DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600

REPLY TO

July 12, 2018

Base Realignment and Closure Division

Ms. Lucrina Jones
U.S. Environmental Protection Agency, Region IX (SFD-8-3)
75 Hawthorne St.
San Francisco, CA 94105

SUBJECT: Final Five-Year Review Report for the Former Sacramento Army Depot, Sacramento, California

Dear Ms. Jones:

The Department of the Army completed the Five-Year Review for the Former Sacramento Army Depot located in Sacramento, California and is providing you with a hard and digital copy of the final report. This is the fifth Five Year Review for the Sacramento Army Depot. All comments and response to comments are provided as attachments in the report and a notice placed in the Sacramento Bee alerting the public of the completion of the final report.

If you have any questions please do not hesitate to call the Base Environmental Coordinator (BEC) Scott Armstrong, CALIBRE, (916) 261-4577.

Sincerely,

Mr. Andrew Van Dyke
Program Manager
Operations Branch
BRAC Division

Enclosure

Copies Furnished:
Mr. Ben Fries, California Department of Toxic Substances Control (DTSC)
Mr. Mark Bare, California Regional Water Quality Control Board, Central Valley
Mr. Scott Edwards, Westmark Group
Mr. Paul Giller, Plexus Scientific Corporation
Mr. Jeff Sgambato, Plexus Scientific Corporation

DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600

REPLY TO

July 12, 2018

Base Realignment and Closure Division

Mr. Ben Fries
California Department of Toxic Substances Control
Brownfields & Environmental Restoration
8800 Cal Center Dr.
Sacramento, CA 95826-3200

SUBJECT: Final Five-Year Review Report for the Former Sacramento Army Depot, Sacramento, California

Dear Mr. Fries:

The Department of the Army completed the Five-Year Review for the Former Sacramento Army Depot located in Sacramento, California and is providing you with a hard and digital copy of the final report. This is the fifth Five Year Review for the Sacramento Army Depot. All comments and response to comments are provided as attachments in the report and a notice placed in the Sacramento Bee alerting the public of the completion of the final report.

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DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600

REPLY TO

July 12, 2018

Base Realignment and Closure Division

Mr. Mark Bare
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, CA. 95670

SUBJECT: Final Five-Year Review Report for the Former Sacramento Army Depot, Sacramento, California

Dear Mr. Bare:

The Department of the Army completed the Five-Year Review for the Former Sacramento Army Depot located in Sacramento, California and is providing you with a hard and digital copy of the final report. This is the fifth Five Year Review for the Sacramento Army Depot. All comments and response to comments are provided as attachments in the report and a notice placed in the Sacramento Bee alerting the public of the completion of the final report.

If you have any questions please do not hesitate to call the Base Environmental Coordinator (BEC) Scott Armstrong, CALIBRE, (916) 261-4577.

Sincerely,

Mr. Andrew Van Dyke
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Operations Branch
BRAC Division

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Mr. Mark Bare, California Regional Water Quality Control Board, Central Valley
Mr. Scott Edwards, Westmark Group
Mr. Paul Giller, Plexus Scientific Corporation
Mr. Jeff Sgambato, Plexus Scientific Corporation

FINAL

Fifth Five-Year Review Report

for

Sacramento Army Depot

Sacramento

Sacramento County, California

July 2018

Prepared by:

THE DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
BASE REALIGNMENT AND CLOSURE DIVISION
600 ARMY PENTAGON
WASHINGTON, DC 20310-0600

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ACRONYMS

µg/L	Micrograms per Liter
%	Percent
1,2-DCA	1,2-Dichloroethane
BAGES	Berry Avenue Groundwater Extraction System
BEC	Base Realignment and Closure Environmental Coordinator
BRAC	Base Realignment and Closure
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cDCE	cis-1,2-Dichloroethene
COC	Contaminant of Concern
CT	Carbon Tetrachloride
CVRWQCB	Central Valley Regional Water Quality Control Board
DTSC	California Department of Toxic Substances Control
ESD	Explanation of Significant Differences
FS	Feasibility Study
FFS	Focused Feasibility Study
FYR	Five-Year Review
gpm	Gallons per Minute
GWMPA	Groundwater Monitoring Plan Amendment
IC	Institutional Control
IDW	Investigation-derived Waste
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
NCP	National Contingency Plan
NPL	National Priorities List
OU	Operable Unit
PCE	Tetrachloroethene
PFAS	Per- and Polyfluoroalkyl Substances
Plexus	Plexus Scientific Corporation
ppm	Parts per Million
RAOs	Remedial Action Objectives
ROD	Record of Decision
RSL	Regional Screening Level
SAAD	Sacramento Army Depot, also known as Sacramento Army Depot Activity (abbreviated as SADA in earlier project documents)
SCEMD	Sacramento County Environmental Management Department
SEMS	Superfund Enterprise Management System
SPGES	South Post Groundwater Extraction System
SVE	Soil Vapor Extraction
TCE	Trichloroethene
tDCE	trans-1,2-Dichloroethene
USEPA	United States Environmental Protection Agency
UU/UE	Unlimited Use and Unrestricted Exposure
VOC	Volatile Organic Compound
Westmark	The Westmark Group

1.0 INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and documents recommendations to address them.

The Army, as lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. §§ 9601 et seq.) ("CERCLA") and Executive Order 12580, has prepared this FYR pursuant to CERCLA Section 121 and consistent with the National Contingency Plan (NCP), 40 CFR § 300.430(f)(4)(ii)), and in consideration of U.S. Environmental Protection Agency (USEPA) policy.

This is the Fifth FYR Report for the former Sacramento Army Depot (SAAD). The triggering action for this review is the date of the USEPA's concurrence on the Fourth FYR Report dated September 24, 2012. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

SAAD currently consists of three operable units (OUs): the South Post Burn Pits/Corrective Action Management Unit (CAMU), South Post Groundwater (also known as the "South Post Plume"), and Parking Lot 3 Groundwater. At these areas, hazardous substances, pollutants, or contaminants remain above levels that allow for UU/UE. The following table includes a remedial status summary for OUs at SAAD (**Table 1-1**).

Table 1-1. Remedial Status Summary

Area	Remedial Status	SEMS OU ID
South Post Plume	Operation and Maintenance	2[A]
South Post Burn Pits/CAMU	Operation and Maintenance	5[A]
Parking Lot 3 Groundwater	Operation and Maintenance	1
Tank 2	Remedial Action Complete / No Further Action	3[A,B]
Oxidation Lagoons	Remedial Action Complete / No Further Action	4[A]
Building 300 Burn Pit	Remedial Action Complete / No Further Action	1
Battery Disposal Well Investigation-derived Waste (IDW)	Remedial Action Complete / No Further Action	1

SEMS – Superfund Enterprise Management System
A – Records of Decision (RODs) or Interim RODs were prepared and executed for these OUs prior to the completion of a Basewide ROD in 1995. The 1995 Basewide ROD addressed all OUs and other areas where remaining contamination would not allow for UU/UE.
B – Not addressed in 1995 Basewide ROD because remedial action objectives (RAOs) had been achieved.

The SAAD Superfund Site FYR was led by the Army with support from Plexus Scientific Corporation (Plexus) and The Westmark Group (Westmark). Plexus and Westmark are

consultants that provide the Army with environmental remediation support at SAAD. The review began in August 2017.

SAAD is located at 8350 Fruitridge Road, Sacramento, California, in central Sacramento County, approximately 7 miles southeast of downtown Sacramento (**Figure 1-1**). SAAD occupied approximately 490 acres of land that is bound on the north by Fruitridge Road, on the east by Florin Perkins Road, on the south by Elder Creek Road, and on the west by the Southern Pacific Railroad tracks. SAAD was established in 1942 as an electronics maintenance facility primarily responsible for equipment receipt, storage, issue, repair, and disposal. Placement on the Base Realignment and Closure (BRAC) list in 1991 resulted in the closure of SAAD in 1995. After closure, portions of the property were transferred at different times for a combination of commercial/industrial, State, and Federal-related reuse. Property transfer details are presented on **Figure 1-2**.

SAAD is currently used for industrial/commercial purposes and by the Department of Defense (Navy/Marine Corps and Army), California Army National Guard, and the City of Sacramento. SAAD is also bound on all sides by land currently zoned as industrial/commercial, although some residential neighborhoods lie approximately 0.25 to 0.5 miles to the west beyond the Southern Pacific Railroad tracks. The reasonably anticipated future land use (i.e., industrial/commercial) of SAAD and the surrounding area is not expected to change.

Soil and groundwater have been impacted by SAAD's repair, maintenance, and storage activities. The primary waste-generating activities consisted of metal plating and painting operations. Storage tanks, burn pits, unlined wastewater lagoons, and disposal areas have been identified as contamination sources at SAAD. Additional site background information for SAAD was presented in the *Explanation of Significant Differences* (ESD) dated May 2017. The former facility map is presented on **Figure 1-3**.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Sacramento Army Depot		
USEPA ID: CA0210020780		
Region: 9	**State:** CA	**City/County:** Sacramento/Sacramento County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** United States Army
Author name: Andrew Van Dyke
Author affiliation: ACSIM ODB PM
Review period: September 18, 2017 – January 15, 2018
Date of site inspection: August 18, 2017
Type of review: Statutory
Review number: 5
Triggering action date: September 24, 2012
Due date *(five years after triggering action date)*: September 24, 2017

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2.0 RESPONSE ACTION SUMMARY

The Army conducted the initial contamination assessments in 1979. Investigations conducted in 1981 by the Army Environmental Health Agency identified the South Post Burn Pits as a source of volatile organic compound (VOC) contamination in groundwater. Subsequent groundwater sampling performed by the Central Valley Regional Water Quality Control Board (CVRWQCB) southwest of SAAD discovered that contamination had moved beyond its boundaries. The Army then conducted additional investigations with emphasis on sites with the highest potential for releases to the environment. The following were sites determined to represent the greatest threats: the South Post Plume, Tank 2, the Oxidation Lagoons, and the South Post Burn Pits. To expedite clean-up, these four sites were addressed as OUs under separate RODs.

In 1989, a groundwater extraction and treatment system was installed to address the South Post Plume. As stipulated in the OU ROD for the South Post Burn Pits, soil vapor extraction (SVE) was implemented in 1994. A soil washing pilot test was conducted at the Oxidation Lagoons in 1993; however, this treatment method was found to be ineffective. Soil vapor extraction was performed at Tank 2 in 1992, clean-up goals were met, and no further action was deemed necessary.

The *Basewide Remedial Investigation/Feasibility Study* (FS), completed in late-1994, determined the site-wide nature and extent of contamination, identified contaminants of concern (COCs), developed RAOs, and evaluated potential remedial alternatives to address areas of contamination not previously addressed in an OU FS. Human health and ecological risks were evaluated in the *Basewide Human Health Risk Assessment*, completed in May 1994, and the *Basewide Ecological Risk Assessment* completed in August 1994. The Basewide ROD, completed in January 1995, included remedies for all sites where unacceptable risk remained. The Basewide ROD also amended two prior OU RODs (South Post Burn Pits and Oxidation Lagoons) and one Interim OU ROD (South Post Plume). A chronological summary of additional important site events and relevant dates regarding the assessment, investigation, and remediation at SAAD are presented in **Appendix A**.

2.1 Basis for Taking Action

Historical activities conducted at SAAD resulted in soil and groundwater contamination. Soil contaminants consisted of metals, pesticides, polychlorinated biphenyls, polynuclear aromatic hydrocarbons, VOCs, and semi-volatile organic compounds, while groundwater contamination consisted of only VOCs. Potential receptors included site workers and hypothetical future residents. Prior to implementation of the soil remedies, the following potentially complete exposure pathways were identified in the site risk assessment: incidental ingestion, dermal adsorption, and inhalation of vapors. No receptors are currently exposed to soil or groundwater contamination.

Response action summaries are presented below for the South Post Burn Pits/CAMU, South Post Plume, and the Parking Lot 3 Groundwater. Only the South Post Burn Pits/CAMU soil-related site is presented below because the Second FYR determined that, except for the stabilized mass (South Post Burn Pits/CAMU), all contaminated soil has been remediated and no longer needs to be discussed in subsequent FYR reports.

2.2 South Post Burn Pits / Corrective Action Management Unit

The following sections detail the RAOs, remedy components, remedy implementation, and operation and maintenance of the selected remedy.

2.2.1 Remedial Action Objectives

The following RAOs were established for the South Post Burn Pits in the 1993 OU ROD and revised as indicated in the 1995 Basewide ROD:

- Reduce the potential for inhaling arsenic, cadmium, and chromium in dust to an acceptable risk level by reducing either the metals concentrations in soil or the amount of potential dust by 75 percent (%).
- Reduce the potential for ingesting arsenic in soil so that risk is reduced to background level, by either reducing the concentration of arsenic to the background level (7.3 milligrams per kilogram [mg/kg]) or reducing the amount of soil which can be ingested by 81%.
- Reduce migration of VOCs to groundwater above the groundwater clean-up levels (drinking water standards). Trichloroethene (TCE), 1,2-dichloroethene, and tetrachloroethene (PCE) concentration must be reduced by 98%, 96%, and 92%, respectively. These reductions correspond to soil concentrations of 5 micrograms per kilogram or less and soil gas concentrations of 5 parts per billion by volume or less[1].
- Reduce lead concentrations in soil to 174 parts per million (ppm) or less, which is the concentration that is recommended by the California Department of Toxic Substances Control (DTSC) for lead exposures to children, ages 1-6 years. This requires reducing lead concentrations in soil or reducing the potential for ingestion of soil containing lead by 92%[2].

Residual in-situ soil metal concentrations following excavation of impacted soil at the South Post Burn Pits was not to exceed the clean-up level concentrations outlined in **Table 2-1**.

Table 2-1. South Post Burn Pits Clean-up Levels

Contaminant	Residual Concentration (mg/kg)
Arsenic	7.3
Cadmium	88
Chromium VI	16
Lead[2]	500
Total Chromium	112

[1] This RAO was subsequently modified in the 1995 Basewide ROD because these soil VOC clean-up levels were considered technically infeasible to attain.
[2] This RAO was subsequently modified in the 1995 Basewide ROD to reduce lead concentrations in soil to 500 ppm.

2.2.2 Remedy Components

The remedy for the South Post Burn Pits identified in the 1993 OU ROD consisted of the following components:

- In-situ SVE to remove VOCs;
- Excavation/stabilization of soil containing non-volatile compounds; and
- Institutional controls (ICs) in the form of restrictive covenants to prohibit disturbance of the stabilized soil.

The 1995 Basewide ROD amended the original remedy by removing the SVE clean-up goals as unattainable and shutting off the SVE system. The original soil excavation/ stabilization remedy was also amended to include soil from three other areas of contamination: Oxidation Lagoons, Building 300 Burn Pit, and Battery Disposal Well IDW. Soil from these locations were consolidated, stabilized, and placed under a 10-foot thick layer of clean soil in a CAMU. The CAMU was placed in the South Post Burn Pits area. A soil moisture monitoring system was installed below the CAMU to periodically evaluate the integrity of the stabilized mass.

2.2.3 Remedy Implementation

The following clean-up activities have been completed at the South Post Burn Pits:

- Soil vapor extraction began in May 1994 and concluded on January 1995 and was conducted again from March 1995 to September 1995. Approximately 138 pounds of VOCs, an estimated 98% of the mass present in the vapor phase, were removed from the soil.
- Impacted soil from the South Post Burn Pits was excavated in 1995 and placed temporarily on a storage pad for consolidation and stabilization in the CAMU.
- Consolidation, stabilization, and placement of impacted soil in the CAMU derived from the South Post Burn Pits, Oxidation Lagoons, Building 300 Burn Pit, and the Battery Disposal Well IDW was completed by the fall of 1996.

The CAMU received all designated soil and the site was regraded in October 1996. Four pairs of lysimeters were installed under the CAMU to monitor for leaching of metals from the stabilized soil. Lysimeter pairs (East and West) were installed at each location to provide redundancy and sufficient volume for sampling. Lysimeter locations are presented on **Figure 2-1**. Closure of the remedial action at the South Post Burn Pits was approved by the USEPA because it was determined that all remedial objectives had been met.

ICs were established to prevent disturbance of the stabilized mass within the CAMU. The ICs for the CAMU are summarized in **Table 2-2**.

Table 2-2. Corrective Action Management Unit Institutional Controls Summary

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel	IC Objective	Title of IC Instrument Implemented and Date[3]
CAMU	Yes	Yes	Parcel 2B	See below for prohibited activities.	Stabilized Mass Covenant, Quitclaim Deed No. DACA05-9-03-592, September 2005
Prohibited Activity					
Any construction of improvements over the stabilized mass and associated monitoring system – the monitoring system includes lysimeters and monitoring wells. No residential structures shall be allowed on the cover including any mobile home or factory-built housing, constructed or installed for use as residential human habitation, hospital for humans, or public or private school for persons. Construction of improvements above either of the stabilized masses that do not meet the following conditions: • The surface drainage shall not be adversely affected in such a way as to cause surface water to pond or to drain improperly. • Any change in grading plans shall be subject to review and approval by the Parties and the USEPA. • Improvements are not to disturb the subsurface stabilized mass. • Disturbance of the lysimeters is prohibited, unless replacements are installed and approved by the regulatory agencies. • Significant surface loads (e.g., construction of buildings or facilities that would normally require a soils report) on the cover shall not be allowed unless a detailed analysis is performed that determines the magnitude and extent of allowable surface loading, if any, that can be tolerated. • Vehicle access to the cover area shall be limited to those periods of the year (May through October) when the cover soil can adequately support wheel loading (i.e., access shall not be allowed during and directly after periods of precipitation when the cover soil may be too saturated to adequately support a vehicle as evidence by the formation of tire tracks). • Planting of landscaping on or adjacent to the cover that requires irrigation is to be avoided. However, such materials can be planted (e.g., ball fields) if the irrigation system is properly designed and operated so that it provides adequate moisture for plant growth without adding significantly to the amount of percolation that would be expected from precipitation. • Vegetation having root systems that might penetrate the cover to the depth of the stabilized mass are prohibited. • Groundwater recharge areas (i.e., ponds) are prohibited near, or on top of, the stabilized mass.					

2.2.4 System Operations / Operation and Maintenance

The following monitoring and maintenance activities are conducted to maintain the protectiveness and integrity of the CAMU:

- Lysimeters located under the CAMU are sampled on an annual basis for metals (chromium and lead) and pH;

[3] ICs are also documented in the Parcel 2B Finding of Suitability to Transfer dated March 2004.

- The 10-foot soil cover of clean, native fill material over the stabilized mass is inspected and maintained regularly;
- The ICs are inspected on annual basis by the Army and enforced by the state (DTSC and CVRWQCB).

Lysimeter sampling was established on a semi-annual basis in the 1995 Basewide ROD; however, modification of the groundwater monitoring program detailed in the 2009 *Groundwater Monitoring Plan Amendment* (GWMPA) concluded that only annual lysimeter sampling was required. Therefore, lysimeter sampling has been conducted on an annual basis since 2009. The last lysimeter sampling event was conducted in March 2017. The results were reported in the *Winter 2017 Semi-Annual Groundwater Monitoring Report* dated July 2017. The lysimeter sampling results conducted during the fifth FYR period indicate that the soil stabilization efforts conducted at the CAMU have been effective.

The Army conducts routine inspections to confirm that ICs are enforced and that there are no activities or issues that may result in human exposure to contaminants associated with the CAMU. An annual report is submitted to the DTSC, which summarizes the results of the Army's routine IC monitoring. The last annual report was submitted as an appendix to the *Summer 2016 Annual Groundwater Monitoring Report* dated February 2017. It concluded that the cover was in-place and undisturbed and that the lysimeters were functioning as intended. The annual IC inspection is generally conducted during the summer sampling event. The 2017 annual (summer) groundwater monitoring report, including the 2017 IC inspection, is currently under production and will be finalized in early-2018.

2.3 South Post Plume

The following sections detail the RAOs, remedy components, remedy implementation, and operation and maintenance of the selected remedy.

2.3.1 Remedial Action Objectives

The following RAOs were established for the South Post Plume in the 1995 Basewide ROD[4]:

- Modify the existing treatment facility (South Post Groundwater Extraction System [SPGES]) to accept an increased flow rate of 450 gallons per minute (gpm);
- Reduce contaminants in the groundwater to concentrations equal to or less than respective maximum contaminant levels (MCLs);
- Prevent further migration of the VOC plume off-site through complete capture of groundwater contamination and reduction of plume size[5];
- Capture the contamination detected in aquifer zone C more rapidly; and
- Achieve final remediation goals (MCLs) at the South Post Plume in nine years (i.e., by 2004).

The groundwater clean-up levels as specified in the 1995 Basewide ROD are included in **Table 2-3**.

[4] The 1995 Basewide ROD amended the 1989 Interim OU ROD for the South Post Plume.
[5] This RAO was not included in the 1995 Basewide ROD and was first mentioned in the Second FYR Report dated December 2001.

Table 2-3. South Post Plume Clean-up Levels

Constituent	Clean-up Level (µg/L)	Source of Clean-up Level
TCE	5	Federal MCL
PCE	5	Federal MCL
cis-1,2-Dichloroethene (cDCE)	6	State MCL
1,2-Dichloroethane (1,2-DCA)	0.5	State MCL
trans-1,2-Dichloroethene (tDCE)	10	State MCL
Carbon Tetrachloride (CT)	0.5	State MCL
µg/L = micrograms per liter		

2.3.2 Remedy Components

The remedy for the South Post Plume was selected, amended, and modified by three decision documents: 1989 Interim OU ROD, 1995 Basewide ROD, and 2017 ESD.

- The 1989 Interim OU ROD established the remedy of groundwater extraction from aquifer zone A/B and treatment using ultraviolet light and chemical oxidation.
- The 1995 Basewide ROD amended the original remedy by extending the area of clean-up to include impacted groundwater beyond the southern boundary (off-site) of SAAD and within aquifer zone C.
- The 2017 ESD modified the remedy by discontinuing active groundwater extraction to allow natural processes to occur while monitoring groundwater conditions over time. The modified remedy includes the following major components:
    - Long-term groundwater sampling plan;
    - Groundwater monitoring;
    - Installation of additional groundwater monitoring wells; and
    - Maintenance of the Berry Avenue Groundwater Extraction System (BAGES) for use as a contingency.

The modified remedy includes contingency actions if groundwater conditions warrant their implementation. The contingency action (groundwater extraction) would be triggered if TCE concentrations exceed a concentration of 20 µg/L in selected monitoring wells. The contingency action and decision point summary for the South Post Plume from the 2017 ESD is presented in **Appendix B**. The 2017 ESD also includes provisions for the completion of a Remedy Effectiveness Report to be conducted in 2022. The Remedy Effectiveness Report will evaluate TCE concentrations and make recommendations regarding continued implementation of the current remedy.

ICs were established to prevent potential receptor exposure to contaminated groundwater in the South Post Plume. The ICs for the South Post Plume are summarized in **Table 2-4**.

Table 2-4. South Post Plume Institutional Controls Summary

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel	IC Objective	Title of IC Instrument Implemented and Date[6]
Groundwater	Yes	Yes	Parcel 2B	See below for prohibited activities.	South Post Groundwater Covenant, Quitclaim Deed No. DACA05-9-03-592, September 2005
Prohibited Activity					
Construction of any well. Extraction, use of consumption of groundwater from wells within the boundary of the Property. Use of any groundwater within the boundary of the property. Construction or creation of any groundwater recharge area, unlined surface impoundment, or disposal trenches. Any activity that could interfere with or adversely affect the groundwater treatment system, extraction wells, piping systems or groundwater treatment plant.					

2.3.3 Remedy Implementation

The first groundwater monitoring wells were installed in 1981, and the last groundwater monitoring well was installed in 2009. A total of 120 groundwater monitoring wells have been installed since 1981 in multiple water-bearing zones (**Figure 2-1**). The water-bearing zones beneath SAAD are composed of a series of sand, silty-sand, and sandy-silt units. These units have been grouped into three general water-bearing zones, informally designated as the "A/B," "C," and "D" hydrogeologic zones.

The groundwater extraction and treatment system (SPGES) was installed in 1989. Extraction wells for the SPGES were installed in two phases: EW0001 through EW0007 were installed following the 1989 Interim OU ROD, and EW0010 through EW0013 were installed following the 1995 Basewide ROD. The remedy was optimized in 2009/2010 and the SPGES was replaced by the BAGES. The BAGES consists of two extraction wells (EW0015 and EW0016). A total of 13 extraction wells have been installed (**Figure 2-2**).

The BAGES was placed in stand-by mode in March 2013 to evaluate the South Post Plume under non-pumping conditions. The suspension of active groundwater extraction was prompted by declining contaminant concentrations. While active pumping was suspended, a rebound and monitoring natural attenuation evaluation were conducted. The results of these studies were utilized to further optimize the remedy for the South Post Plume. A modified remedy was selected for the South Post Plume in the 2017 ESD.

A detailed history of the remedy implemented for the South Post Plume was presented in the *Monitored Natural Attenuation Evaluation Results Report* dated November 2014 and the 2017 ESD. A new GWMPA is being developed to optimize the groundwater monitoring program.

[6] ICs are also documented in the Parcel 2B Finding of Suitability to Transfer dated March 2004.

Per the 2017 ESD, additional downgradient monitoring wells will be installed south of MW1030/ MW1031 following the completion of the GWMPA. These monitoring wells are intended to fully delineate the downgradient extent of the South Post Plume.

2.3.4 System Operations / Operation and Maintenance

The BAGES was shut down in March 2013. However, the BAGES is being maintained as a contingency if trigger concentrations are exceeded. The BAGES is secured within an 8-foot high fence and a locked gate. The fence and gate are inspected periodically to ensure security is maintained.

The concentration of TCE remains above the MCL in the South Post Plume, and RAOs have not been met. Groundwater monitoring continues on a semi-annual basis according to the *Technical Memorandum – Interim Groundwater Monitoring Plan* (Interim Plan). The Interim Plan superseded the *Technical Memorandum – Groundwater Monitoring Plan Amendment* (2009 GWMPA), beginning with the summer 2016 annual event. A GWMPA is being developed to optimize the monitoring program based on the modified remedy selected by the 2017 ESD. The GWMPA will also include recommendations to abandon unnecessary monitoring wells and the SPGES (treatment plant and extraction wells) because they are no longer required for the remedy.

The Army conducts routine inspections to confirm that ICs are enforced and that there are no activities or issues that may result in human exposure to contaminants associated with the South Post Plume. An annual report is submitted to the DTSC, which summarizes the results of the Army's routine IC monitoring. The last annual report was submitted as an appendix to the *Summer 2016 Annual Groundwater Monitoring Report*. It indicated that the ICs were protective and in-place and that groundwater well installation or groundwater use have not occurred. The annual IC inspection is generally conducted during the summer sampling event. The 2017 annual (summer) groundwater monitoring report, including the 2017 IC inspection, is currently under production and will be finalized in early-2018.

2.4 Parking Lot 3 Groundwater

The following sections detail the RAOs, remedy components, remedy implementation, and operation and maintenance of the selected remedy.

2.4.1 Remedial Action Objectives

The goal of the selected remedy is to restore groundwater for its beneficial use as a potential drinking water source by reducing contaminant concentrations below MCLs (the more stringent of either the Federal or State levels). The groundwater clean-up levels included in the 1995 Basewide ROD are included in **Table 2-5**.

Table 2-5. Parking Lot 3 Groundwater Clean-up Levels

Contaminant	Clean-up Level (µg/L)	Source of Clean-up Level
TCE	5	Federal MCL
PCE	5	Federal MCL
1,2-DCA	0.5	State MCL
CT	0.5	State MCL

2.4.2 Remedy Components

The 1995 Basewide ROD established the remedy of extraction and treatment for VOC-affected groundwater at Parking Lot 3. The selected remedy included extraction of groundwater from aquifer zone A/B, treatment using carbon adsorption at the wellhead, and discharge to the sanitary sewer.

Active groundwater extraction was discontinued in 2002 to allow natural processes to occur while monitoring groundwater conditions over time. The 2017 ESD modified the remedy by officially discontinuing active groundwater extraction. The modified remedy includes the following major components:

- Long-term groundwater sampling plan;
- Installation and operation of an air sparging/SVE system as a contingency; and
- Maintenance of the Parking Lot 3 extraction wells (EW0008 and EW0009) as a contingency.

The modified remedy includes contingency actions if groundwater conditions warrant their implementation. The contingency actions (i.e., groundwater extraction) would be triggered if TCE concentrations exceed a concentration of 25 µg/L in selected monitoring wells. The contingency action and decision point summary for the Parking Lot 3 Groundwater from the 2017 ESD is presented in **Appendix C**. The 2017 ESD also includes provisions for the completion of a Remedy Effectiveness Report to be conducted in 2022. The Remedy Effectiveness Report will evaluate TCE concentrations and make recommendations regarding continued implementation of the current remedy.

ICs were established to prevent potential receptor exposure to contaminated groundwater in the Parking Lot 3 Groundwater. The ICs for the Parking Lot 3 Groundwater are summarized in **Table 2-6**.

Table 2-6. Parking Lot 3 Groundwater Institutional Controls Summary

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel	IC Objective	Title of IC Instrument Implemented and Date[7]
Groundwater	Yes	Yes	Parcel 2A	See below for prohibited activities.	Land Use Restrictions, Quitclaim Deed No. DACA05-9-99-569, August 2000
Prohibited Activity					
Construction of any well. Use of any groundwater within the boundary of the property. Construction or creation of any groundwater recharge area (i.e., ponds). Any activity that could interfere with or adversely affect the remedial system (i.e., monitoring wells, extraction wells, pipelines connecting extraction wells with sewer lines). Residential land use is prohibited.					

2.4.3 Remedy Implementation

Groundwater monitoring began at Parking Lot 3 in 1981. The first groundwater monitoring wells were installed in 1981, and the last groundwater monitoring wells was installed in 2009. A total of 120 groundwater monitoring wells have been installed since 1981 (**Figure 2-1**) in multiple water-bearing zones. The water-bearing zones beneath SAAD are composed of a series of sand, silty-sand, and sandy-silt units. These units have been grouped into three general water-bearing zones, informally designated as the "A/B," "C," and "D" hydrogeologic zones.

Contaminated soil at Parking Lot 3 was treated during an air-sparging pilot test that was conducted from August 1993 to January 1994. A dual-phase extraction pilot test was conducted from October 1994 to January 1995. Approximately 460 pounds of TCE were removed from the soil and groundwater during these tests.

Two groundwater extraction wells (EW0008 and EW0009) were installed at Parking Lot 3 in 1994 (**Figure 2-2**). The extraction wells began operation in March 1996. Extraction well operation continued until June 2002 when the wells were shut-off after meeting the criteria detailed in the *Monitoring and Close-out Plan for Parking Lot 3* (URS, 2002). Over 200 million gallons of groundwater have been extracted from Parking Lot 3.

A detailed history of the remedy implemented for the Parking Lot 3 Groundwater was presented in the *Monitored Natural Attenuation Evaluation Results Report* dated November 2014 and the 2017 ESD. A new GWMPA is being developed to optimize the groundwater monitoring program.

2.4.4 System Operations / Operation and Maintenance

EW0008 and EW0009 were shut down in June 2002. However, EW0008 and EW0009 are being maintained as a contingency if trigger concentrations are exceeded. The extraction wells are

[7] ICs are also documented in the Parcel 2A Finding of Suitability to Transfer dated October 1998.

secured within an 8-foot high fence and a locked gate. The fence and gate are inspected periodically to ensure security is maintained. Security patrols routinely monitor the site.

The concentration of TCE remains above the MCL in the Parking Lot 3 Groundwater and RAOs have not been met. Groundwater monitoring continues on a semi-annual basis according to the Interim Plan. A GWMPA is being developed to optimize the monitoring program based on the modified remedy selected by the 2017 ESD. The GWMPA will also include recommendations to abandon unnecessary monitoring wells.

The Army conducts routine inspections to confirm that ICs are enforced and that there are no activities or issues that may result in human exposure to contaminants associated with the Parking Lot 3 Groundwater. An annual report is submitted to the DTSC, which summarizes the results of the Army's routine IC monitoring. The last annual report was submitted as an appendix to the *Summer 2016 Annual Groundwater Monitoring Report*. It indicated that the ICs were protective and in-place and that groundwater well installation or groundwater use have not occurred. The annual IC inspection is generally conducted during the summer sampling event. The 2017 annual (summer) groundwater monitoring report, including the 2017 IC inspection, is currently under production and will be finalized in early-2018.

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3.0 PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the Fourth FYR Report, as well as the recommendations from the Fourth FYR Report and the current status of those recommendations.

Table 3-1. Protectiveness Determinations/Statements from the Fourth Five-Year Review

OU	Protectiveness Determination	Fourth FYR Protectiveness Statement
5 (South Post Burn Pits/CAMU)	Short-term Protective	The remedy currently protects human health and the environment in the short-term because contaminated soil exceeding clean-up levels has been excavated, stabilized, and placed in a CAMU at SAAD. However, in order for the remedy to be protective in the long-term, the ICs must continue to be enforced and the physical integrity of the soil cover over the CAMU must be maintained.
2 (South Post Plume)	Short-term Protective	The remedy currently protects human health and the environment in the short-term because ICs prevent exposure to contamination remaining above the clean-up goals. In addition, the South Post Plume is currently under the influence of a groundwater extraction system, which is actively reducing contaminant concentration and preventing further migration. However, in order for the remedy to be protective in the long-term, the ICs restricting groundwater use must continue to be enforced until clean-up goals are achieved.
1 (Parking Lot 3 Groundwater)	Short-term Protective	The remedy currently protects human health and the environment in the short-term because ICs prevent exposure to contamination remaining above the clean-up goals. However, in order for the remedy to be protective in the long-term, the ICs restricting groundwater use must continue to be enforced until clean-up goals are achieved.
Site-wide	Protective	Because the remedial actions are protective, the site is protective of human health and the environment.

Table 3-2. Status of Recommendations from the Fourth Five-Year Review

OU #	Issue	Fourth FYR Recommendations	Current Status
N/A	1. The origin of the cDCE MCL for impacted groundwater at SAAD has not been established in a decision document.	1. Clarify the origin of the cDCE MCL in a ROD Amendment or ESD.	Considered But Not Implemented
2	2. Groundwater concentrations of TCE remain above RAOs at the South Post Groundwater OU.	2. Continue groundwater treatment and monitoring at the South Post Groundwater OU. If contaminant concentrations remain above ROD goals (MCLs), then prepare a Focused Feasibility Study (FFS) to evaluate remedial alternatives. The results of the FFS will then be used to prepare a ROD Amendment or ESD.	Completed
1	3. Groundwater concentrations of TCE remain above RAOs at Parking Lot 3.	3. Continue groundwater monitoring. Prepare a ROD Amendment or ESD for Parking Lot 3, if MCLs are not achieved by the end of FY 2013.	Completed

Current Implementation Status of Recommendation #1

At SAAD, the numerical clean-up level for cDCE was set at 6 µg/L in the 1995 Basewide ROD. The origin of the cDCE MCL does not require clarification in an ESD or ROD Amendment because clarification of its origin would not have a significant impact on the scope, performance, or cost of the remedy. Post-ROD changes that do not have a significant remedy impact are categorized as non-significant or minor changes. Non-significant or minor changes are recorded in the post-ROD file in lieu of the preparation of an ESD or ROD Amendment. The origin of the cDCE MCL has been correctly identified in **Table 2-3**, and this Fifth FYR Report will be added to the post-ROD file upon its completion.

