Superfund Records Center
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Joint Base Cape Cod

AIR FORCE CIVIL ENGINEER CENTER

Final Storm Drain-5 Groundwater Explanation of Significant Differences

August 2014

Prepared for:
AFCEC/JBCC
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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ii
1.0 INTRODUCTION 1-1
1.1 STATEMENT OF PURPOSE 1-3
1.2 AUTHORIZING SIGNATURES 1-3
2.0 SITE HISTORY, SITE CONTAMINATION, AND SELECTED REMEDY 2-1
2.1 INSTALLATION LOCATION AND HISTORY 2-1
2.2 SD-5 SOURCE AREA HISTORY, CONTAMINATION, AND REMEDIAL ACTIONS 2-2
2.3 SD-5 GROUNDWATER EXISTING SELECTED REMEDY 2-3
3.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES AND EXPECTED OUTCOMES 3-1
3.1 SIGNIFICANT DIFFERENCES FROM THE SELECTED REMEDIES 3-1
3.2 EXPECTED OUTCOMES 3-3
4.0 STATUTORY DETERMINATION 4-1
5.0 STATE AGENCY COMMENTS AND PUBLIC PARTICIPATION ACTIVITIES 5-1
5.1 COMMENTS FROM THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION 5-1
5.2 PUBLIC PARTICIPATION ACTIVITIES 5-1
6.0 REFERENCES 6-1

Figures

Figure 1-1 Joint Base Cape Cod, Massachusetts
Figure 1-2 JBCC IRP Plumes and SD-5 Plume Boundary
Figure 2-1 SD-5 Groundwater Plume (2005 Delineation)
Figure 2-2 SD-5 Plume 1999 and 2005 Comparison
Figure 2-3 TCE Concentration Trends in the SD-5 Long-Term Monitoring Network Wells
Figure 3-1 TCE Concentration Trends in SD-5 South Groundwater

Appendices

Appendix A SD-5 South Groundwater - TCE Analytical Results (1996-2013)
Appendix B SD-5 South Groundwater – Groundwater Travel Time Analysis
Appendix C MassDEP Concurrence Letter

ACRONYMS AND ABBREVIATIONS

AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Engineering and the Environment
ANG	Air National Guard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
ETR	extraction, treatment, and reinjection
FFA	Federal Facility Agreement
ft	foot or feet
ft/day	feet per day
gpm	gallons per minute
IRP	Installation Restoration Program
JBCC	Joint Base Cape Cod
LTM	long term monitoring
LUCs	land use controls
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MMR	Massachusetts Military Reservation
NCP	National Contingency Plan
NDIL	Non-Destructive Inspection Laboratory
NGB	National Guard Bureau
NPL	National Priorities List

ACRONYMS AND ABBREVIATIONS

RAOs	Remedial Action Objectives
ROD	Record of Decision
SD-5	Storm Drain-5
SD-5N	Storm Drain-5 North
SD-5S	Storm Drain-5 South
SRTF	Sandwich Road Treatment Facility
SVE	soil vapor extraction
TCE	trichloroethene
USAF	U.S. Air Force
VOC	volatile organic compound
µg/L	microgram per liter

1.0 INTRODUCTION

This *Draft Storm Drain-5 Groundwater Explanation of Significant Differences* (ESD) has been prepared to document changes to the estimated aquifer restoration timeframe at the Storm Drain-5 (SD-5) groundwater site. The Record of Decision (ROD) for SD-5 was combined with the Eastern Briarwood and Western Aquafarm sites. The *Final Record of Decision for Groundwater at Eastern Briarwood, Western Aquafarm and Storm Drain-5* (AFCEE, 2006) was signed on 14 August 2006 by the Air Force Center for Engineering and the Environment (AFCEE)[1] and on 28 September 2006 by the U.S. Environmental Protection Agency (EPA). SD-5 is an Installation Restoration Program (IRP) site, associated with the Joint Base Cape Cod (JBCC)[2]; formerly known as the Massachusetts Military Reservation [MMR]), located on Cape Cod, Massachusetts (Figures 1-1 and 1-2). The Comprehensive Environmental Response, Compensation, and Liability Information System number for the MMR site is MA2570024487.

This ESD was prepared in accordance with *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (EPA 1999). In accordance with Executive Order 12580, the U.S. Air Force (USAF) is the lead agency for remedial actions at the MMR and this document is being issued by the USAF as the lead agency. The MMR was added to the National Priorities List (NPL) in 1989. A Federal Facility Agreement (FFA), which provided the legal framework for investigating and remediating numerous operable units at the MMR, was signed in 1991 (EPA et al. 1991). In 1996, the FFA was amended to add the USAF as the lead agency for the cleanup at MMR (EPA et al. 2002). The FFA, as amended, requires the USAF to implement Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements at MMR. In addition to the USAF, the EPA and National Guard Bureau (NGB) are parties to the FFA for the MMR. The Massachusetts Department of Environmental Protection

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1 In October 2012, AFCEE adopted a new organizational name (AFCEC). Therefore, the AFCEE and AFCEC acronyms refer to the same entity, but are used in this document in relation to the date of a specific topic or document.

2 In July 2013, the Massachusetts Military Reservation (MMR) adopted a new name, the Joint Base Cape Cod (JBCC). Therefore, the MMR and JBCC acronyms refer to the same location, but are used in this document in relation to the date of the specific topic/document.

(MassDEP) is not a signatory of the FFA, but is an active participant in the clean-up process and provides guidance and direction to the remedy selection and oversight process.

