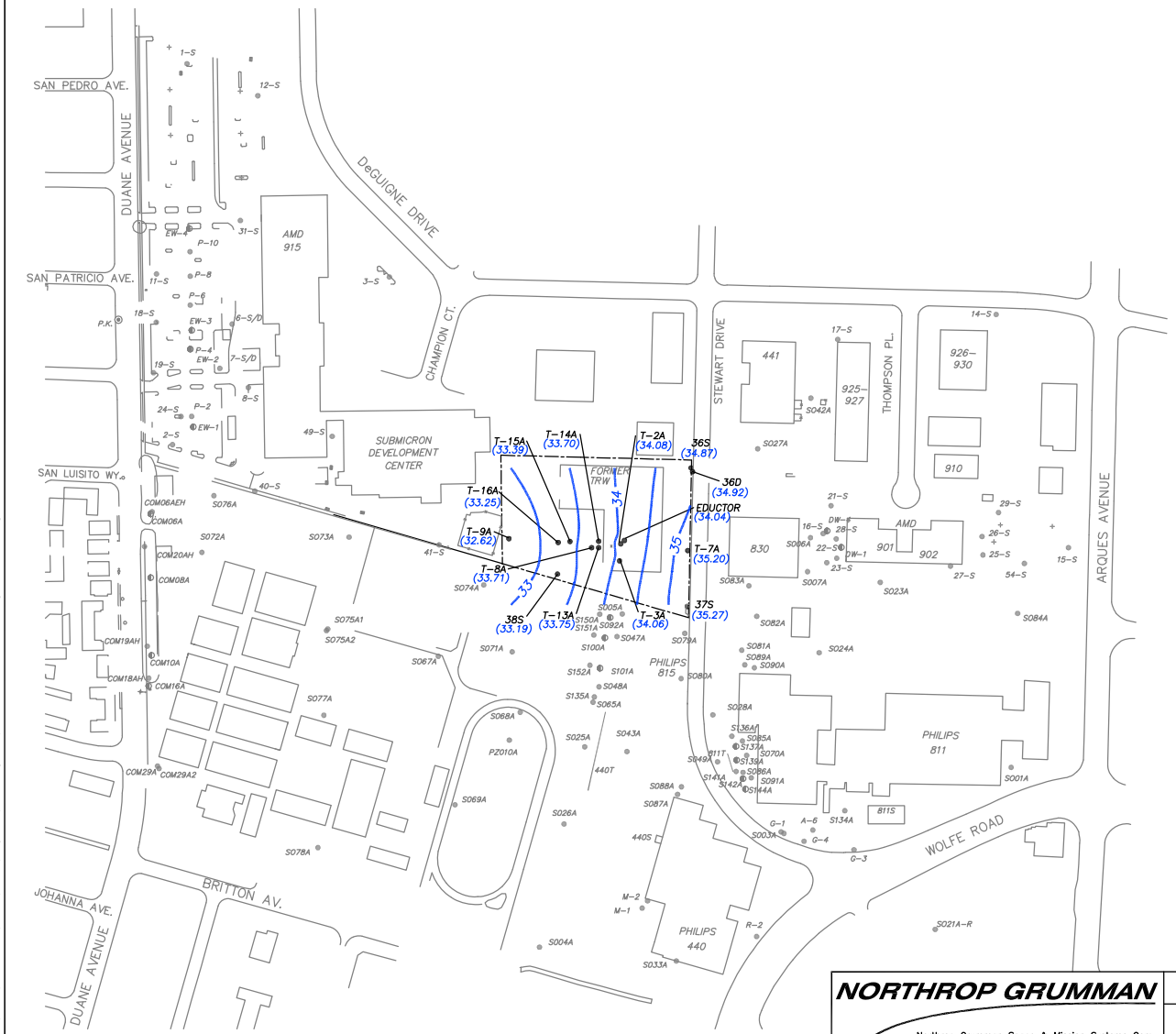


NORTHROP GRUMMAN	Former TRW Microwave Site **Previous Remedial Activities**	**FIGURE 3**



LEGEND:

- INDICATES APPROXIMATE LOCATION OF ZONE A MONITORING WELL
- INDICATES APPROXIMATE LOCATION OF ZONE A EXTRACTION WELL
- (34.82) INDICATES WATER–LEVEL ELEVATION IN ZONE A MONITORING WELL (FEET, MSL & NAVD 88) IN OCTOBER 2014
- INDICATES APPROXIMATE POTENTIOMETRIC SURFACE CONTOUR IN ZONE A IN OCTOBER 2014

SCALE
0 300 600 FEET

NORTHROP GRUMMAN
Northrop Grumman Space & Mission Systems Corp.

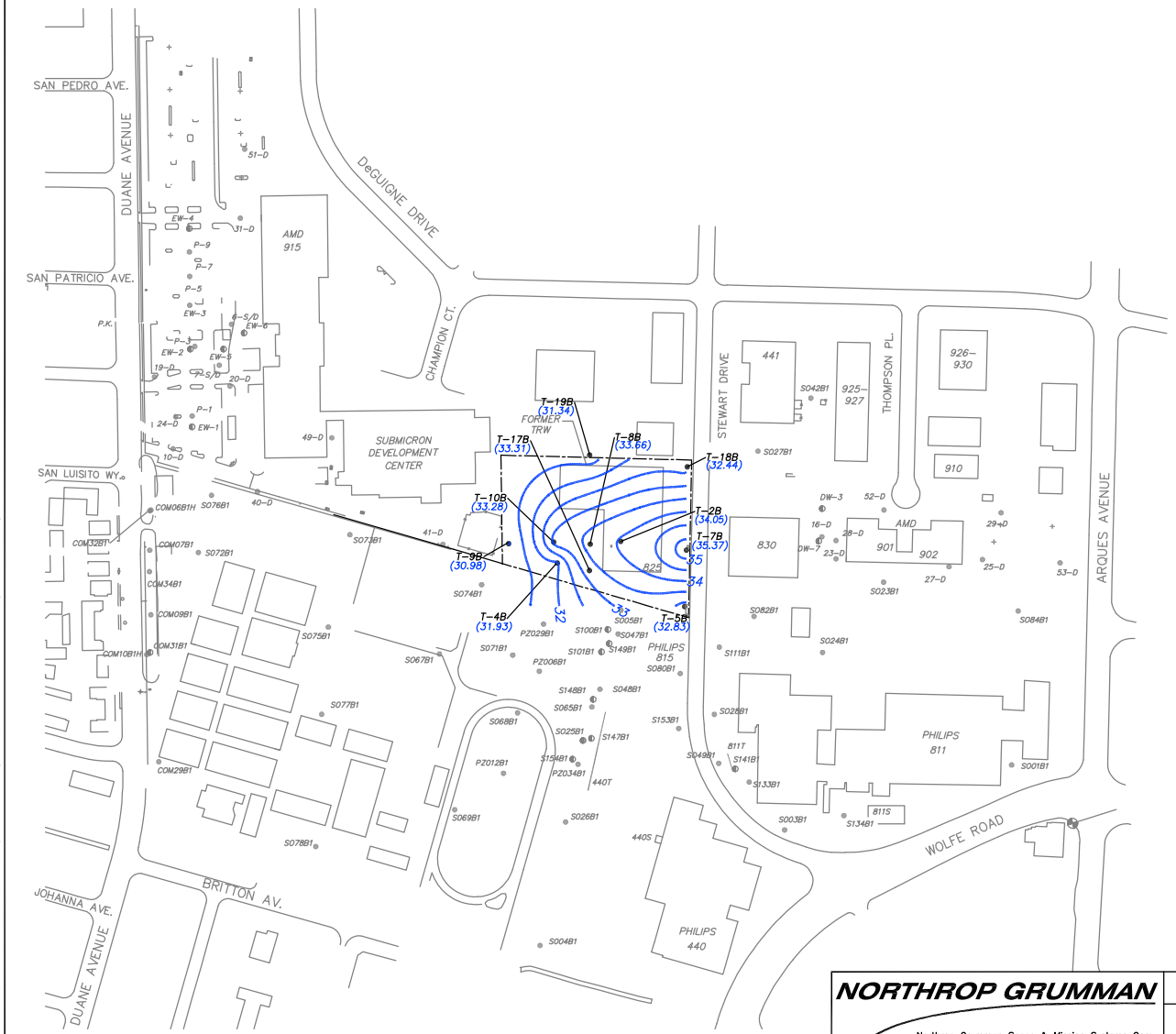
FORMER TRW MICROWAVE SITE

POTENTIOMETRIC SURFACE CONTOURS
ZONE A
OCTOBER 2014

DATE 12–30–2014
FIGURE 4

File: W:\work\60147454\CADD\2012\Projects\2014 Figures\60134425 – 2014 – Fig 2 thru 8.dwg Time: Feb 05, 2015 – 8:42am