Current Implementation Status of Recommendation #2

Groundwater treatment and monitoring of the South Post Plume continued following the completion of the fourth FYR, but contaminant concentrations remained above the clean-up levels (i.e., MCLs) and a FFS was prepared. The FFS included a detailed and comparative analysis of alternatives for the South Post Plume. The results of the FFS were utilized in the preparation of the 2017 ESD. The 2017 ESD modified the remedy to discontinue active groundwater extraction to allow natural processes to occur while monitoring groundwater conditions. The modified remedy includes contingency actions if groundwater conditions warrant their implementation. The 2017 ESD was signed by the Army, DTSC, and USEPA in May 2017.

Current Implementation Status of Recommendation #3

Groundwater monitoring of the Parking Lot 3 Groundwater continued following the completion of the fourth FYR, but contaminant concentrations remained above the clean-up levels (i.e., MCLs) and an FFS was prepared. The FFS included a detailed and comparative analysis of alternatives for the Parking Lot 3 Groundwater. The results of the FFS were utilized in the preparation of the 2017 ESD. The 2017 ESD modified the remedy to allow natural processes to occur while monitoring groundwater conditions. The modified remedy includes contingency

actions if groundwater conditions warrant their implementation. The 2017 ESD was signed by the Army, DTSC, and USEPA in May 2017.

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4.0 FIVE-YEAR REVIEW PROCESS

4.1 Community Notification, Involvement, and Site Interviews

A public notice was made available by newspaper posting in the Sacramento Bee (local newspaper) on July 2, 2018, stating that the FYR has been completed. A copy of the public notice is presented in **Appendix D**. The results of the review and the report are available at the information repository located at the United States Army Corps of Engineers, Sacramento District, 1325 J Street, Suite 820, Sacramento, California 94105.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that have been implemented to date. Plexus interviewed the BRAC Environmental Coordinator (BEC); representatives from the CVRWQCB; and the Plexus Project Manager to gather information on the site for the FYR. The individuals interviewed are summarized in **Table 4-1**.

Table 4-1. Interview Summary

Name	Title	Organization	Date/Method of Interview
Scott Armstrong	BEC	Calibre	10/19/17; Telephone
Mark Bare	Remedial Project Manager	CVRWQCB	11/1/17; Telephone
Marie McCrink	Division Manager	CVRWQCB	11/1/17; Telephone
Paul Giller	Project Manager	Plexus	11/10/17: Telephone

The interviews did not identify any problems related to IC implementation or enforcement. The interviews also did not identify any problems with the operation and maintenance of the remedy. The site interview response forms are included in **Appendix E**.

4.2 Data Review

Data from recent and historical monitoring reports were evaluated as part of the FYR process. Sampling event data for the South Post Burn Pits/CAMU, the South Post Plume, and the Parking Lot 3 Groundwater are discussed in the following sections.

4.2.1 South Post Burn Pits/Corrective Action Management Unit

Lysimeter monitoring has been conducted on at least an annual basis for the South Post Burn Pits/CAMU since the fourth FYR. Lysimeter locations are presented on **Figure 2-1**. Lysimeter samples are collected for total chromium, total lead, and pH analyses to monitor the integrity of the stabilized mass. Total chromium, total lead, and pH lysimeter data collected since the fourth FYR are presented in **Table 4-2**, **Table 4-3**, and **Table 4-4**, respectively.

Table 4-2. Lysimeter Total Chromium Data Summary

Lysimeter	August 2012	April 2013	April 2014	May 2015	February 2016	August 2016	March 2017
L-1E	< 5.0	< 5.0	< 5.0	NS	< 5.0	< 5.0	<5.0
L-1W	NS	NS	NS	NS	NS	NS	NS
L-2E	< 5.0	< 5.0	5.7	13 (J)	5.8	< 5.0	< 5.0
L-2W	< 5.0	< 5.0	5.9	22	5.9	< 5.0	2 (J)
L-3E	< 5.0	< 5.0	<5.0	< 5.0	< 5.0	< 5.0	< 5.0
L-3W	< 5.0	< 5.0	< 5.0	NS	< 5.0	< 5.0	2.1 (J)
L-4E	NS	< 5.0	NS	NS	NS	NS	NS
L-4W	< 5.0	< 5.0	< 5.0	NS	< 5.0	< 5.0	< 5.0

NS = Insufficient soil moisture collected for sampling. J = Result is estimated.
Data presented in µg/L.
Detections are shaded.

Table 4-3. Lysimeter Total Lead Data Summary

Lysimeter	August 2012	April 2013	April 2014	May 2015	February 2016	August 2016	March 2017
L-1E	< 5.0	< 5.0	< 5.0	NS	< 5.0	< 5.0	< 5.0
L-1W	NS	NS	NS	NS	NS	NS	NS
L-2E	< 5.0	< 5.0	< 5.0	< 5.0	78	5.4	4.2 (J)
L-2W	< 5.0	< 5.0	< 5.0	ND	15	14	8.6
L-3E	< 5.0	< 5.0	<5.0	6.9	< 5.0	< 5.0	< 5.0
L-3W	7.7	< 5.0	< 5.0	NS	8.1	< 5.0	< 5.0
L-4E	NS	< 5.0	NS	NS	NS	NS	NS
L-4W	< 5.0	< 5.0	< 5.0	NS	9.5	27	< 5.0

NS = Insufficient soil moisture collected for sampling. J = Result is estimated.
Data presented in µg/L.
Detections are shaded.

Table 4-4. Lysimeter pH Data Summary

Lysimeter	August 2012	April 2013	April 2014	May 2015	February 2016	August 2016	March 2017
L-1E	6.5	6.2	6.5	7.0	NM	7.0	7.6
L-1W	NM	6.4	7.0	7.0	NM	NM	NM
L-2E	7.2	6.7	6.5	7.0	NM	7.0	7.3
L-2W	7.0	6.7	7.0	7.5	NM	7.0	7.3
L-3E	7.0	6.6	6.0	7.0	NM	7.0	7.0
L-3W	6.0	6.6	6.0	7.0	NM	7.0	6.9
L-4E	NM	6.8	6.5	7.5	NM	NM	NM
L-4W	7.0	6.9	6.5	7.0	NM	7.0	7.3

NM = Insufficient soil moisture collected for sampling.
Data presented in specific units.

Lysimeter sampling data indicate that soil stabilization efforts have been effective at the South Post Burn Pits/CAMU. Total chromium concentrations were predominately less than the reporting limit (5.0 µg/L), total lead concentrations were predominately less than the reporting limit (5.0 µg/L), and pH ranged between 6.0 and 7.6 during the current FYR period.

4.2.2 South Post Plume

Groundwater monitoring has been conducted on a semi-annual basis for the South Post Plume since the fourth FYR. Monitoring well locations are presented on **Figure 2-1**. TCE was the only COC consistently detected above the MCL during the current FYR period. TCE concentration data collected from the South Post Plume during the last five annual sampling events and the semi-annual event conducted in February/March 2017 are presented in **Table 4-5**.

Table 4-5. South Post Plume Trichloroethene Data Summary

Monitoring Well	Aquifer Zone	July/August 2012	July 2013	June 2014	September 2015	August 2016	Feb./March 2017
MW0005A	A	1.2	1.0	1.0	0.8 (J+)	*	*
MW0009	B	0.8	0.7	0.7	0.8 (J+)	*	*
MW0016	A	< 0.5	< 0.5	< 0.5	< 0.5	*	*
MW1004	B	1.1	1.1	1.1	1.0 (J+)	*	*
MW1005	A	0.6	< 0.5	0.5	< 0.5	*	*
MW1015	B	< 0.5	< 0.5	< 0.5	0.5 (J+)	*	*
MW1016	A	< 0.5	< 0.5	< 0.5	< 0.5	*	*
MW1023	B	< 0.5	1.4	1.2	1.1 (J+)	0.8	1.0
MW1024	A	**5.2**	4.3	3.9	3.2 (J+)	2.5	1.3
MW1026	C	1.2	0.7	0.7	< 0.5	< 0.5	< 0.5
MW1027	B	**8.7**	**11**	**14**	**18 (J+)**	**13**	**14**
MW1028	A	**6.3**	**6.4**	**6.7**	**5.1**	**5.1**	4.0
MW1030	B	1.2	2.7	4.5	**7.3 (J+)**	**7.0**	**7.8**
MW1031	A	1.9	3.1	4.4	**7.8 (J+)**	**7.8**	**7.4**
MW1032	B	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
MW1033	A	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
MW1034	B	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
MW1035	A	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NS
MW1036	B	0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5
MW1037	A	< 0.5	< 0.5	0.5	0.5 (J+)	0.5	< 0.5
MW1038	B	2.9	2.7	**7.2**	**7.7**	0.7	1.0
MW1039	B	0.7	0.9	1.1	0.9 (J+)	1.0	1.0

Data presented in µg/L.
Bold table entries exceed the MCL of 5 µg/L.
J+ = Result is estimated and biased high.
NS = Not sampled because wellhead was damaged by heavy vehicular traffic.
* = Interim Plan adopted in August 2016 and sampling of this monitoring well was not required during the annual or semi-annual event.

Histograms depicting TCE and other COC concentrations with potentiometric surface data over time for selected monitoring wells provide historical trend information for the COCs associated the South Post Plume. Histograms are provided in **Appendix F**. TCE concentration data from the semi-annual 2017 event conducted in February/ March 2017 is presented for the South Post Plume in aquifer zones A, B, and C on **Figures 4-1**, **4-2**, and **4-3**, respectively.

Data review indicates the following information for the South Post Plume during the current FYR period:

- The only COC consistently detected above the MCL (5 µg/L) was TCE; cDCE was briefly detected above the MCL (6 µg/L) at MW1023 prior to the shutdown of the BAGES in March 2013.
- The MCL was exceeded at only three monitoring wells: MW1027, MW1030, and MW1031 in February/March 2017.
- The South Post Plume is continuing to stabilize after more than 20 years of continuous groundwater extraction.
- The TCE concentration in the downgradient monitoring wells MW1030 and MW1031 exceeded the MCL for the first time, but the upgradient extent of the South Post Plume contracted, as monitored by MW1024 and MW1028.
- The downgradient edge of the South Post Plume is not fully delineated; however, modeling conducted for the MNA evaluation concluded that TCE concentrations greater than the MCL would migrate no more than several hundred feet downgradient of MW1030/MW1031. The 2017 ESD includes provisions for the installation of two additional monitoring wells south of MW1030/MW1031 to delineate the downgradient extent of the South Post Plume.

4.2.3 Parking Lot 3 Groundwater

Groundwater monitoring has been conducted on a semi-annual basis for the Parking Lot 3 Groundwater since the fourth FYR. Monitoring well locations are presented on **Figure 2-1**. TCE was the only COC detected above the MCL during the current FYR period. TCE concentration data collected from the Parking Lot 3 Groundwater during the last five annual sampling events and the semi-annual event conducted in February/March 2017 are presented in **Table 4-6**.

Table 4-6. Parking Lot 3 Trichloroethene Data Summary

Monitoring Well	Aquifer Zone	July/August 2012	July 2013	June 2014	September 2015	August 2016	Feb./March 2017
MW0050	A	2.9	2.7	3.7	3.1	2.4	2.1
MW0073	A	**12**	**17**	**19**	**17**	**17**	4.4

Data presented in µg/L.
Bold table entries exceed the MCL of 5 µg/L.

Histograms depicting TCE and other COC concentrations with potentiometric surface data over time for MW0050 and MW0073 provide historical trend information for the COCs associated with the Parking Lot 3 Groundwater. Histograms are provided in **Appendix F**. TCE

concentration data from the semi-annual 2017 event conducted in February/March 2017 are presented for the Parking Lot 3 Groundwater on **Figure 4-1**.

Data review indicates the following information for the Parking Lot 3 Groundwater during the current FYR period:

- The only COC detected above the MCL (5 µg/L) was TCE.
- TCE concentrations fluctuated during the current FYR period consistent with historical data trends for the Parking Lot 3 Groundwater.
- RAOs were met in February/March 2017, but monitoring will continue to evaluate TCE concentration trends.

4.3 Site Inspection

A site inspection was conducted on August 18, 2017. The site inspection was conducted by the Army's consultant Westmark. The purpose of the inspection was to assess the protectiveness of the remedy, including the integrity of the CAMU's soil cover and access restricting fencing, adherence to land use restrictions that prevent groundwater use, and the condition of the groundwater treatment systems.

No significant issues were identified regarding the CAMU's soil cap or the access restricting fencing. The ICs in-place include prohibitions on the use of groundwater until clean-up levels are achieved, disturbance of the soil cap, and any other activities or actions that may interfere with the implemented remedies. No activities were observed that violated the ICs. The soil cap and surrounding area were undisturbed, and no new uses of groundwater were observed. The groundwater treatment systems were observed to be in good condition. The Site Inspection Checklist and Site Photographs are presented in **Appendix G** and **Appendix H**, respectively.

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5.0 TECHNICAL ASSESSMENT

This section of the FYR provides the framework for the protectiveness determinations in **Section 7.0**. The Technical Assessment is divided into three sections that are associated with the South Post Burn Pits/CAMU, South Post Plume, and the Parking Lot 3 Groundwater. Per the Second FYR Report, remedy protectiveness assessments for the Oxidation Lagoons, Building 300 Burn Pit, and the Battery Disposal Well IDW are no longer required because clean-up levels have been met and remaining concentrations pose no threat of exposure.

5.1 South Post Burn Pits / Corrective Action Management Unit

The following sections present an assessment of the selected remedy for the South Post Burn Pits, including its function and current applicability and protectiveness.

5.1.1 Question A: Is the remedy functioning as intended by the decision documents?

5.1.1.1 Remedial Action Performance

The CAMU continues to operate and function as designed. Lysimeter monitoring indicates that the soil stabilization and containment efforts have been effective. No opportunities for optimization or early indicators of potential issues have been identified at this time.

5.1.1.2 Systems Operations/Operation and Maintenance

The CAMU's operating procedures are working in a manner that will continue to maintain the effectiveness of the remedy. The cover and lysimeter monitoring network required no maintenance during the current FYR period. The lysimeter monitoring network was sampled on an annual basis as required.

5.1.1.3 Implementation of Institutional Controls

ICs were implemented by the Stabilized Mass Covenant. The Stabilized Mass Covenant was included with Quitclaim Deed No. DACA05-9-03-592, and recorded by the City of Sacramento in September 2005. The Army conducts routine inspections to confirm that ICs are enforced and that no prohibited activities have occurred. An annual report is submitted to the DTSC, which summarizes the results of the Army's periodic IC monitoring.

5.1.2 Question B: Are the exposure assumptions, toxicity data, clean-up levels, and remedial action objectives at the time of the remedy selection still valid?

5.1.2.1 Changes in Standards and To-Be-Considered Criteria

ARARs identified in the 1995 Basewide ROD and discussed in prior FYR reports are still valid. There have been no ARAR changes that would affect the protectiveness of the remedy since the last FYR.

The information provided in Table I-1 of **Appendix I** is pertinent to the remediation objectives stated in the 1995 Basewide ROD for the South Post Burn Pits. The clean-up levels established for the soil contaminants (arsenic, cadmium, chromium VI, lead, and total chromium) associated with the South Post Burn Pits are compared to current USEPA Regional Screening Levels (RSLs) in Table I-1. Only the soil clean-up level for chromium VI exceeds the current industrial RSL. However, the concentrations

remaining after soil excavation are low, and it is expected that the remaining risk, even considering the changes in some toxicity values, would still fall within the USEPA risk range. Additionally, the CAMU, and Stabilized Mass Covenant, would prevent the completion of an exposure pathway in the South Post Burn Pits area.

5.1.2.2 Changes in Toxicity and Other Contaminant Characteristics

The Human Health Risk Assessment method and results for SAAD are detailed in the *Basewide Human Health Risk Assessment* (Kleinfelder, 1994). Directly comparing toxicity values, then (1993) and now, is an efficient method to screen for changes in the level of protectiveness. Table I-3 of **Appendix I** provides a direct comparison between the 1993 toxicity values and 2017 toxicity values for the soil contaminants (arsenic, cadmium, chromium VI, lead, and total chromium) assigned clean-up levels in the 1995 Basewide ROD. Of these five contaminants, toxicity values have been revised or newly developed for arsenic, cadmium, and chromium VI. Toxicity values for these three soil-related contaminants indicate somewhat greater estimated hazards and risks. As previously indicated, it is expected that the remaining risk would still fall within the USEPA target risk range and no complete exposure pathway exists.

5.1.2.3 Changes in Risk Assessment Methods

To date, standardized risk assessment methodologies have not changed in a manner that would affect the protectiveness of the remedy.

5.1.2.4 Changes in Exposure Pathways

There have been no changes in exposure pathways or land use, and no new contaminants, contaminant sources, or remedy by-products have been identified.

5.1.2.5 Expected Progress Toward Meeting Remedial Action Objectives

RAOs have been met for the South Post Burn Pits/CAMU.

5.1.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The outside physical setting has not changed, and there have been no catastrophic weather events that have affected the remedy.

5.2 South Post Plume

The following sections present an assessment of the selected remedy for the South Post Plume, including its function and current applicability and protectiveness.

5.2.1 Question A: Is the remedy functioning as intended by the decision documents?

5.2.1.1 Remedial Action Performance

The remedy for the South Post Plume was modified by the 2017 ESD from groundwater extraction to long-term monitoring with contingency actions if TCE concentrations exceed a defined trigger concentration. The modified remedy has been operating and functioning as designed and trigger concentrations have not been exceeded. If clean-up levels are not achieved by 2022, then a Remedy Effectiveness Report will be prepared to evaluate continued implementation of the current remedy. The downgradient edge of the South Post Plume is not fully delineated; however, modeling concluded that the South

Post Plume would migrate no more than several hundred feet downgradient. Additional monitoring wells will be installed to define and monitor the downgradient extent of the plume. A forthcoming GWMPA will include these additional monitoring wells, and will make recommendations to optimize the groundwater monitoring program and abandon unnecessary monitoring wells and the SPGES (treatment plant and extraction wells) because they are no longer required for the remedy.

5.2.1.2 Systems Operations/Operation and Maintenance

The BAGES was placed in stand-by in March 2013. Since that time, it has been operated periodically to maintain its operational status. Continued maintenance of the BAGES for use as a contingency is required by the current remedy.

5.2.1.3 Implementation of Institutional Controls

ICs were implemented by the South Post Groundwater Covenant. The South Post Groundwater Covenant was included with Quitclaim Deed No. DACA05-9-03-592, and recorded by the City of Sacramento in September 2005. The Army conducts routine inspections to confirm that ICs are enforced and that no prohibited activities have occurred (i.e., well installation, use of groundwater, or disturbance to the treatment systems). An annual report is submitted to the DTSC, which summarizes the results of the Army's periodic IC monitoring.

Additionally, well permits in this area are issued by the Sacramento County Environmental Management Division (SCEMD). The SCEMD has been provided with information regarding the extent of groundwater impacts on- and off-site of SAAD, and will also be provided a copy of this FYR to guide their decision-making in regard to well installation to ensure that ICs are enforced and effective.

5.2.2 Question B: Are the exposure assumptions, toxicity data, clean-up levels, and remedial action objectives at the time of the remedy selection still valid?

5.2.2.1 Changes in Standards and To-Be-Considered Criteria

ARARs identified in the 1995 Basewide ROD and discussed in prior FYR reports are still valid. There have been no ARAR changes that would affect the protectiveness of the remedy since the last FYR.

The information provided in Table I-2 of **Appendix I** is pertinent to the remediation objectives stated in the 1995 Basewide ROD for the South Post Plume. The clean-up levels established for the groundwater contaminants (1,2-DCA, cDCE, tDCE, TCE, and PCE) associated with the South Post Plume are compared to current California MCLs in Table I-2. The comparison indicates that the clean-up levels are consistent with the current California MCLs.

The risk posed by vapor intrusion was evaluated in the third FYR and fourth FYR. These prior evaluations indicated that vapor intrusion did not pose a risk; however, using data obtained during the current FYR period, the Army conducted an additional screening level evaluation. The screening process and data are provided in **Appendix J**. The results of the evaluation still indicate that groundwater contamination associated with the South Post Plume does not pose an unacceptable vapor intrusion risk due to groundwater depth, low contaminant concentrations, and prevailing soil characteristics and geology.

5.2.2.2 Changes in Toxicity and Other Contaminant Characteristics

The Human Health Risk Assessment method and results for SAAD are detailed in the *Basewide Human Health Risk Assessment* (Kleinfelder, 1994). Directly comparing toxicity values, then (1993) and now, is an efficient method to screen for changes in the level of protectiveness. Table I-3 of **Appendix I** provides a direct comparison between the 1993 toxicity values and 2017 toxicity values for the groundwater contaminants (1,2-DCA, CT, cDCE, tDCE, TCE, and PCE) assigned clean-up levels in the 1995 Basewide ROD. As shown in Table I-3 of **Appendix I**, toxicity values for each of the groundwater-related chemicals have been changed, and indicate somewhat greater estimated hazards and risks. At this time, concentrations corresponding to risks greater than $1x10^{-6}$ do remain on-site. However, no new MCLs have been promulgated, ICs are in-place, and there is no complete exposure pathway for groundwater.

5.2.2.3 Changes in Risk Assessment Methods

To date, standardized risk assessment methodologies have not changed in a manner that would affect the protectiveness of the remedy.

5.2.2.4 Changes in Exposure Pathways

There have been no changes in exposure pathways or land use, and no new contaminants, contaminant sources, or remedy by-products have been identified.

5.2.2.5 Expected Progress Toward Meeting Remedial Action Objectives

RAOs have not yet been achieved; however, the MCL was exceeded at only three groundwater monitoring wells during the sampling event in February/March 2017.

5.2.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The outside physical setting has not changed, and there have been no catastrophic weather events that have affected the remedy.

5.3 Parking Lot 3 Groundwater

The following sections present an assessment of the selected remedy for the Parking Lot 3 Groundwater, including its function and current applicability and protectiveness.

5.3.1 Question A: Is the remedy functioning as intended by the decision documents?

5.3.1.1 Remedial Action Performance

The remedy for the Parking Lot 3 Groundwater was modified by the 2017 ESD from groundwater extraction to long-term monitoring with contingency actions if TCE concentrations exceed a defined trigger concentration. The modified remedy has been operating and functioning as designed and trigger concentrations have not been exceeded. If clean-up levels are not achieved by 2022, then a Remedy Effectiveness Report will be prepared to evaluate continued implementation of the current remedy. A forthcoming GWMPA will make recommendations to optimize the groundwater monitoring program and abandon unnecessary monitoring wells because they are no longer required for the remedy.

5.3.1.2 Systems Operations/Operation and Maintenance

The extraction wells (EW0008/EW0009) at Parking Lot 3 were placed in stand-by mode in June 2002. Since that time, they have been operated periodically to maintain their operational status. Continued maintenance of EW0008/EW0009 for use as a contingency is required by the current remedy.

5.3.1.3 Implementation of Institutional Controls

ICs were implemented by Quitclaim Deed No. DACA05-9-99-569, and recorded by the City of Sacramento in August 2000. The Army conducts routine inspections to confirm that ICs are enforced and that no prohibited activities have occurred (i.e., well installation, use of groundwater, or disturbance to the treatment systems). An annual report is submitted to the DTSC, which summarizes the results of the Army's periodic IC monitoring.

5.3.2 Question B: Are the exposure assumptions, toxicity data, clean-up levels, and remedial action objectives at the time of the remedy selection still valid?

5.3.2.1 Changes in Standards and To-Be-Considered Criteria

ARARs identified in the 1995 Basewide ROD and discussed in prior FYR reports are still valid. There have been no ARAR changes that would affect the protectiveness of the remedy since the last FYR.

The information provided in Table I-2 of **Appendix I** is pertinent to the remediation objectives stated in the 1995 Basewide ROD for the Parking Lot 3 Groundwater. The clean-up levels established for the groundwater contaminants (1,2-DCA, CT, cDCE, tDCE, TCE, and PCE) associated with the Parking Lot 3 Groundwater are compared to current California MCLs in Table I-2. The comparison indicates that the clean-up levels are consistent with the current California MCLs.

The risk posed by vapor intrusion was evaluated in the fourth FYR. This evaluation indicated that vapor intrusion did not pose a risk; however, using data obtained during the current FYR period, the Army conducted an additional screening level evaluation using hypothetical building scenarios, although no buildings are present at Parking Lot 3. The screening process and data are provided in **Appendix K**. The results of the evaluation still indicate that groundwater contamination associated with the Parking Lot 3 Groundwater does not potentially pose an unacceptable vapor intrusion risk due to groundwater depth, low contaminant concentrations, and prevailing soil characteristics and geology.

5.3.2.2 Changes in Toxicity and Other Contaminant Characteristics

The Human Health Risk Assessment method and results for SAAD are detailed in the *Basewide Human Health Risk Assessment* (Kleinfelder, 1994). Directly comparing toxicity values, then (1993) and now, is an efficient method to screen for changes in the level of protectiveness. Table I-3 of **Appendix I** provides a direct comparison between the 1993 toxicity values and 2017 toxicity values for the groundwater contaminants (1,2-DCA, CT, cDCE, tDCE, TCE, and PCE) assigned clean-up levels in the 1995 Basewide ROD. As shown in Table I-3 of **Appendix I**, toxicity values for each of the groundwater-related chemicals have been changed and indicate somewhat greater estimated hazards

and risks. At this time, concentrations corresponding to risks greater than $1x10^{-6}$ do remain on-site. However, no new MCLs have been promulgated, ICs are in-place, and there is no complete exposure pathway for groundwater.

5.3.2.3 Changes in Risk Assessment Methods

To date, standardized risk assessment methodologies have not changed in a manner that would affect the protectiveness of the remedy.

5.3.2.4 Expected Progress Toward Meeting Remedial Action Objectives

RAOs were achieved in the last sampling event in February/March 2017; however, because of past concentration fluctuations experienced in this area, groundwater monitoring will continue to evaluate RAO achievement over time.

5.3.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The outside physical setting has not changed, and there have been no catastrophic weather events that have affected the remedy.

6.0 ISSUES/RECOMMENDATIONS

Issues related to current site operations, conditions, and activities that may prevent the selected remedies from being protective are listed in **Table 6-1**.

Table 6-1. Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the FYR:				
None				
Issues and Recommendations Identified in the FYR:				
OU(s): South Post Burn Pits/CAMU	**Issue Category**: Monitoring			
	Issue: Fluctuating lead concentrations in lysimeters.			
	Recommendation: Determine if groundwater downgradient of the CAMU has been impacted by lead.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Army	USEPA/DTSC	9/30/2018
OU(s): South Post Plume	**Issue Category**: Monitoring			
	Issue: The downgradient extent of the South Post Plume is not fully delineated.			
	Recommendation: Install two downgradient groundwater monitoring wells in aquifer zone A/B to delineate the downgradient extent of the South Post Plume. Include the additional groundwater monitoring wells in the forthcoming GWMPA.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Army	USEPA/DTSC	8/30/18
OU(s): Parking Lot 3 Groundwater, South Post Plume	**Issue Category**: Other			
	Issue: Emerging contaminants (per- and polyfluoroalkyl substances (PFAS)) concern.			
	Recommendation: Prepare a formal response documenting the Army's position on PFAS usage at SAAD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	No	Army	USEPA/DTSC	12/31/2018

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7.0 PROTECTIVENESS STATEMENTS

The following sections contain protectiveness statements regarding the selected remedies for the South Post Burn Pits/CAMU, the South Post Plume, and the Parking Lot 3 Groundwater. The protectiveness statements were prepared according to USEPA guidance.

7.1 South Post Burn Pits/Corrective Action Management Unit Protectiveness Statement

The remedy for the South Post Burn Pits/CAMU is protective of human health and the environment.

7.2 South Post Plume Protectiveness Statement

The remedy for the South Post Plume is protective of human health and the environment.

7.3 Parking Lot 3 Groundwater Protectiveness Statement

The remedy for the Parking Lot 3 Groundwater is protective of human health and the environment.

7.4 Site-wide Protectiveness Statement

Because the remedial actions at all OUs are protective, the site is protective of human health and the environment.

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8.0 NEXT REVIEW

The next FYR will be conducted in 2022, and will be due no later than September 24, 2022.

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Figures

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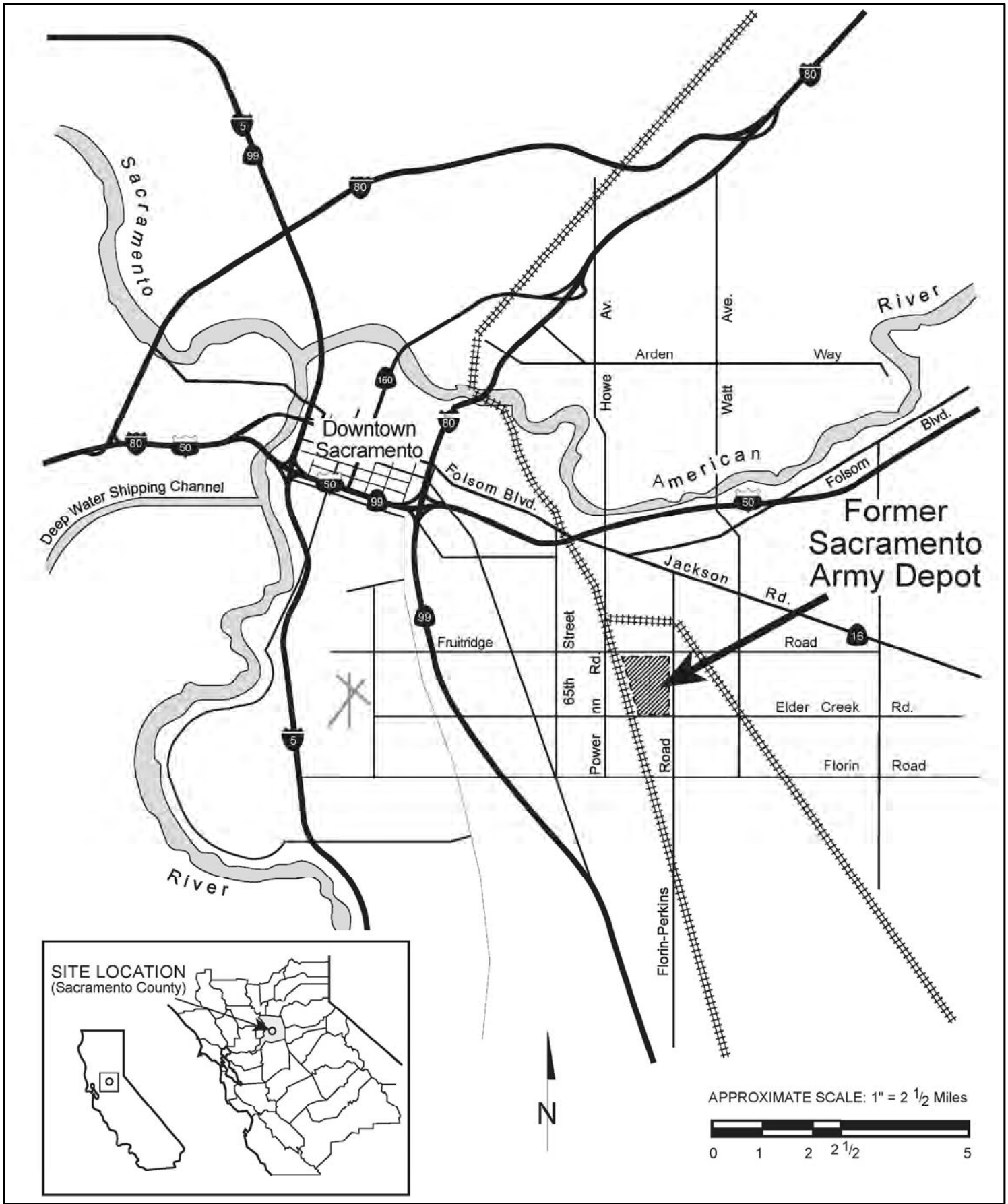
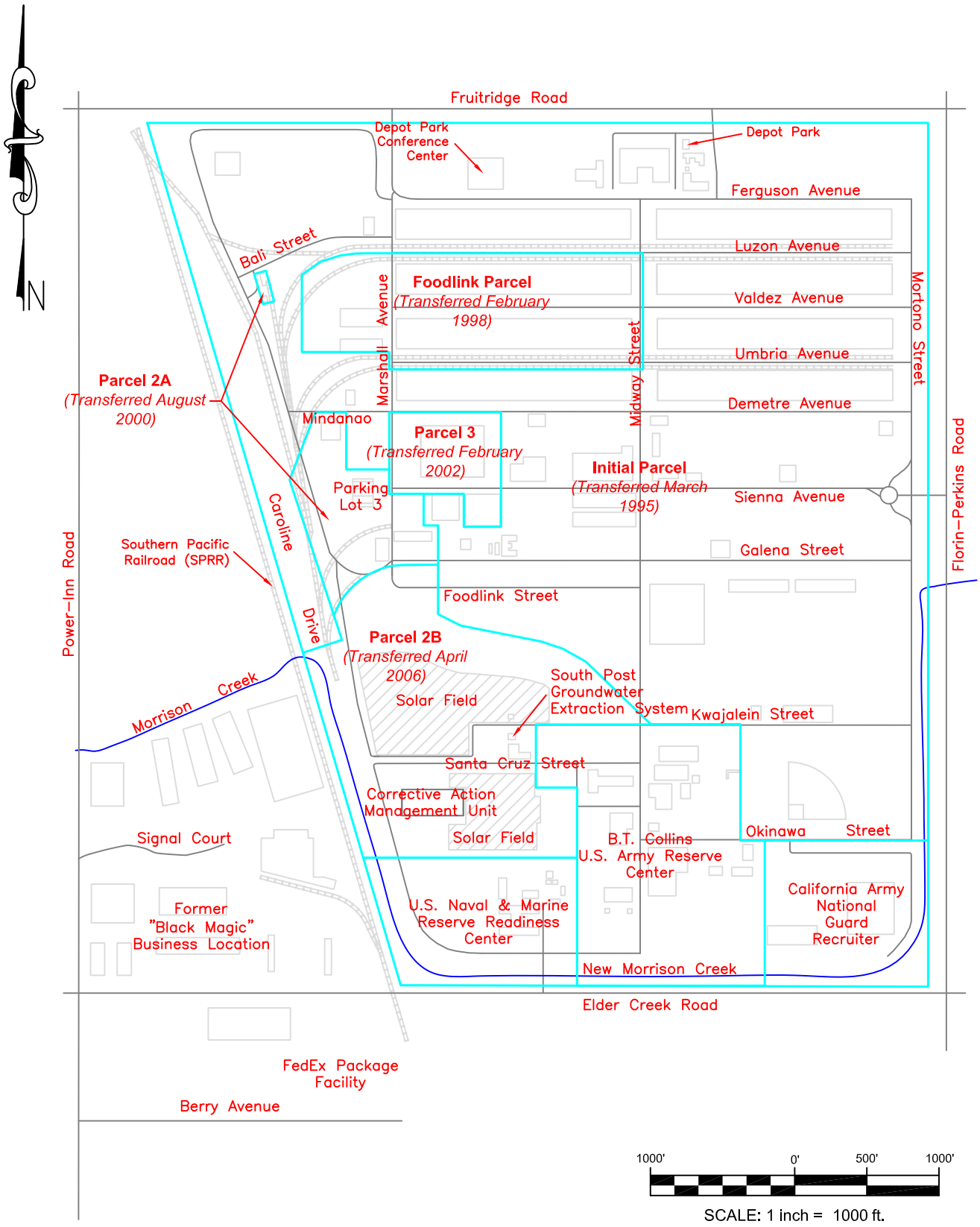