The Department of Defense and EPA, with concurrence from the MassDEP, implemented an interim action for the SD-5 groundwater plume and six other MMR plumes under an Interim ROD (IROD) (ANG, 1995). The selected interim remedy for the SD-5 plume included extraction of contaminated groundwater and discharge of treated water to groundwater (and/or other beneficial use) and institutional controls. Based on the investigational history and nature of the SD-5 plume, a phased design and construction approach was adopted and three interim remedial systems were installed: SD-5 North (SD-5N) extraction, treatment, and reinjection (ETR) System, SD-5 South (SD-5S) Axial Recirculation Well System, and the SD-5S Hooppole Road Extraction Well System (Section 2.2). The SD-5 interim remedial systems operated under the IROD between August 1997 and February 2004 (AFCEE, 2006).

The ROD for SD-5 groundwater was completed in 2006. The selected remedy for SD-5 groundwater as specified in the ROD was long term monitoring (LTM) with land use controls (LUCs) (AFCEE, 2006). In 2011, an ESD was prepared that clarified the inclusion of monitored natural attenuation as a component of the selected remedy for SD-5 and several other JBCC IRP groundwater sites, revised the LUCs, slightly modified the phrasing of the remedial action objectives (RAOs), and added text regarding the three-step process to achieve site closure (AFCEE, 2011).

The SD-5 LTM program is ongoing and the LUCs are in place and are functioning as intended (AFCEC, 2013). However, the timeframe to achieve aquifer restoration at SD-5 is longer than was predicted in the ROD, primarily due to the presence of contamination in low hydraulic conductivity aquifer materials. Since the LUCs are in place and are functioning as intended, the remedy remains protective of human health and the environment (AFCEC, 2013). This ESD is being completed in order to amend the estimate of aquifer restoration timeframe at SD-5.

1.1 STATEMENT OF PURPOSE

The AFCEC is issuing this ESD in accordance with §117(c) of CERCLA and 40 Code of Federal Regulations (CFR) Section 300.435(c)(2)(i) of the National Contingency Plan (NCP) which requires the publication of an ESD to amend the restoration timeframe presented in the ROD. As required by Section 300.825(a)(2) of the NCP, this ESD will become part of the Administrative Record for the SD-5 IRP site at the JBCC. The Administrative Record is available for public review at the AFCEC IRP Office (322 East Inner Road, Otis ANG Base, Massachusetts, 02542) Monday - Friday, 8 a.m. to 4 p.m., excluding federal and state holidays.

1.2 AUTHORIZING SIGNATURES

The following signatures represent the decision to authorize this ESD for the SD-5 Groundwater IRP site at the JBCC.

U.S. AIR FORCE

Marilyn C. Croach PhD, SES

MARILYN C. CROACH, PhD, SES
Deputy Director
Air Force Civil Engineer Center

Date: 18 August 2014

U.S. ENVIRONMENTAL PROTECTION AGENCY

JAMES T. OWENS III
Director
Office of Site Remediation and Restoration

Date: 9/30/14

2.0 SITE HISTORY, SITE CONTAMINATION, AND SELECTED REMEDY

This section presents background information on the SD-5 IRP groundwater site, including an overview of the physical and chemical characteristics, history, and selected remedy.

2.1 INSTALLATION LOCATION AND HISTORY

The JBCC comprises approximately 22,000 acres on Cape Cod and provides facilities for several operating command units: the Air National Guard (ANG), the Massachusetts Army National Guard, the USAF, the U.S. Coast Guard, and the Veterans Affairs. Past military training, maneuvers, and aircraft operations, maintenance and support activities at the JBCC have resulted in releases of hazardous materials that contaminated soil in source areas and generated plumes of contaminated groundwater in the unconfined sand and gravel aquifer that underlies the JBCC and the surrounding towns.

The MMR, listed on the NPL as Otis Air National Guard/Camp Edwards, is located on upper Cape Cod, Massachusetts (Figure 1-1). The SD-5 groundwater site is split into two areas, SD-5 North (SD-5N) which is located on-base, within the JBCC, and SD-5 South (SD-5S) which is located off-base (Figure 1-2). The SD-5 plume has not been delineated since 2005 when it consisted of a series of disconnected small zones of contamination where trichloroethene (TCE) concentrations remained above the TCE Maximum Contaminant Level (MCL) of 5 micrograms per liter (μg/L) (Figures 1-2 and 2-1). Figure 2-2 presents a comparison of the SD-5 plume boundary in 1999, when the plume was spilt into SD-5N and SD-5S areas, and in 2005 when it was last delineated. TCE at concentrations above the MCL remain in two of the three wells still monitored under the SD-5 LTM program, in the SD-5S area (Figure 2-3). TCE concentrations have decreased below the MCL in the well located in the SD-5N area.

2.2 SD-5 SOURCE AREA HISTORY, CONTAMINATION, AND REMEDIAL ACTIONS

The primary source of the SD-5 groundwater plume was historical releases from a leaching well at the Non-Destructive Inspection Laboratory (NDIL), a Corrosion Control Shop, and sumps in two aircraft hangers (ANG, 1994) located with the vicinity of Branshaw Street on the MMR (Figure 2-1). The SD-5 groundwater plume was defined as the extent of groundwater containing the contaminant of concern TCE at concentrations greater than the MCL of 5 µg/L (AFCEE, 2006).

Source area remedial actions including the demolition of buildings/hangers and removal of leaching wells and drainage structures were conducted between 1990 and 2003. The ANG removed approximately 700 gallons of contaminated fluid from an NDIL leaching well in 1990 and the NDIL leaching well was removed in 1996. This removal action was completed as part of the MMR drainage structure removal program and also included the removal of four other drainage structures at SD-5 in 1996 (AFCEE, 2006). Excavation of contaminated soils at the SD-5 source area began in April 2001. Approximately 6,500 tons of soil were removed and taken off-site for disposal at a state-permitted landfill. In August 2002, a soil vapor extraction (SVE) system was installed at the site to remediate volatile organic compounds (VOCs) in the subsurface (Figure 2-1). The SVE system removed approximately 5 pounds of VOCs and was shut down in March 2003 with concurrence from the regulatory agencies (AFCEE, 2006).