Home Server Folder: \\usora1fp001\env_prod\Projects\ET\DATA\work\60147454\CADD\2012\Projects\2014 Figures



LEGEND:

- INDICATES APPROXIMATE LOCATION OF ZONE B1 MONITORING WELL
- INDICATES APPROXIMATE LOCATION OF ZONE B1 EXTRACTION WELL
- (33.02) INDICATES WATER–LEVEL ELEVATION IN ZONE B1 MONITORING WELL (FEET, MSL & NAVD88) IN OCTOBER 2014
- INDICATES APPROXIMATE POTENTIOMETRIC SURFACE CONTOUR IN ZONE B1 IN OCTOBER 2014

SCALE
0 300 600 FEET

NORTHROP GRUMMAN
Northrop Grumman Space & Mission Systems Corp.

FORMER TRW MICROWAVE SITE

POTENTIOMETRIC SURFACE CONTOURS
ZONE B1
OCTOBER 2014

DATE 12–30–2014
FIGURE 5

File: W:\work\60147454\CADD\2012\Projects\2014 Figures\60134425 – 2014 – Fig 2 thru 8.dwg Time: Feb 05, 2015 – 8:42am

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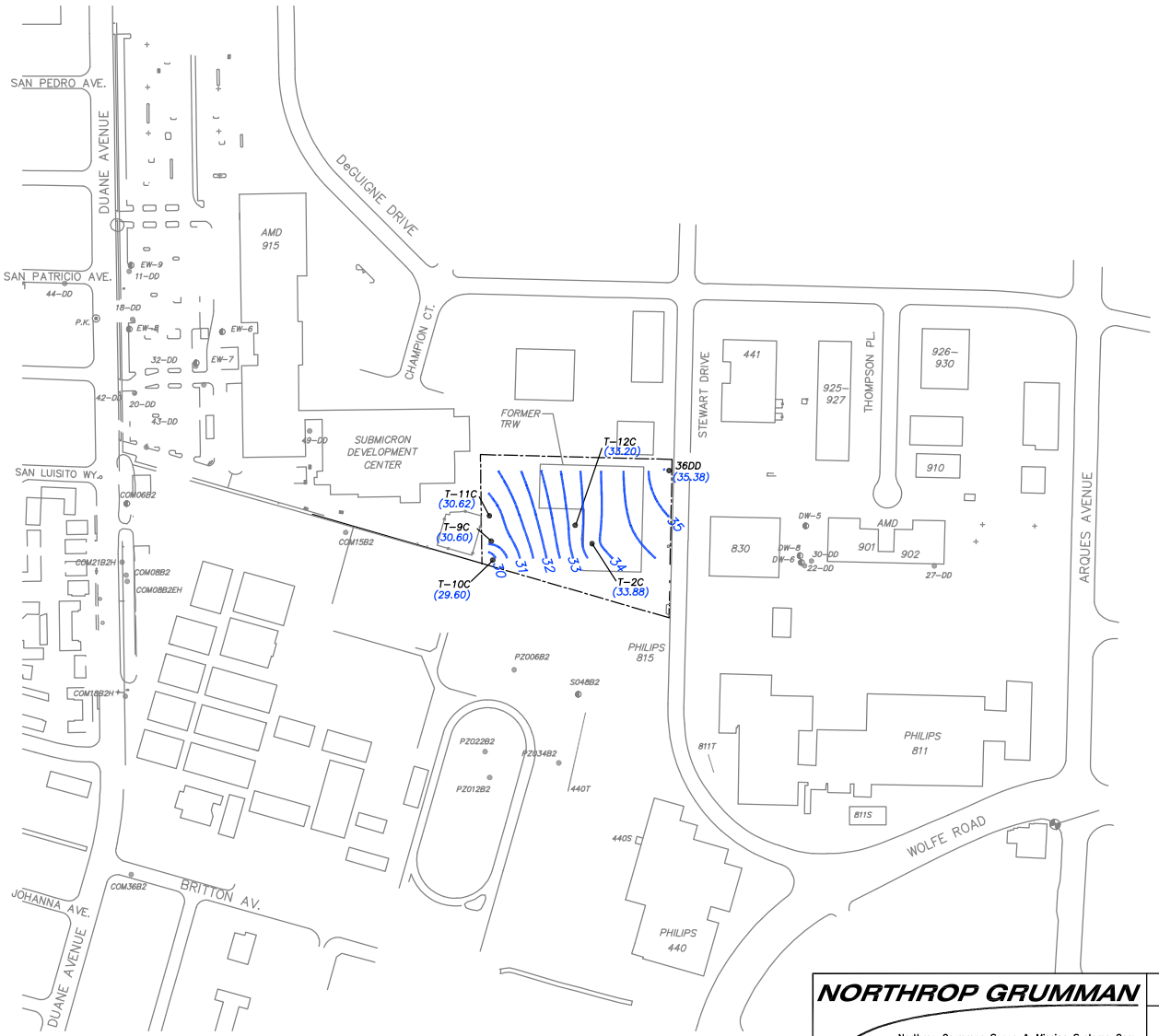


LEGEND:

- ● INDICATES APPROXIMATE LOCATION OF ZONE B2 MONITORING WELL
- ◐ INDICATES APPROXIMATE LOCATION OF ZONE B2 EXTRACTION WELL
- (35.53) INDICATES WATER–LEVEL ELEVATION IN ZONE B2 MONITORING WELL (FEET, MSL & NAVD88) IN OCTOBER 2014
- ~ INDICATES APPROXIMATE POTENTIOMETRIC SURFACE CONTOUR IN ZONE B2 IN OCTOBER 2014

N

SCALE
0 300 600 FEET

NORTHROP GRUMMAN
Northrop Grumman Space & Mission Systems Corp.