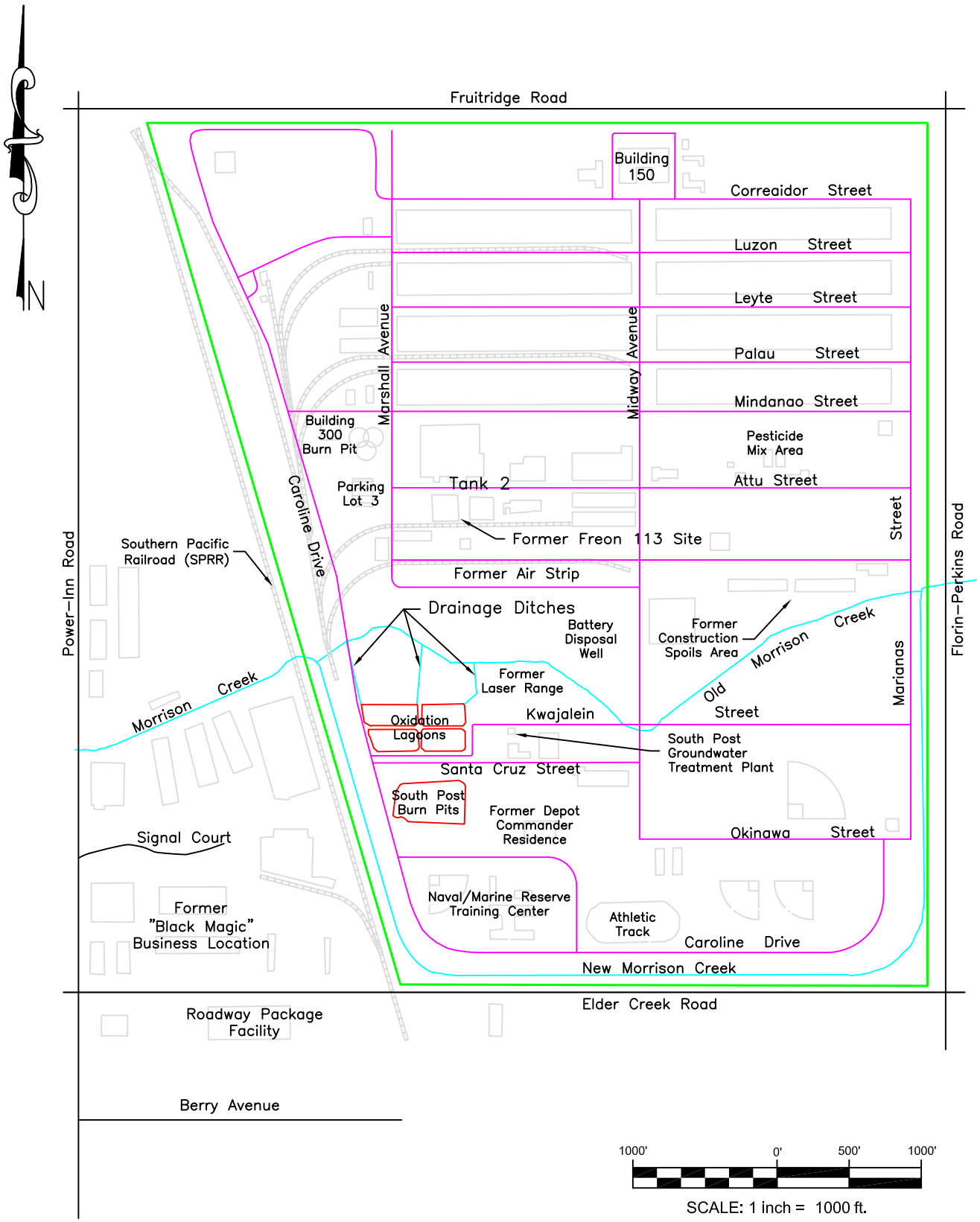
Celebrating 30 years PLEXUS scientific	Drawn By: PLEXUS Project No.: 8282-3AC Date: 10-26-17 Filename: Figure1-1*.dwg	SITE LOCATION MAP FIFTH FIVE-YEAR REVIEW REPORT FORMER SACRAMENTO ARMY DEPOT SACRAMENTO, CALIFORNIA	FIGURE 1-1



Drawn By:	PLEXUS	PROPERTY TRANSFER MAP FIFTH FIVE-YEAR REVIEW REPORT	FIGURE 1-2
Project No.:	8282-3AC		
Date:	10-26-17	FORMER SACRAMENTO ARMY DEPOT SACRAMENTO, CALIFORNIA	
Filename:	Figure1-2*.dwg		

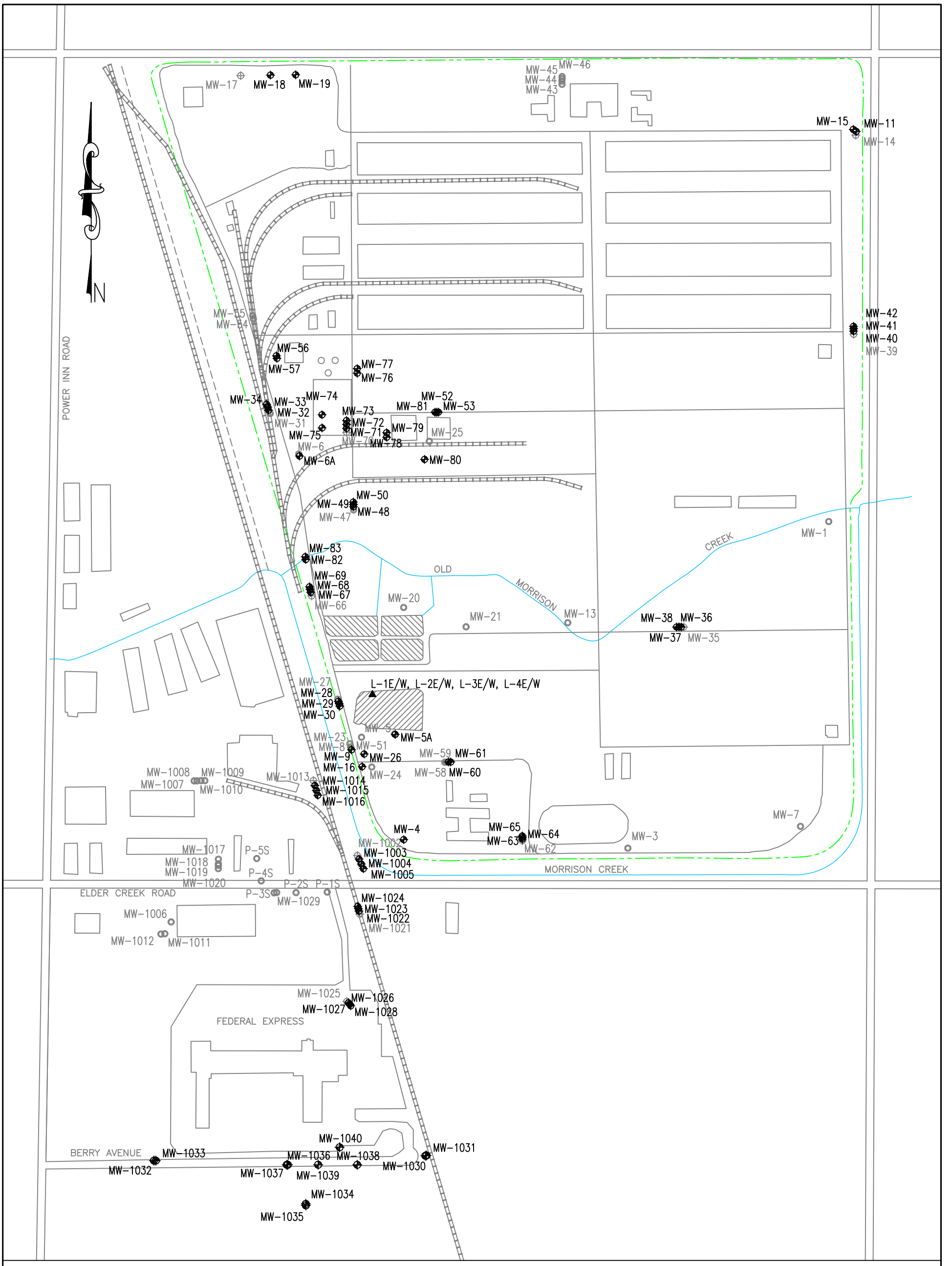
PLEXUS scientific

5. Deliverables > FYR_2017 > Figures > PDF



Drawn By:	PLEXUS	FORMER FACILITY MAP FIFTH FIVE-YEAR REVIEW REPORT	FIGURE 1-3
Project No.:	8282-3AC		
Date:	10-26-17	FORMER SACRAMENTO ARMY DEPOT SACRAMENTO, CALIFORNIA	
Filename:	Figure1-3.dwg		

PLEXUS scientific



LEGEND

MW-1029	GROUNDWATER MONITORING WELL LOCATION
MW-40	ABANDONED GROUNDWATER MONITORING WELL LOCATION
MW-1	DESTROYED GROUNDWATER MONITORING WELL LOCATION
P-1S	DESTROYED PIEZOMETER LOCATION
L-1E/W	LYSIMETER LOCATION

600' 0' 300' 600'

SCALE: 1 inch = 600 ft.

Notes:

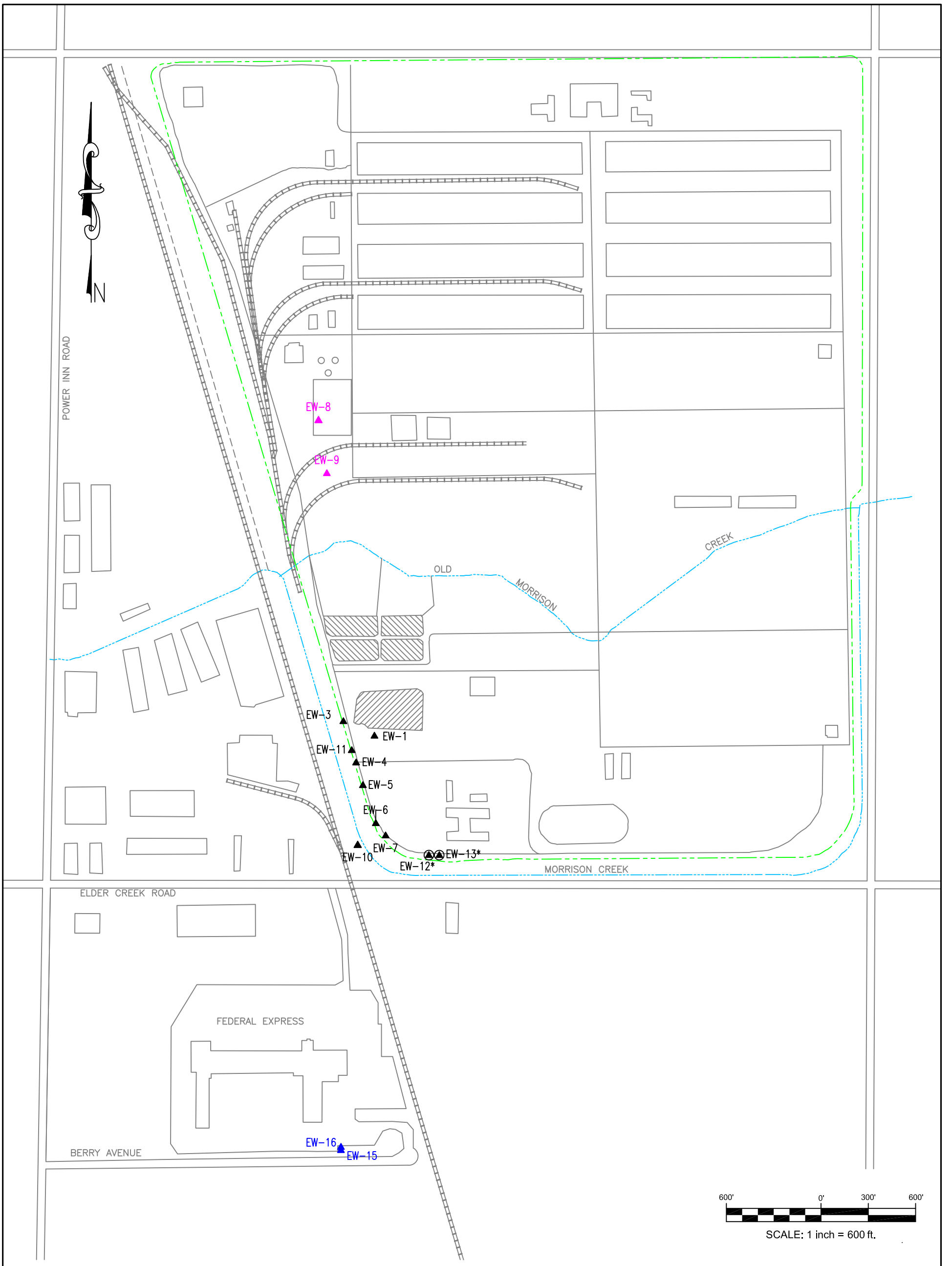
Property lines and lysimeter locations illustrated are approximate and not based on land survey.

Drawn By:	PLEXUS
Project No.:	8282-3AC
Date:	10-26-17
Filename:	Figure2-1*.dwg

MONITORING WELL LOCATION MAP
FIFTH FIVE-YEAR REVIEW REPORT

FORMER SACRAMENTO ARMY DEPOT
SACRAMENTO, CALIFORNIA

FIGURE
2-1



SCALE: 1 inch = 600 ft.

LEGEND

▲	EW-3	SOUTH POST GROUNDWATER EXTRACTION SYSTEM EXTRACTION WELL
▲	EW-15	BERRY AVENUE GROUNDWATER EXTRACTION SYSTEM EXTRACTION WELL
▲	EW-8	PARKING LOT 3 EXTRACTION WELL
◭	EW-12*	ABANDONED HORIZONTAL EXTRACTION WELL

Notes:

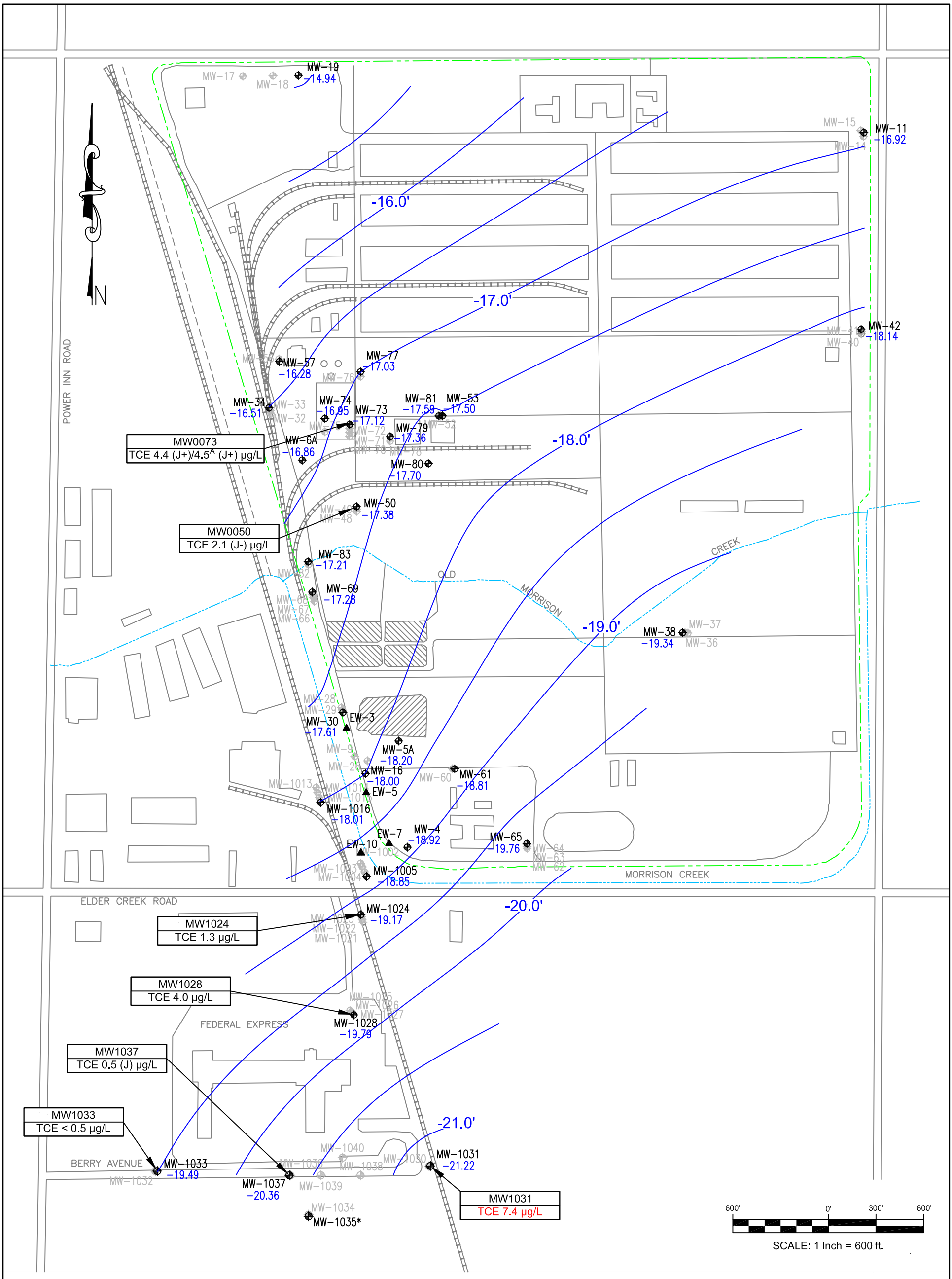
Property lines illustrated are approximate and not based on land survey.

Drawn By:	PLEXUS
Project No.:	8282-3AC
Date:	10-26-17
Filename:	Figure2-2*.dwg

EXTRACTION WELL LOCATION MAP
FIFTH FIVE-YEAR REVIEW REPORT

FORMER SACRAMENTO ARMY DEPOT
SACRAMENTO, CALIFORNIA

FIGURE
2-2



Notes:

Water level data used to generate this contour map were collected in March 2017.

Analytical results shown in red exceed the Maximum Contaminant Level (MCL) of 5.0 µg/L.

* MW-1035 could not be accessed during the sampling event because of wellhead damage.

A) Duplicate sample result.

J = Result is estimated.

J- =Result is estimated and biased low.

J+ = Result is estimated and biased high.

LEGEND

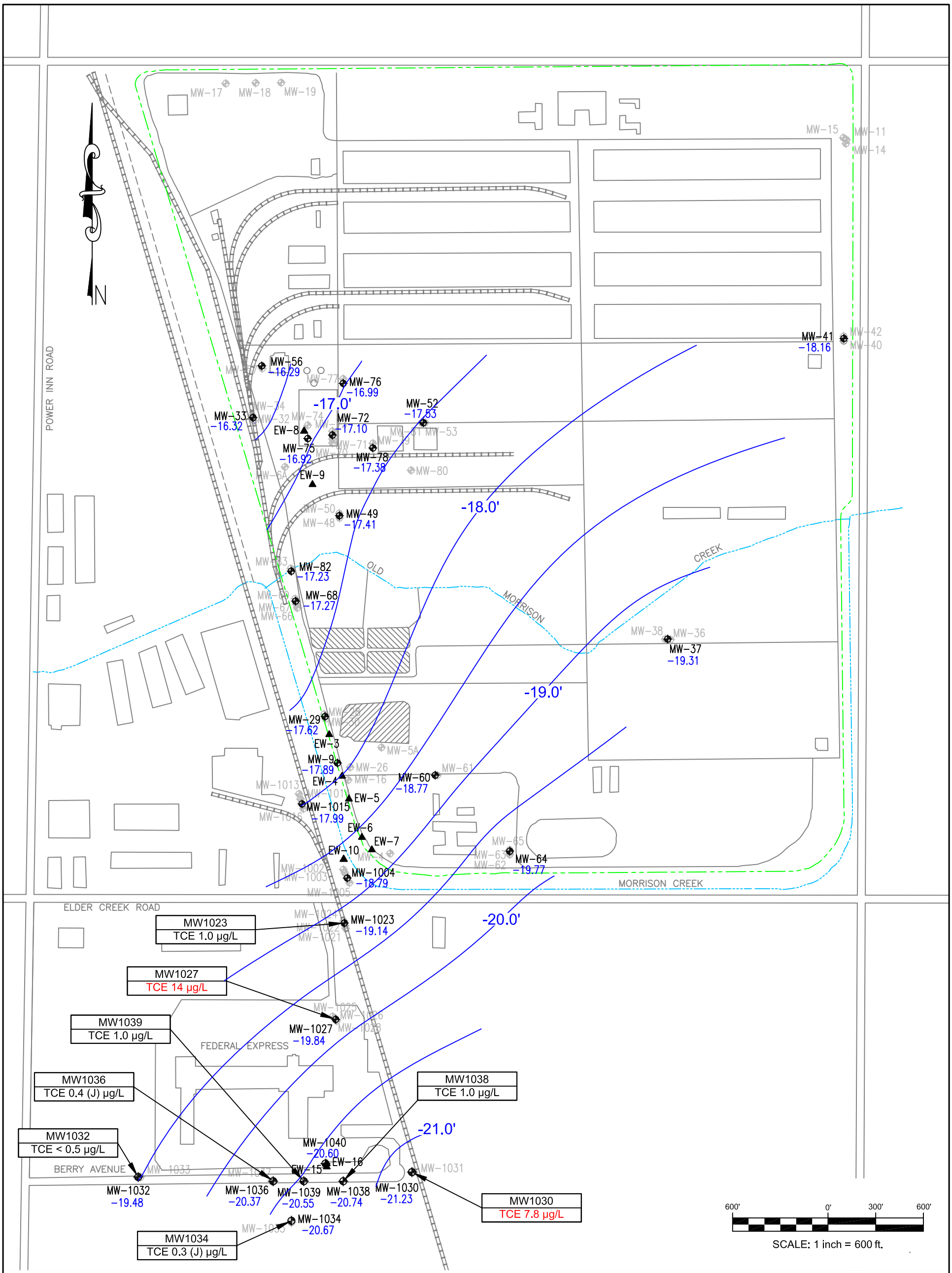
MW-1033	GROUNDWATER MONITORING WELL - AQUIFER ZONE A
MW-1034	GROUNDWATER MONITORING WELL IN THE B, C, OR D AQUIFER ZONE
EW-7	GROUNDWATER EXTRACTION WELL LOCATION
-23'	GROUNDWATER ELEVATION CONTOUR (Mean Sea Level ~ feet)
-23.38	GROUNDWATER ELEVATION (Mean Sea Level ~ feet)
MW1033 TCE <0.5 µg/L	TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)

Drawn By:	PLEXUS
Project No.:	8282-3AC
Date:	09-25-17
Filename:	Figure4-1*.dwg

Aquifer Zone A
TCE and Potentiometric Surface Data - Feb/March 2017
Fifth Five Year Review Report

Former Sacramento Army Depot
Sacramento, Califoria

FIGURE
4-1



LEGEND

MW-1034	GROUNDWATER MONITORING WELL - AQUIFER ZONE B
MW-1035	GROUNDWATER MONITORING WELL IN THE A, C, OR D AQUIFER ZONE
EW-7	GROUNDWATER EXTRACTION WELL LOCATION
-23'	GROUNDWATER ELEVATION CONTOUR (Mean Sea Level ~ feet)
-21.85	GROUNDWATER ELEVATION (Mean Sea Level ~ feet)
MW1034 / TCE < 0.5 µg/L	TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)

Notes:

Water level data used to generate this contour map were collected in March 2017.

Analytical results shown in red exceed the Maximum Contaminant Level (MCL) of 5.0 µg/L.

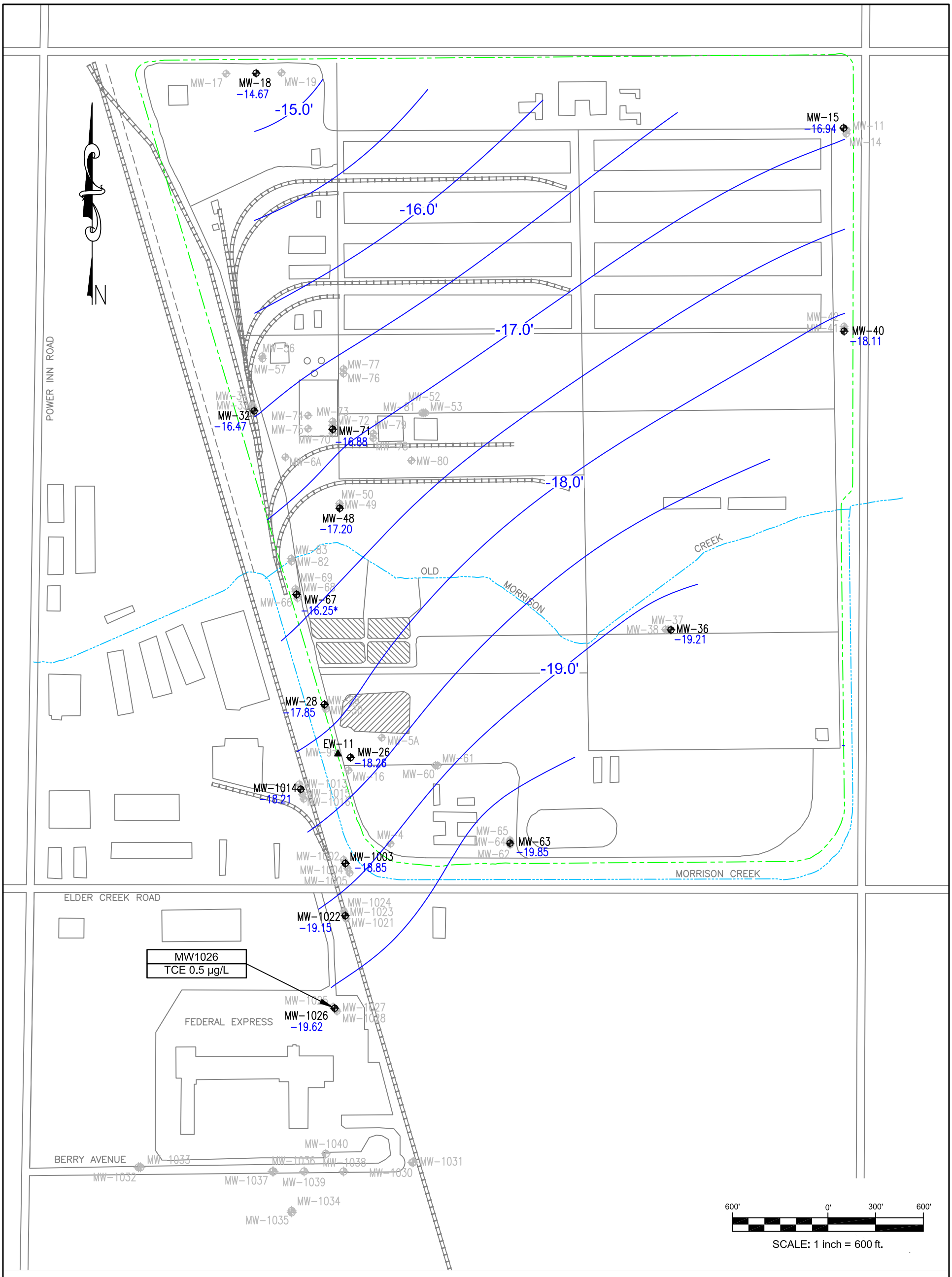
J = Result is estimated.

Drawn By:	PLEXUS
Project No.:	8282-3AC
Date:	12-20-17
Filename:	Figure4-2*.dwg

Aquifer Zone B
TCE and Potentiometric Surface Data - Feb/March 2017
Fifth Five Year Review Report

Former Sacramento Army Depot
Sacramento, Califoria

FIGURE
4-2



LEGEND

MW-1026	GROUNDWATER MONITORING WELL - AQUIFER ZONE C
MW-1035	GROUNDWATER MONITORING WELL IN THE A, B, OR D AQUIFER ZONE
EW-11	GROUNDWATER EXTRACTION WELL LOCATION
-21'	GROUNDWATER ELEVATION CONTOUR (Mean Sea Level ~ feet)
-22.18	GROUNDWATER ELEVATION (Mean Sea Level ~ feet)
MW1026 / TCE < 0.5 µg/L	TRICHLOROETHENE (TCE) CONCENTRATION IN MICROGRAMS PER LITER (µg/L)

Notes:

Water level data used to generate this contour map were collected in March 2017.

* Not utilized for potentiometric surface generation.

Drawn By:	PLEXUS
Project No.:	8282-3AC
Date:	09-25-17
Filename:	Figure4-3*.dwg

Aquifer Zone C
TCE and Potentiometric Surface Data - Feb/March 2017
Fifth Five Year Review Report

Former Sacramento Army Depot
Sacramento, Califoria

FIGURE
4-3

Appendix A
Site Chronology

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Event	Date
United States Army Toxic and Hazardous Materials Agency conducted a historical data review to assess areas of potential contamination at the former Sacramento Army Depot (SAAD).	1978-1979
Army initiated investigation of soil and groundwater at SAAD.	Early 1981
Initial Community Relations Plan	August 1986; updated in 1988 and 1992
SAAD placed on National Priorities List with a Hazard Ranking System Score of 44.46.	August 1987
Federal Facilities Agreement signed between the Army, State of California, and United States Environmental Protection Agency (USEPA) Region IX.	December 1988
South Post Groundwater Operable Unit (OU) Interim Record of Decision (ROD) – extraction and treatment of groundwater initiated in November.	October 1989
SAAD placed on Base Realignment and Closure (BRAC) list.	1991
Tank 2 OU Interim ROD and Implementation of Remedial Action.	December 1991
South Post Burn Pits OU Interim ROD – soil vapor extraction initiated the following year.	March 1993
Oxidation Lagoons OU Interim ROD.	September 1993
SAAD Reuse Plan	June 1994
Restoration Advisory Board (RAB) established.	June 1994
Basewide Human Health Risk Assessment completed.	May 1994
Basewide Remedial Investigation Report completed.	September 1994
Basewide Proposed Plan completed.	November 1994
Basewide Feasibility Study completed.	December 1994
Basewide ROD – amended Interim South Post Plume, Oxidation Lagoons, and South Post Burn Pits OU RODs.	January 1995
SAAD closed.	March 1995
The Army transferred 306 acres of the former SAAD to the City of Sacramento.	March 1995
Remedial Design completed.	July 1995
Soil remedial action associated with Corrective Action Management Unit (CAMU).	July 1995 – November 1996
First Five-Year Review (FYR) Report	January 1996

Event	Date
Army Independent Review Team groundwater remedy evaluation (a.k.a., Groundwater Extraction Treatment System Effectiveness Review).	June 1999
South Post extracted groundwater no longer treated after concentrations fall below sewer permit discharge limits.	January 2000
Groundwater remedy meeting with focus on Parking Lot 3 – decision process established to determine when ROD provisions had been achieved.	March 2000
Second FYR Report	December 2001
Horizontal wells: Extraction Well (EW) 0012 and EW0013 properly abandoned.	January 2002
Army transfers Parcel 2A to the City of Sacramento.	March 2002
Parking Lot 3 Groundwater extraction wells: EW0008 and EW0009, turned off after concentrations fall below ROD provisions (concentrations subsequently rebound).	June 2002
The EPA and the California Department of Toxic Substances Control (DTSC) conditionally concur with the Close-out and Monitoring Report prepared for Parking Lot 3 Groundwater.	August 2002
Groundwater purged from Monitoring Well (MW) 0050 at Parking Lot 3.	July and September 2003
Remedial Design Addendum prepared to clarify ROD implementation.	March 2004
Fate and Transport Model updated.	November 2004
Correspondence between DTSC and the Army regarding the Parking Lot 3 Groundwater remedy.	January to March 2005
FedEx property groundwater investigation.	October 2005
Army transfers Parcel 2B to the City of Sacramento.	April 2006
Draft Final Groundwater Cleanup Optimization Report (including updated Fate and Transport Model) proposes comprehensive revision to the groundwater remedies.	March 2007
Third FYR Report	September 2007
New Groundwater Monitoring Plan Amendment/Technical Memorandum issued by Army for SAAD to optimize groundwater sampling program and reduce costs.	June 2009

Event	Date
South Post Groundwater Extraction System (SPGES) shutdown and placed in stand-by so that performance of the Berry Avenue Groundwater Extraction System (BAGES) could be evaluated independent of the SPGES over a period of 12 months.	October 2009
BAGES on-line and operating continuously at designed extraction rate of approximately 60 gpm.	February 2010
DTSC approve Army request to evaluate the performance of a new more efficient groundwater extraction system (BAGES) for treatment of the South Post Groundwater (also known as the "South Post Plume"); Work Plan for the BAGES installation and operation is finalized; including contingencies for restart of the SPGES.	March 2010
The DTSC, EPA, and the Central Valley Regional Water Quality Control Board (CVRWQCB) request from the Army a Technical Memorandum assessing hydraulic capture achieved by the BAGES; the memorandum is also to assess the current nature and extent of affected groundwater in the South Post Plume.	October 2010
The DTSC, EPA, and CVRWQCB request from the Army a Receptor Survey to evaluate downgradient drinking water sources that may be impacted by the South Post Plume.	October 2010
Army and Regulators agree to discontinue RAB meetings and presentations.	October 2010
Vapor Migration Pathway Assessment Pilot Test is initiated.	August 2010
Vapor Migration Pathway Assessment Pilot Test complete following three months of soil vapor extraction from the northern extent of the South Post Plume.	December 2010
Draft Final Soil Vapor Testing and Soil Vapor Extraction System Installation Report issued, including results of pilot test and plans for additional vapor extraction technology evaluation; secondary source of soil VOCs ruled out.	August 2011
Army presents Draft Final Technical Memorandum to the DTSC, EPA, and CVRWQCB for review.	September 2011
Final Technical Memorandum issued; it contains an updated nature and extent of the South Post Plume and confirms that the BAGES can capture the South Post Plume without concurrent operation of the SPGES.	April 2012
The DTSC, EPA, and the Central Valley Regional Water Quality Control Board (CVRWQCB) agree to a one-year shut down rebound study for the South Post Plume	April 2012

Event	Date
Fourth FYR Report	September 2012
Final Soil Vapor Testing and Soil Vapor Extraction System Installation Report issued, including recommendation to not conduct a second soil vapor extraction test, but rather focus resources on a monitored natural attenuation (MNA) and rebound evaluation for the South Post Plume.	November 2012
BAGES shutdown to conduct a rebound and MNA evaluation under non-pumping conditions in the South Post Plume.	March 2013
Rebound and MNA evaluation conducted.	March 2013 – May 2014
Final Rebound Evaluation Report issued, including recommendation to leave the BAGES shutdown because contaminant concentration rebound and migration within the South Post Plume were minimal. A recommendation to prepare a Focused Feasibility Study to evaluate alternative remedies for the South Post Plume was also provided.	September 2014
Final MNA Evaluation Results Report issued, including recommendation for potential use of MNA as a remedy for the South Post Plume, but indicated that MNA alone would not be effective for the Parking Lot 3 Groundwater. A recommendation to prepare a Focused Feasibility Study to evaluate alternative remedies for the South Post Plume and Parking Lot 3 Groundwater was also provided.	November 2014
Final Focused Feasibility Study issued, including a detailed analysis of alternative remedies for the South Post Plume and Parking Lot 3 Groundwater.	October 2015
Final Explanation of Significant Differences issued with regulatory concurrence and signature, including alternative remedies for the South Post Plume and Parking Lot 3 Groundwater.	May 2017

Appendix B
Decision Point and Contingency Action Summary for the South Post Plume

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Contingency Action and Decision Point Summary for the South Post Plume

Operable Unit	Upper TCE Concentration Trigger for Action	Summary of Actions to be Taken if Exceeded	Decision Point	Summary of Actions to be Taken Based on the Results of the Remedy Effectiveness Report
South Post Plume	20 micrograms per liter at any of the following monitoring wells: MW1023, MW1024, MW1027, MW1028, MW1030, and MW1031.	Restart Berry Avenue Groundwater Extraction System until the trigger concentration is achieved at each monitoring well where it was exceeded.	FY 2022: Complete Five-Year Review, evaluate remedy progress, and provide Remedy Effectiveness Report[1].	If the remedy has not been achieved but a declining concentration trend[2] can be established in the plume, then the remedy may be reassessed in a Record of Decision (ROD) Amendment. If a declining concentration trend[2] cannot be established, and the Remedy Effectiveness Report recommends continuing evaluation, then additional monitoring will be conducted through the next Five-Year Review. If a declining concentration trend[2] cannot be established, and the Remedy Effectiveness Report does not recommend continuing evaluation, then the pump and treat will be restarted or an alternate remedy may be included in a ROD Amendment.