In August 1997, AFCEE began operation of an extraction, treatment, and reinjection (ETR) system to address the groundwater contamination at SD-5 as part of an interim remedy (ANG, 1995). It contained a series of 10 extraction wells operating at a design flow rate of 355 gallons per minute (gpm), eight reinjection wells located at the base boundary and a treatment plant known as the Sandwich Road Treatment Facility (SRTF) (Figure 2-1). Operation of the remedial system contained the SD-5 plume at the base boundary and the SD-5 plume was split into two parts, the SD-5N plume was located on base and the hydraulically downgradient portion, the SD-5S plume was located off base (Figure 2-2).

Based on the investigational history and nature of the SD-5S plume, a phased design and construction approach was adopted. Phase I addressed the axial portion of the SD-5S plume and included two recirculating wells (Figure 2-1). Phase II addressed the southernmost portion of the SD-5S plume and included one extraction well with treatment at the SRTF (Figure 2-1). In June 1999, AFCEE began operation of two SD-5S recirculating wells at a combined flow rate of 120 gpm. In January 2000, AFCEE installed an extraction well that operated at 100 gpm to capture additional contamination at SD-5S.

The SD-5 groundwater contaminants were largely removed by these three interim remedial systems: SD-5N ETR System, SD-5S Axial Recirculation Well System, and the SD-5S Hooppole Road Extraction Well System (Figure 2-1).

In December 2000, AFCEE, with concurrence from the regulatory agencies, turned off one recirculating well because TCE concentrations in the groundwater in the vicinity of the well were below the MCL. In April 2003, the second recirculating well was shut down, and in February 2004 the SD-5S extraction well was shutdown. The SD-5N ETR system operated in various configurations until August 2003 when the final extraction well was shut down. The SRTF and the SD-5N reinjection wells are components of Chemical Spill-10 ETR remedial systems and are still operating.

Even though the treatment systems for this plume have been shut down, AFCEC continues to monitor the natural attenuation of the remaining TCE in the SD-5 area under the SD-5 LTM program which is the selected remedy as specified in the final ROD for SD-5.

2.3 SD-5 GROUNDWATER EXISTING SELECTED REMEDY

This ESD amends the estimate of aquifer restoration timeframe presented in the ROD; there is no change to the groundwater remedy that was identified in the SD-5 ROD, which is LTM with LUCs (AFCEE, 2006).

3.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES AND EXPECTED OUTCOMES

This section describes the rationale for amending the estimate of aquifer restoration timeframe that was originally presented in the SD-5 ROD (AFCEE, 2006).

3.1 SIGNIFICANT DIFFERENCES FROM THE SELECTED REMEDIES

The SD-5 groundwater contamination was largely addressed through the operation of the three interim remedial systems. Since the interim remedial systems were shut down, the natural attenuation of the remaining TCE in the SD-5 area has been monitored under an LTM program. The groundwater contamination at SD-5 has not been delineated as a contiguous plume since 2005 due to its limited extent. When last able to be delineated in 2005, the SD-5 plume consisted of a series of disconnected small zones of contamination where TCE concentrations remained above the MCL (Figures 2-1 and 2-2).

Modeling completed at the time of the ROD predicted TCE concentrations in the SD-5 area would decrease below the MCL by approximately 2008 (AFCEE, 2006). TCE has not been detected at concentrations exceeding the MCL in the SD-5N monitoring network since 2008 and therefore the aquifer restoration timeframe predicted at the time of the ROD for the SD-5N area has been achieved. TCE concentrations in many of the SD-5S monitoring network wells had also decreased below the MCL by 2008, however, TCE MCL exceedances remain in two wells, 00MW0524B and 28MW0035B (AFCEC, 2012) (Figure 2-3). TCE contamination has been more persistent at these two locations, because both of these monitoring wells are screened within a relatively low hydraulic conductivity silty sand layer which is likely playing a role in the persistent nature of the residual contamination (AFCEE, 2004). Based on the results from direct push drilling completed hydraulically upgradient of each of these two wells, and on LTM data collected from downgradient wells, contamination at these two locations is not contiguous or extensive (AFCEE, 2004). Since the two wells where TCE MCL exceedances remain are both screened in a relatively low permeability layer, the contamination is likely not migrating very far downgradient and is expected to attenuate over time.

A revised estimate of aquifer restoration timeframe has been developed using historical TCE concentration data and approximations of groundwater velocities to estimate travel time for the upgradient trailing edge of contamination to migrate past downgradient network wells 00MW0524B and 28MW0035B. Upgradient monitoring well 28MW0033B was selected for this analysis because it is located hydraulically upgradient from 00MW0524B and 28MW0035B and monitoring data confirm that the trailing edge of TCE contamination has migrated past this location (Figure 3-1). TCE concentrations at 28MW0033B exceeded the MCL between 1998 and 2002 and then low level concentrations remained until 2008 when concentrations decreased below the reporting limit of 1 µg/L (Figure 3-1 and Appendix A).

Groundwater travel time analysis results are presented in Appendix B. Based on observed groundwater elevation data collected during synoptic water level monitoring events in the SD-5S area, an appropriate horizontal hydraulic gradient for this area is 0.002 feet per foot (ft/ft) (AFCEE, 2004). An effective porosity of 30 percent and hydraulic conductivities ranging from 15 to 250 feet per day (ft/day) are consistent with values previously used to support modeling and hydrogeologic analysis in the SD-5 area and at other JBCC plumes. Based on these values, groundwater velocities calculated for this area ranged from 0.1 to 1.7 ft/day and travel times from 28MW0033B to the furthest downgradient well, 28MW0035B, are estimated to range from 2 to 31 years. Travel times for the higher hydraulic conductivity ranges (100 to 250 ft/day) varied from 2 to 5 years and this is consistent with plume migration and TCE concentration trends observed at monitoring wells screened in the higher permeability sands. Travel times for the lower hydraulic conductivity ranges of 15 and 50 ft/day were 9 and 31 years, respectively.