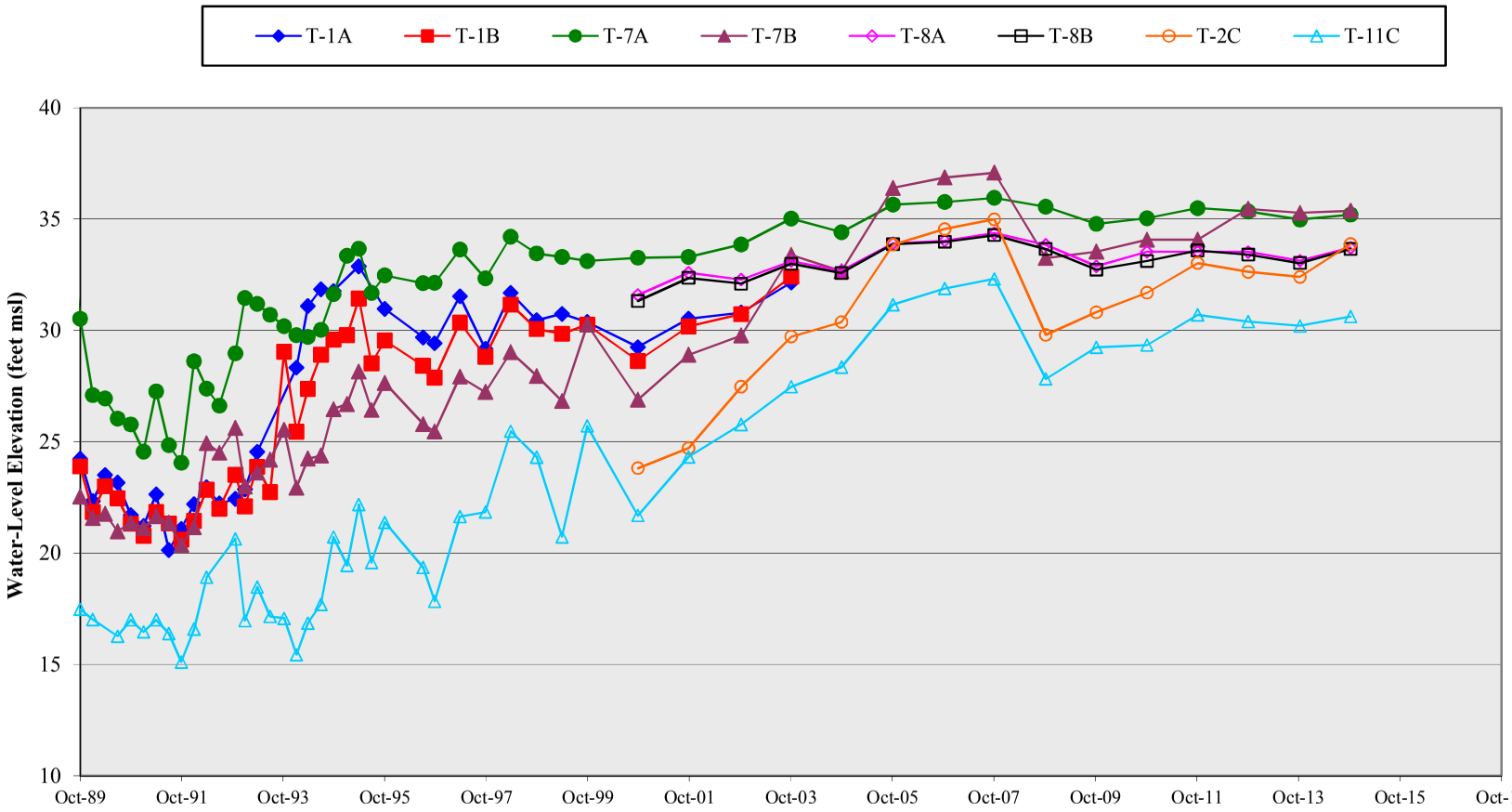
FORMER TRW MICROWAVE SITE

POTENTIOMETRIC SURFACE CONTOURS
ZONE B2
OCTOBER 2014

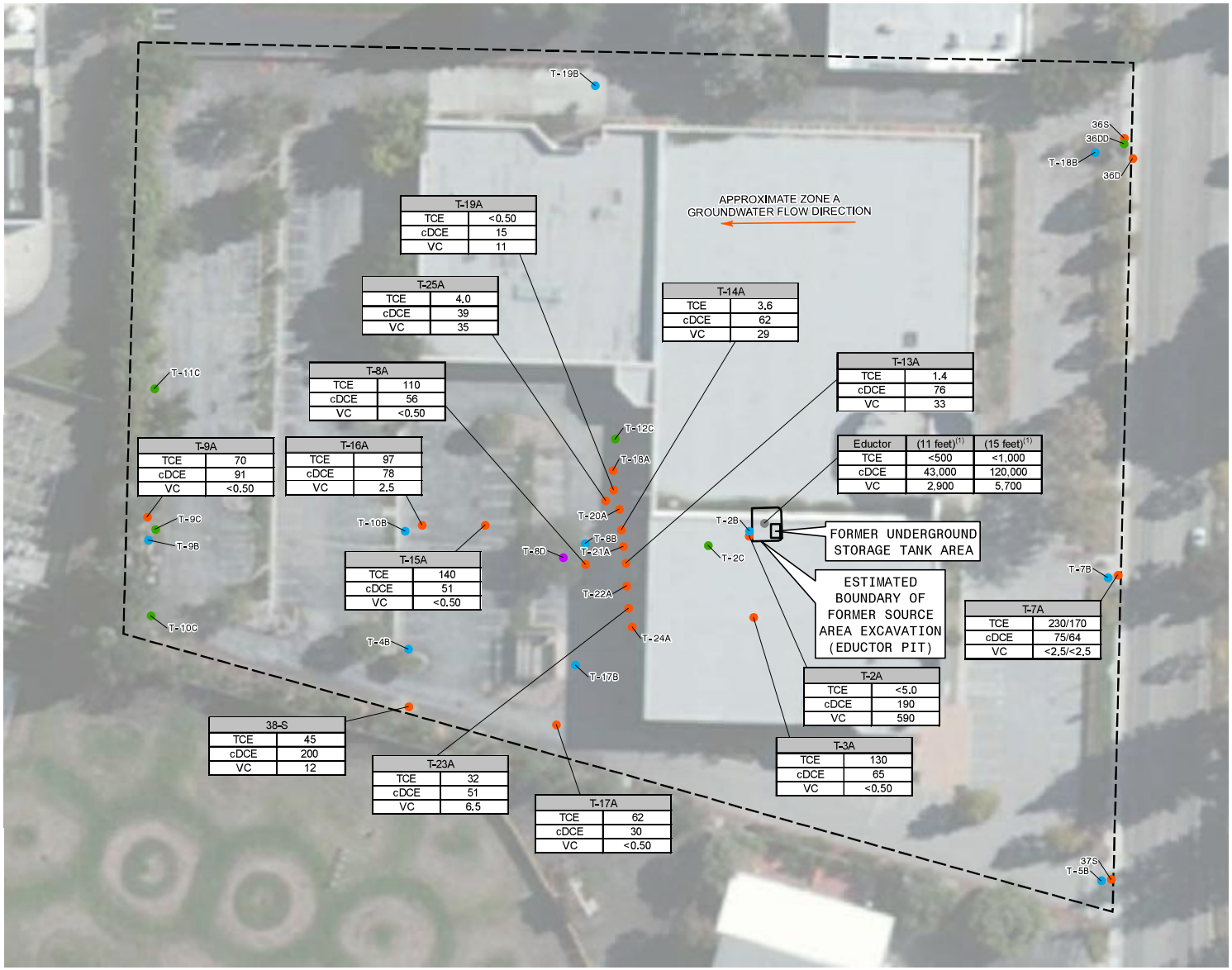
DATE 12–30–2014
FIGURE 6

File: W:\work\60147454\CADD\2012\Projects\2014 Figures\60134425 – 2014 – Fig 2 thru 8.dwg Time: Feb 05, 2015 – 8:43am

Home Server Folder: \\usora1fp001\env_prod\Projects\ET\DATA\work\60147454\CADD\2012\Projects\2014 Figures



	Former TRW Microwave Site	
NORTHROP GRUMMAN	**Water-Level Elevations vs. Time - Wells T-1A, T-1B, T-7A, T-7B, T-8A, T-8B, T-2C, and T-11C** Note: Per Water Board approval, wells T-1A and T-1B were abandoned in February 2004. Wells T-8A, T-8B, and T-2C were included in this figure starting with year 2000 data, corresponding with suspension of groundwater extraction at these wells. Elevations presented in NAVD88.	**FIGURE 7**



LEGEND

- A-ZONE MONITORING WELL
- B1-ZONE MONITORING WELL
- B2-ZONE MONITORING WELL
- B4-ZONE MONITORING WELL
- EDUCTOR
- PROPERTY BOUNDARY

ABBREVIATIONS

- / DENOTES DUPLICATE SAMPLE
- < NOT DETECTED AT OR ABOVE THE DETECTION LIMIT SHOWN
- cDCE cis-1,2-DICHLOROETHENE
- ANALYSIS RESULTS
- TCE TRICHLOROETHENE
- VC VINYL CHLORIDE

NOTE

(1) THE EDUCTOR WAS SAMPLED AT TWO DISCRETE INTERVALS, 11 FEET BELOW GROUND SURFACE AND 15 FEET BELOW GROUND SURFACE.