1) Remedy Effectiveness Report will evaluate trichloroethene (TCE) concentrations and determine the concentration trend. Trends will be evaluated by Mann-Kendall analyses using semi-annual TCE sampling results gathered between Five-Year Reviews. Trends will be calculated for the South Post Plume using MW1023, MW1024, MW1027, MW1028, MW1030, and MW1031.

2) A declining concentration trend can be established when the monitoring network exhibits a "decreasing" trend with a Confidence Factor greater than 95% as determined by Mann-Kendall analysis. The trend analysis will utilize no less than ten sampling events/distinct concentrations over a five-year period for each monitoring well; non-detects will be included at half the detection limit.

Appendix C

Decision Point and Contingency Action Summary for the Parking Lot 3 Groundwater

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Contingency Action and Decision Point Summary for Parking Lot 3 Groundwater

Operable Unit	Upper TCE Concentration Trigger for Action	Summary of Actions to be Taken if Exceeded	Decision Point	Summary of Actions to be Taken Based on the Results of the Remedy Effectiveness Report
Parking Lot 3	25 micrograms per liter at MW0050 and MW0073.	Restart EW8/EW9 until the trigger concentration is achieved at each monitoring well where it was exceeded.	FY 2022: Complete Five-Year Review, evaluate remedy progress, and provide Remedy Effectiveness Report[1].	If the remedy has not been achieved but a declining concentration trend[2] can be established in the plume, then the remedy may be reassessed in a Record of Decision (ROD) Amendment. If a declining concentration trend[2] cannot be established, and the Remedy Effectiveness Report recommends continuing evaluation, then additional monitoring will be conducted through the next Five-Year Review. If a declining concentration trend[2] cannot be established, and the Remedy Effectiveness Report does not recommend continuing evaluation, then the pump and treat will be restarted or an alternate remedy may be included in a ROD Amendment.

1) Remedy Effectiveness Report will evaluate trichloroethene (TCE) concentrations and determine the concentration trend. Trends will be evaluated by Mann-Kendall analyses using semi-annual TCE sampling results gathered between Five-Year Reviews. Trends will be calculated for the South Post Plume using MW1023, MW1024, MW1027, MW1028, MW1030, and MW1031.

2) A declining concentration trend can be established when the monitoring network exhibits a "decreasing" trend with a Confidence Factor greater than 95% as determined by Mann-Kendall analysis. The trend analysis will utilize no less than ten sampling events/distinct concentrations over a five-year period for each monitoring well; non-detects will be included at half the detection limit.

Appendix D
Public Notice

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PUBLIC NOTICE

Five Year Evaluation of the Record of Decision for Remedial Actions

US Army BRAC Office, DAIM-ODB
Former Sacramento Army Depot

The United States Department of the Army completed a **five-year review of the environmental remedy** at the former Sacramento **Army Depot (SAAD).** Groundwater was impacted by past industrial solvent disposal and is being remediated as part of the present selected remedy. The purpose of this review is to confirm that the implemented remedial actions continue to be protective of human health and the environment. This five-year review is required pursuant to the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) § 121 and the National Contingency Plan (NCP) 40 CFR §300.430(f)(4)(ii). **A copy of the final five-year review** is available for public review at the information repository at the **United States Army Corps of Engineers, Sacramento District, 1325 J Street, Suite 820, Sacramento, California 94105.** All questions should be directed to the Army BRAC Environmental Coordinator: Scott Armstrong, 916-261-4577.

Appendix E
Interview Responses

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QUESTIONNAIRE
SACRAMENTO ARMY DEPOT
FIFTH FIVE-YEAR REVIEW

Person Interviewed: Mark Bare / Marie McCrink

Title: Remedial Project Manager / Division Manager

Organization/Community: CVRWQCB

1. What is your overall impression of the remedial actions as well as the on-going and long-term monitoring activities at this site?

   Mark:

   I've only been the regulator for 6 months. They currently seem to be protective of the human health and the environment. Looks like you have the plume under control. Currently, there are no groundwater extraction systems running. And the two systems, the South Post and the Berry Avenue systems both have continency plans built into them so that if levels go above a certain amount, they will be turned back on. The latest sampling, I saw seems to be below so it seems everything is going along as planned for the moment.

   Marie:

   I should say that I dabble in this project occasionally because very little happens and most of it is taken care by my case manager, whoever that might have been at the time, and so my overall impression is that there isn't a whole lot left to do there. But the two areas that are left are proceeding as planned, the Parking Lot 3 and South Post Plume with the two extraction systems.

2. Do you feel that the progress of the project has been adequately conveyed to the public and that an effort has been made to seek their input?

   Mark:

   I don't have any knowledge of that, I have not seen where the Army has reached out to anybody, but there's not been anything going on while I've had the case where they've had to, so I just say no knowledge of them.

   Marie:

   There also has been no need as best as my understanding to reach out to the public under my watch which began in the summer of 2012. I've been the supervisor on this project over the last 5 years. I have heard that in the past they have reached out to the community and the response has been very minimal. Maybe back in the 90s that might have been different, but in the 2000s when they reach out there has been minimal response from the public.

3. Are you aware of any community concerns regarding this site? Please provide details.

   Mark:

   None that I know of. No one has contacted me from the general public to inquire about it, there's have been no records review that I've known about.

Marie:

The same. We have not received any input on this site, other than from the Army and their consultant, Scott Armstrong, and [Plexus].

4. Are you aware of any problems or concerns associated with on-going monitoring and maintenance activities?

Mark:

None that I'm aware of. It seems like at this point they're just keeping the two systems: South Post Plume and Berry Avenue, maintained just in case they have to be restarted, but I'm not aware of any issues they've had with that.

Marie:

It's been pretty quiet and I am not aware of any problems or concerns with ongoing maintenance activities. Like Mark said, they keep everything ready to go. And then I think there is also a system associated with Parking Lot 3 that can be turned back on too. They keep everything on call, on standby.

5. Do you feel that the land-use controls at this site are in place and adequately enforced?

Mark:

As I currently understand them, yes. They're set up right now to protect any potential receptors and it seems like they have everything maintained to keep that as is. Everything is still commercial.

Marie:

I concur.

6. Do you feel well informed about the on-going and long-term monitoring activities?

Mark:

I've read quite a bit about them. I was contacted by Scott Armstrong (BEC) suggesting that I review the latest ESD, so, I'm becoming well informed.

Marie:

The five-year review is really going to help. Yes, I think that I'm informed about the long-term monitoring activities. There's an annual report that comes out once a year. We've seen 2016, and won't see 2017 for a while now. And that's what everyone agreed to, just the annual. I think they collect semi-annual data, but I don't think a separate report is prepared.

7. Do you have any comments, suggestions, or recommendations regarding the management of this site?

   Mark:

   I basically have two action items that I wrote down. I noticed there is a lingering TCE hot spot that we may need to address down the road. I saw references to the chromium issue, but we'll have to revisit that because the state did away with the chromium IV MCL this year. I guess it was the Sacramento court. We'll just want to revisit that because they did vacate the MCL, but will reestablish it. And that would probably take 18 to 24 months. I'd guess I'm saying I'd like to discuss it now as we're doing this five-year reivew so that if it does pop up half way through as an issue for us we go ahead and think about it now.

   Marie:

   A Superior Court vacated the new 10 mg/l MCL that the state had promulgated and so we are now back to the 50 mg/l total chromium MCL which is the state one, and the Federal is 100, but I believe that we were still using the 50 here at SAAD, but there were still some lingering questions from some data like maybe 7 to 10 years ago and also the possibility of some off site migration to the south.

   The MCL will likely end up somewhere less than 50 and greater than 10. The 10 was so difficult for small water purveyors to deal with. It was putting everyone out of business. It was technically feasible and not economically feasible, and the court did not feel that the economic feasibility of the new MCL was adequately addressed in the process.

   I know we went through a very cumbersome process to determine the trigger concentrations, and then just the lingering spot where we had that TCE hit between 12-19 for 10 years. Mark is a very proactive case manager and may do some out the box thinking about that. All in the effort to get you guys to a NFA status.

Interviewer (Name/Organization): Janice Wellman/Plexus Scientific Corporation

Date/Time of Interview: November 1, 2017/2 PM EST

Method of Interview (Telephone/Visit/Other): Telephone_

QUESTIONNAIRE
SACRAMENTO ARMY DEPOT
FIFTH FIVE-YEAR REVIEW

Person Interviewed: Scott Armstrong

Title: Senior Analyst / Base Realignment and Closure Environmental Coordinator

Organization/Community: CALIBRE

1. What is your overall impression of the remedial actions as well as the on-going and long-term monitoring activities at this site?

   Going as planned after the signed ESD. At the end game so everything is as expected.

2. Do you feel that the progress of the project has been adequately conveyed to the public and that an effort has been made to seek their input?

   Yes. We don't do the RAB meetings because there was no interest. The public has been informed through SAAD and newspaper with no comments.

3. Are you aware of any community concerns regarding this site? Please provide details.

   No, none at all.

4. Are you aware of any problems or concerns associated with on-going monitoring and maintenance activities?

   No, we just updated the ROD and ESD. Changed the remedy, no ongoing changes, just finishing out the site. Nothing unusual or expected.

5. Do you feel that the land-use controls at this site are in place and adequately enforced?

   Yes.

6. Do you feel well informed about the on-going and long-term monitoring activities?

   Yes.

7. Do you have any comments, suggestions, or recommendations regarding the management of this site?

   No, just stay on top of changes. Important that the Army stay on top of who's coming in to keep them properly informed so there doesn't have to be a continuous review and everyone is aware of the site history.

Interviewer (Name/Organization): Janice Wellman/Plexus Scientific Corporation

Date/Time of Interview: October 19, 2017, 2:00 pm EST

Method of Interview (Telephone/Visit/Other): Telephone

QUESTIONNAIRE
SACRAMENTO ARMY DEPOT
FIFTH FIVE-YEAR REVIEW

Person Interviewed: Paul Giller

Title: Project Manager

Organization/Community: Plexus Scientific Corporation

1. What is your overall impression of the remedial actions as well as the on-going and long-term monitoring activities at this site?

   The ongoing and long-term activities at the site have been sufficient to oversee the remedial actions and are expected to be optimized in the future.

2. Do you feel that the progress of the project has been adequately conveyed to the public and that an effort has been made to seek their input?

   Yes. In the past years the RAB has been active, however in the last several years there have been no RAB activities. We have however sought their input when the RAB was active.

3. Are you aware of any community concerns regarding this site? Please provide details.

   No, I'm not aware of any community concerns regarding this site.

4. Are you aware of any problems or concerns associated with on-going monitoring and maintenance activities?

   I'm not aware of any problems with these.

5. Do you feel that the land-use controls at this site are in place and adequately enforced?

   Yes. The land-use controls are in place, they are adequately enforced. Part of the site is on the base and part of the site is under the control of the City of Sacramento.

6. Do you feel well informed about the on-going and long-term monitoring activities?

   Yes. I've been involved with this project since 2008. I have working knowledge of the current sampling activities and I also have knowledge of the planned optimization and long-term monitoring tasks.

7. Do you have any comments, suggestions, or recommendations regarding the management of this site?

   This site involves multiple agencies, the US Army, US EPA, CA EPA with DTSC and the Waterboard. We've had a good collaborative working relationship among these entities. There are new regulators who will be working on this site from all three agencies the EPA, DTSC, Waterboard. We look forward to continuing with them.

QUESTIONNAIRE
SACRAMENTO ARMY DEPOT
FIFTH FIVE-YEAR REVIEW

Interviewer (Name/Organization): Janice Wellman, Plexus Scientific Corporation
Date/Time of Interview: November 10, 2017/11:00 am EST
Method of Interview (Telephone/Visit/Other): Telephone

Appendix F
Histograms

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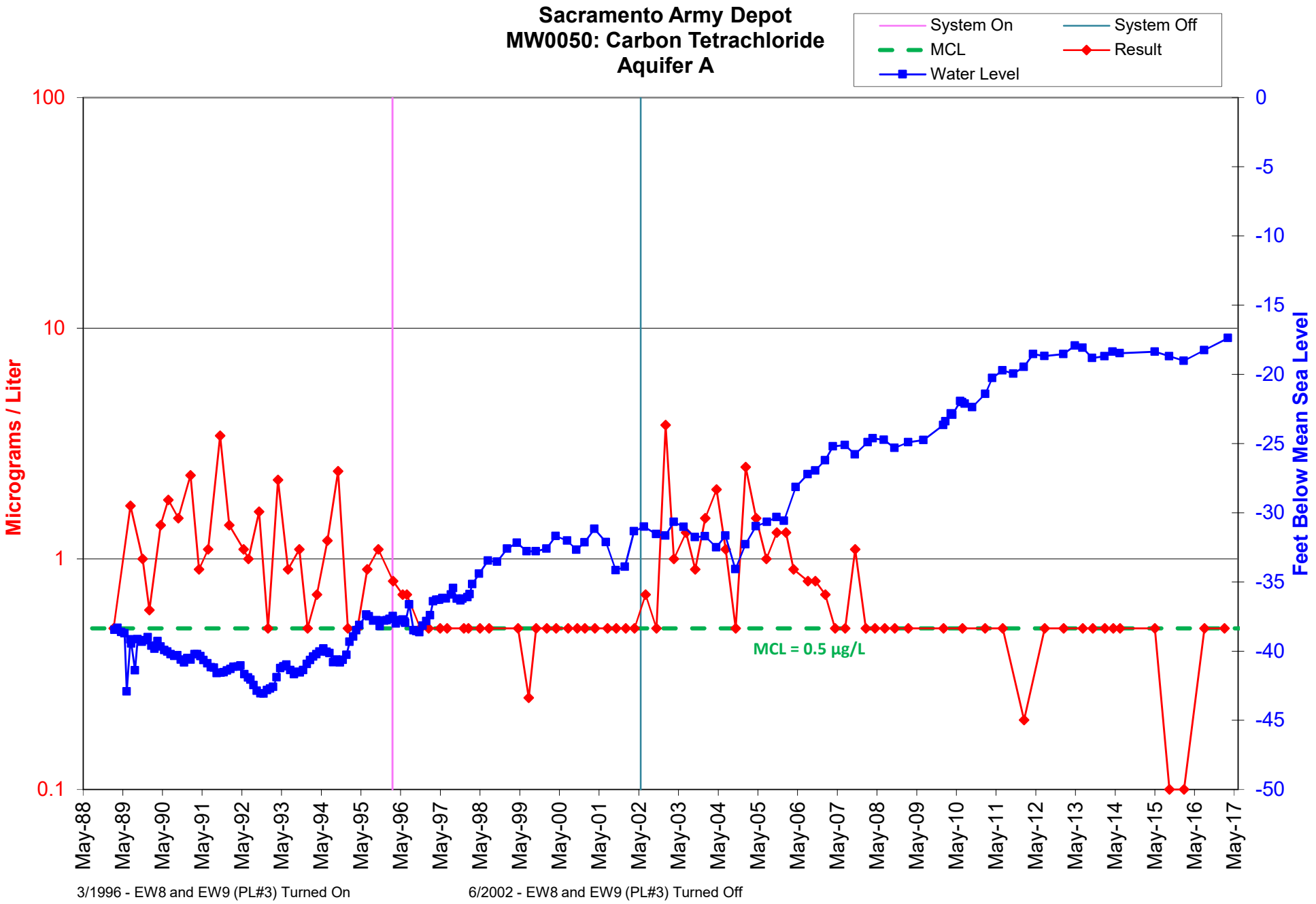
Sacramento Army Depot
MW0050: Carbon Tetrachloride
Aquifer A
System On
System Off
MCL
Result
Water Level
Micrograms / Liter
Feet Below Mean Sea Level
100
10
1
0.1
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
MCL = 0.5 µg/L
May-88
May-89
May-90
May-91
May-92
May-93
May-94
May-95
May-96
May-97
May-98
May-99
May-00
May-01
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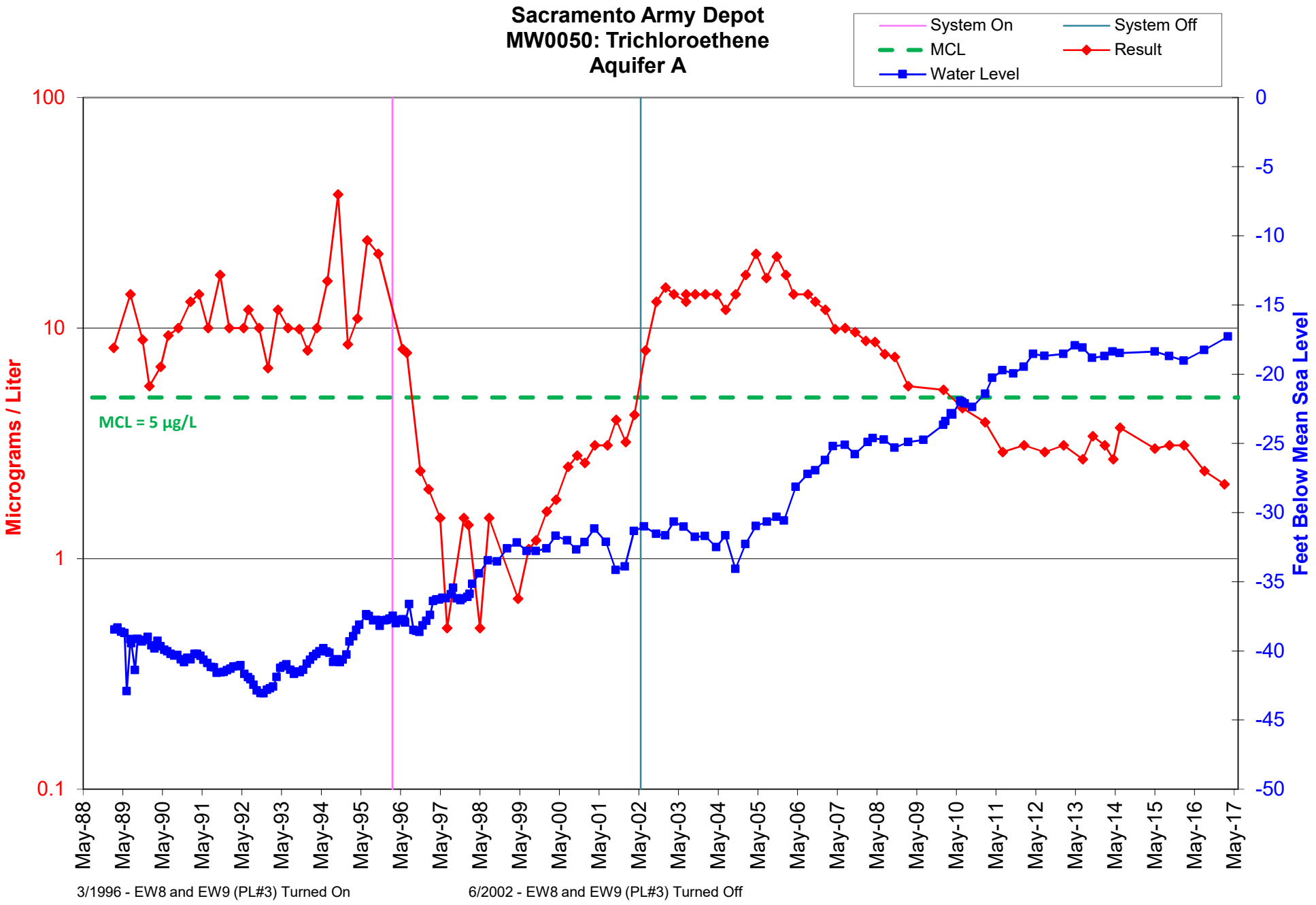
3/1996 - EW8 and EW9 (PL#3) Turned On
6/2002 - EW8 and EW9 (PL#3) Turned Off


Sacramento Army Depot
MW0050: Trichloroethene
Aquifer A
System On
System Off
MCL
Result
Water Level
100
10
1
0.1
Micrograms / Liter
MCL = 5 µg/L
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Feet Below Mean Sea Level
May-88
May-89
May-90
May-91
May-92
May-93
May-94
May-95
May-96
May-97
May-98
May-99
May-00
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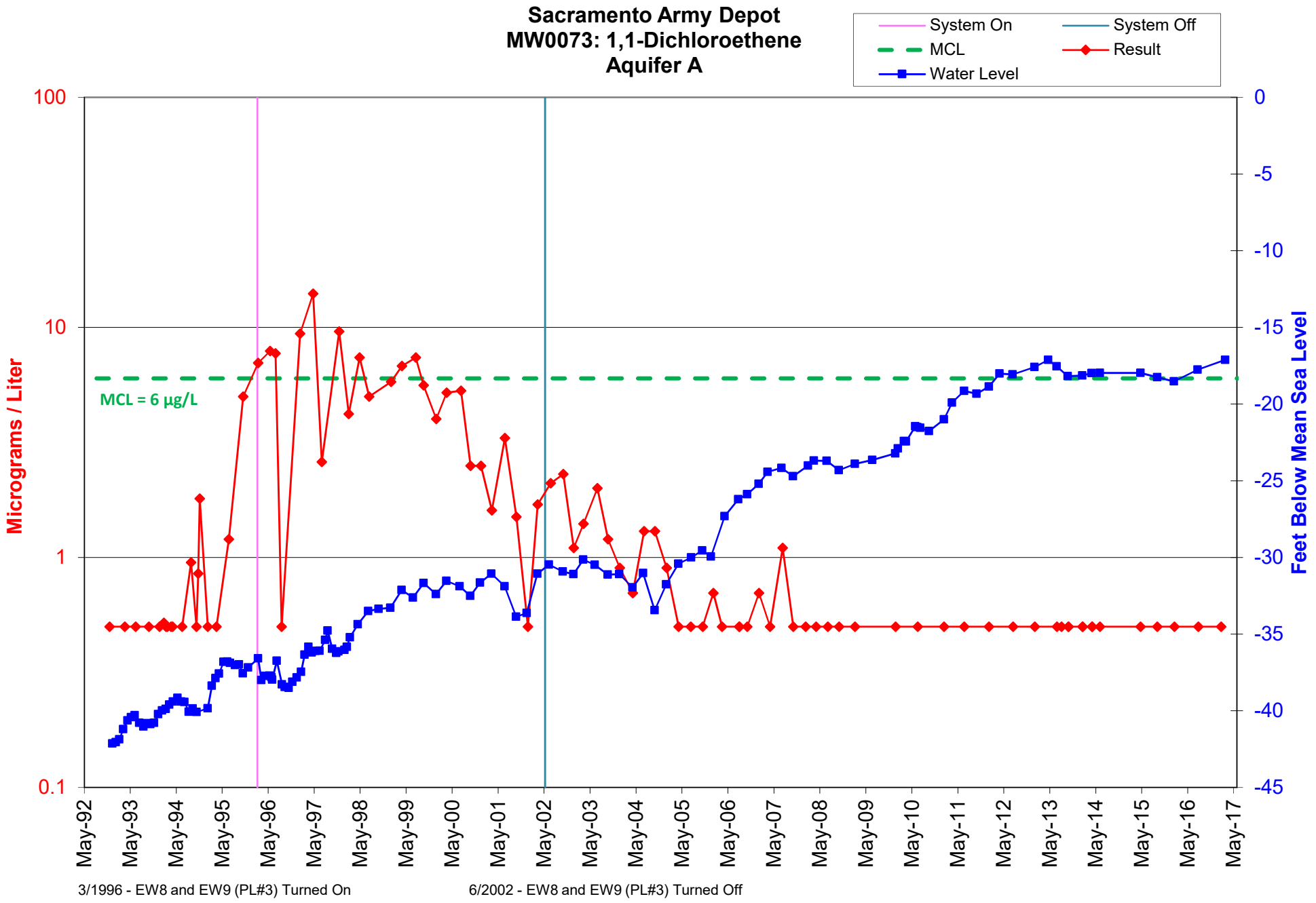
May-17
3/1996 - EW8 and EW9 (PL#3) Turned On
6/2002 - EW8 and EW9 (PL#3) Turned Off


Sacramento Army Depot
MW0073: 1,1-Dichloroethene
Aquifer A
System On
System Off
MCL
Result
Water Level
100
10
1
0.1
Micrograms / Liter
MCL = 6 µg/L
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
Feet Below Mean Sea Level
May-92
May-93
May-94
May-95
May-96
May-97
May-98
May-99
May-00
May-01
May-02
May-03
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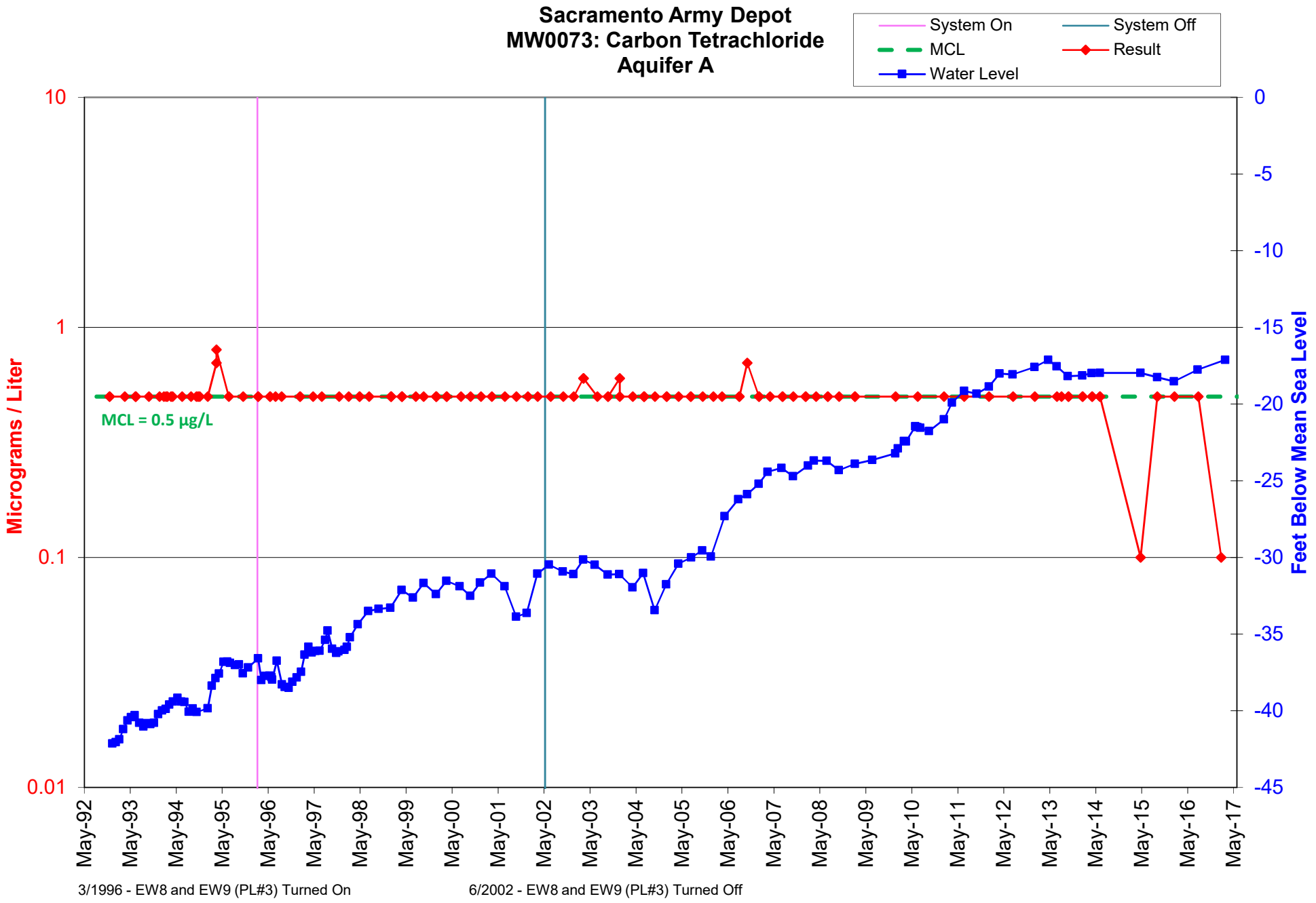
Sacramento Army Depot
MW0073: Carbon Tetrachloride
Aquifer A
System On
System Off
MCL
Result
Water Level
Micrograms / Liter
Feet Below Mean Sea Level
MCL = 0.5 µg/L
10
1
0.1
0.01
0
-5
-10
-15
-20
-25
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May-92
May-93
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3/1996 - EW8 and EW9 (PL#3) Turned On
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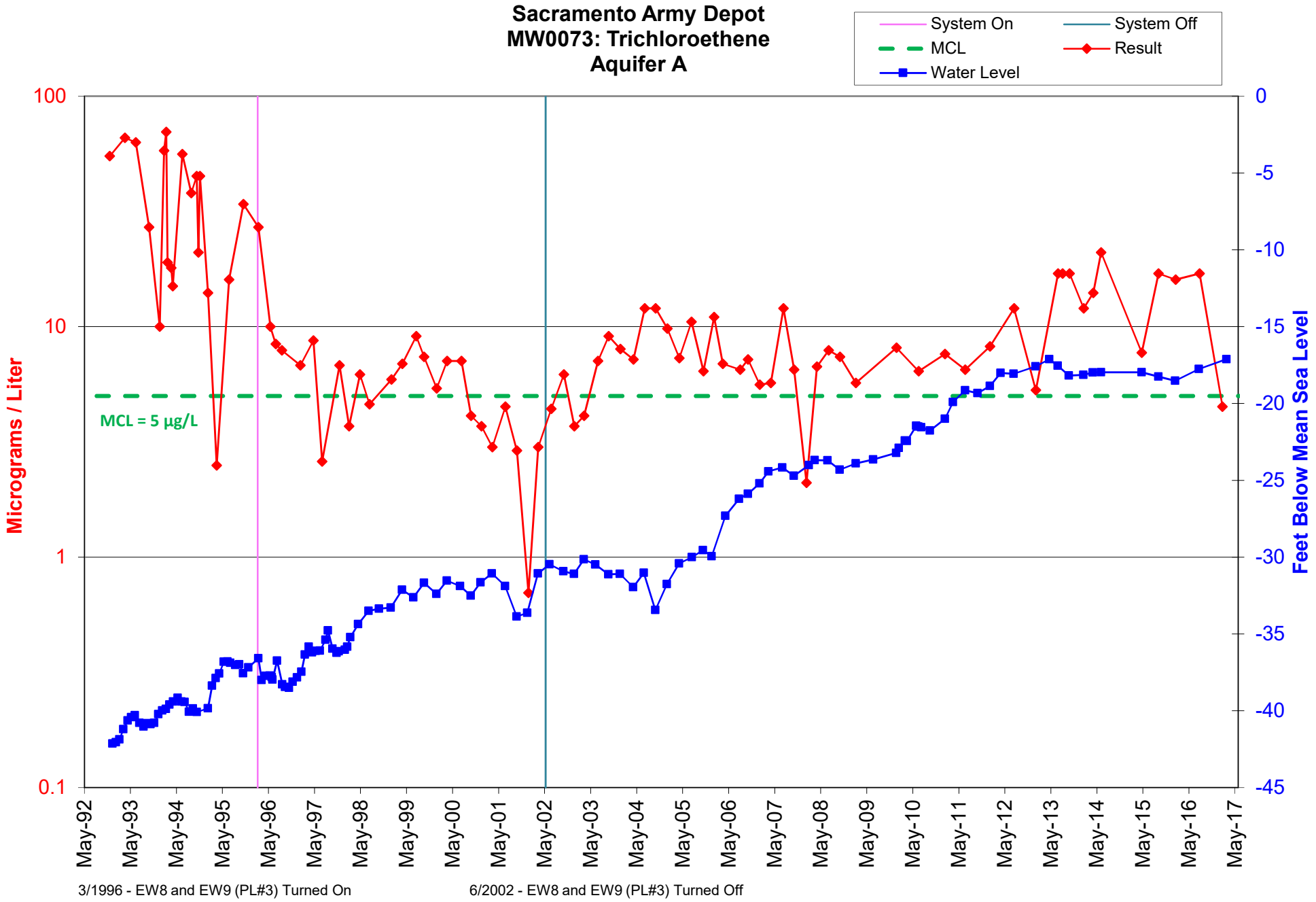
Sacramento Army Depot
MW0073: Trichloroethene
Aquifer A
System On
System Off
MCL
Result
Water Level
Micrograms / Liter
Feet Below Mean Sea Level
MCL = 5 µg/L
100
10
1
0.1
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
May-92
May-93
May-94
May-95
May-96
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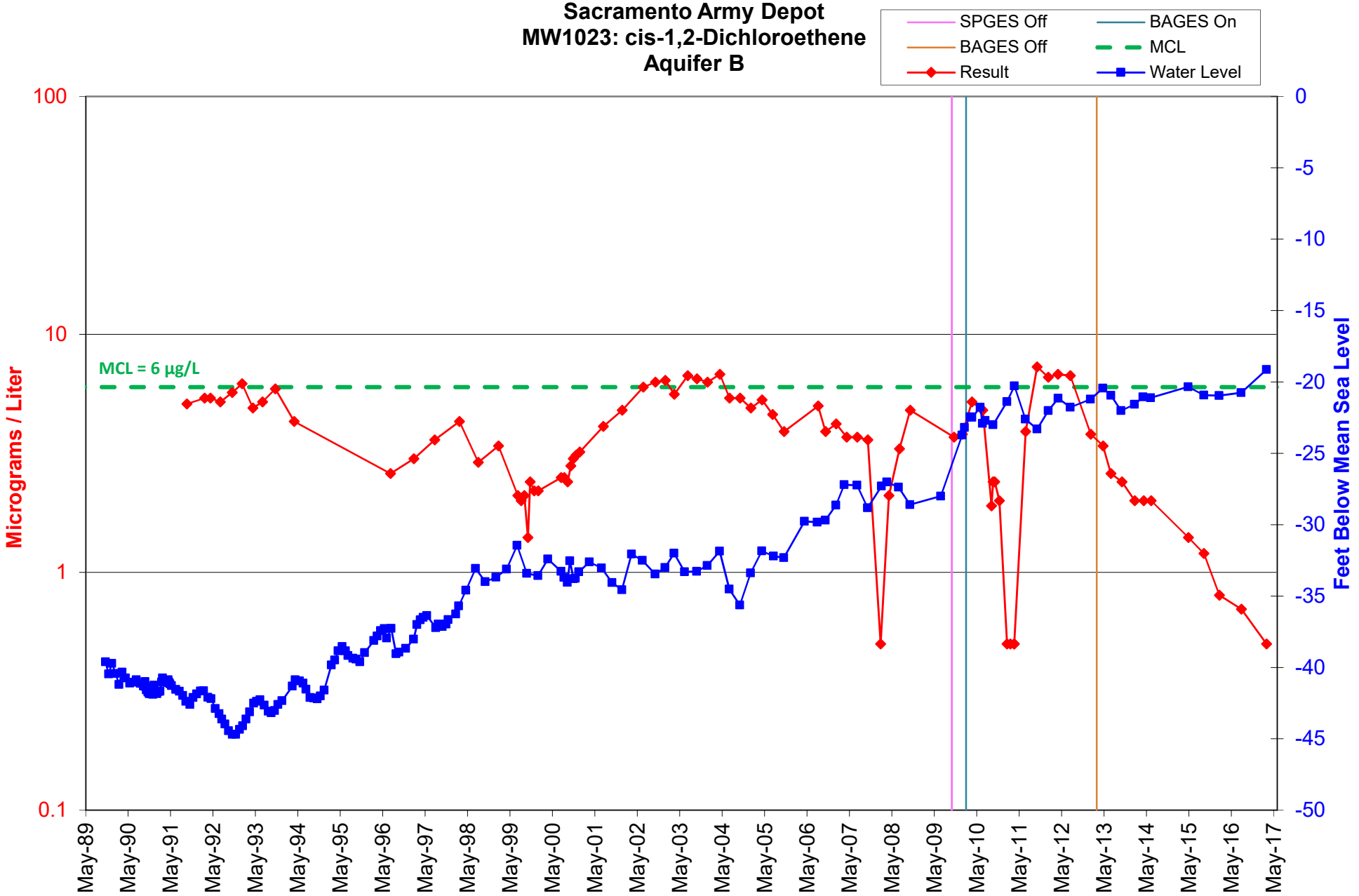
May-98
May-99
May-00
May-01
May-02
May-03
May-04
May-05
May-06
May-07
May-08
May-09
May-10
May-11
May-12
May-13
May-14
May-15
May-16
May-17
3/1996 - EW8 and EW9 (PL#3) Turned On
6/2002 - EW8 and EW9 (PL#3) Turned Off