Based on observed data (Appendix A), TCE contamination is not widespread in the SD-5S area and is not expected to migrate substantially downgradient (i.e., to Johns Pond) at concentrations above the MCL after TCE concentrations at 28MW0035B have deceased below the MCL. Although groundwater modeling results indicate that contamination in the SD-5 South area migrates toward and discharges into John Pond

(AFCEE, 2004), the travel time for migration from 28MW0035B to Johns Pond is not expected to impact the estimated aquifer restoration timeframe.

This approach of using travel times to estimate aquifer restoration timeframes is inherently conservative because it assumes advective transport only and does not consider the other contaminant transport processes (such as dispersion and dilution) that result in contaminant concentration reduction. Therefore, an average timeframe for the lower hydraulic conductivities (20 years) is being used to amend the aquifer restoration timeframe. Since TCE contamination at concentrations exceeding the MCL migrated past 28MW0033B in 2002, and using a travel time of 20 years (mid-range for the lower hydraulic conductivities assessed), the updated estimate of aquifer restoration timeframe for the SD-5S area is 2022.

3.2 EXPECTED OUTCOMES

The purpose of this ESD is to formally amend the estimate of aquifer restoration timeframe from 2008 (AFCEE, 2006) to 2022. No changes were made to the final remedy or to the RAOs (AFCEE, 2006, 2011). Since the LUCs are in place and are functioning as intended, the remedy remains protective (AFCEC, 2013). Monitoring will continue under the SD-5 LTM program to provide the necessary data to manage potential exposure risks, determine when RAOs have been met, and to evaluate optimization opportunities. Although the aquifer restoration timeframe has been extended beyond the initial estimate of 2008; continued LTM is not expected to add substantial costs to the remedy since the current SD-5 LTM program consists of monitoring three wells (00MW0524B, 28MW0004, and 28MW0035B) biennially. It is estimated that the cost of additional sampling and reporting needed to reach RAOs will be $46,000 which is approximately an 8.5% increase to the total post-ROD cost ($540,452) that was included in the ROD (AFCEE, 2006). The difference in the aquifer restoration timeframe presented in Section 3.1 of this ESD does not fundamentally alter the groundwater remedy selected in the SD-5 ROD with respect to scope, performance, or cost.

4.0 STATUTORY DETERMINATION

This ESD modifies the estimate of aquifer restoration timeframe for the SD-5 groundwater site at the JBCC as presented in the ROD (AFCEE, 2006). The SD-5 groundwater remedy is protective of human health and the environment, complies with federal and Commonwealth of Massachusetts requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. The SD-5 groundwater remedy utilizes permanent solutions to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, in accordance with Section 121 of CERCLA. The proposed changes in this ESD do not fundamentally change the SD-5 groundwater remedy with respect to scope, performance, or cost.

The LTM program is ongoing and the LUCs are in place and are functioning as intended. Through pre-ROD operation of the SD-5 remedial system and natural attenuation processes, groundwater cleanup levels have been achieved at SD-5N and are expected to be achieved at SD-5S. However, the timeframe to achieve aquifer restoration at SD-5S (2022) will be longer than predicted in the ROD (2008), primarily due to the presence of contamination in low hydraulic conductivity aquifer materials. Since the LUCs are in place and are functioning as intended, the remedy remains protective (AFCEC, 2013).

5.0 STATE AGENCY COMMENTS AND PUBLIC PARTICIPATION ACTIVITIES

As part of the ESD review process, the regulatory agencies (EPA and MassDEP) were given the opportunity to comment on the draft version of this ESD. Responses to the regulatory agency comments were documented in the 11 March 2014 Response to Comments Letter. The EPA and MassDEP concurred with the AFCEC's responses on 18 March 2014 and 19 March 2014, respectively.

5.1 COMMENTS FROM THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

MassDEP concurrence with this ESD can be found in Appendix C.

5.2 PUBLIC PARTICIPATION ACTIVITIES

In accordance with Section 117(d) of CERCLA, 42 United States Code §9617(D), AFCEC will publish a notice in the Cape Cod Times and the Mashpee Enterprise that describes this ESD and its availability in the Administrative Record. In accordance with 40 CFR Section 300.435(c)(2)(i) and 300.825(a)(2), this ESD and all documents that support the changes and clarifications are contained in the Administrative Record for the IRP at JBCC.