WELL	
ANALYTE	CONCENTRATION IN MICROGRAMS PER LITER

N

0 25 50 Feet

1 " = 50 '

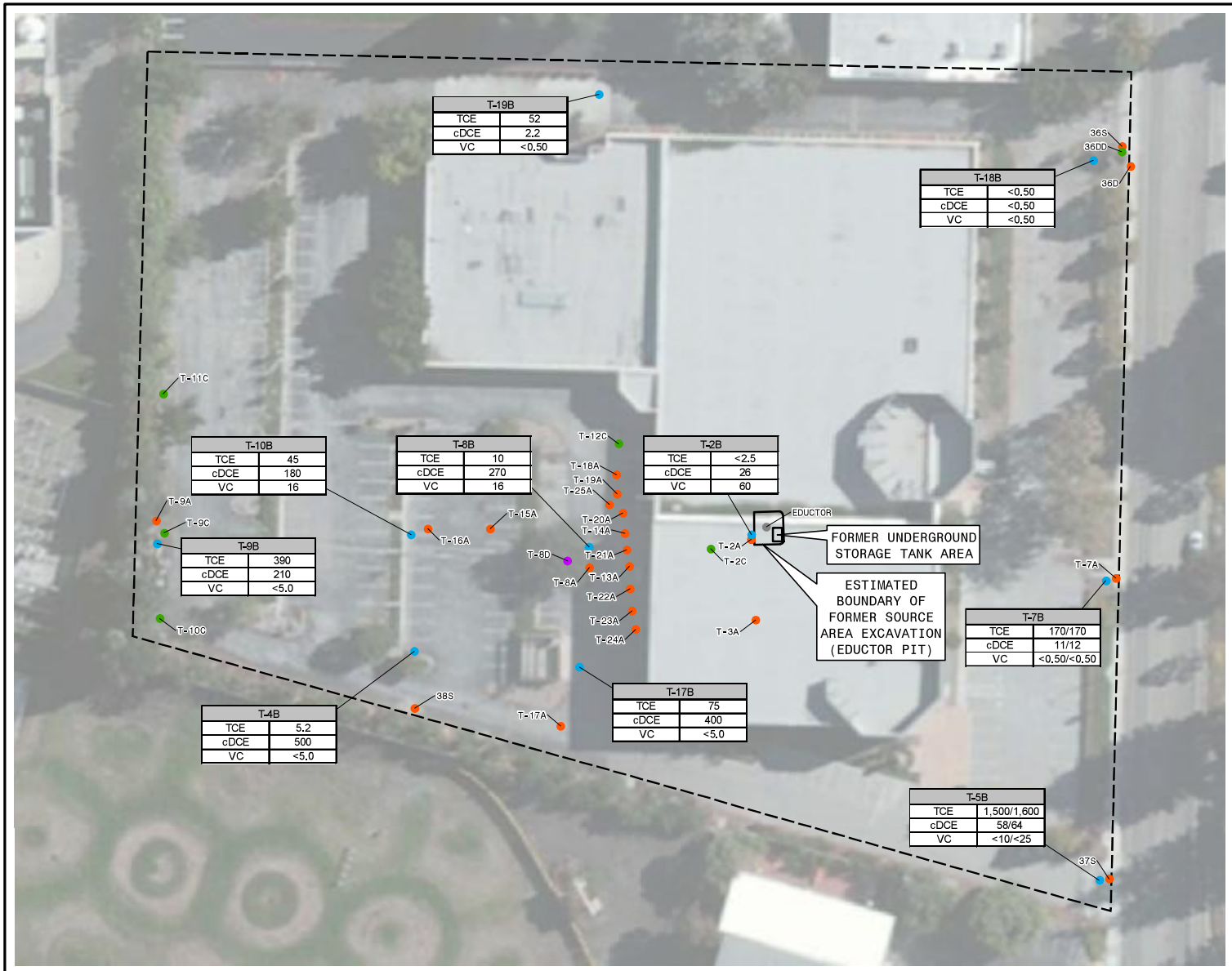
Former TRW Microwave Site

Zone A Analytical Results October 2014

Date	Project No.	Figure
12-2014	60238860	8

NORTHROP GRUMMAN

File: W:\work\60238860_NG\GIS\Projects\Zone_A_Results_Oct2014.mxd
Date: Thursday, February 05, 2015 9:00:50 AM



LEGEND

- A-ZONE MONITORING WELL
- B1-ZONE MONITORING WELL
- B2-ZONE MONITORING WELL
- B4-ZONE MONITORING WELL
- EDUCTOR
- PROPERTY BOUNDARY

ABBREVIATIONS

/	DENOTES DUPLICATE SAMPLE
<	NOT DETECTED AT OR ABOVE THE DETECTION LIMIT SHOWN
cDCE	cis-1,2-DICHLOROETHENE
	ANALYSIS RESULTS
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE

WELL	
ANALYTE	CONCENTRATION IN MICROGRAMS PER LITER

N

0 25 50 Feet

1 " = 50 '

Former TRW Microwave Site

Zone B1 Analytical Results October 2014

Date 12-2014	NORTHROP GRUMMAN	Figure 9
Project No. 60238860		

File: W:\work\60238860_NG\GIS\Projects\Zone_B1_Results_Oct2014.mxd
Date: Thursday, February 05, 2015 9:01:57 AM

LEGEND

- A-ZONE MONITORING WELL
- B1-ZONE MONITORING WELL
- B2-ZONE MONITORING WELL
- B4-ZONE MONITORING WELL
- EDUCTOR
- PROPERTY BOUNDARY

ABBREVIATIONS

/	DENOTES DUPLICATE SAMPLE
<	NOT DETECTED AT OR ABOVE THE DETECTION LIMIT SHOWN
cDCE	cis-1,2-DICHLOROETHENE
	ANALYSIS RESULTS
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE

NOTE

(1) GROUNDWATER ANALYTICAL DATA PROVIDED BY AMD.

WELL	
ANALYTE	CONCENTRATION IN MICROGRAMS PER LITER

N

0 25 50 Feet

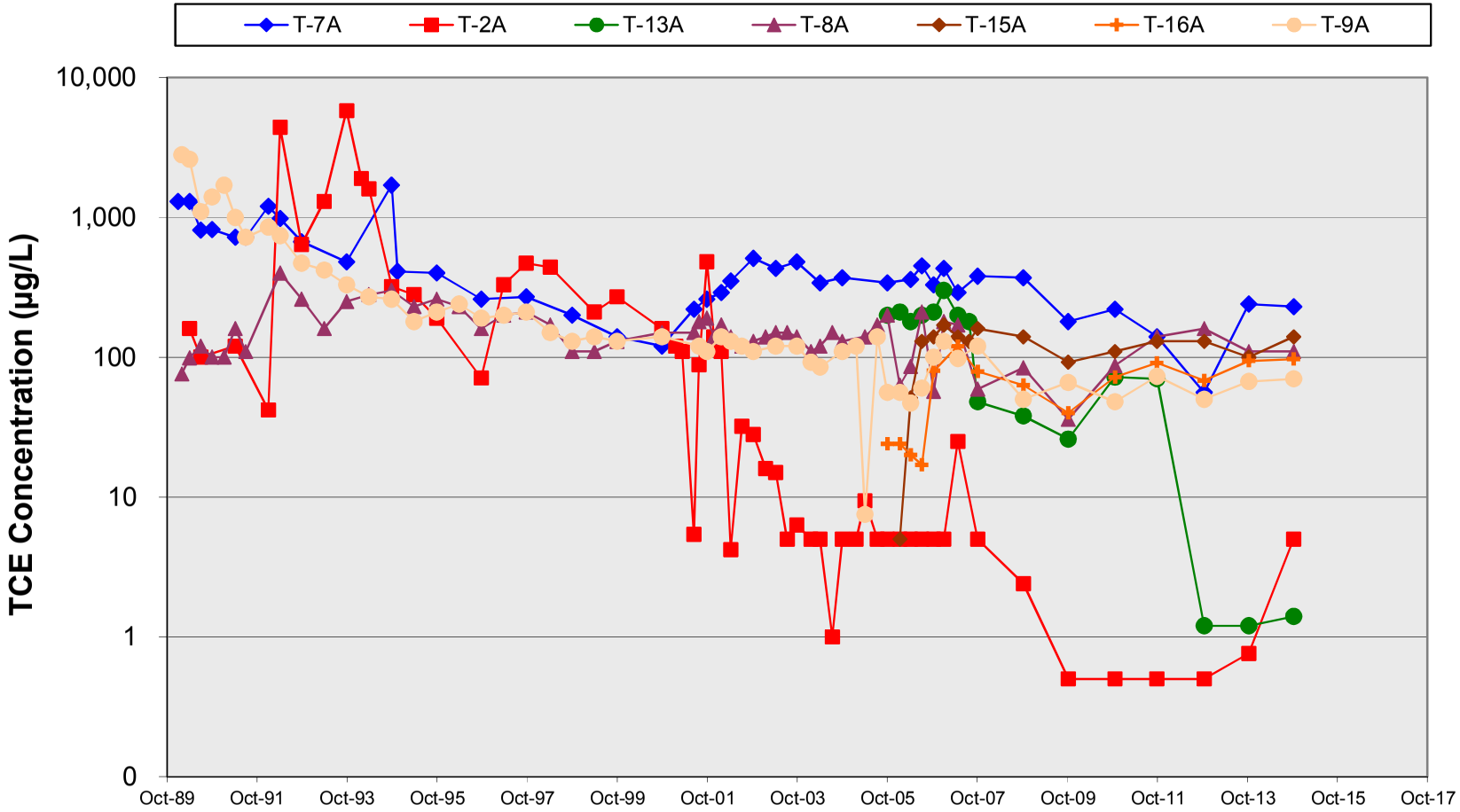
1 " = 50 '