Sacramento Army Depot
MW1023: cis-1,2-Dichloroethene
Aquifer B



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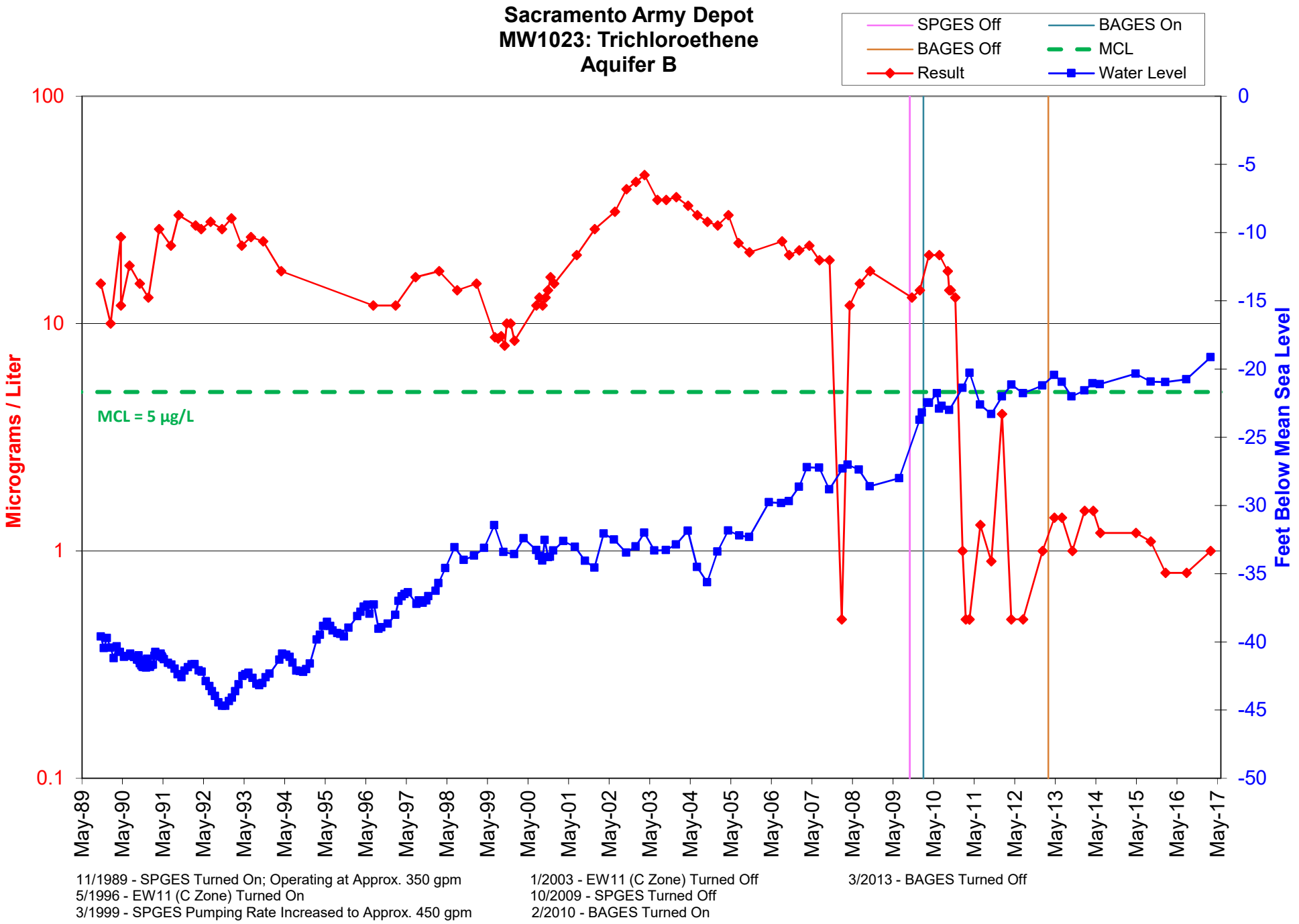
5/1996 - EW11 (C Zone) Turned On
3/1999 - SPGES Pumping Rate Increased to Approx. 450 gpm

1/2003 - EW11 (C Zone) Turned Off
10/2009 - SPGES Turned Off
2/2010 - BAGES Turned On

3/2013 - BAGES Turned Off



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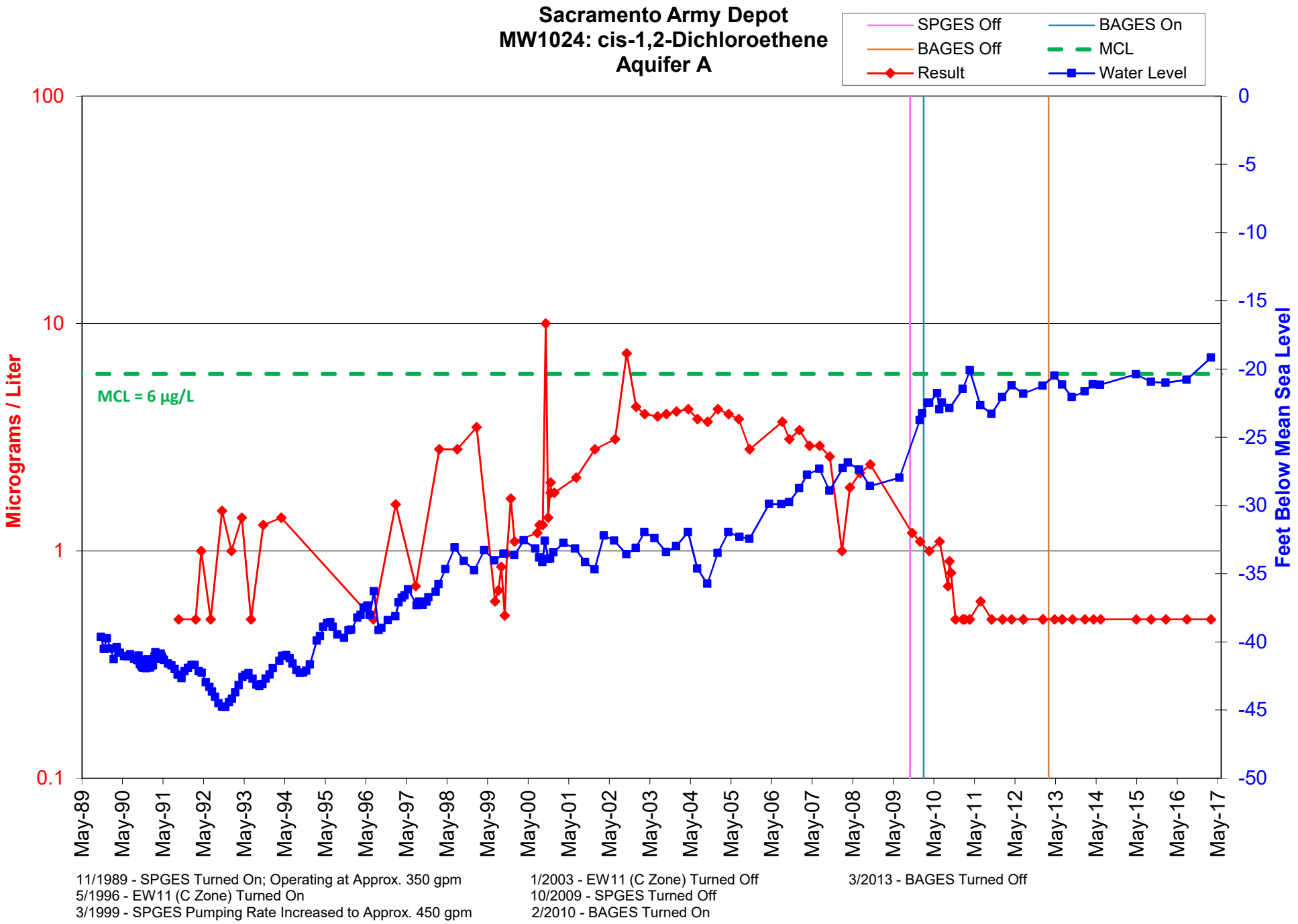

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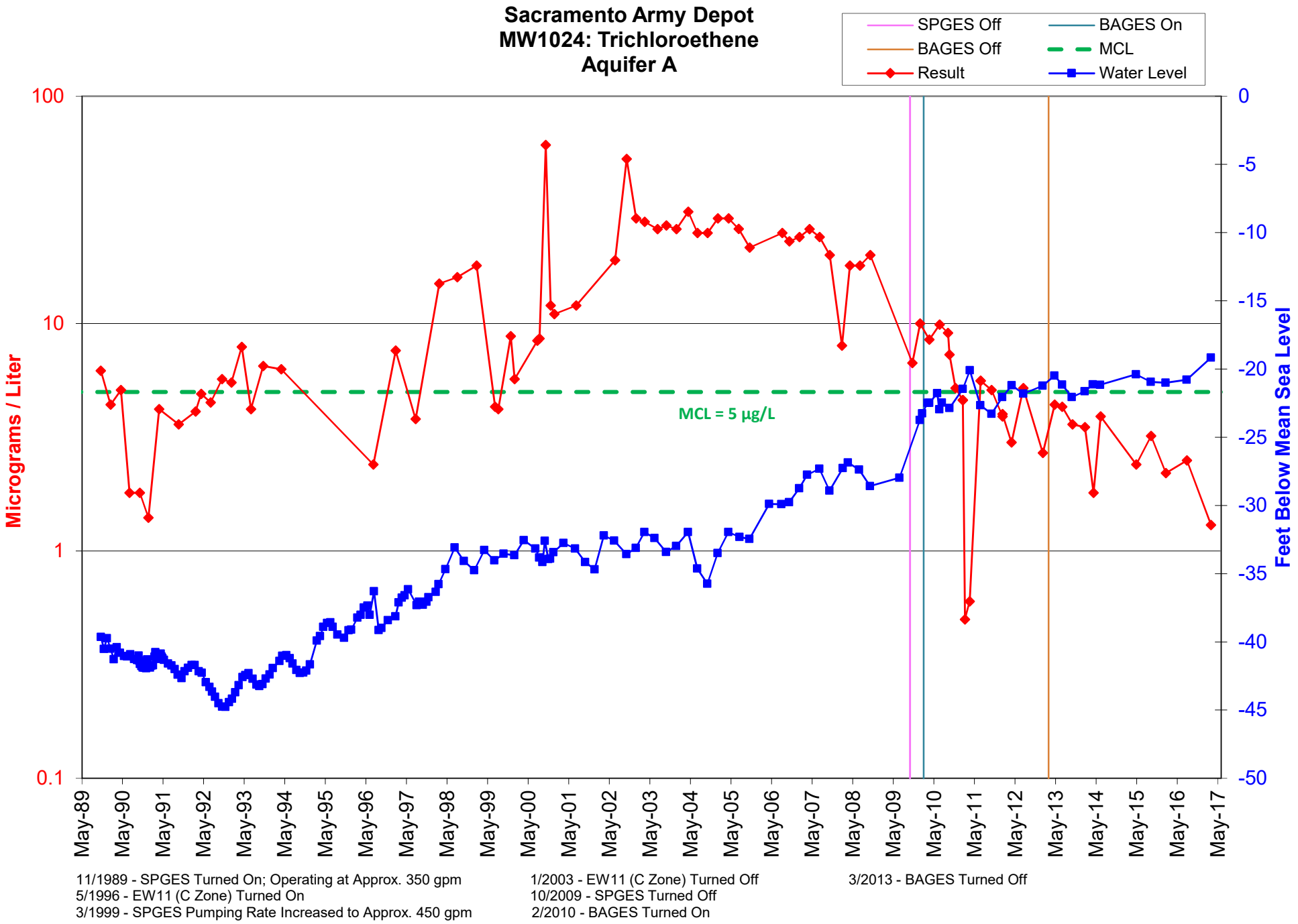

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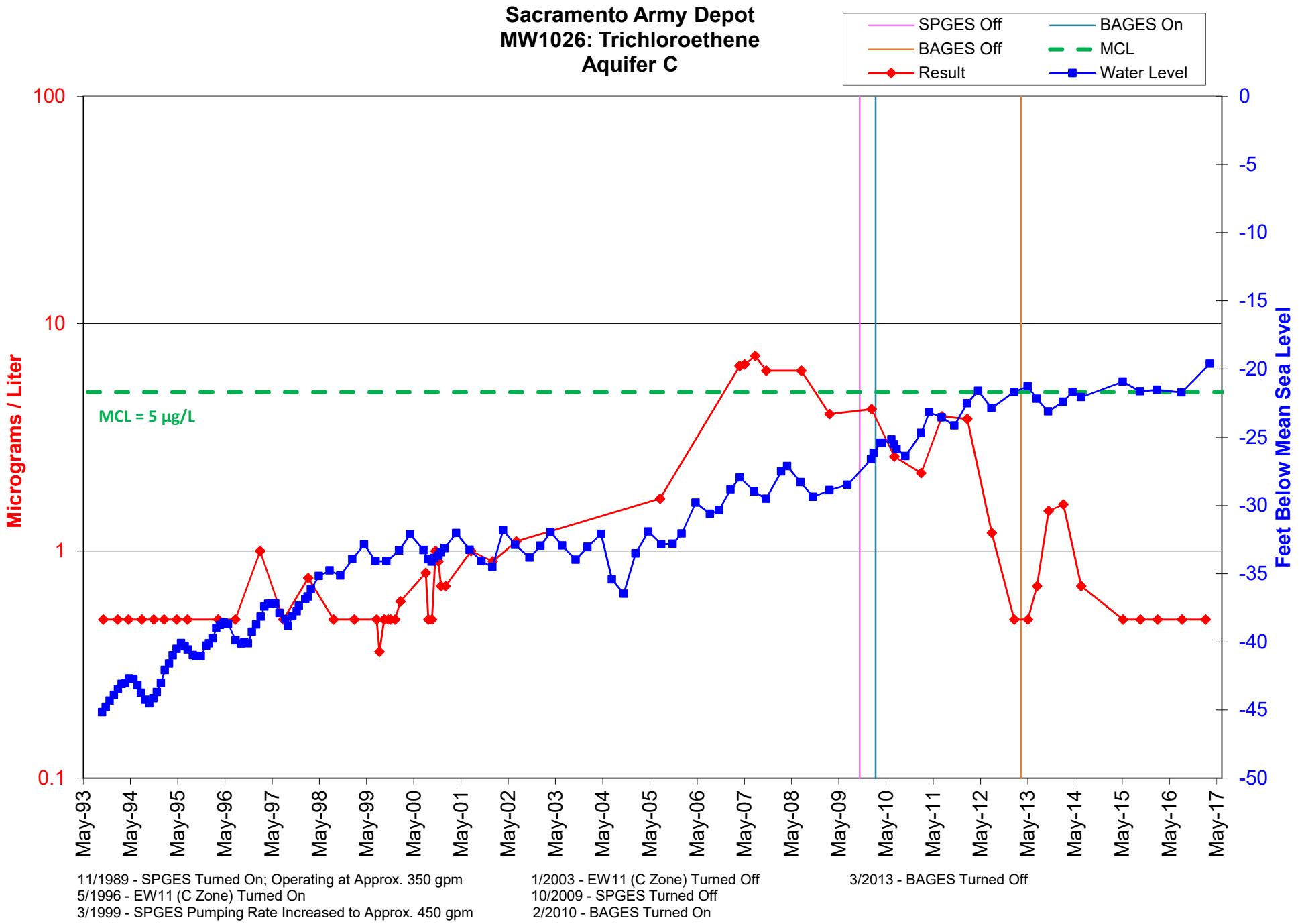
10/2009 - SPGES Turned Off
2/2010 - BAGES Turned On
3/2013 - BAGES Turned Off



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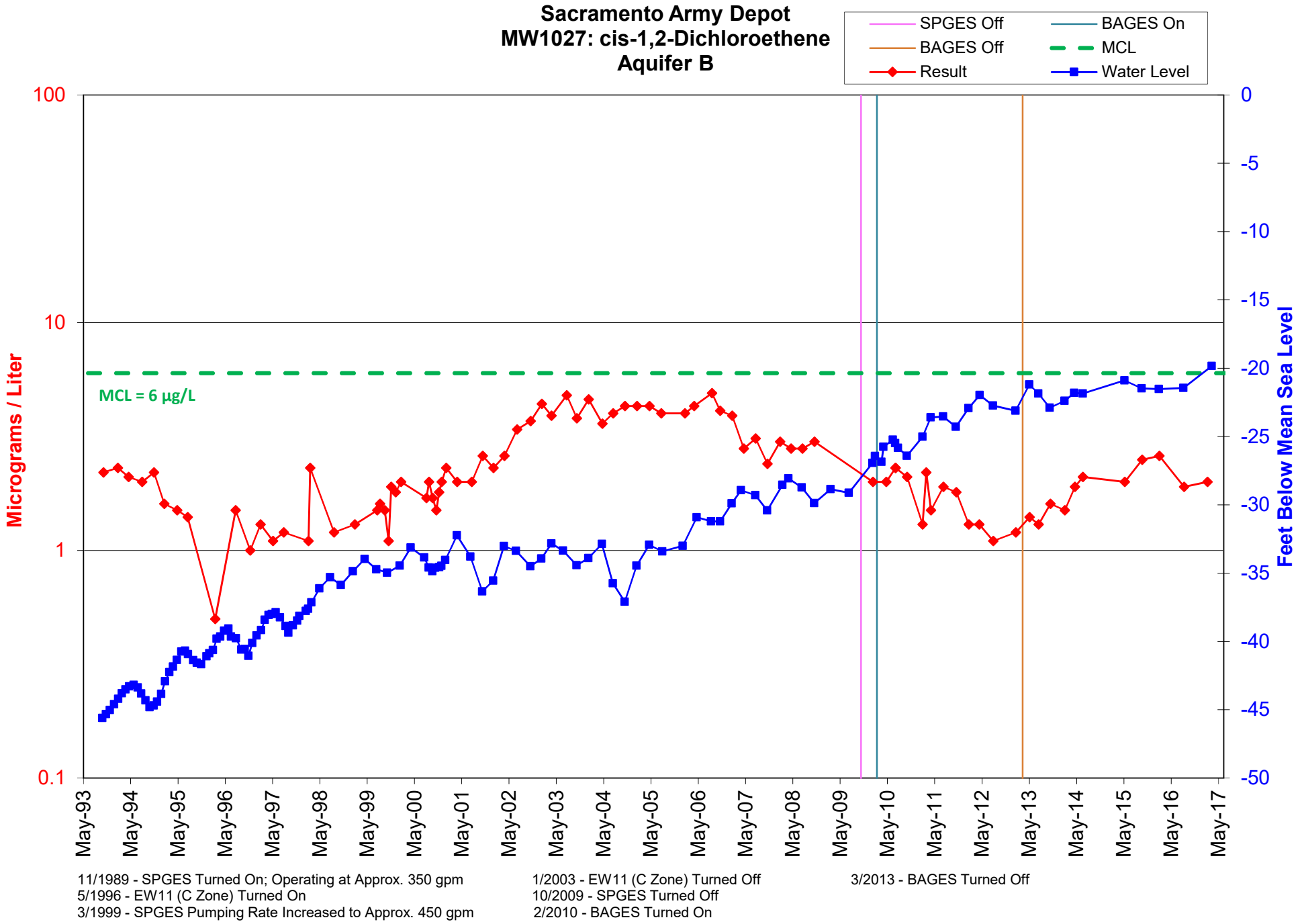
2/2010 - BAGES Turned On
3/2013 - BAGES Turned Off



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2/2010 - BAGES Turned On
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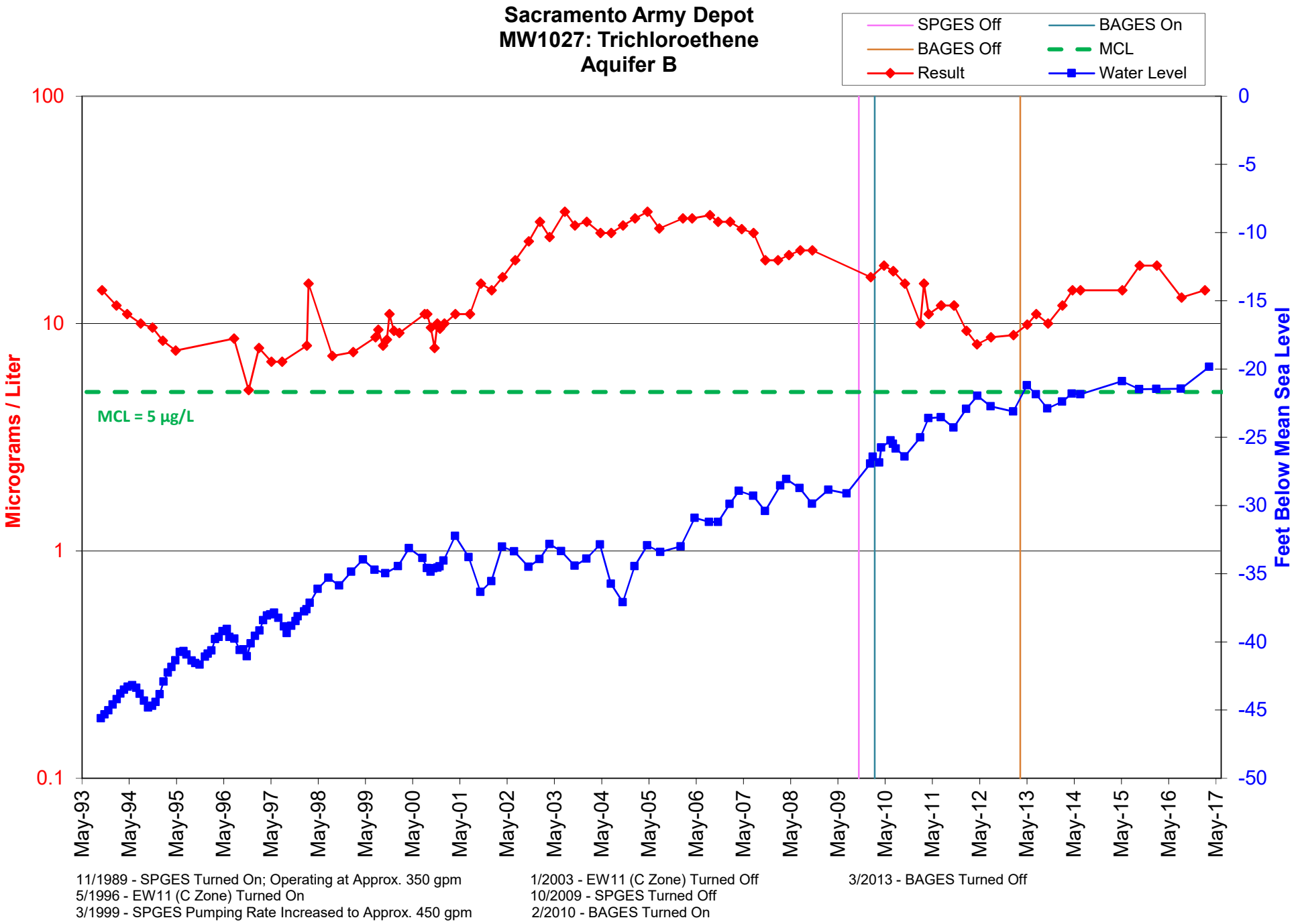

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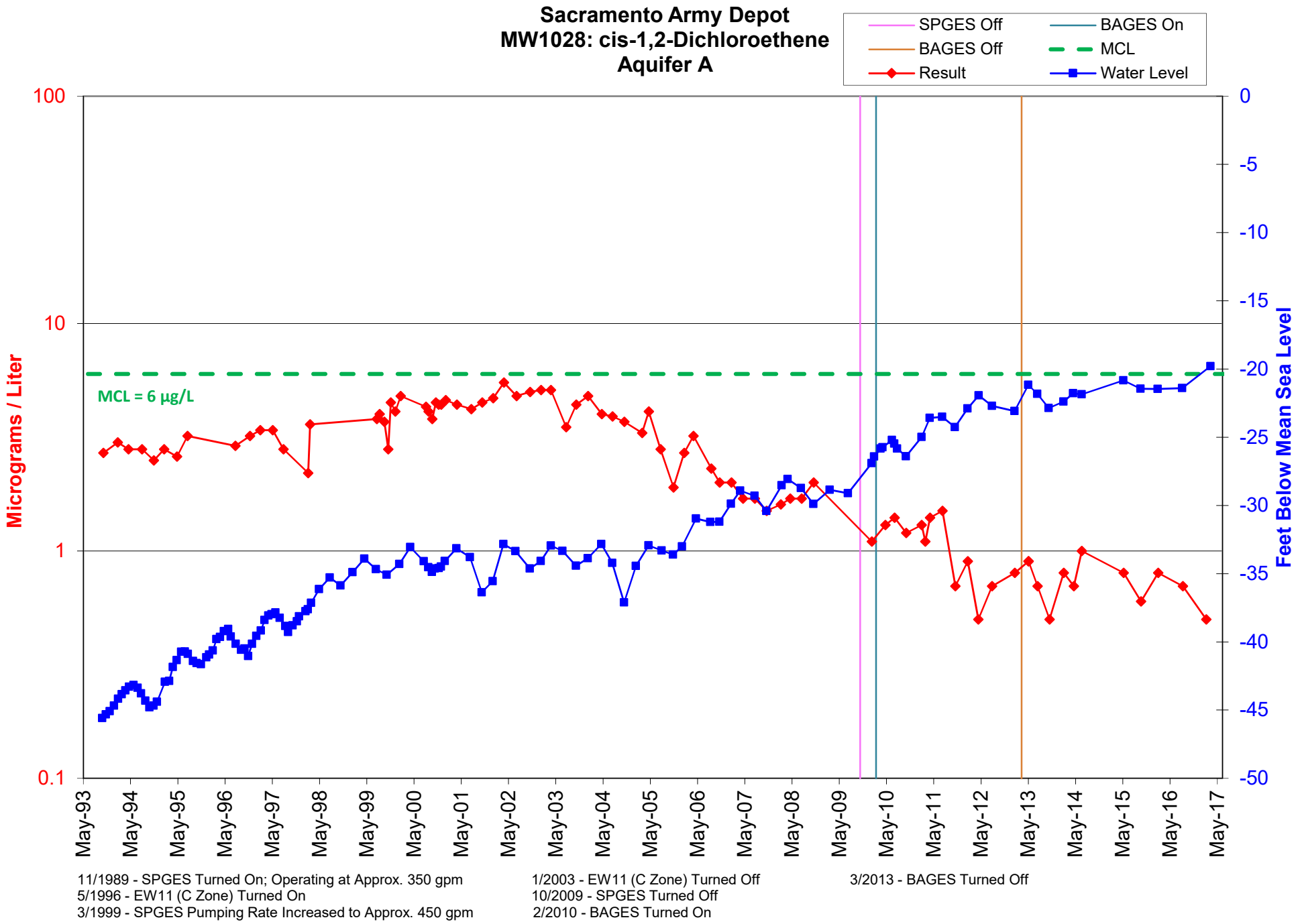
2/2010 - BAGES Turned On
3/2013 - BAGES Turned Off



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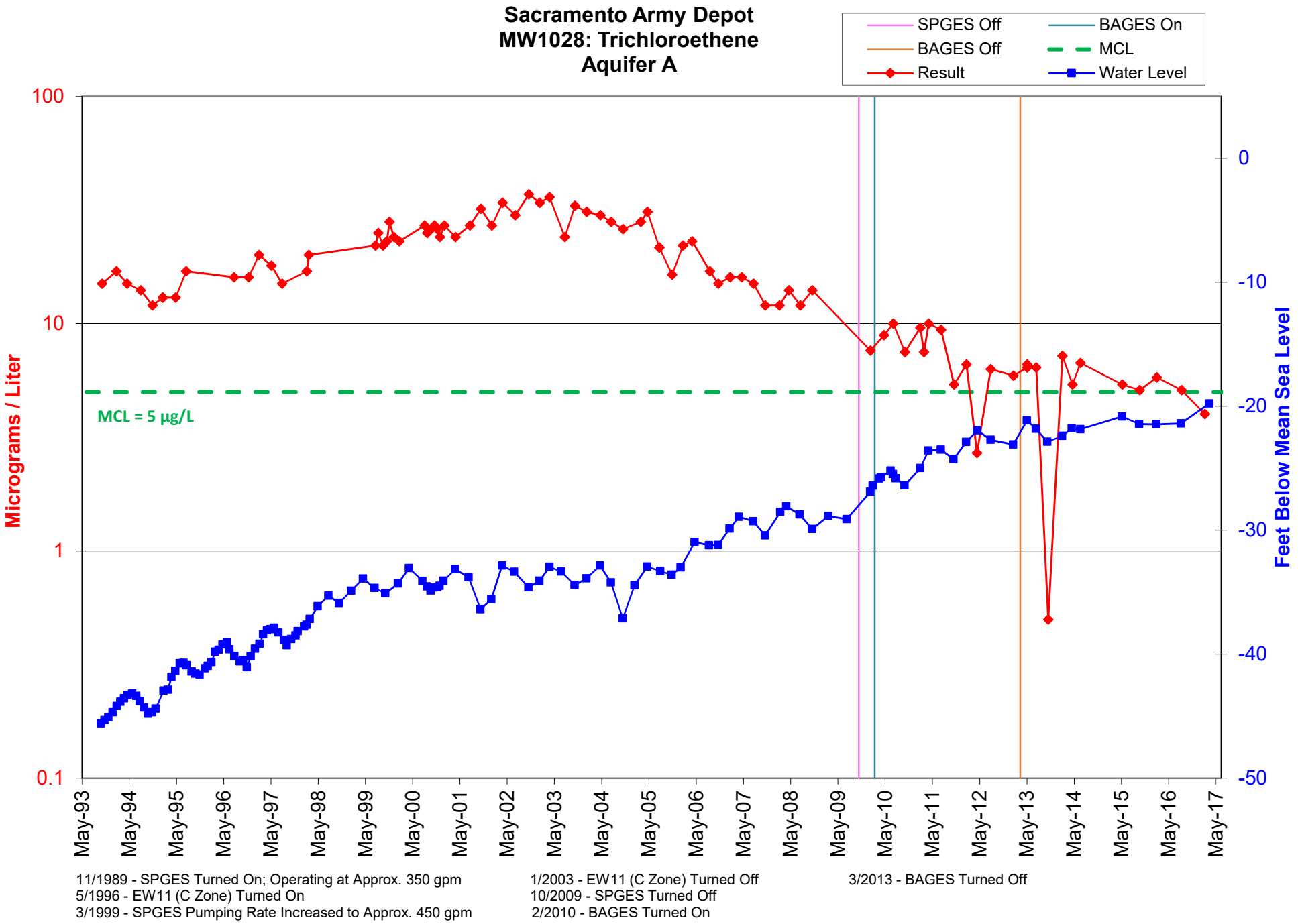