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FIGURES

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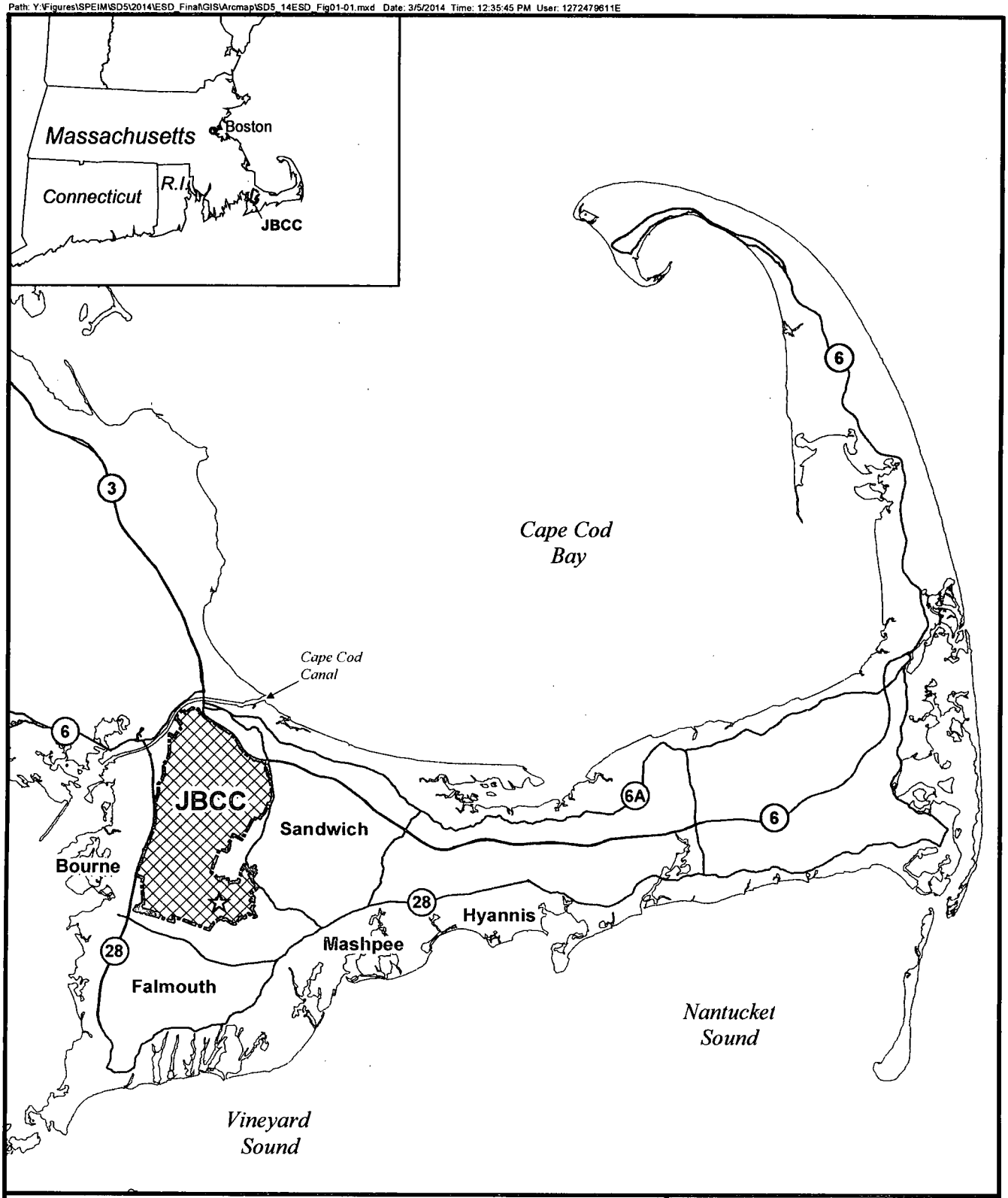

Data Source: AFCEC, JBCC-AFCEC Data Warehouse

Legend

Joint Base Cape Cod

SD-5 Source Area

0 3 6 Miles

FIGURE 1-1

JOINT BASE CAPE COD, MASSACHUSETTS

AFCEC - Joint Base Cape Cod

Final Storm Drain-5 Groundwater Explanation of Significant Differences

CH2MHILL.

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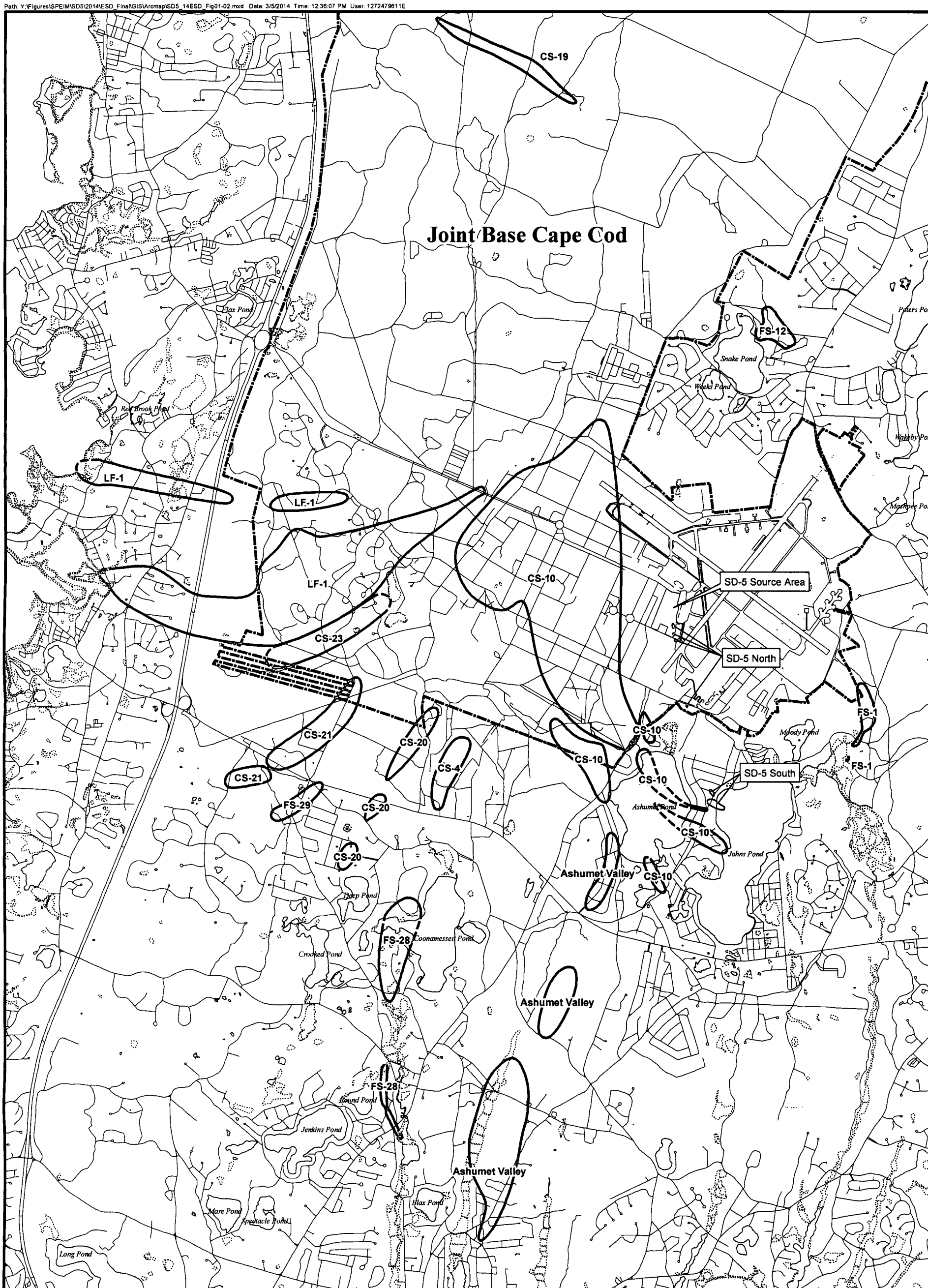