Former TRW Microwave Site

Zone B2 Analytical Results October 2014

Date 12-2014	NORTHROP GRUMMAN	Figure
Project No. 60238860		10

File: W:\work\60238860_NG\GIS\Projects\Zone_B2_Results_Oct2014.mxd
Date: Thursday, February 05, 2015 9:01:12 AM



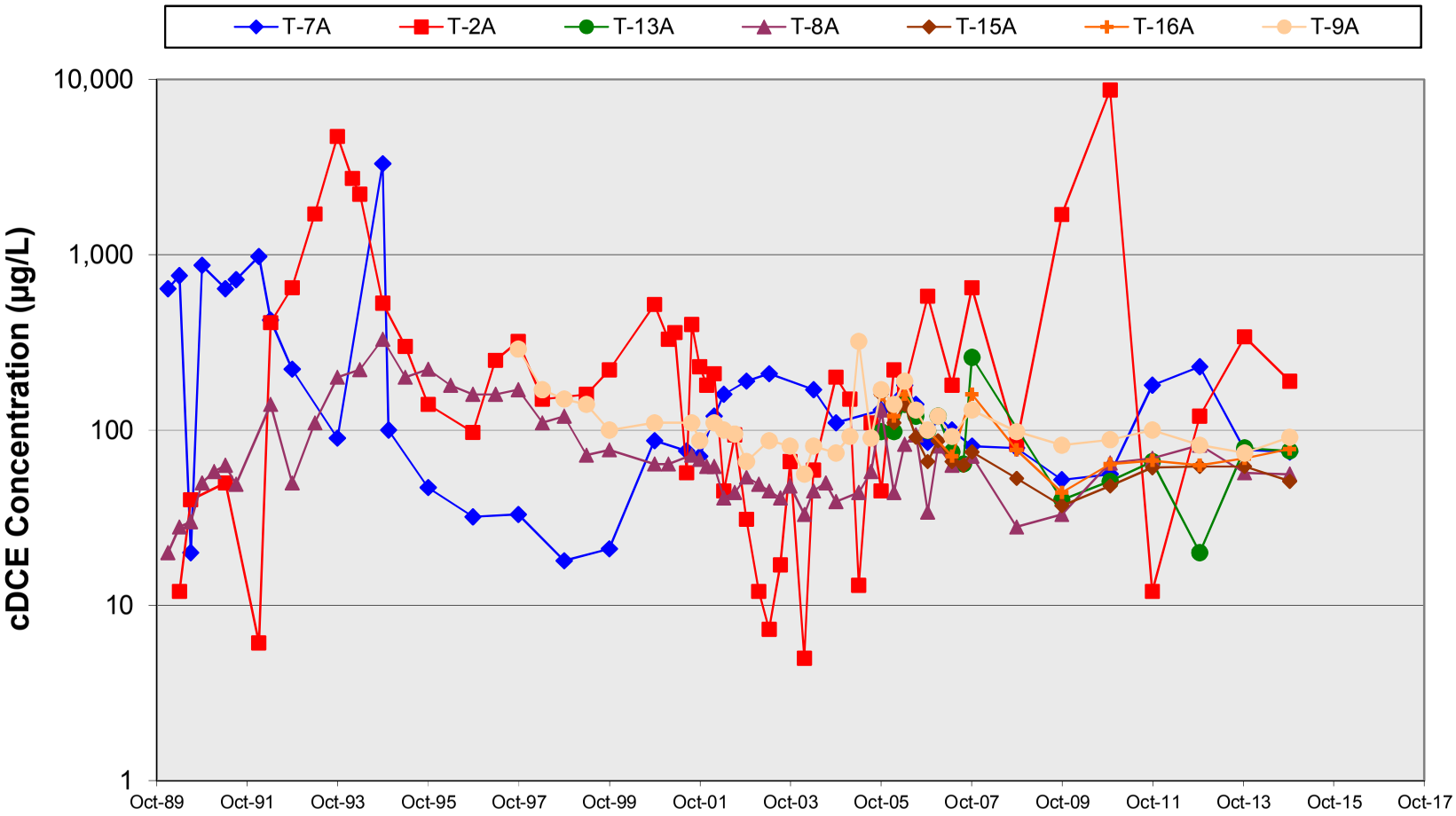
NORTHROP GRUMMAN

Former TRW Microwave Site

TCE Concentrations vs. Time - Wells T-2A, T-7A, T-8A, T-9A, T-13A, T-15A, and T-16A

Note: For non-detects less than 5 µg/L, detection limit is presented for the data point. For non-detects greater than 5 µg/L, the data point has been omitted from the figure.