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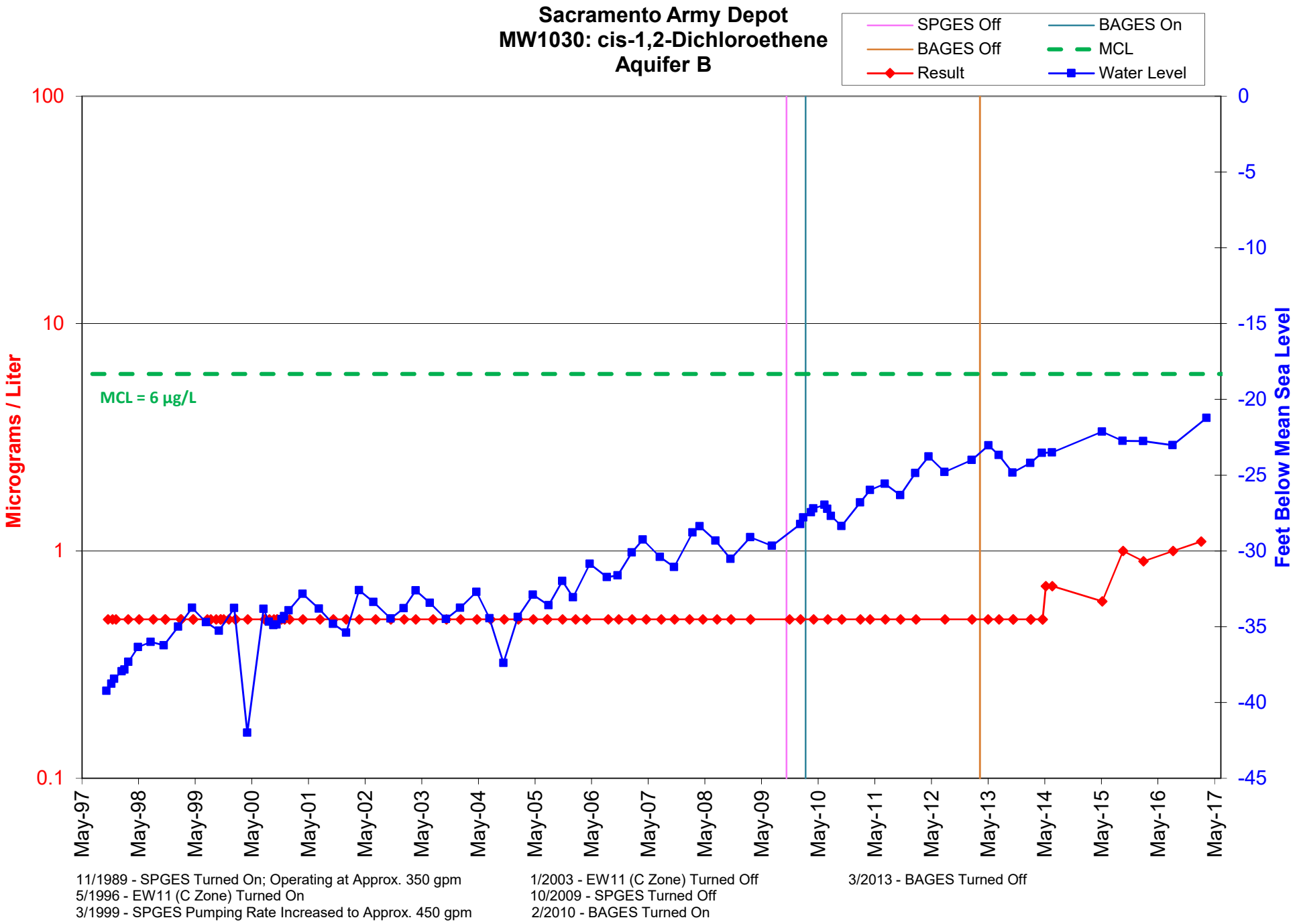
3/1999 - SPGES Pumping Rate Increased to Approx. 450 gpm
1/2003 - EW11 (C Zone) Turned Off
10/2009 - SPGES Turned Off
2/2010 - BAGES Turned On
3/2013 - BAGES Turned Off



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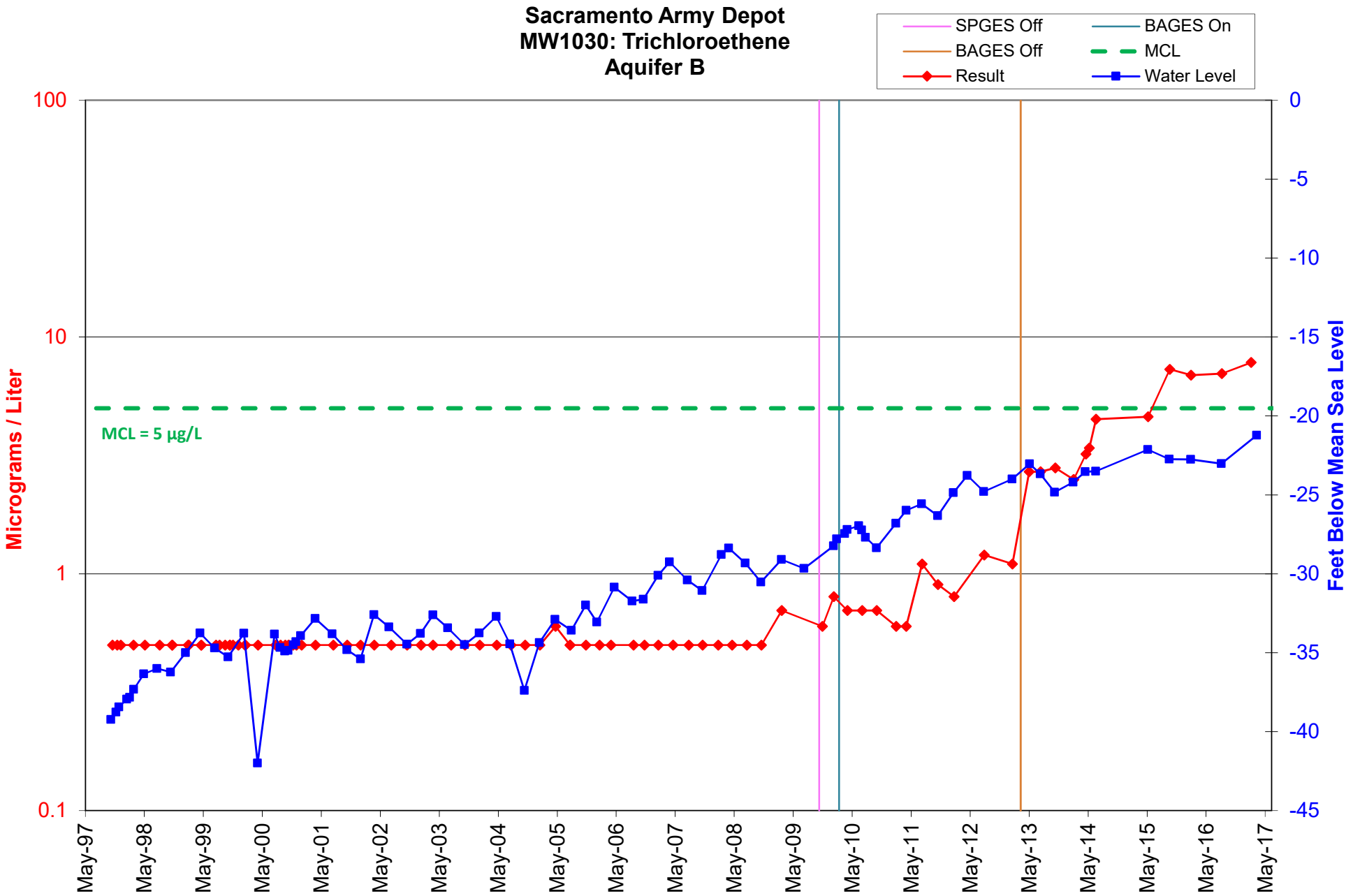
1/2003 - EW11 (C Zone) Turned Off
10/2009 - SPGES Turned Off
2/2010 - BAGES Turned On

3/2013 - BAGES Turned Off



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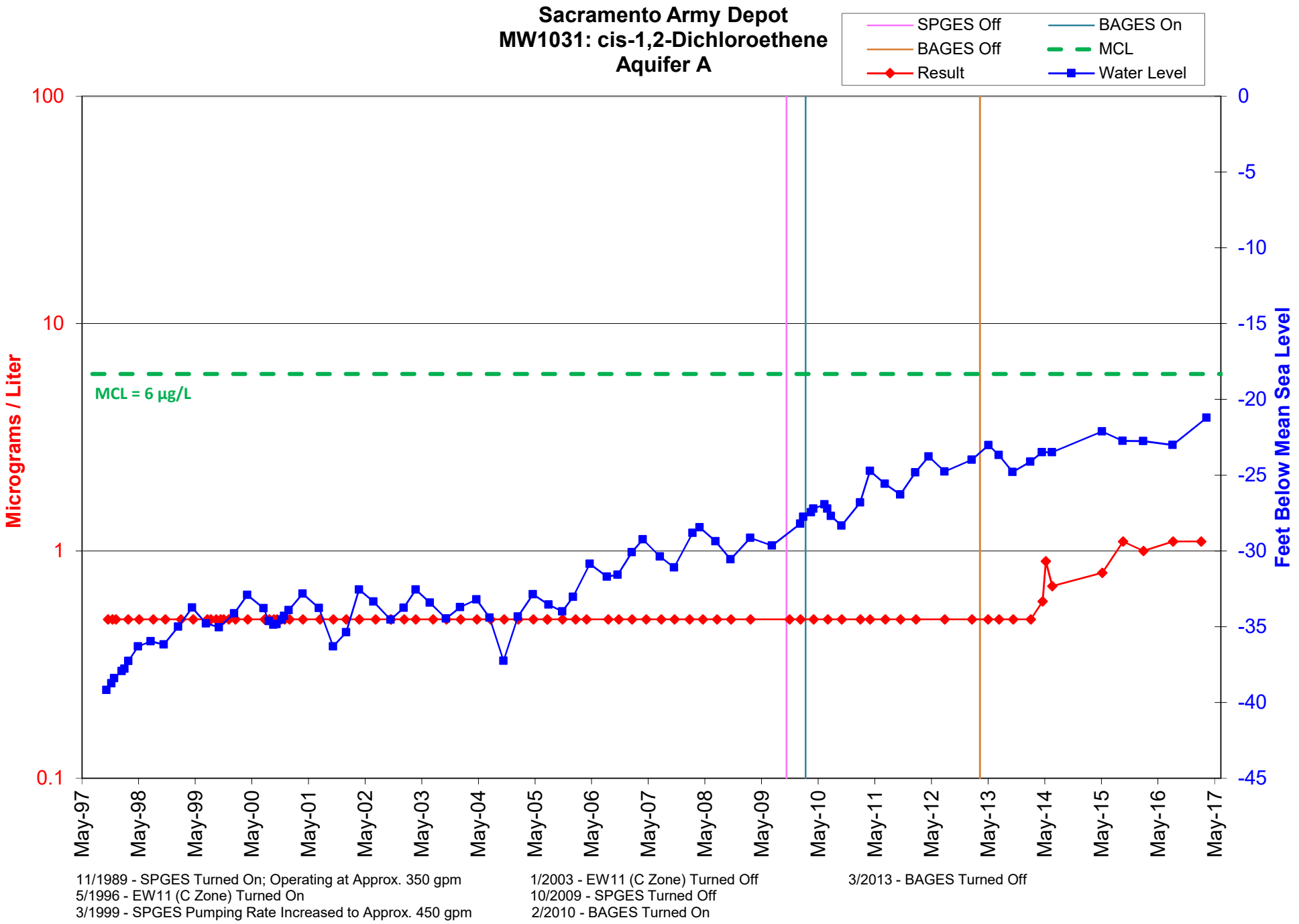

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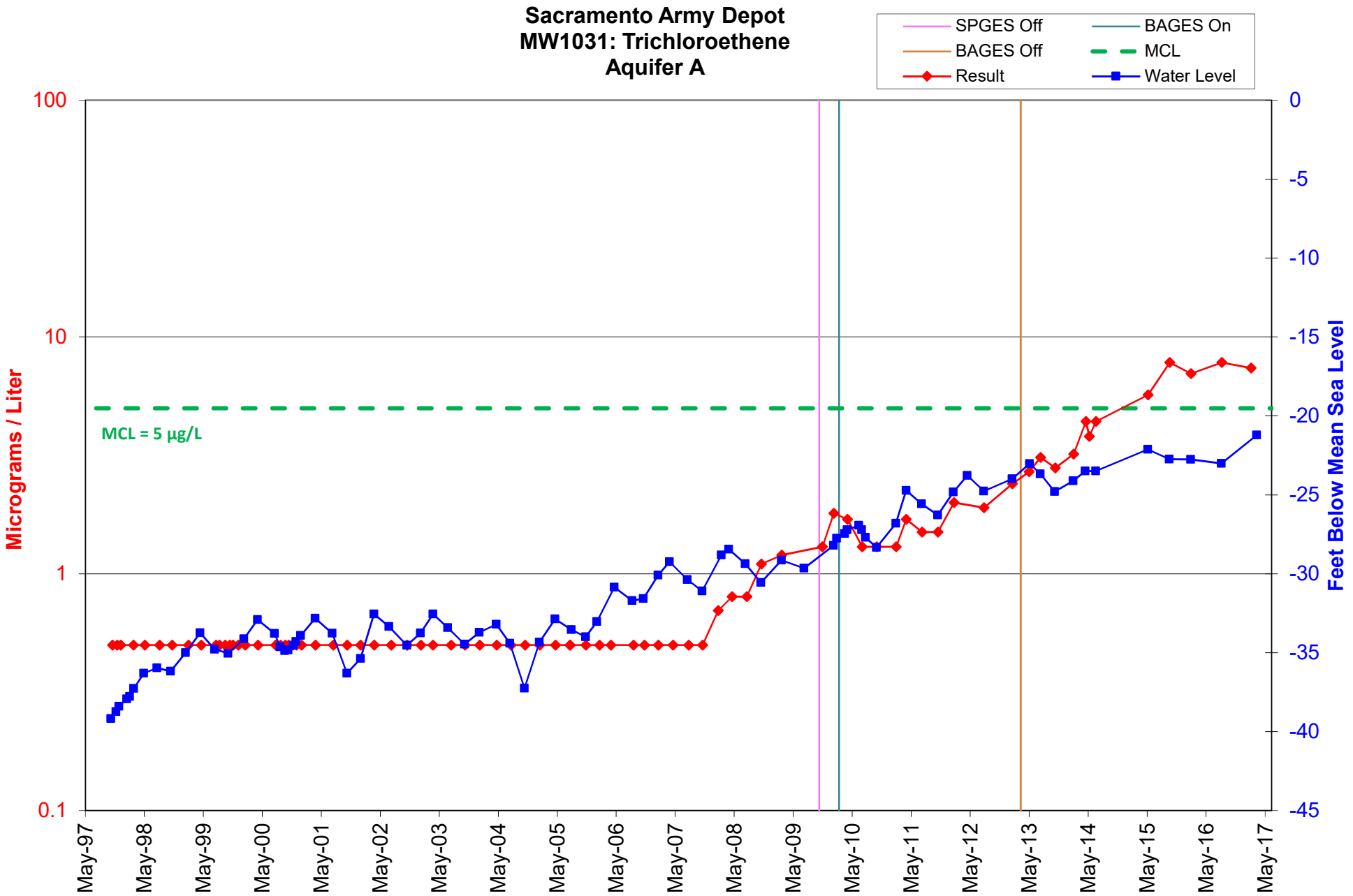

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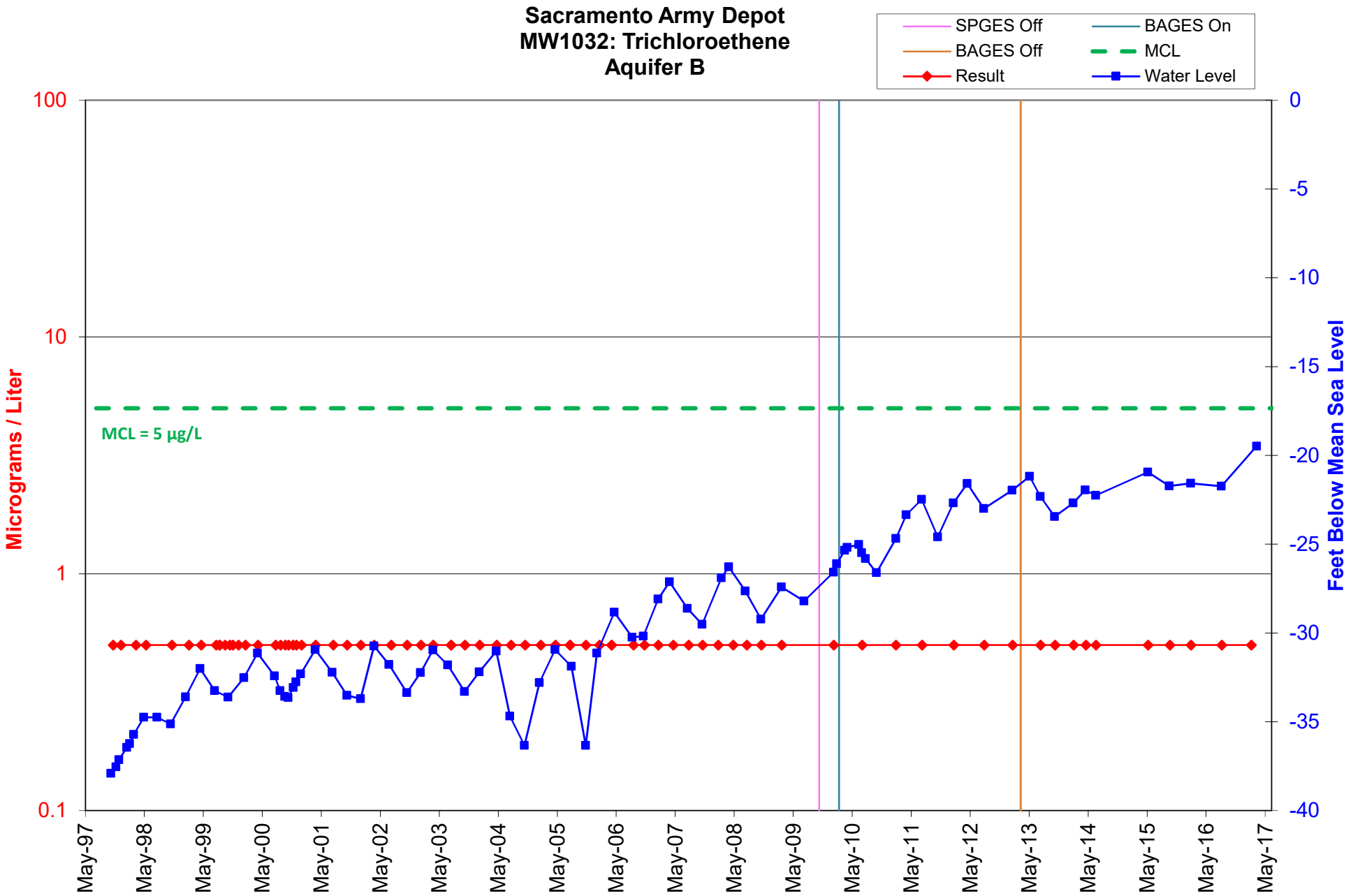

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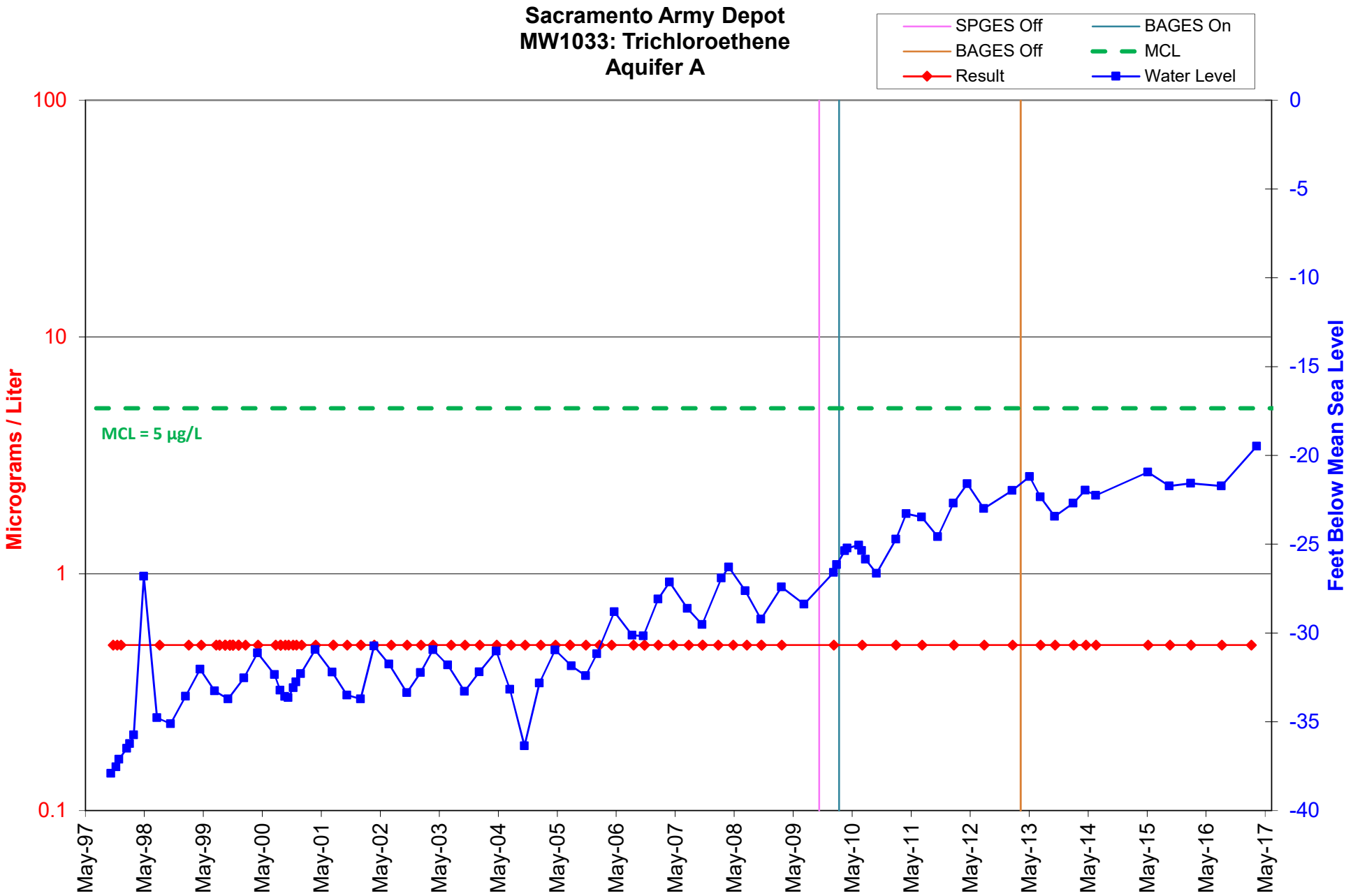

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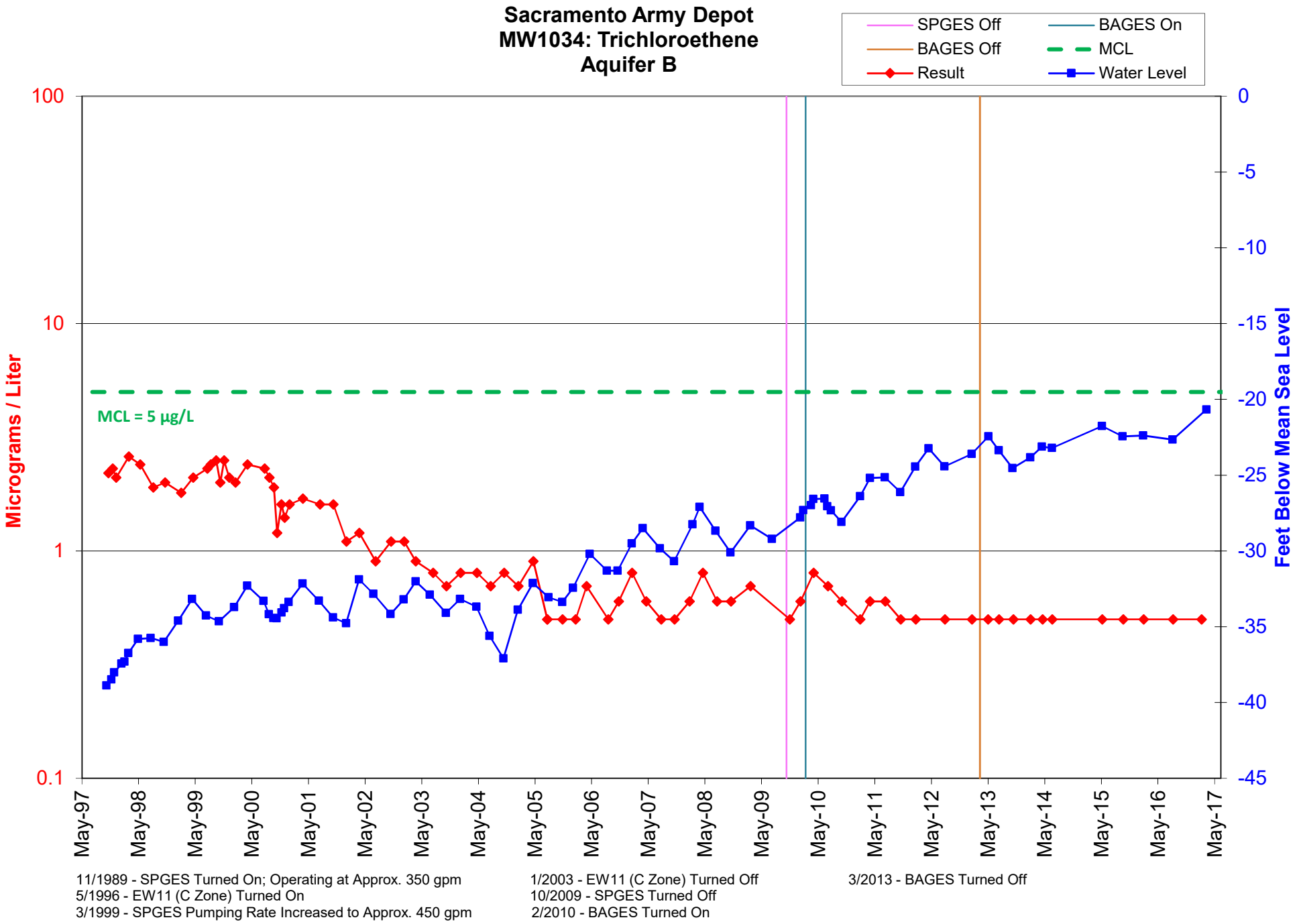

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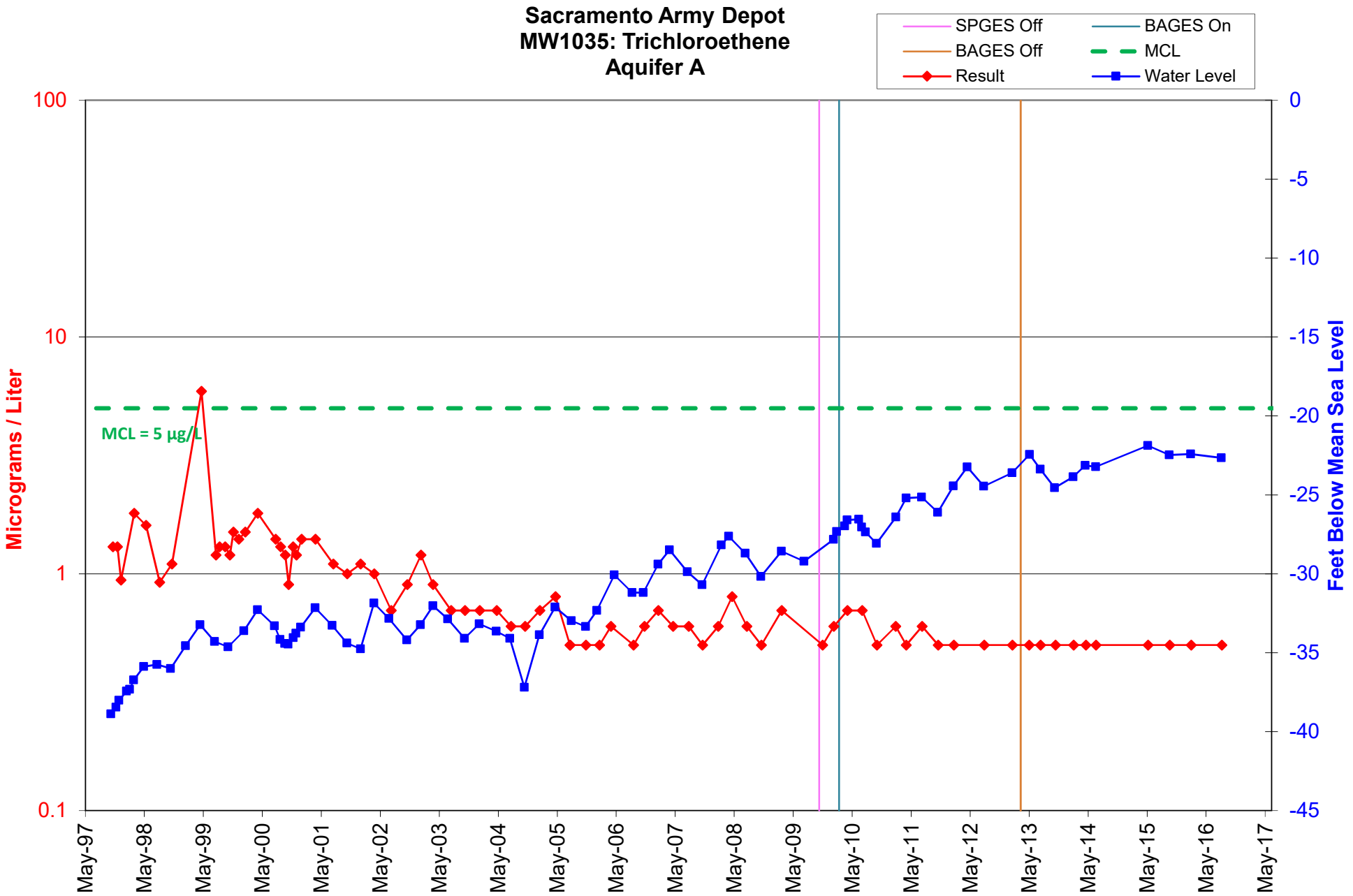

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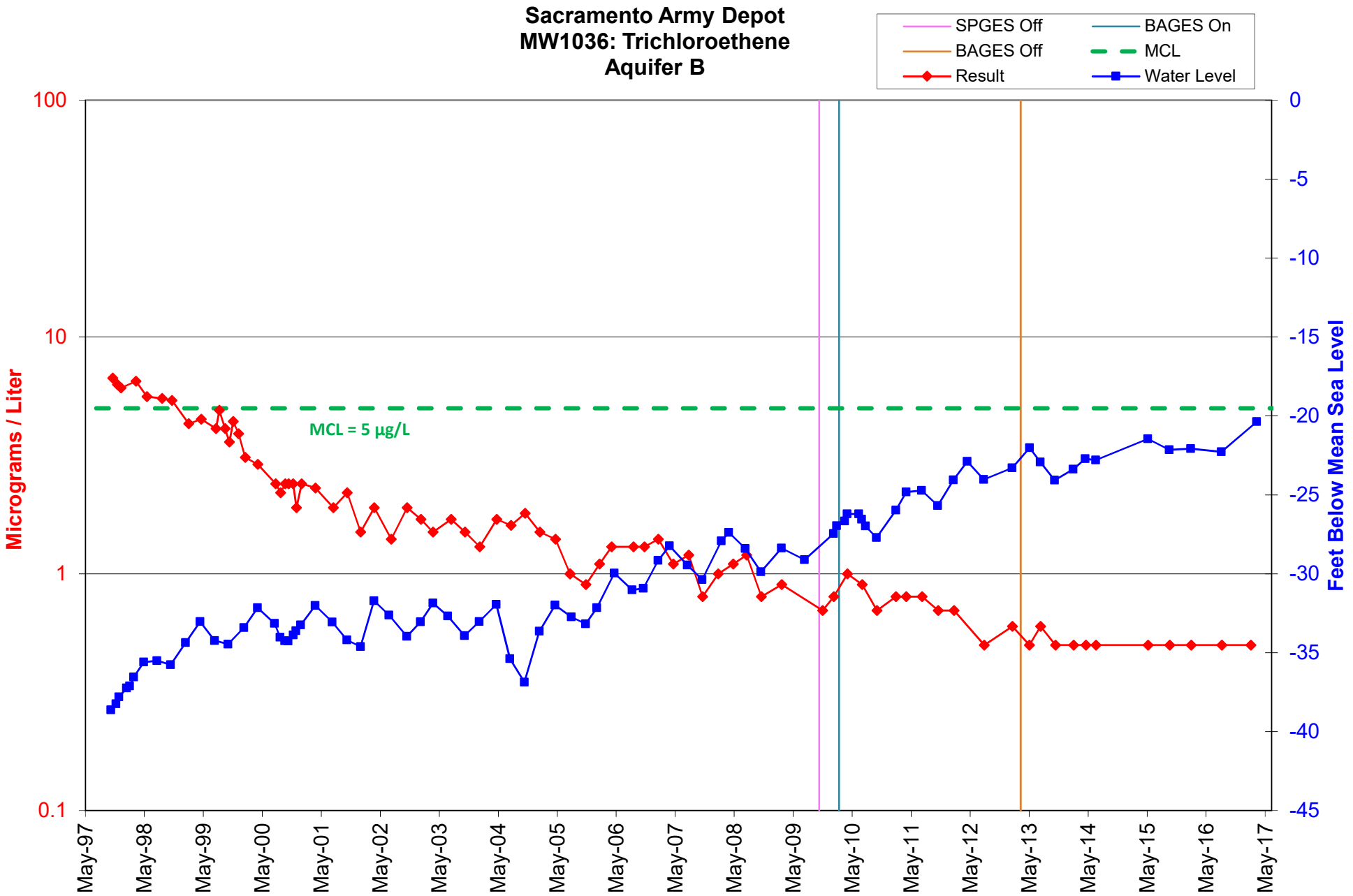

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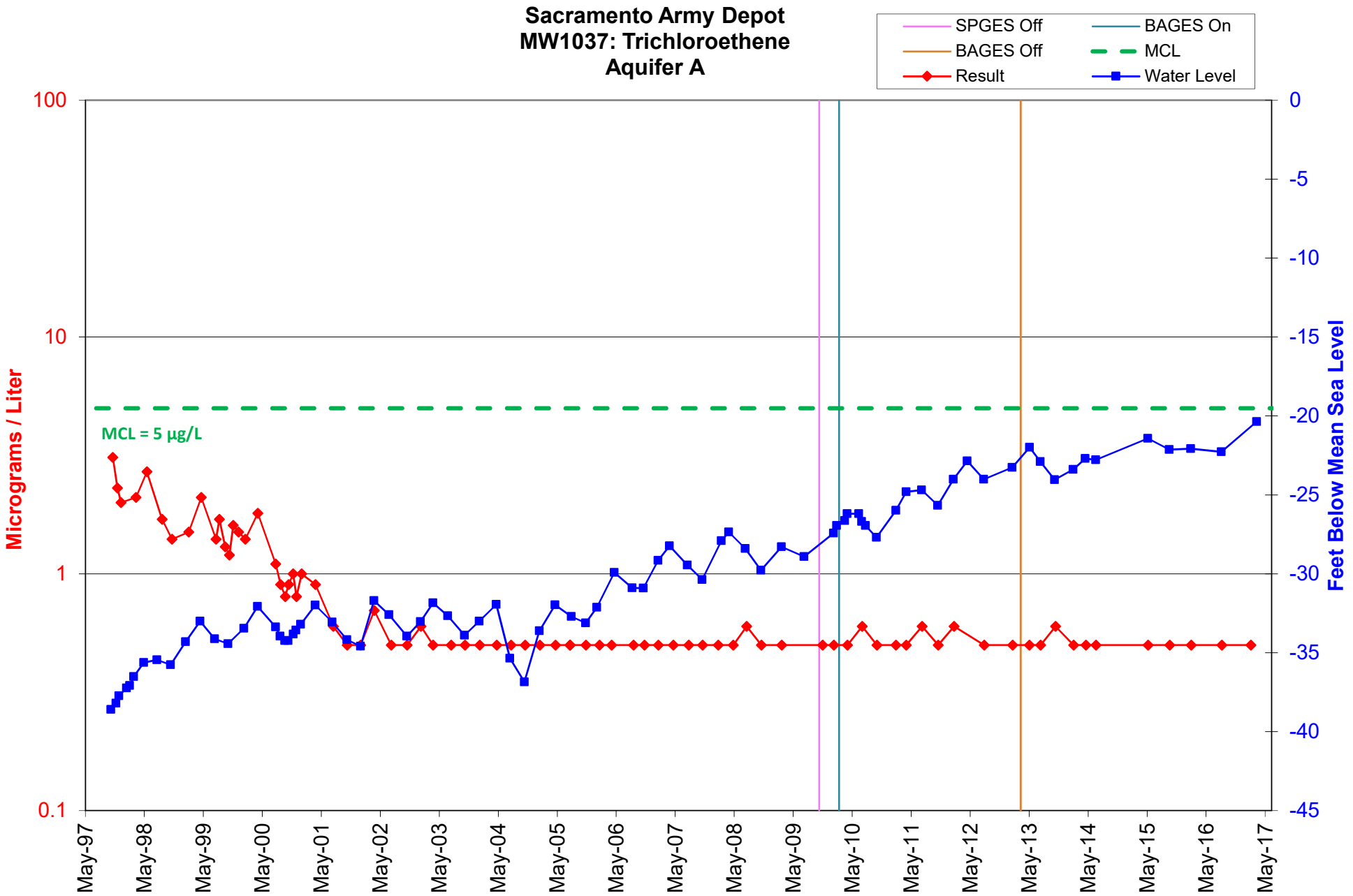