Legend

- Joint Base Cape Cod Boundary
- Other AFCEC Current Plume Boundary (Dashed Where Inferred)
- SD-5 2005 Plume Boundary
- Bog/Wetland
- Source Area

Data Source: AFCEC JBCC IRP Data Warehouse
JBCC Boundary from Massachusetts Air National Guard 2011

N

0 1,900 3,800 Feet

FIGURE 1-2

JBCC IRP PLUMES AND SD-5 PLUME BOUNDARY

AFCEC - Joint Base Cape Cod

Final Storm Drain-5 Groundwater Explanation of Significant Differences

CH2MHILL.

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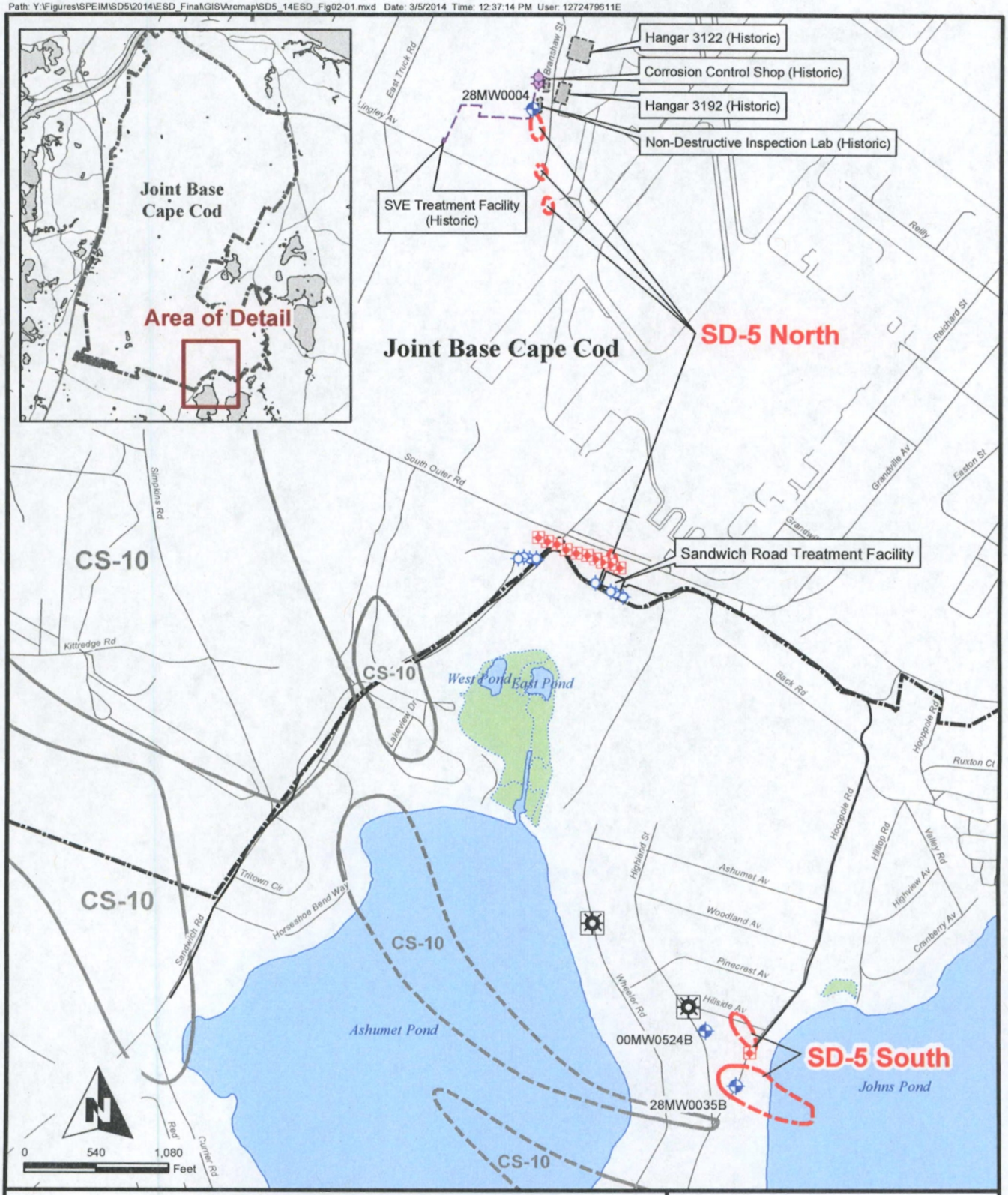

Data Source: AFCEC, December 2013, MMR-AFCEC Data Warehouse

Legend

- Joint Base Cape Cod
- SD-5 2005 Plume Boundary (Dashed Where Inferred)
- Other AFCEC Current Plume Boundary
- Bog/Wetland
- Historic Building Site
- Historic SVE Pipeline
- Historic SVE Extraction Well (Operational from 2002 to 2003)
- Reinjection Well (On)
- Extraction Well (Off)
- Recirculating Well (Abandoned)
- Monitoring Well (Current Long-Term Monitoring Network)

FIGURE 2-1

SD-5 GROUNDWATER PLUME (2005 DELINEATION)

AFCEC - Joint Base Cape Cod

Final Storm Drain-5 Groundwater Explanation of Significant Differences

CH2MHILL.