FIGURE 11



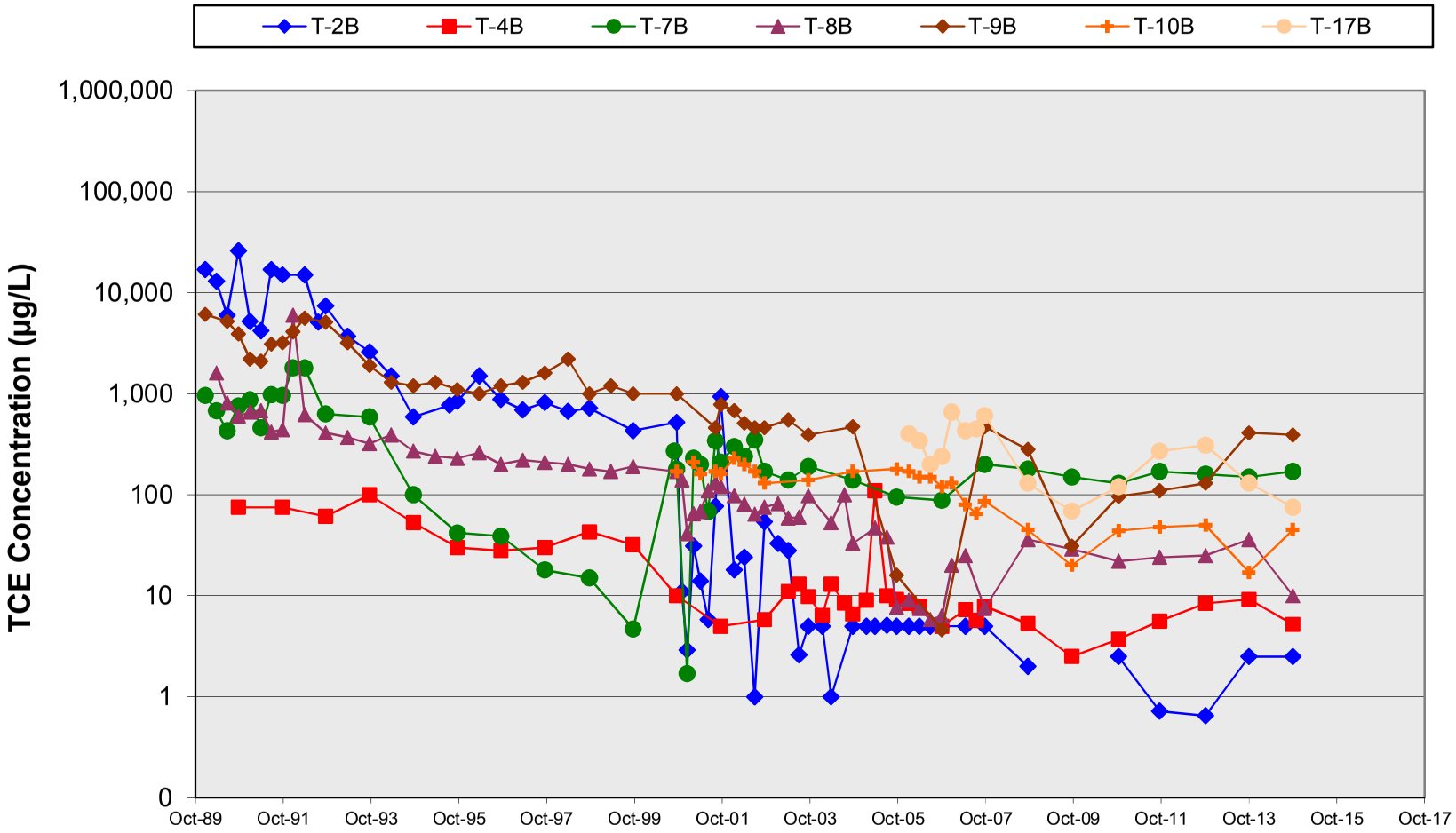
NORTHROP GRUMMAN

Former TRW Microwave Site

cDCE Concentrations vs. Time - Wells T-2A, T-7A, T-8A, T-9A, T-13A, T-15A, and T-16A

Note: For non-detects less than 5 µg/L, detection limit is presented for the data point. For non-detects greater than 5 µg/L, the data point has been omitted from the figure. Data reported as total 1,2-DCE prior to 1996.

FIGURE 12



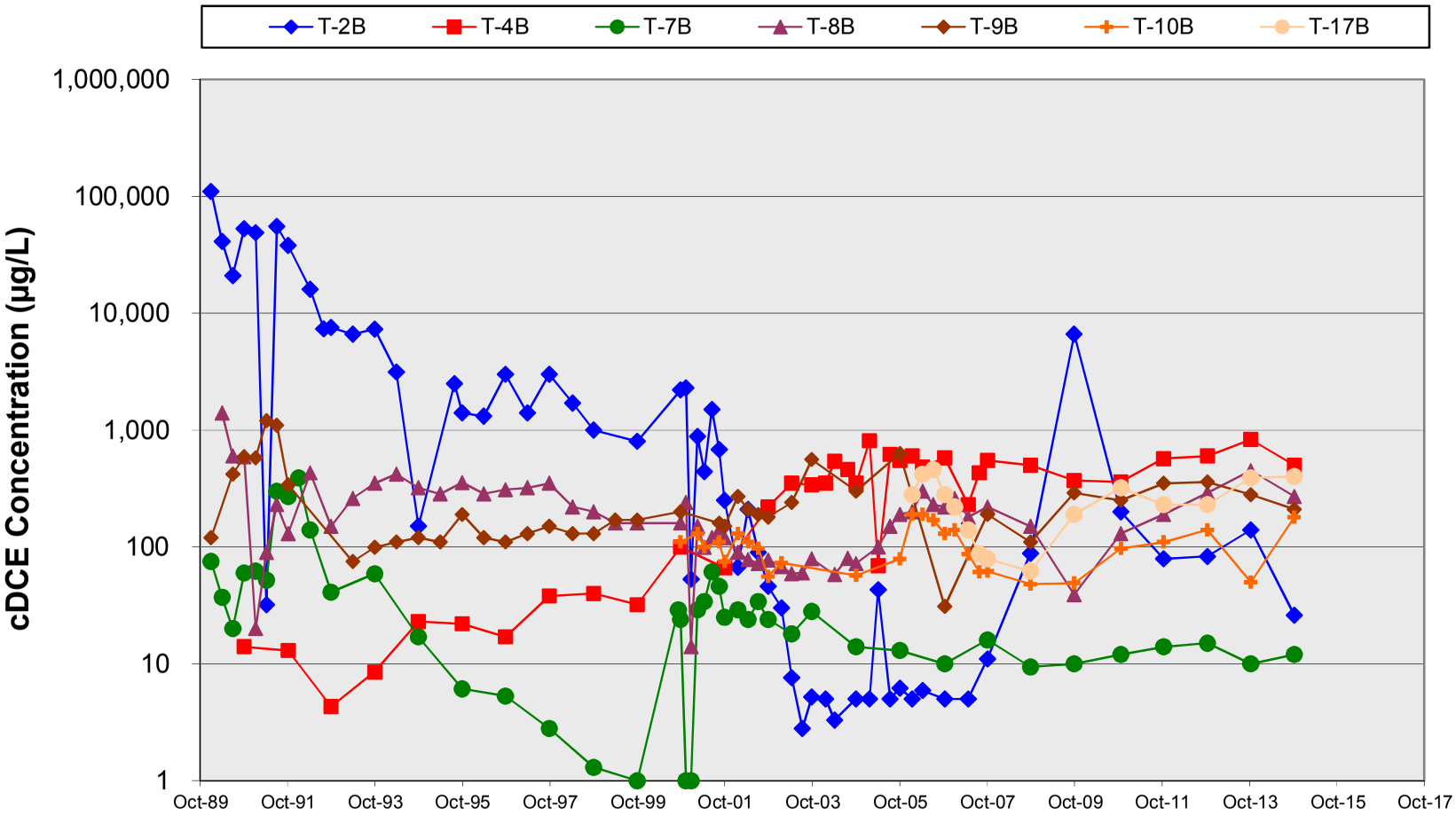
NORTHROP GRUMMAN

Former TRW Microwave Site

TCE Concentrations vs. Time - Wells T-2B, T-4B, T-7B, T-8B, T-9B, T-10B, and T-17B

Note: For non-detects less than 5 µg/L, detection limit is presented for the data point. For non-detects greater than 5 µg/L, the data point has been omitted from the figure.