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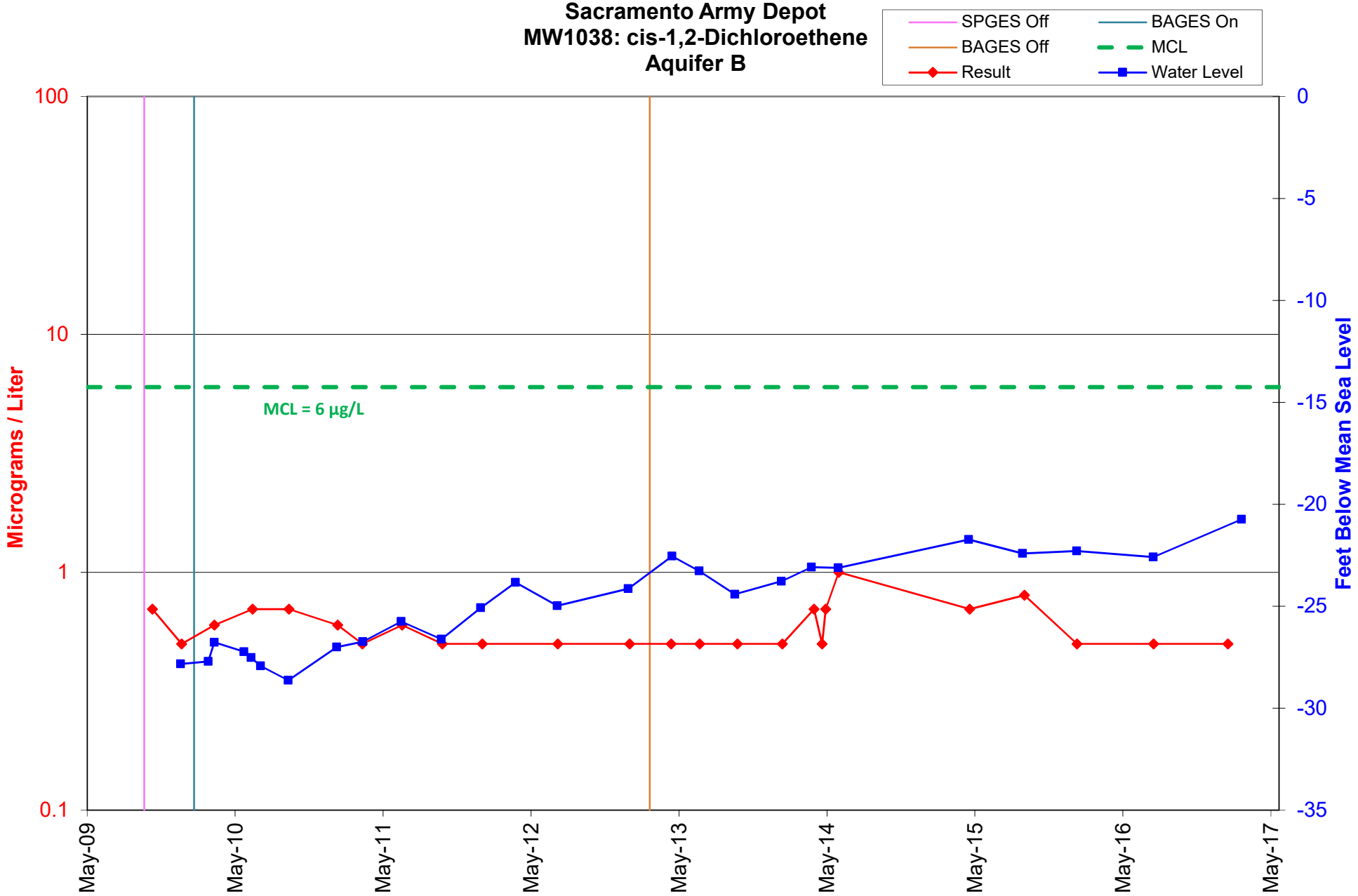
Sacramento Army Depot
MW1038: cis-1,2-Dichloroethene
Aquifer B



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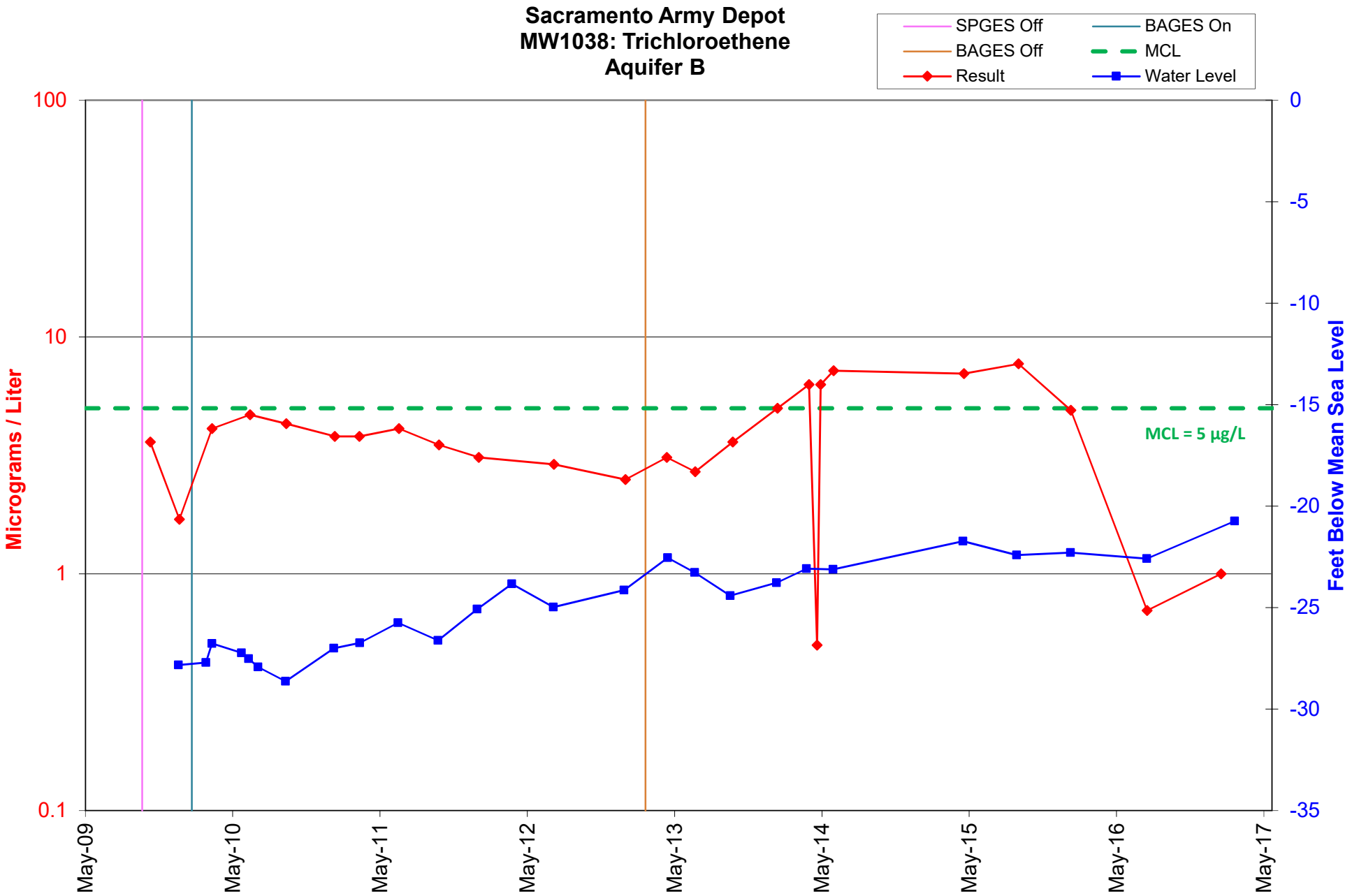

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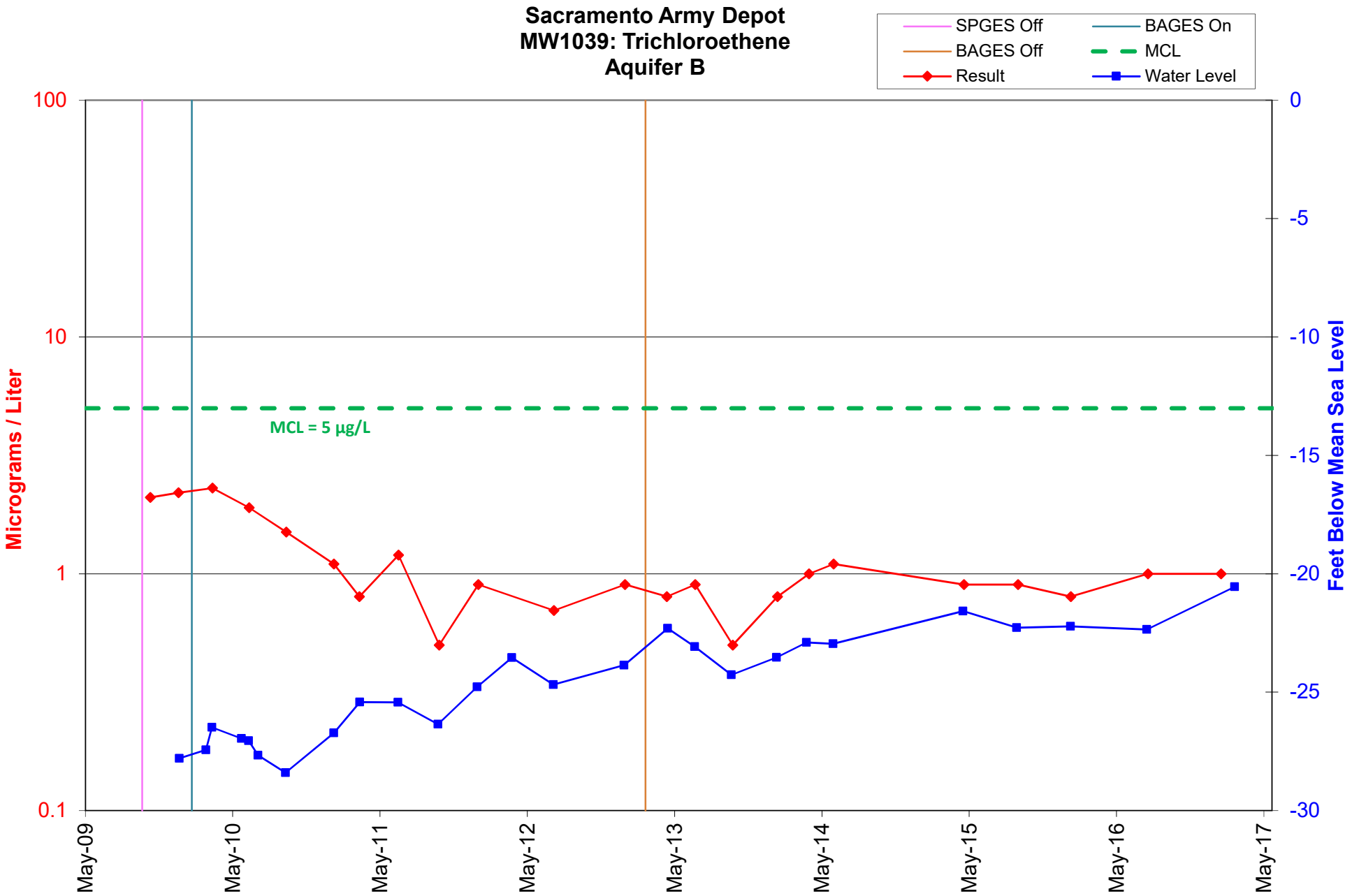

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2/2010 - BAGES Turned On

3/2013 - BAGES Turned Off

Appendix G
Site Inspection Checklist

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I. SITE INFORMATION	
Site name: Former Sacramento Army Depot	**Date of inspection: August 18, 2017**
Location and Region: Sacramento CA; Region 9	**EPA ID: CA0210020780**
Agency, office, or company leading the five-year review: ACSIM BRAC	**Weather/temperature: Hot, 90's, clear**

Remedy Includes: (Check all that apply)

- x Landfill cover/containment
- x Access controls
- x Institutional controls
- x Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other_____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____Robert Chambers_____ _____Technician _____ ___8/18/17_____
   Name Title Date
   Interviewed x at site ☐ at office ☐ by phone Phone no. 916-729-8981
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

   Agency ___see individual interviews__
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐ Report attached _____
   _____

   Agency _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐ Report attached _____
   _____

   Agency _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐ Report attached _____
   _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
x O&M manual x Readily available x Up to date ☐ N/A
☐ As-built drawings ☐ Readily available ☐ Up to date ☐ N/A
x Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A
Remarks: Documents located in file onsite. Verified applicability to current remedy and found acceptable.

2. **Site-Specific Health and Safety Plan** x Readily available x Up to date ☐ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A
Remarks: Updated in 2015 and verified for relevance. No changes required.

3. **O&M and OSHA Training Records** x Readily available x Up to date ☐ N/A
Remarks Located in office posted on wall
_____

4. **Permits and Service Agreements**
☐ Air discharge permit ☐ Readily available ☐ Up to date ☐ N/A
x Effluent discharge x Readily available x Up to date ☐ N/A
☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☐ N/A
☐ Other permits_____ ☐ Readily available ☐ Up to date ☐ N/A
Remarks: Effluent discharge permit with county has been updated in June 2017 and is being renewed.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date x N/A
Remarks_____
_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date x N/A
Remarks_____
_____

7. **Groundwater Monitoring Records** x Readily available x Up to date ☐ N/A
Remarks: Groundwater monitoring is conducted semi-annually and records are kept at the designated library.

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date x N/A
Remarks_____
_____

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☐ N/A
x Water (effluent) ☐ Readily available ☐ Up to date ☐ N/A
Remarks: Effluent discharge volumes reported monthly to County per permit requirements. Semi-annual concentration verification results are included in monitoring reports and provided to County.

10. **Daily Access/Security Logs** x Readily available x Up to date ☐ N/A
Remarks: Applicable to gated area and kept up to date in office.

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house x Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records**
☐ Readily available x Up to date
x Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A
Remarks: Fencing is in good condition and site secure.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks: Access controlled by fencing. Depot Park area has manned security gate. Army Reserve entrance has gate and signs. All closed gates are locked.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes x No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes x No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Inspections
Frequency: Annually
Responsible party/agency: Department of the Army, BRAC Division
Contact : Scott Armstrong; BRAC Environmental Coordinator; 8/18/2017; 916-261-4577
Name Title Date Phone no.

Reporting is up-to-date x Yes ☐ No ☐ N/A
Reports are verified by the lead agency x Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met x Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No x N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** x ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map x No vandalism evident
Remarks_____
_____

2. **Land use changes on site** x N/A
Remarks_____
_____

3. **Land use changes off site** x N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map x Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map x Settlement not evident
Areal extent_____ Depth_____
Remarks_____
_____

2. **Cracks** ☐ Location shown on site map x Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map Erosion not evident
Areal extent_____ Depth <8”
Remarks Slight erosion on eastern edge of cap. Erosion does not extend to a depth greater than 8 inches on average and does not breech cap.

4. **Holes** ☐ Location shown on site map x Holes not evident
Areal extent_____ Depth_____
Remarks_____
_____

5. **Vegetative Cover** ☐ Grass x Cover properly established x No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks: Landfill cover has native grasses and field vegetation. Root systems do not appear to be robust enough to influence integrity of cover.

6. **Alternative Cover (armored rock, concrete, etc.)** x N/A
Remarks_____
_____

7. **Bulges** ☐ Location shown on site map x Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

8.	**Wet Areas/Water Damage**	x Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Areal extent_____
	☐ Ponding	☐ Location shown on site map	Areal extent_____
	☐ Seeps	☐ Location shown on site map	Areal extent_____
	☐ Soft subgrade	☐ Location shown on site map	Areal extent_____
	Remarks_____		
9.	**Slope Instability**	☐ Slides ☐ Location shown on site map	x No evidence of slope instability
	Areal extent_____		
	Remarks_____		
B. Benches	☐ Applicable x N/A		
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	x N/A or okay
	Remarks_____		
2.	**Bench Breached**	☐ Location shown on site map	x N/A or okay
	Remarks_____		
3.	**Bench Overtopped**	☐ Location shown on site map	x N/A or okay
	Remarks_____		
C. Letdown Channels	☐ Applicable x N/A		
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement**	☐ Location shown on site map	x No evidence of settlement
	Areal extent_____	Depth_____	
	Remarks_____		
2.	**Material Degradation**	☐ Location shown on site map	x No evidence of degradation
	Material type_____	Areal extent_____	
	Remarks_____		
3.	**Erosion**	☐ Location shown on site map	x No evidence of erosion
	Areal extent_____	Depth_____	
	Remarks_____		

4. **Undercutting** ☐ Location shown on site map x No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ x No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable x N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
x N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance x N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance x N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
x Properly secured/locked x Functioning x Routinely sampled x Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed x N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable x N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable x N/A

1. **Outlet Pipes Inspected** ☐ Functioning x N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning x N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable x N/A

1. **Siltation** Areal extent_____ Depth_____ x N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning x N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning x N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable x N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable x N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable x N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES x Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines x Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
x Good condition x All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks: Pumps replaced in Berry Avenue extraction wells in June 2016

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
x Good condition☐ Needs Maintenance
Remarks: Pipelines and valves associated with the remedy are functioning as designed. Extraction well boxes are in acceptable condition for operation of the system.

3. **Spare Parts and Equipment**
x Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable x N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System x Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent)_____
☐ Others_____
☐ Good condition ☐ Needs Maintenance
x Sampling ports properly marked and functional
x Sampling/maintenance log displayed and up to date
x Equipment properly identified
x Quantity of groundwater treated annually: in monthly reports
☐ Quantity of surface water treated annually_____
Remarks_____
_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A x Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Tanks, Vaults, Storage Vessels**
x N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
Remarks_____

4. **Discharge Structure and Appurtenances**
☐ N/A x Good condition☐ Needs Maintenance
Remarks_____

5. **Treatment Building(s)**
☐ N/A x Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
x Properly secured/locked x Functioning x Routinely sampled ☐ Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: Several of the monitoring well boxes have been damaged. Damage has not affected the integrity of the well or the remedy. Repairs are being scheduled as soon as funding is available.

D. Monitoring Data

1. Monitoring Data
X Is routinely submitted on time x Is of acceptable quality

2. Monitoring data suggests:
x Groundwater plume is effectively contained x Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance x N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
The modified remedy includes long-term monitoring and contingency actions. It is effective and functioning as designed.

B. Adequacy of O&M

	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The current operations and monitoring program is adequate in maintaining the long-term protectiveness of the remedy. This is evident in the falling concentration trends observed in the monitoring wells located in the vicinity of the extraction wells and toe of the plume. Reduction of contaminants is expected to continue under the current operational scheme providing concurrence with the goals of the ROD.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None identified or expected.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Groundwater monitoring optimization will be evaluated during the development of the forthcoming groundwater monitoring plan amendment.

Appendix H
Site Photographs

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Berry Avenue Groundwater Extraction System (October 9, 2017)

Parking Lot 3 Groundwater Extraction System (October 9, 2017)
EW0008 (left) and EW0009 (right)

Corrective Action Management Unit (October 9, 2017)

Appendix I
Risk Assessment and Toxicology Evaluation

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Table I-1. Changes in Chemical-Specific Soil Standards

Contaminant	Clean-up Levels[3]	USEPA RSLs[1]		CHHSLs[2]	
		Residential	Industrial	Residential	Commercial/ Industrial
Arsenic	7.3 mg/kg[A]	0.68 mg/kg	3.0 mg/kg	0.07 mg/kg	0.24 mg/kg
Cadmium	88 mg/kg	71 mg/kg	980 mg/kg	1.7 mg/kg	7.5 mg/kg
Chromium (VI)	16 mg/kg	0.30 mg/kg	6.3 mg/kg	17 mg/kg	37 mg/kg
Total Chromium	112 mg/kg	Total chromium values no longer provided.			
Lead	500 mg/kg	400 mg/kg	800 mg/kg	80 mg/kg	320 mg/kg

1) United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) dated June 2017.
2) California Human Health Screening Levels (CHHSLs) dated January 2005; lead values revised in September 2009.
3) Clean-up levels established for the South Post Burn Pits.
A) Clean-up level based on background concentrations.
mg/kg = milligrams per kilogram

Table I-2. Changes in Chemical-Specific Groundwater Standards

Contaminant	Clean-up Levels[1]	California Maximum Contaminant Levels[2]
Carbon Tetrachloride	0.5 µg/L	0.5 µg/L
cis-1,2-Dichloroethene	6 µg/L	6 µg/L
1,2-Dichloroethane	0.5 µg/L	0.5 µg/L
trans-1,2-Dichloroethene	10 µg/L	10 µg/L
Tetrachloroethene	5 µg/L	5 µg/L
Trichloroethene	5 µg/L	5 µg/L

1) Clean-up levels established for the South Post Plume and the Parking Lot 3 Groundwater.
2) California Maximum Contaminant Levels dated July 2014.
mg/kg = milligrams per kilogram
µg/L = micrograms per Liter
µg/m^3 = micrograms per cubic meter

Table I-3. Direct Comparison Between 1993 Toxicity Values and June 2017 RSLs[1,2]

Chemical	Ingestion Exposure				Inhalation Exposure				Comment
	RfDo mg/kg/day		SFo (mg/kg-day)$^{-1}$		RfCi mg/m^3		IUR (μg/m^3)$^{-1}$		
	1993[A]	2017[B]	1993[A]	2017[B]	1993[A]	2017[B]	1993[A]	2017[B]	
Arsenic	0.0003	0.0003	1.75	1.5*	-	1.5E-5	15	0.0043*	
Cadmium	0.001	0.0005*	-	-	-	0.00001	15	0.0018*	
Carbon Tetrachloride	0.0007	0.004**	0.15	0.07*	0.00057	0.1*	0.15	6E-6*	No change to the MCL.
Chromium (total)	1	-	-	-	-	-	-	-	The remedy assumed all chromium was in the VI valence state.
Chromium VI	0.005	0.003*	0.42	0.5**	-	0.0001	510	0.084*	
cis-1,2-Dichloroethene	0.01	0.002*	-	-	0.01	-	-		No change to the MCL.
1,2-Dichloroethane	-	0.006	0.09	0.091**	-	0.007**	0.09	2.6E-5*	No change to the MCL.
Lead	-	-	-	-	-	-	-	-	Lead is evaluated separately.
Tetrachloroethene	0.01	0.006*	0.05	0.0021*	0.01	0.04**	0.05	2.6E-7*	No change to the MCL.
trans-1,2-Dichloroethene	0.01	0.02**	-	-	0.01	0.06**	-	-	No change to the MCL.
Trichloroethene	0.006	0.0005**	0.015	0.0059*	0.006	0.002*	0.01	4.1E-6*	No change to the MCL.

1) – The non-carcinogens' reference dose values for oral (RfDo) and inhalation (RfDi) pathways of exposure and the oral and inhalation cancer potency factors (SFo and SFi, respectively) are listed.
2) – Potentially significant changes are shaded.
A) – From Table 4-2 of "*Basewide Human Health Risk Assessment*" (Kleinfelder, 1994).
B) – Toxicity values as they appear on the United States Environmental Protection Agency Regional Screening Level Table dated June 2017.
*Changes in toxicity values indicate an increase in estimated risks or hazards.
**Changes in toxicity values indicate a decrease in estimated risks or hazards.
MCL – Maximum Contaminant Level
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meter
μg/m^3 – micrograms per cubic meter
IUR – Inhalation Unit Risk

Appendix J
Vapor Intrusion Screening for the South Post Plume

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VAPOR INTRUSION SCREENING FOR THE SOUTH POST PLUME

This attachment was originally prepared at the request of the U.S. Environmental Protection Agency (USEPA) for the Third Five-Year Review to address the vapor intrusion (VI) screening process for the South Post Plume, Question B, "Are the exposure assumptions, toxicity data, clean-up levels and remedial action objectives used at the time of the remedy selection still valid?"

Since the fourth five-year review conducted in 2012, potential VI issues have continued to have visibility across the nation, and when conducting a risk assessment, should be considered as a possible exposure pathway posed by releases of hazardous chemicals into the environment. Vapor intrusion is not recognized as an Applicable or Relevant and Appropriate Requirement (ARAR) in the 1995 Basewide Record of Decision (ROD) for the former Sacramento Army Depot (SAAD); however, in an effort to address this continually evolving issue, the Army conducted a screening level investigation to determine if VI was a viable exposure pathway groundwater contamination associated with the South Post Plume.

The Army thoroughly reviewed USEPA guidance, the California Department of Toxic Substances Control (DTSC) guidance, Army guidance, and the Johnson & Ettinger (J&E) model, and utilized the DTSC automated screening tool (automated excel spreadsheet; last revised in 2014) to evaluate VI risk associated with contaminated groundwater in the South Post Plume at SAAD.

The following sections address general site conditions, process, data, tools used, and results of this VI screening.

Site Background/Hydrogeology

SAAD is located in the Central Valley of California, and overlies a thick sequence of alluvial sediments consisting of silt, sand, gravel, and hardpans. These sediments are laterally and vertically discontinuous. In general, the shallow site soil has moderate to very low permeability. The water-bearing zones beneath SAAD are composed of a series of sand, silty sand, and sandy silt units. These units have been grouped into three general water-bearing zones, informally designated as the "A/B," "C," and "D" aquifer zones. The A/B aquifer zone consists of the upper A and the lower B aquifer zones which are commonly interconnected. The vadose zone above the shallowest water-bearing zone and the aquitard between the water-bearing zones consist primarily of silt, silty clay, and clay. The approximate depths of the primary water-bearing zones from ground surface are presented in **Table J-1**.

Table J-1 – Aquifer Zone Depth Interval Summary

Aquifer Zone	Depth Interval (feet below ground surface)
A/B	79 to 148
C	156 to 188
D	195 to 230

The three aquifer zones can be subdivided into two depositional regimes. The upper regime comprising the A/B aquifer zone is heterogeneous, and laterally and vertically discontinuous.

This regime is composed of silt with interbedded fine-grained arkosic sand lenses. The lower regime is composed of laterally continuous units comprising two distinct water-bearing zones: aquifer zone C and aquifer zone D. These two zones are typically highly productive, consisting of fine- to coarse- grained, moderately graded sand interbedded with silt and clay.

For the assessment, the area of concern deals specifically with the geology in the vadose zone. A fence diagram and real-time data from a previous Cone Penetrometer Test (CPT) were provided in the Third Five-Year Review as further reference to the geological conditions in the area specific to the South Post Plume. The CPT data was collected from a sample location approximately 75 feet to the south of MW1025. In general, there was evidence that clay, silt, and sand layers were continuous (when depths are corrected for elevation) at elevations that were comparable to layers and elevations found in boring logs for the following monitoring well clusters: MW1025 through MW1028, MW1021 through MW1024, and MW1036/MW1037.

Vapor Intrusion Screening

During the original assessment, the Army utilized the DTSC screening guidelines, "*Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*" (Revised February 2005), to analyze the risk associated with possible VI via contaminated groundwater under the Federal Express (FedEx) property. Since the time of this original assessment, the DTSC has published a new final guidance document (October 2011).

Both documents recommend the following step-wise approach for the evaluation of VI. For sites with existing buildings, Steps 1 through 11 apply. For sites with proposed buildings, Steps 1, 2, 3, 5, 6, 7, and 11 apply.

Step 1 – Identify the spill(s) or release(s).

Step 2 – Characterize the site.

Step 3 – Identify the site as one where VI into indoor air may represent a complete exposure pathway (volatile organic compounds [VOCs] are detected in the subsurface).

Step 4 – For an existing building, identify whether an imminent hazard exists from vapors migrating into indoor air. If none exists,

Step 5 – Perform a screening evaluation using the provided default vapor attenuation factors. If a potential risk exists,

Step 6 – Collect additional site data.

Step 7 – Perform a modeling evaluation using site-specific physical parameters and building parameters as appropriate. If the calculated risk is still significant,

Step 8 – For an existing building, prepare an indoor air sampling work plan, which includes an assessment of the utility corridors and the development of a contingency plan for appropriate response actions. Also, conduct appropriate public outreach with the affected community.

Step 9 – For an existing building, conduct indoor air sampling.

Step 10 – For an existing building, evaluate the data to determine if the indoor air concentrations are acceptable. If they are not,

Step 11a – For an existing building, mitigate indoor air exposure, implement engineering

controls, and remediate the VOC contamination as appropriate.

Step 11b – If no building exists on the site, and the calculated risk is significant, remediate subsurface VOC contamination or implement institutional measures to assure that engineering controls are installed in any future buildings.

Step 11c – For both circumstances, institute long-term monitoring at the site.

The DTSC has also published a decision tree for use when screening a site for VI concerns. The decision tree mirrors the steps outlined above, but only steps 1 through 5 are necessary to complete the screening process at SAAD. To completely assess the possibility of VI in Step 5, the Army utilized the 2014 DTSC EXCEL™ screening tool based on calculations from the J&E model. DTSC guidance provides the following summary of this screening method:

"Fate and transport models can assist in evaluating the degradation of indoor air quality due to the intrusion of subsurface volatile contaminants. When used in combination with site-specific information, the results of modeling will add to the overall weight of evidence used to evaluate the exposure pathway. The Johnson and Ettinger (1991) model (J/E) is one of the most commonly used models for evaluating the indoor air exposure pathway. DTSC has selected the J/E model as the recommended approach to evaluate the vapor intrusion pathway in California. USEPA programmed the J/E model into Microsoft EXCEL™ and added a health risk component that calculates the risk from inhaling the specific chemical at the concentration estimated in indoor air."

DTSC guidance also describes usage of the J&E model:

"The J/E model is a simple, deterministic model, having single-point inputs and outputs. The J/E model is based on the basic principles of contaminant fate and transport, contaminant partitioning between media, and the physical and chemical properties of the contaminants themselves. The model incorporates both diffusion and advection as mechanisms of transport of subsurface vapor into the indoor air environment."

The Army utilized the automated DTSC 2014 EXCEL™ spreadsheet model to screen for VI risk related to buildings on the FedEx property directly above the South Post Plume. Using site-specific inputs,

"the J/E model can allow users to quickly screen sites for VI risk. The output of the J/E model is the dimensionless attenuation factor "alpha" State of California DTSC / Cal – EPA Vapor Intrusion Guidance Document – Final, October 2011 (α) that represents the ratio of the indoor air concentration to the vapor concentration at a subsurface source. Using the attenuation factor and the appropriate target indoor air concentrations, contaminant concentrations in soil gas and groundwater that are protective of human health can be calculated, and these calculated values can be used as site cleanup goals."

Finally, the guidance notes the following when screening for VI risk:

"DTSC recommends the use of a two-phased approach in evaluating the vapor intrusion at a facility. A phase approach ensures that simple cases can be evaluated relatively quickly with minimal resources. The first phase of the evaluation utilizes default attenuation factors to quickly quantify the risk for vapor intrusion (Step 5)… If the preliminary screening demonstrates that the risk associated with vapor intrusion is acceptable, no further evaluation for the exposure pathway is warranted."

Using the DTSC *Screening-Level Model for Groundwater Contamination* (updated March 2014), available at*:* http://dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm, the DTSC decision tree, and site-specific data, the Army concluded:

Step 1 – Identify the spill(s) or release(s): The releases are well documented and covered in this document and previous documents. Trichloroethene (TCE) contamination in groundwater is the main contaminant of concern (COC) at SAAD.

Step 2 – Characterize the site: The site is fully characterized and six COCs were identified: TCE, tetrachloroethene (PCE), carbon tetrachloride (CT), cis-1,2-dichloroethene (cDCE), trans-1,2-dichloroethene (tDCE), and 1,2-dichloroethane (1,2-DCA).

Step 3 – Identify the site as one where vapor intrusion into indoor air may represent a complete exposure pathway (VOCs are detected in the subsurface): The site may represent a complete exposure pathway.

Step 4 – For an existing building, identify whether an imminent hazard exists from vapors migrating into indoor air. If none exists: No imminent hazard exists at this site.

Step 5 – Perform a screening evaluation using the provided default vapor attenuation factors. If a potential risk exists: Potential risk may exist and the Army utilized the J&E model to evaluate risk. The Army also used the following site-specific input parameters to increase the accuracy of the J&E model:

1. TCE data from 2012 through 2017 for MW1027, including the average, maximum, and most recent TCE concentration (February 2017). The MW1025 through MW1028 well cluster is located within proximity to the FedEx property (potential receptors). The TCE data for MW1027 (aquifer zone B) was used because it reported higher TCE concentrations than MW1028 (aquifer zone A) from 2012 through 2017. The use of TCE data for MW1027 represents a conservative approach.
2. Groundwater data from February 2017 for MW1027: 51.97 feet or 1,584 centimeters below ground surface.
3. Silt is the predominant soil strata in the vadose zone above aquifer zone A, and it was used in the model.
4. The program default groundwater temperature of 24 degrees Celsius (^{o}C) was used during calculations. This value is conservative and highly protective.
5. Residential land use was selected for a conservative approach.

The modeling output using the inputs provided in Step 5 is presented in **Table J-2**.

Table J-2 – Vapor Intrusion Screening Summary

Data Range	COC	Actual Concentration (µg/L)	Water Level (cm)	Calculated Concentration (µg/L)[1]	Cancer Risk	Hazard Quotient
Average	TCE	12	1584	6.47E+01	1.90E-07	6.10E-02
	PCE	0.5*	1584	3.44E+01	1.50E-08	1.90E-04
	CT	0.5*	1584	2.73E+00	1.80E-07	2.90E-04
	cDCE	1.69	1584	NA	NA	1.30E-03
	tDCE	0.5*	1584	NA	NA	4.60E-05
	1,2-DCA	0.5*	1584	6.02E+01	8.30E-09	1.20E-04
Maximum	TCE	18	1584	6.47E+01	2.80E-07	9.10E-02
	PCE	0.5*	1584	3.44E+01	1.50E-08	1.90E-04
	CT	0.5*	1584	2.73E+00	1.80E-07	2.90E-04
	cDCE	2.6 J	1584	NA	NA	2.10E-03
	tDCE	0.5*	1584	NA	NA	4.60E-05
	1,2-DCA	0.1	1584	6.02E+01	1.70E-09	2.50E-05
Recent	TCE	14	1584	6.47E+01	2.20E-07	7.10E-02
	PCE	0.5*	1584	3.44E+01	1.50E-08	1.90E-04
	CT	0.5*	1584	2.73E+00	1.80E-07	2.90E-04
	cDCE	2 J	1584	NA	NA	1.60E-03
	tDCE	0.5*	1584	NA	NA	4.60E-05
	1,2-DCA	0.1 J	1584	6.02E+01	1.70E-09	2.50E-05

µg/L = micrograms per liter
cm = centimeters
J = result is estimated.
NA = Not Applicable
* All results below reporting limit and reporting limit used in evaluation.
1) Concentration derived from the J&E Model that would be needed in groundwater to cause an indoor air exposure given depth to contaminant and soil characteristics; silt is the predominant soil strata above the aquifer in this area.