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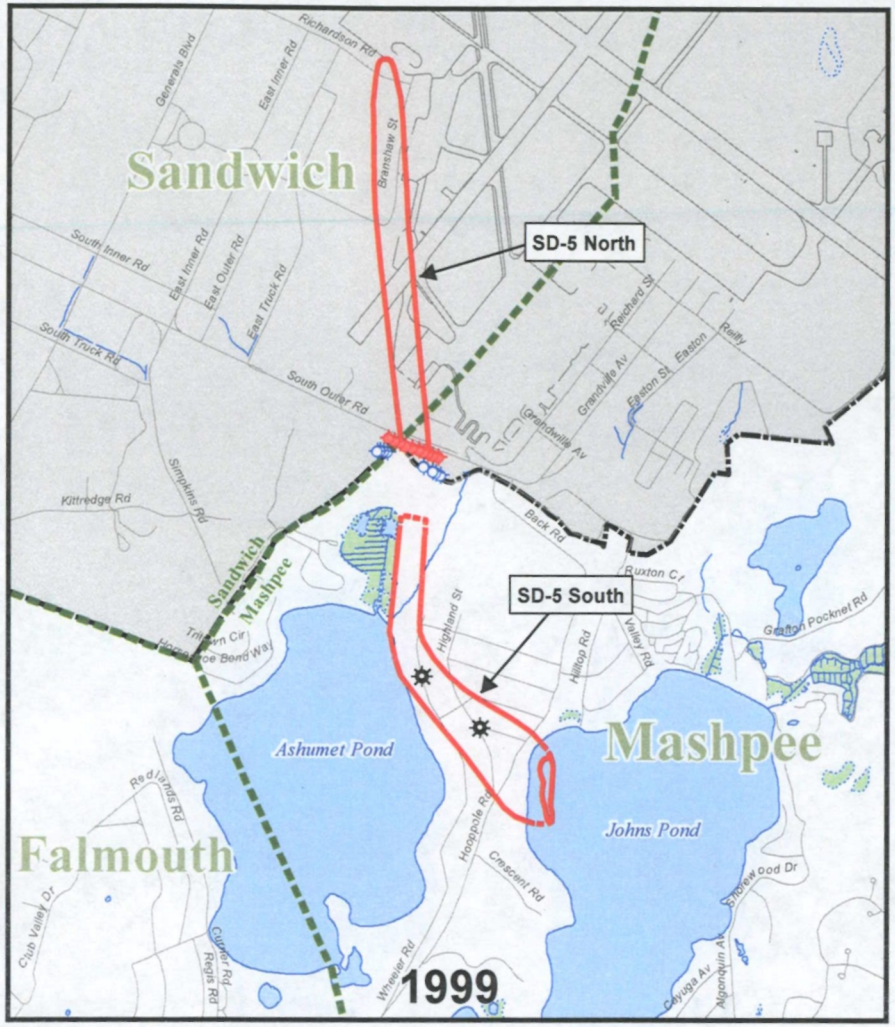
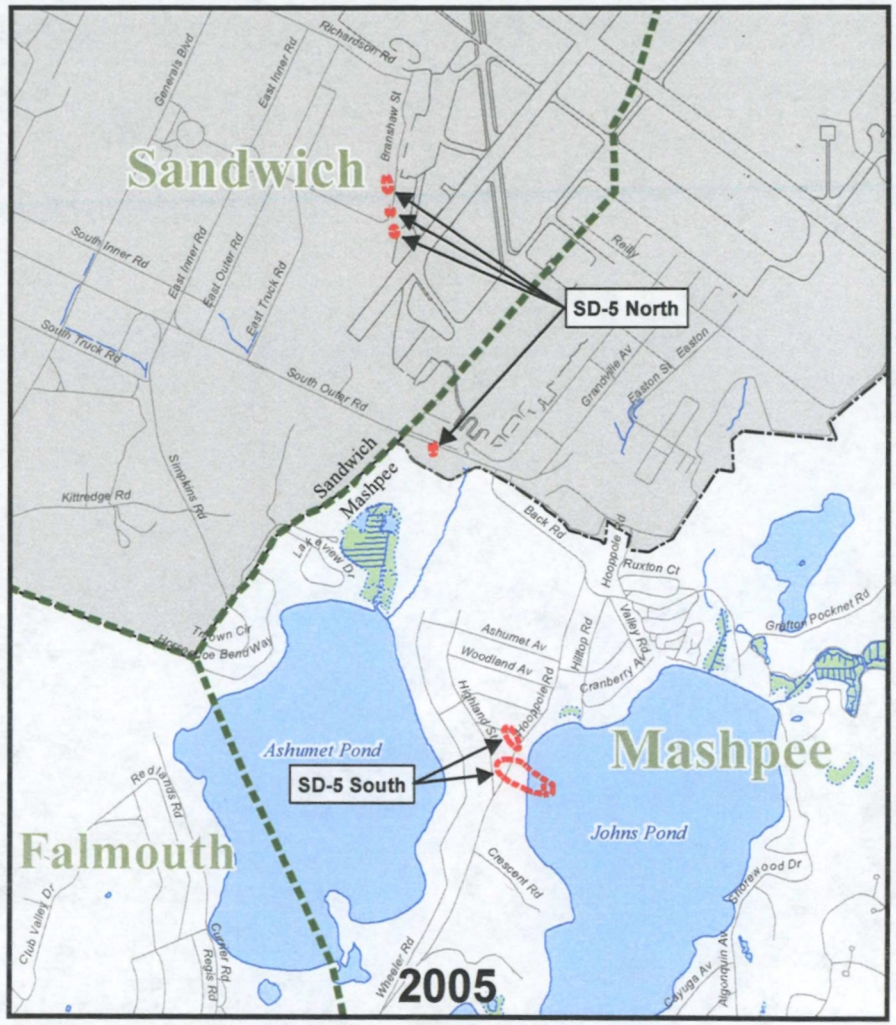