FIGURE 13



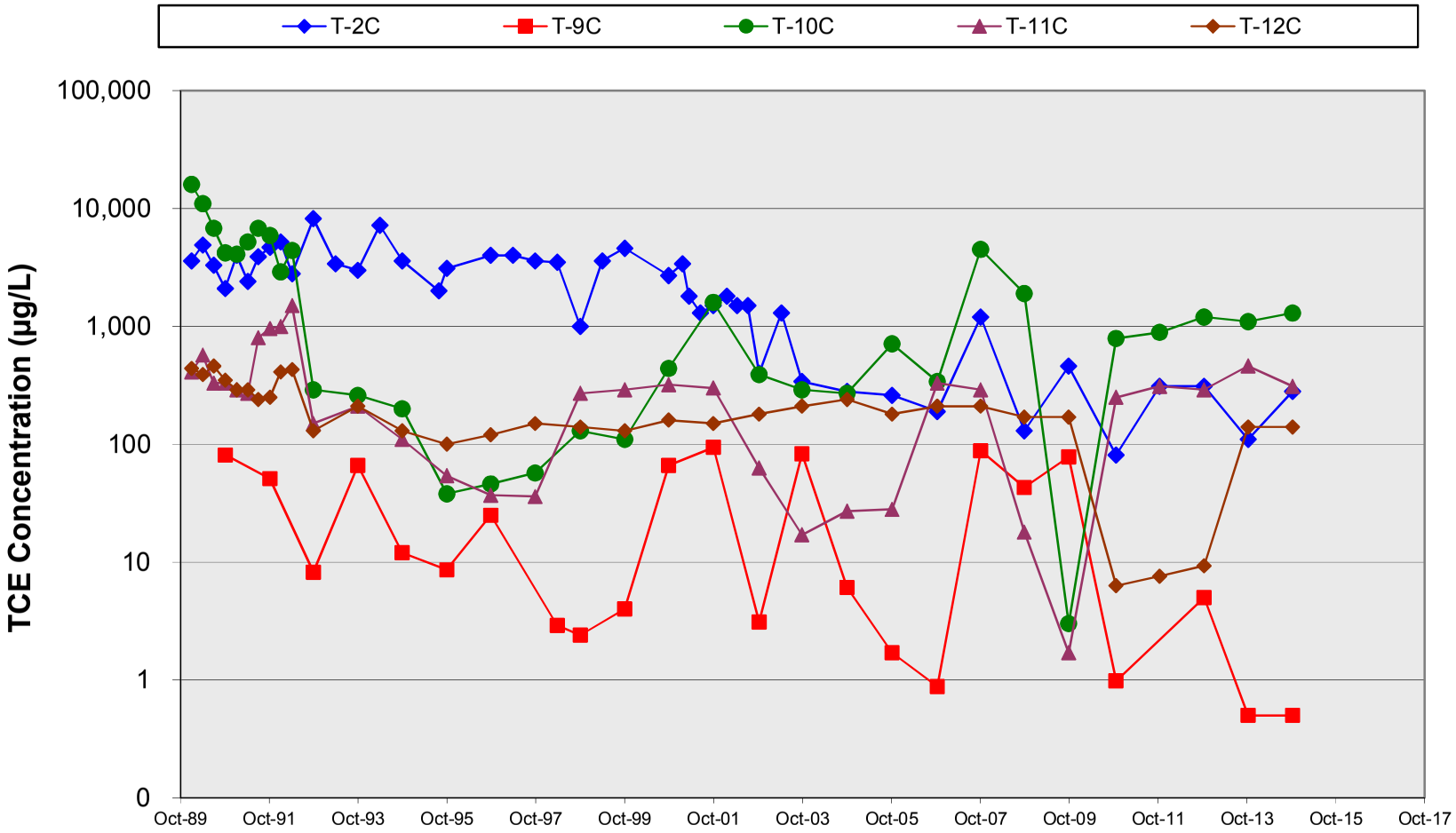
NORTHROP GRUMMAN

Former TRW Microwave Site

cDCE Concentrations vs. Time - Wells T-2B, T-4B, T-7B, T-8B, T-9B, T-10B, and T-17B

Note: For non-detects less than 5 µg/L, detection limit is presented for the data point. For non-detects greater than 5 µg/L, the data point has been omitted from the figure. Data reported as total 1,2-DCE prior to 1996.