Conclusions

The Army screened VI risk for hypothetical residential receptors using average, maximum, and most recent (February 2017) TCE data for MW0073. These data, soil classification, and recent groundwater temperature and elevation were entered in the current (2014) DTSC J&E Excel VI screening tool to assess VI risk. Contaminant concentration and water level inputs used during this screening are similar to the site-specific input parameters used during the 2011 evaluation. Using these data, the Army reevaluated VI risk potentially associated with groundwater contamination located off-site of SAAD on the FedEx property on Berry Avenue (South Post Plume). After extensive review of modeling results, given the depth to contaminants, concentration, and geology, there is not a VI concern associated with groundwater contamination in the South Post Plume.

Appendix K
Vapor Intrusion Screening for the Parking Lot 3 Groundwater

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VAPOR INTRUSION SCREENING FOR PARKING LOT 3 GROUNDWATER

Potential vapor intrusion (VI) issues have continued to have visibility across the nation, and when conducting a risk assessment, VI should be considered as a possible exposure pathway posed by releases of hazardous chemicals into the environment. Vapor intrusion is not recognized as an Applicable or Relevant and Appropriate Requirement (ARAR) in the 1995 Basewide Record of Decision (ROD) for the former Sacramento Army Depot (SAAD). Currently, there are no buildings within the boundary of Parking Lot 3. To assess the risk associated with two hypothetical building types, the Army conducted a screening level investigation to determine if VI was a potential viable exposure pathway for Parking Lot 3 at SAAD.

The Army thoroughly reviewed USEPA (United States Environmental Protection Agency) guidance, the California Department of Toxic Substances Control (DTSC) guidance, Army guidance, and the Johnson & Ettinger (J&E) model, and utilized the DTSC automated screening tool (automated excel spreadsheet; last revised in 2014) to evaluate VI risk associated with contaminated groundwater at Parking Lot 3.

The following sections address general site conditions, process, data, tools used, and results of this VI screening.

Site Background

Parking Lot 3 is located on the western edge of SAAD adjacent to a railroad bed. The area is fenced and capped with asphalt. The parking lot is approximately 350 feet in length and approximately 275 feet in width.

This site has been characterized in detail; however, sampling of groundwater wells within the parking lot is still conducted. Monitoring well MW0073 is sampled on a semi-annual basis and is located within the boundary of the parking lot. Historical characterization activities conducted at Parking Lot 3 include the analysis of soil, soil gas, air sparging effluent, and dual-phase extraction effluent for contaminant of concern (COC) concentration. The remaining COC is trichloroethene (TCE).

Site Hydrogeology

SAAD is located in the Central Valley of California, and overlies a thick sequence of alluvial sediments consisting of silt, sand, gravel, and hardpans. These sediments are laterally and vertically discontinuous. In general, the shallow site soil has moderate to very low permeability. The water-bearing zones beneath SAAD are composed of a series of sand, silty sand, and sandy silt units. These units have been grouped into three general water-bearing zones, informally designated as the "A/B," "C," and "D" aquifer zones. The A/B aquifer zone consists of the upper A and the lower B aquifer zones which are commonly interconnected. The vadose zone above the shallowest water-bearing zone and the aquitard between the water-bearing zones consist primarily of silt, silty clay, and clay. The approximate depths of the primary water-bearing zones from ground surface are presented in **Table K-1**.

Table K-1 – Aquifer Zone Depth Interval Summary

Aquifer Zone	Depth Interval (feet below ground surface)
A/B	79 to 148
C	156 to 188
D	195 to 230

The three aquifer zones can be subdivided into two depositional regimes. The upper regime comprising the A/B aquifer zone is heterogeneous, and laterally and vertically discontinuous. This regime is composed of silt with interbedded fine-grained arkosic sand lenses. The lower regime is composed of laterally continuous units comprising two distinct water-bearing zones: aquifer zone C and aquifer zone D. These two zones are typically highly productive, consisting of fine- to coarse-grained, moderately graded sand interbedded with silt and clay.

Site Geology

SAAD is located in the Great Valley of California, a broad asymmetrical trough filled with a thick assemblage of flat-lying marine and non-marine sediments. The most recent formations deposited in the Great Valley are non-marine sediments derived from the Sierra Nevada foothills and mountains on the east side of the valley, and from the Coast Ranges on the west side of the valley. The sediments under SAAD were carried out of the mountains and deposited by the American River as it meandered westward across the valley floor.

The upper 250 feet of sediments under SAAD are comprised of interbedded sands, silts, and clays, with some coarse gravel underlying the north side of the facility at an approximate depth of 40 feet. Older buried stream channels exist at various locations and depths in the area. These streams have deposited materials ranging in size from gravel to clay as they meandered across the area. Multiple discontinuous hardpans (cemented clays) representing ancient soil horizons exist throughout the site.

Soil boring data collected from Parking Lot 3 indicate that the first 80 feet below ground surface is comprised primarily of silt, silty sand, and sandy silt. In several borings, clayey silt or silty clay were also identified at depths greater than 80 feet. These soil types were used to evaluate VI risk associated with contaminated groundwater at Parking Lot 3.

Vapor Intrusion Screening

During this assessment, the Army utilized the DTSC screening guidelines, *Final Guidance for the Evaluation & Mitigation of Subsurface Vapor Intrusion to Indoor Air* (October 2011), to analyze the hypothetical risk associated with possible VI via contaminated groundwater at Parking Lot 3.

This document recommends the following step-wise approach for the evaluation of VI. For sites with existing buildings, Steps 1 through 11 apply. For sites with proposed buildings, Steps 1, 2, 3, 5, 6, 7, and 11 apply.

Step 1 – Identify the spill(s) or release(s).

Step 2 – Characterize the site.

Step 3 – Identify the site as one where VI into indoor air may represent a complete exposure

pathway (volatile organic compounds [VOCs] have been detected in the subsurface).

Step 4 – For an existing building, identify whether an imminent hazard exists from vapors migrating into indoor air. If none exists,

Step 5 – Perform a screening evaluation using the provided default vapor attenuation factors. If a potential risk exists,

Step 6 – Collect additional site data.

Step 7 – Perform a modeling evaluation using site-specific physical parameters and building parameters as appropriate. If the calculated risk is still significant,

Step 8 – For an existing building, prepare an indoor air sampling work plan, which includes an assessment of the utility corridors and the development of a contingency plan for appropriate response actions. Also, conduct appropriate public outreach with the affected community.

Step 9 – For an existing building, conduct indoor air sampling.

Step 10 – For an existing building, evaluate the data to determine if the indoor air concentrations are acceptable. If they are not,

Step 11a – For an existing building, mitigate indoor air exposure, implement engineering controls, and remediate the VOC contamination as appropriate.

Step 11b – If no building exists on the site, and the calculated risk is significant, remediate subsurface VOC contamination or implement institutional measures to assure that engineering controls are installed in any future buildings.

Step 11c – For both circumstances, institute long-term monitoring at the site.

The DTSC has also published a decision tree for use when screening a site for VI concerns. The decision tree mirrors the steps outlined above, but only steps 1 through 5 are necessary to complete the screening process at SAAD. To completely assess the possibility of VI in Step 5, the Army utilized the 2014 DTSC EXCEL™ screening tool based on calculations from the J&E model. DTSC guidance provides the following summary of this screening method:

"Fate and transport models can assist in evaluating the degradation of indoor air quality due to the intrusion of subsurface volatile contaminants. When used in combination with site-specific information, the results of modeling will add to the overall weight of evidence used to evaluate the exposure pathway. The Johnson and Ettinger (1991) model (J/E) is one of the most commonly used models for evaluating the indoor air exposure pathway. DTSC has selected the J/E model as the recommended approach to evaluate the vapor intrusion pathway in California. USEPA programmed the J/E model into Microsoft EXCEL™ and added a health risk component that calculates the risk from inhaling the specific chemical at the concentration estimated in indoor air."

DTSC guidance also describes usage of the J&E model:

"The J/E model is a simple, deterministic model, having single-point inputs and outputs. The J/E model is based on the basic principles of contaminant fate and transport, contaminant partitioning between media, and the physical and chemical properties of the contaminants themselves. The model incorporates both diffusion and advection as mechanisms of transport of

subsurface vapor into the indoor air environment."

The Army utilized the automated DTSC 2014 EXCEL™ spreadsheet model to screen for VI risk related to buildings on the FedEx property directly above the South Post Plume. Using site-specific inputs,

"the J/E model can allow users to quickly screen sites for VI risk. The output of the J/E model is the dimensionless attenuation factor "alpha" State of California DTSC / Cal – EPA Vapor Intrusion Guidance Document – Final, October 2011 (α) that represents the ratio of the indoor air concentration to the vapor concentration at a subsurface source. Using the attenuation factor and the appropriate target indoor air concentrations, contaminant concentrations in soil gas and groundwater that are protective of human health can be calculated, and these calculated values can be used as site cleanup goals."

Finally, the guidance notes the following when screening for VI risk:

"DTSC recommends the use of a two-phased approach in evaluating the vapor intrusion at a facility. A phase approach ensures that simple cases can be evaluated relatively quickly with minimal resources. The first phase of the evaluation utilizes default attenuation factors to quickly quantify the risk for vapor intrusion (Step 5)… If the preliminary screening demonstrates that the risk associated with vapor intrusion is acceptable, no further evaluation for the exposure pathway is warranted."

Using the DTSC *Screening-Level Model for Groundwater Contamination* (updated March 2014), available at: http://dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm, the DTSC decision tree, and site-specific data, the Army concluded:

Step 1 – Identify the spill(s) or release(s): The groundwater at Parking Lot 3 is currently contaminated with TCE.

Step 2 – Characterize the site: Parking Lot 3 has been extensively characterized and the following contaminants have been identified: TCE, tetrachloroethene, chloroform, and 1,2-dichloroethene.

Step 3 – Identify the site as one where vapor intrusion into indoor air may represent a complete exposure pathway (VOCs are detected in the subsurface): Since no buildings exist on this site and current land use restrictions prohibit residential use or any construction, or other activity, that would interfere with the existing treatment system or monitoring network, a complete pathway does not exist. This assessment was completed to investigate a hypothetical complete exposure pathway in the event a building is constructed within the boundary of Parking Lot 3.

Step 4 – For an existing building, identify whether an imminent hazard exists from vapors migrating into indoor air. If none exists: No imminent hazard exists at this site. There are no buildings on this site.

Step 5 – Perform a screening evaluation using the provided default vapor attenuation factors. If a potential risk exists: Hypothetical screening evaluations were performed. The Army used the following site-specific input parameters to conduct the evaluations:

1. TCE data from 2012 through 2017 for MW0073, including the average, maximum, and most recent TCE concentration (February 2017). MW0073 is located within aquifer zone A at Parking Lot 3.

2. Groundwater data from February 2017 for MW0073: 55.67 feet or 1,697 centimeters below ground surface.
3. Silt is the predominant soil strata in the vadose zone above aquifer zone A, and it was used in the model. In addition, modeling was conducted using other soil types present at the site, including loamy sand, sandy loam, sandy clay loam, and loam.
4. Groundwater temperature data from February 2017 for MW0073: 21.0 degrees Celsius (^{o}C).
5. Commercial land use was selected because current land use restrictions prohibit residential land use.

To conduct this hypothetical assessment of the possibility of VI in Step 5, the Army utilized the DTSC 2014 EXCEL™ screening tool based on calculations from the J&E model. The October 2011 DTSC Final Vapor Intrusion Guidance provides the following summary of this screening method:

The J&E model (Johnson and Ettinger, 1991) is a fate and transport model that simulates the transport of soil vapors in the subsurface by both diffusion and advection into indoor air. The model calculates an attenuation factor, alpha (α), which represents the ratio of predicted indoor air concentrations to subsurface soil gas concentrations. Hence, by inputting subsurface data, the model estimates an indoor air concentration. In September 1998, USEPA programmed the J&E model into Microsoft EXCEL™ and added a health risk component that calculates the risk from inhaling a specific chemical at the concentration estimated in indoor air (USEPA, 2004a).

Individual spreadsheets were generated for different contaminated environmental media: soil gas, soil matrix, and groundwater. Model results are provided as a risk-based soil, soil gas, or groundwater concentration protective of human health or as an estimate of the incremental risk associated with user-defined initial contaminant concentrations. DTSC has modified two USEPA Vapor Intrusion Model spreadsheets, the models for soil gas and for groundwater, by including Cal/EPA OEHHA toxicity factors and California-specific building properties. The spreadsheets can be downloaded from DTSC's website and are recommended for site-specific evaluations.

The modeling output using the inputs provided in Step 5 is presented in **Table K-2**.

Table K-2 – Vapor Intrusion Screening Summary

COC	Data Range	Actual Conc. (µg/L)	Water Level (cm)[1]	Soil Type	Construction Type	Calculated Conc. (µg/L)[1]	Cancer Risk	Hazard Quotient
TCE	Average	12.9	1697	LS	Slab on-Grade (15 cm)	2.05E+01	6.30E+07	2.10E-01
				SL		3.90E+01	3.30E-07	1.10E-01
				SCL		7.47+01	1.70E-07	5.70E-02
				L		5.49E+01	2.30E-07	7.70E-02
				SI		7.45E+01	1.70E-07	5.70E-02
	Max	19		LS		2.05E+01	9.30E-07	3.00E-01
				SL		3.90E+01	4.90E-07	1.60E-01
				SCL		7.48E+01	2.50E-07	8.30E-02
				L		5.49+01	3.50E-07	1.1E_01
				SI		7.45E+01	2.50E-07	8.40E-02
	Recent	4.5 J		LS		2.05E+01	2.20E-07	7.20E-02
				SL		3.90E+01	1.20E-07	3.80E-02
				SCL		7.48E+01	6.00E-08	2.00E-02
				L		5.49E+01	8.20E-08	2.70E-02
				SI		7.45E+01	6.00E-08	2.00E-02
TCE	Average	12.9	1697	LS	Basement (200 cm)	1.67E+01	7.70E-07	2.50E-01
				SL		3.21E+01	4.00E-07	1.30E-01
				SCL		6.20E+01	2.10E-07	6.80E-02
				L		4.54E+01	2.80E-07	9.30E-02
				SI		6.17E+01	2.10E-07	6.90E-02
	Max	19		LS		1.67E+01	**1.10E-06**	3.70E-01
				SL		3.21E+01	5.90E-07	1.90E-01
				SCL		6.20E+01	3.10E-07	1.00E-01
				L		4.54E+01	4.20E-07	1.40E-01
				SI		6.17E+01	3.10E-07	1.00E-01
	Recent	4.5 J		LS		1.67E+01	2.70E-07	8.90E-02
				SL		3.21E+01	1.40E-07	4.60E-02
				SCL		6.20E+01	7.3E=08	2.40E-02
				L		4.54E+01	9.90E-08	3.30E-02
				SI		6.17E+01	7.30E-08	2.40E-02

µg/L = micrograms per liter
cm = centimeters
J = result is estimated.
LS = Loamy Sand; SL = Sandy Loam; SCL = Sandy Clay Loam; L = Loam; S = Silt
1) Concentration derived from the J&E Model that would be needed in groundwater to cause an indoor air exposure given depth to contaminant and soil characteristics; silt is the predominant soil strata above the aquifer in this area.

Conclusions

The Army screened VI risk for two hypothetical building types using average, maximum, and most recent (February 2017) TCE concentration data for MW0073. These data, soil classification, and recent groundwater temperature and elevation were entered in the current (2014) DTSC J&E Excel VI screening tool to assess risk. Contaminant concentration and water level inputs used during this screening are similar to the site-specific input parameters used during the 2012 evaluation. Using these data, the Army reevaluated VI risk potentially associated with groundwater contamination located at Parking Lot 3.

The evaluation also included a review of the extensive historical monitoring and site remediation activities. Site-specific remediation has resulted in a significant reduction of TCE contamination at this site. Additionally, there are no buildings present and land use restrictions prohibit residential use and any construction, or other activity, that would interfere with the existing treatment system or monitoring well network.

When the J&E model was run using the most restrictive soil types, all slab on-grade construction values indicated a cancer risk less than 1E-6 and a hazard index less than 1. A cancer risk value of 1.1E-06 was indicated by only one simulation using a hypothetical building with a basement. This cancer risk value used the most restrictive soil type (sandy loam) and the maximum TCE concentration (19 µg/L) recorded over the last five years. The calculated value is very conservative as sandy loam is not the predominant soil type, TCE concentrations on average have been lower, and the DTSC construction default values were used.

After extensive review of modeling results, given the depth to contaminants, concentration, and geology, there is not a VI concern associated with groundwater contamination at Parking Lot 3. However, even if a future building were to be constructed at Parking Lot 3, the results from this screening must be considered along with the actual proposed location, most recent sampling results, and building foundation engineering plans to determine the potential risk for adverse VI as defined by the DTSC at that time.

Appendix L
Documents Reviewed

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Kleinfelder, 1993. *Superfund Record of Decision, South Post Burn Pits Operable Unit, Sacramento, California.* February.

Kleinfelder, 1994a. *Basewide Human Health Risk Assessment, Sacramento Army Depot, Sacramento, California.* May; Revised May 1997.

Kleinfelder, 1994b. *Basewide Ecological Risk Assessment, Sacramento Army Depot, Sacramento, California.* August; Revised December1997.

Kleinfelder, 1994c. *Basewide Remedial Investigation Report, Sacramento Army Depot, Sacramento, California.* September; Revised May 24, 1996.

Kleinfelder, 1994d. *Basewide Feasibility Study, Sacramento Army Depot, Sacramento, California.* December; Revised September 30, 1996; Revised April 21, 1997.

Kleinfelder, 1995. *Superfund Record of Decision, Sacramento Army Depot Basewide, Sacramento, California.* January.

Kleinfelder, 1996. *Five-Year Review, Sacramento Army Depot, Sacramento, California.* January 30. (First Five-Year Review).

Plexus, 2009. *Groundwater Monitoring Plan Amendment /Technical Memorandum, Sacramento Army Depot, Sacramento California,* Final, June.

Plexus, 2012a. *Fourth Five-Year Review Report, Sacramento Army Depot, Sacramento, California*. Final. September.

Plexus, 2012b. *Summer 2012 Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Final, November.

Plexus, 2013. *Summer 2013 Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Final, November.

Plexus, 2014a. *Rebound Evaluation Report, Former Sacramento Army Depot, Sacramento, California.* Final, September.

Plexus, 2014b. *Summer 2014 Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Final, September.

Plexus, 2014c. *Monitored Natural Attenuation Evaluation Results Report, Former Sacramento Army Depot, Sacramento, California.* Final, November.

URS Corporation, 2001. *Five Year Review, Former Sacramento Army Depot, Sacramento, California*. Final, December. (Second Five-Year Review).

URS Corporation, 2002. *Monitoring and Closeout Plan for Parking Lot 3, Former Sacramento Army Depot*. Final. July.

U.S. Army, 1998. *Finding of Suitability to Transfer Former Sacramento Army Depot Study Areas 12, 28, 57, 58, 59, 60, 61, 62, 74, and 75A, Version 0.06 (2-A FOST).* October.

U.S. Army, 2004. *Finding of Suitability to Transfer Former Sacramento Army Depot Study Areas 78, 80, 81B, 83, 84, 88-89, Version 1.1 (2-B FOST).* March.

USACE, 2008. *Five Year Review, Former Sacramento Army Depot, Sacramento, California*. Sacramento District. Final, April. (Third Five-Year Review).

USACE, 2015. *Focused Feasibility Study, Former Sacramento Army Depot, Sacramento, California.* Los Angeles District, Final, October.

USACE, 2016a. *September 2015 Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Los Angeles District, Final, May.

USACE, 2016b. *Winter 2016 Semi-Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Los Angeles District, Final, August.

USACE, 2017a. *Summer 2016 Semi-Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Los Angeles District, Final, February.

USACE, 2017b. *Explanation of Significant Differences, Former Sacramento Army Depot, Sacramento, California.* Los Angeles District, Final, May.

USACE, 2017c. *Winter 2017 Semi-Annual Groundwater Monitoring Report, Former Sacramento Army Depot, Sacramento, California.* Los Angeles District, Final, July.

USEPA, 2001. *Comprehensive Five-Year Review Guidance*. OSWER Directive 9355.7-03B-P. EPA 540-R-01-007. June.

USEPA, 2009. *Five-Year Reviews, Frequently Asked Questions (FAQs) and Answers.* OSWER No. 9355.7-21, September.

USEPA, 2011. *Program Priorities for Federal Facility Five-Year Review*. OSWER Memorandum, August 1.

USEPA, 2011. *Recommended Evaluation of Institutional Controls: Supplement to the 'Comprehensive Five-Year Review Guidance'*. OSWER Directive 9355.7-18, September 13.

USEPA, 2012. *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews.* OSWER Directive 9200.2-111, September 13.

USEPA, 2012. *Assessing Protectiveness at Sites for Vapor Intrusion. Supplement to the Comprehensive Five-Year Review Guidance.* OSWER Directive 9200.2-84, December 3.

Westmark, 2016. *Technical Memorandum – Interim Groundwater Monitoring Plan, Former Sacramento Army Depot, Sacramento, CA.* Final, August 5.

Appendix M
Regulatory Agency Comments with Army Response to Comments

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Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006

Reviewer: Lucrina Jones (EPA)

Item	Reference	Comment – March 15, 2018	Action
1	Section 1 – Introduction, Five Year Summary Form	The review period should reflect the actual period of the review and not the entire five years. Revise the review period dates.	**A:** The review period in the Five-Year Review Summary Form will be revised as follows, "*September 18, 2017 – January 15, 2018*."
2	Section 2.2.1 – Remedial Action Objectives	Per the Revised California Human Health Screening Levels for Lead, September 2009, the soil screening level for lead for commercial/industrial is now 320 mg/kg. Discuss and confirm if the updated lead cleanup level of 500 mg/kg in the 1995 Basewide ROD Amendment for the South Post Burn Pits is still protective.	**A:** Please see the Army's response to EPA Comment 5.
3	Section 4.1 – Community Notification, Involvement and Site Interviews	Revise text to remove "representatives from USEPA" and "DTSC" from the list of individuals interviewed for the Five-Year Review Process.	**A:** The text was deleted as recommended from the list of individuals interviewed for the Five-Year Review.
4	Section 4.2.2 – South Post Plume and Table 4-5 South Post Plume TCE Data Summary	TCE concentrations (from 2012-2017) from monitoring wells MW1027/MW1028 and MW1030/1031 have been gradually increasing and as per Final Summer 2017 Annual GW Monitoring Report, the TCE concentration for MW1027 is 16 ug/L (J flagged = estimated and biased low) is approaching the trigger concentration of 20 ug/L. The Army should closely monitor TCE concentrations and ensure contingency actions take place should TCE concentrations exceed trigger levels.	**A:** The Army will continue to monitor the South Post Plume and will ensure contingency actions take place should TCE concentrations exceed trigger levels.

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn

Review Comments			
Project:	Sacramento Army Depot, Sacramento, California		
Document:	*Draft Fifth Five-Year Review Report*		
Contract:	W912PL-15-C-0006		
Reviewer: Lucrina Jones (EPA)			
Item	Reference	Comment – March 15, 2018	Action
5	Section 5.1.2.1 – Changes in Standards and To-Be-Considered Criteria and Table H-1 Changes in Chemical-Specific Soil Standards	Not only should cleanup levels be compared to EPA's RSLs but to the California Human Health Screening Levels (CHHSLs) as well for all related chemicals of concern. Evaluate if cleanup levels are below both EPA's RSLs and the CHHSLs.	**N:** The CHHSLs are not properly promulgated cleanup standards; therefore, they do not qualify as ARARs and should not be used as comparison criteria. The COC concentrations remaining after soil excavation at the South Post Burn Pits are low, there are no risk receptors, and the remaining risk, even considering the changes in some toxicity values, would still fall within the EPA risk range. In addition, the CAMU and Stabilized Mass Covenant prevent the completion of an exposure pathway in the South Post Burn Pits area. Therefore, the cleanup levels established in the ROD are still protective.

Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006

Reviewer: Mark Bare (California Central Valley Regional Water Quality Control Board (CVRWQCB))

Item	Reference	Comment – March 21, 2018	Action
1	None	In Central Valley Water Board correspondence dated August 11, 2016 staff reviewed the policy memorandum Perfluorinated Compounds (PFCs) Contamination Assessment dated June 10,2016. In this correspondence Central Valley Water Board staff required SAAD to prepare a sampling plan to determine the possible presence of PFCs in groundwater and be submitted for regulatory review. Sampling for PFCs at SAAD should at a minimum include the following compounds: perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHXS), perfluoroheptanoic acid (PFHPA), perfluorononanoic acid (PFNA), and perfluorobutanesulfonic acid (PFBS)." Representatives for SAAD responded in correspondence dated August 11, 2016, and stated that "*the Army is working this situation on a DoD level and will provide funding and guidance to each installation for sampling accordingly. The Sacramento Army Depot is on the list of installations that may need to address this issue due to former fire fighter training activities and expects to receive direction from the Assistant Chief of Staff for Installation Management (ACSIM) on this issue. ACSIM has contacted SAAD multiple times in their efforts to address this emergent situation and will coordinate efforts as the situation evolves.*" The SAAD response correspondence also stated that the Army would formally respond to the Central Valley Water Board letter when direction from ACS IM on how they want to proceed at SAAD is received. No response to the Central Valley Water Board letter can be located and is not present on GeoTracker. **Directive:** SAAD must address the issue of PFCs Contamination Assessment in the FYR. An entry to Section 6: Issues/Recommendations must be added that states where in the evaluation process to determine the possible presence of PFCs in groundwater SAAD currently stands. The entry should include a timeline for when a work plan to address the potential PFCs contamination is expected to be submitted for regulatory review.	**N:** The Army has evaluated SAAD as a possible PFC site due to the Fire Fighter Training Area north of the old landing strip and south of Bldg. 300. The information available notes that the area was utilized for training as follows: <u>Firefighter Training Area:</u> The SAAD Fire Department reportedly conducted firefighter training at the intersection of Midway Avenue and the airstrip runway. Several times a year from 1958 until 1963, 3,785 to 5,677 liters of gasoline, oils, or JP4 fuel were reportedly placed into a shallow unlined pit and ignited (USATHAMA 1979). The exact location of the Firefighter Training Area is unknown but is believed to be north of the laser range, immediately south of the runway, and approximately 700 feet west of Midway Avenue. Further research into the military history of PFCs indicates DoD beginning to use Aqueous Film Forming Foam (AFFF) mostly in the Navy and Air Force beginning in the mid-1970s. Given the timeframe of the DoD beginning to use AFFF, almost a decade after the SAAD training area was closed, there is no apparent reason to assume that there is a PFC source area at SAAD or that anything other than water was used during these training activities. As a result, there are currently no plans by DoD to perform sampling for PFCs at SAAD. The Army is preparing a formal written response and will submit it to the Central Valley Water Board when it is completed.

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn

Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006

Reviewer: Mark Bare (California Central Valley Regional Water Quality Control Board (CVRWQCB))

Item	Reference	Comment – March 21, 2018	Action
2	Table 4-3, Page 22	A review of Table 4-3. Lysimeter Total Lead Data Summary on Page 22 of the FYR shows multiple detections of lead above the current Federal and California groundwater Maximum Contamination Level (MCL) of 15 micrograms per Liter (µg/L). The highest detection was in August of 2016 at a concentration of 78 µg/L which is greater than 5 times the MCL. These detections indicate that lead could be leaching from the stabilized CAMU and potentially impacting the groundwater. **Directive:** SAAD must determine if groundwater in the area of the CAMU has been impacted by lead. Central Valley Water Board staff recommends sampling monitoring wells that are immediately down-gradient from the CAMU. Please provide a work plan letter to collect these samples by May 28, 2018. A report documenting the results of the sampling activities must be submitted within 60 days of completing field activities.	**N:** Currently, there is no indication that lead is leaching from the stabilized CAMU and impacting groundwater. However, the Army is aware of the fluctuations in lead concentrations from the lysimeter samples and, per BCT discussions, will evaluate plans to sample groundwater from monitoring well MW-5A for lead.

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn

Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006

Reviewer: Ben Fries (California Department of Toxic Substances Control)

Item	Reference	Comment – February 27, 2018	Action
1	South Post Burn Pits Clean-up Levels – Section 2.2.1, Table 2-1, Page 6	The clean-up levels presented in Table 2-1 should reflect the clean-up levels for the identified contaminants of concern as presented in the current Record of Decision (ROD). The value for lead presented in the table of 174 milligrams per kilogram (mg/kg) is the clean-up level for lead listed in the 1993 ROD for the South Post Burn Pits Operable Unit. However, Section 9.4 of the subsequent 1995 Basewide ROD presents a South Post Burn Pits ROD Amendment, which includes an updated lead clean-up level of 500 mg/kg.	**A:** Table 2-1 on Page 6 will be modified to indicate the updated lead clean-up level of 500 mg/kg as specified in the current 1995 Basewide ROD.
2	Current Implementation Status of Recommendation #1 – Section 3.0, Page 18	This section should identify the correct location within this document where the origin of the Maximum Contaminant Level (MCL) for cis-1,2-dichloroethene (cDCE) can be found. The text indicates the origin is identified in Table 2-2; however, Table 2-2 provides a description of institution controls for the corrective action management unit (CAMU).	**A:** The correct table reference is Table 2-3. The text has been changed to reference Table 2-3.

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn

Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006

Reviewer: Ben Fries (California Department of Toxic Substances Control)

Item	Reference	Comment – February 27, 2018	Action
3	Date of Public Notice by Newspaper Posting – Section 4.1, Page 21	The text should be modified to include the date on which the public notice was posted in the local newspaper. The current text contains residual language from the US EPA's Five-Year Review Recommended Template requesting the date be entered ("Click here to enter a date"), but not the date itself.	**A:** A notice will be placed in the local newspaper to notify the public of the completion of the Five-Year Review and its availability for review at the information repository. A copy of the Final Five-Year Review will be placed in the information repository at the United States Army Corps of Engineers, Sacramento District, 1325 J Street, Suite 820, Sacramento, California 94105. The date of the public notice will be included in the Final Five-Year Review. A sample of the public notice is attached. The first paragraph in Section 4.1 was revised as follows, "*A public notice was made available by newspaper posting in the Sacramento Bee (local newspaper) on (To-Be-Determined), stating that the FYR has been completed. The results of the review and the report are available at the information repository located at the United States Army Corps of Engineers, Sacramento District, 1325 J Street, Suite 820, Sacramento, California 94105.*"

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn

Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006
Reviewer: Mark Bare (CVRWQCB)	

Item	Reference	Comments – June 11, 2018	Action
1	Army Response to CVRWQCB Comment 1 from March 21, 2018	On Page 3 of 6, SAAD states that *"research into the military history of PFCs indicates DoD beginning to use Aqueous Film Forming Foam (AFFF) mostly in the Navy and Air Force beginning in the mid-1970s."* The citation also states that firefighting activities occurred at SAAD from 1958 through 1963. SAAD's current plan to address the issue is to prepare a formal written response that will be submitted to the Central Valley Water Board when it has been completed. While the Central Valley Water Board concurs with the plan to submit a formal response that addresses the question of Perfluorinated Compounds (PFCs) now referred to as Per- and Polyfluoroalkyl Substances (PFAS) related to firefighting activities during previous base operations, this is not the only potential source of PFAS at SAAD. The previously cited Central Valley Water Board correspondence dated August 11, 2016, states in Comment 1: *"Chromium solutions were historically used for plating of metals related to operations at SAAD. Many plating operations used a chemical fume suppressant and many of the chemical fume suppressants contained PFCs."* Based on this information, investigation of the presence of PFAS at SAAD is still warranted to address this data gap. **Directive:** SAAD must address the issue of PFAS contamination assessment related to the chemical fume suppressants. An entry to Section 6: Issues/Recommendations in the FYR must be added for this issue and recommendations related to this assessment included. The entry should include a timeline for when a work plan to address the potential PFAS contamination is expected to be submitted for regulatory review. Additionally, Central Valley Water Board staff will review the formal written response related to PFAS from firefighting activities at SAAD once it is submitted. Based on that review, a determination if additional investigation is warranted will be made. This issue should also be included in Section 6 of the FYR as an unresolved action item.	**N:** The Army will add the PFAS issue to Section 6: Issues/Recommendations in the FYR for the Parking Lot 3 Groundwater and South Post Plume OUs; however, the Army searched historical records, site PAs, and RIs for any indication of foam usage on site and there is no indication of it ever being used at the installation. Further research into the military history of PFCs indicates the DoD beginning to use Aqueous Film Forming Foam (AFFF) mostly in the Navy and Air Force beginning in the mid-1970s. Given the timeframe of the DoD beginning to use AFFF, after the operation of the area in question ceased, there is no apparent reason to assume that there is a PFC source area at SAAD or that chemical fume suppressants were used at SAAD. As a result, there are currently no plans by DoD to perform sampling for PFCs at SAAD.

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn

Review Comments

Project:	Sacramento Army Depot, Sacramento, California
Document:	*Draft Fifth Five-Year Review Report*
Contract:	W912PL-15-C-0006
Reviewer: Mark Bare (CVRWQCB)	

Item	Reference	Comments – June 11, 2018	Action
2	Army Response to CVRWQCB Comment 2 from March 21, 2018	On Page 4 of 6 in the RTCs, SAAD states there is no indication that lead is leaching from the stabilized CAMU and impacting groundwater. In the four years ranging from 2012 to 2015 there were only 2 detections for lead with the highest detected concentration equaling 7.7 micrograms per Liter (µg/L). In 2016 alone, there were seven detections for lead and there were two detections during the first quarter of 2017 for a total of nine detection in 1.5 years. Of these nine detections, seven exceeded the previously detected high of 7.7 µg/L and three exceeded the current Federal and California groundwater Maximum Contamination Level (MCL) of 15 µg/L. This data shows a clear indication that lead detections have increased in the lysimeters and that lead could be leaching from the stabilized CAMU and potentially impacting the groundwater. **Directive:** An entry to Section 6: Issues/Recommendations in the FYR must be added to address the issue of increased lead detections in the lysimeters and recommendations included to determine if groundwater down-gradient of the CAMU has been impacted by lead. Central Valley Water Board staff require sampling of monitoring wells that are immediately downgradient from the CAMU. A work plan for this assessment must be submitted prior to the Central Valley Water Board concurrence with the FYR to verify this issue is being addressed.	**N:** The Army will add the lysimeter issue to Section 6: Issues / recommendation in the FYR for the South Post Plume OU; however, the Army does not agree that the submittal of a work plan is necessary for finalization of the FYR. The Army and BCT are aware of the fluctuating lead concentrations in the lysimeters and are working to address the issue. The Army will determine if groundwater downgradient of the CAMU is impacted by lead through sampling MW-5A. Sampling is expected to occur prior to the end of the third quarter of 2018.

Action Codes: A – Accepted/Concur N – Non-Concur D – Action Deferred W – Withdrawn