FIGURE 14



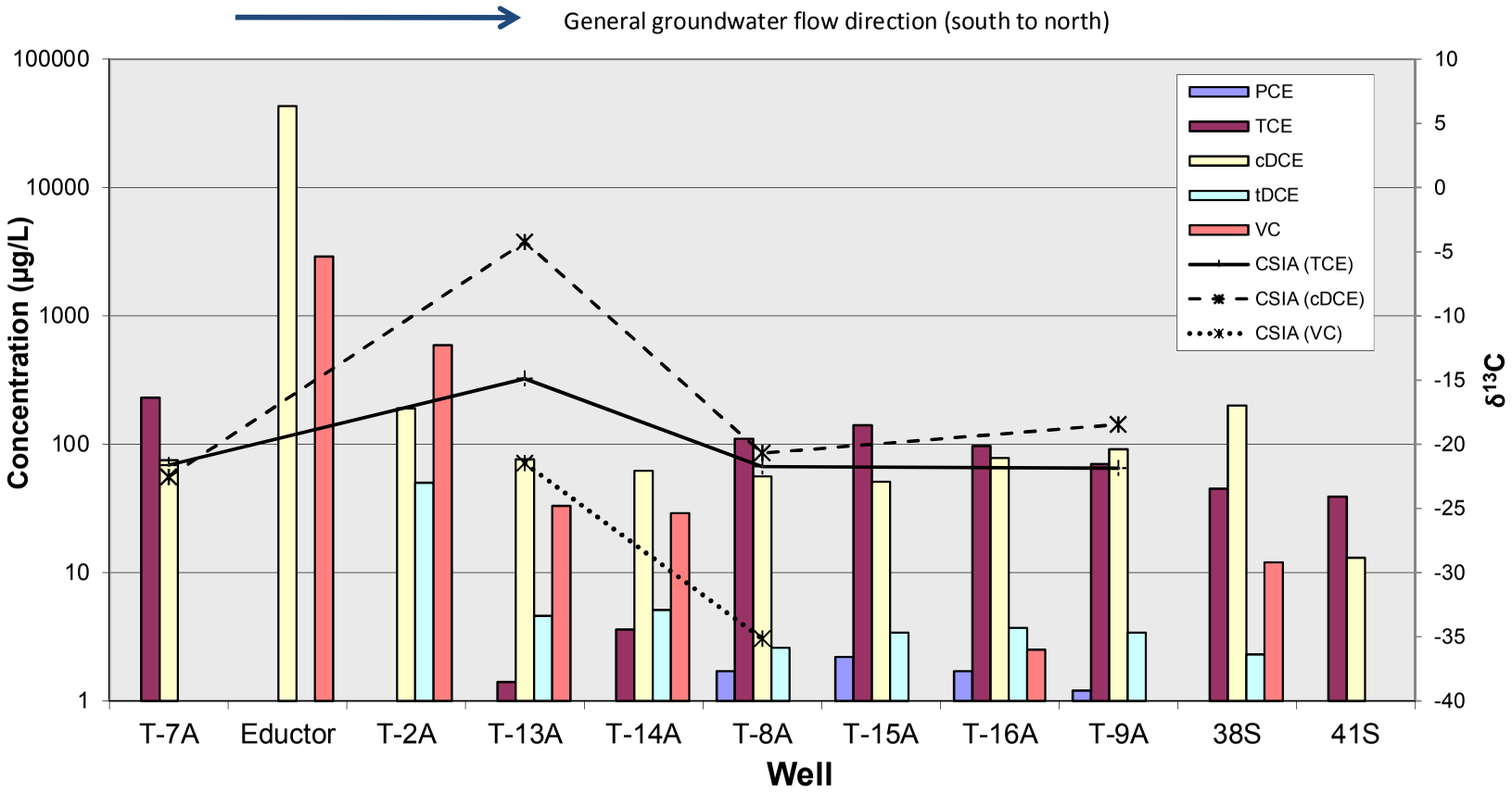
NORTHROP GRUMMAN

Former TRW Microwave Site

TCE Concentrations vs. Time - Wells T-2C, T-9C, T-10C, T-11C, and T-12C

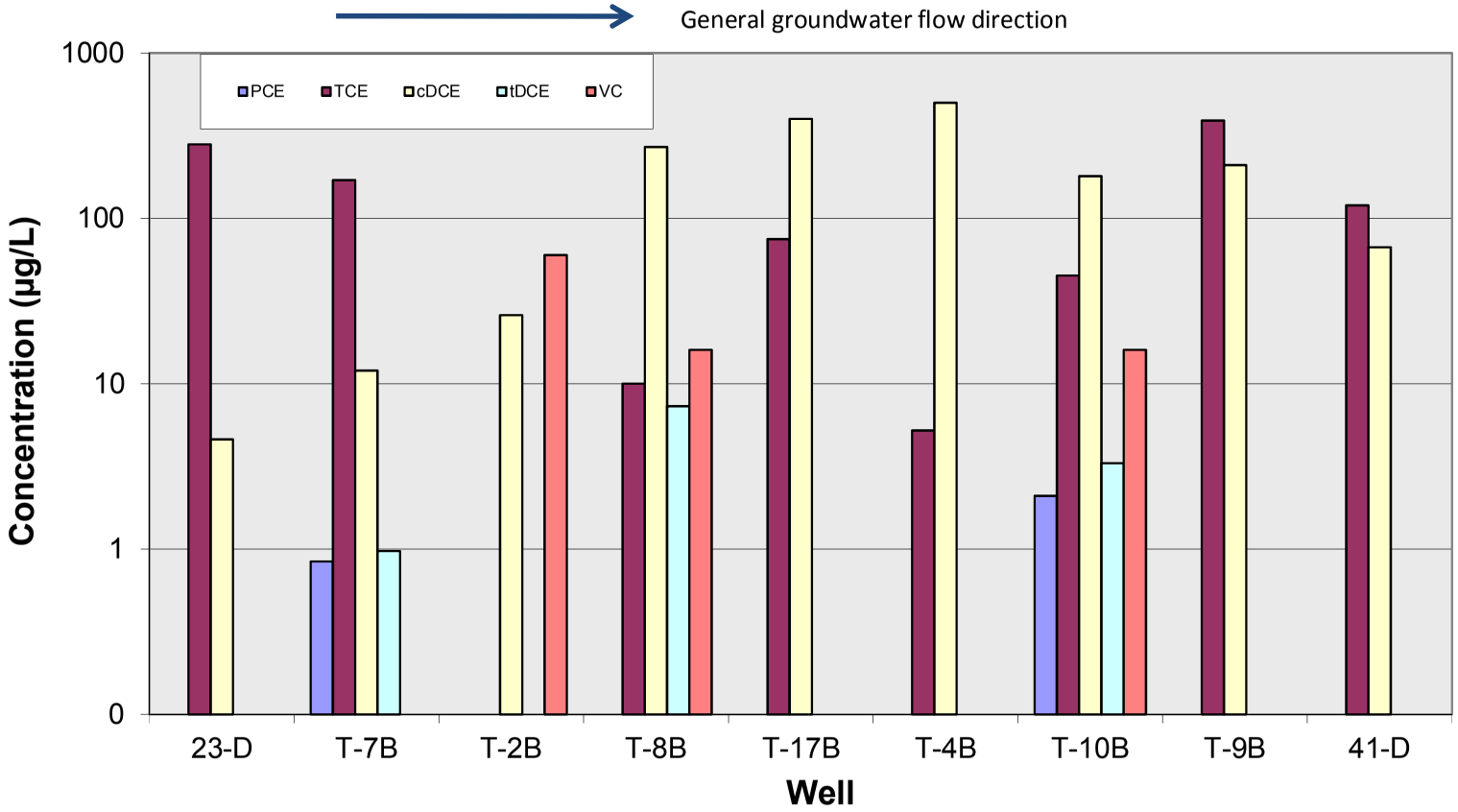
Note: For non-detects less than 5 µg/L, detection limit is presented for the data point. For non-detects greater than 5 µg/L, the data point has been omitted from the figure.

FIGURE 15



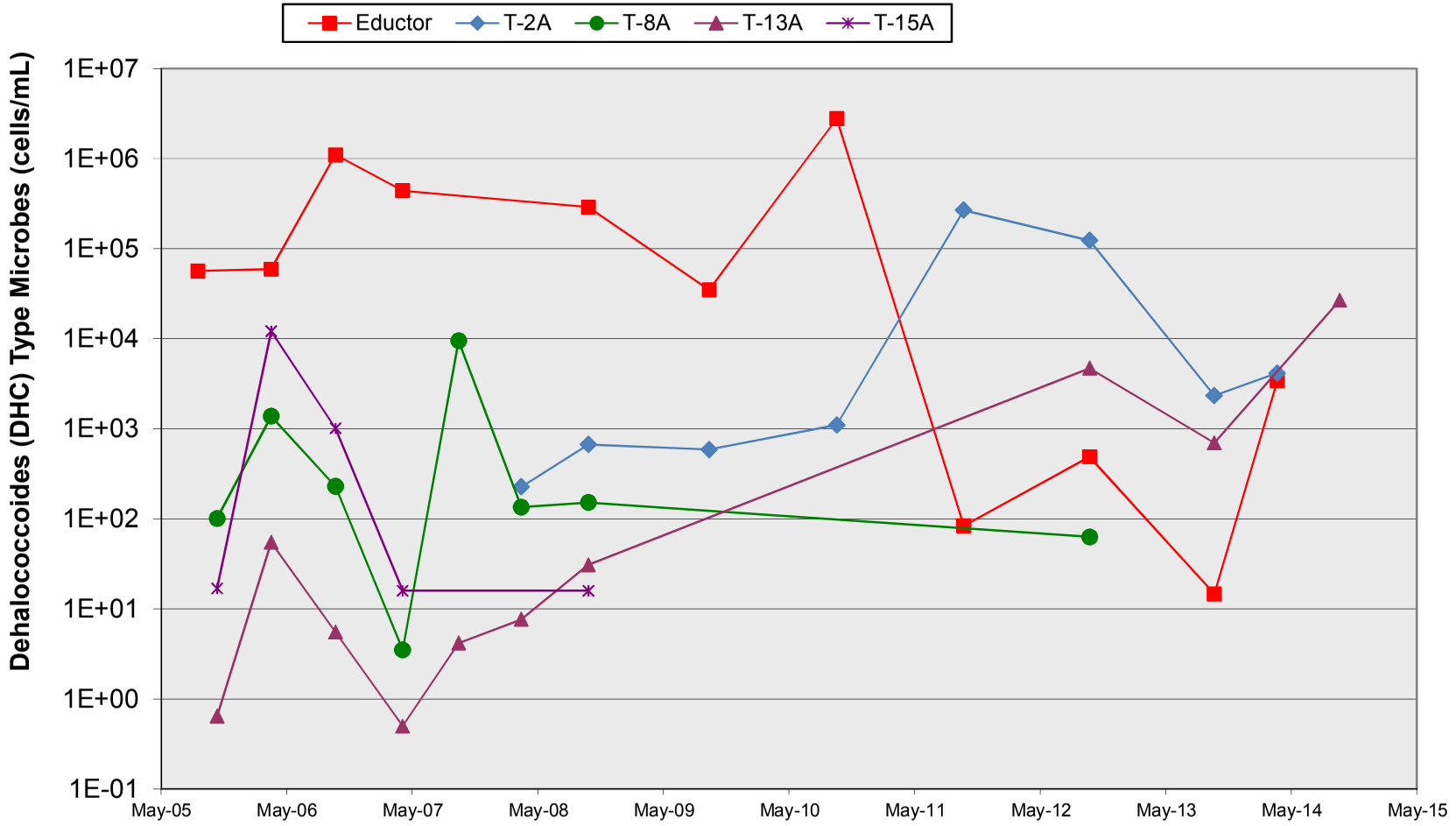
Note: Groundwater flow direction is generally along the wells listed above, from south to north, from onsite well T-7A to offsite AMD well 41S.

NORTHROP GRUMMAN	Former TRW Microwave Site	
	Chlorinated Ethene Concentrations, Zone A - October 2014	**FIGURE 16**



Note: Groundwater flow direction is generally along the wells listed above from offsite well 23-D to offsite well 41-D.

NORTHROP GRUMMAN	Former TRW Microwave Site	
	Chlorinated Ethene Concentrations, Zone B1 - October 2014	**FIGURE 17**



NORTHROP GRUMMAN	Former TRW Microwave Site **Dehalococcoides (Dhc) Type Microbe Concentrations vs. Time - Wells Eductor, T-8A, T-13A and T-15A**	**FIGURE 18**