Data Source: AFCEC, JBCC-AFCEC Data Warehouse

Legend

- Town Boundary
- Joint Base Cape Cod Boundary
- Plume Boundary (Dashed Where Inferred)
- Bog/Wetland
- Extraction Well
- Recirculating Well
- Reinjection Well

N

0 1,100 2,200 Feet

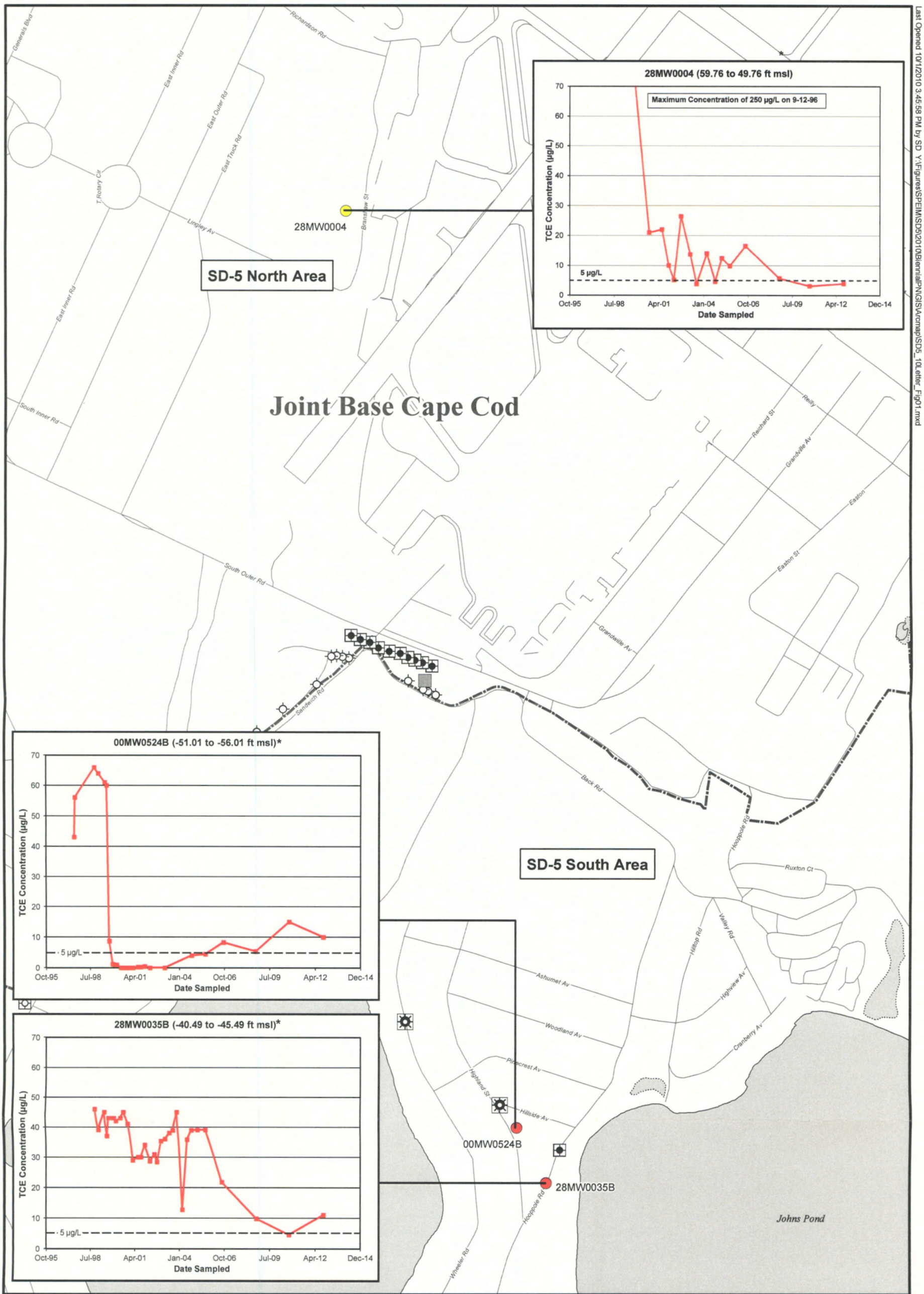
FIGURE 2-2

SD-5 PLUME
1999 AND 2005 COMPARISON

AFCEC - Joint Base Cape Cod

Final Storm Drain-5 Groundwater Explanation of Significant Differences

CH2MHILL.



Last Opened 10/1/2010 3:45:58 PM by SD Y:\Figures\SPEIM\SD5\2010\Biennial\PN\GIS\Arcmap\SD5_10Letter_Fig01.mxd

Data Source: AFCEC, December 2013, JBCC-AFCEC Data Warehouse

Legend

- Extraction Well (On)
- Extraction Well (Off)
- Reinjection Well (On)
- Treatment Plant
- Recirculating Well (Abandoned)
- Joint Base Cape Cod
- CS-10 Plume Boundary (Dashed Where Inferred)
- Treatment System Piping

TCE Detections

- > MCL
- BRL to MCL

*Value in parentheses is monitoring well screen elevation

0 325 650 Feet

FIGURE 2-3

TCE CONCENTRATION TRENDS IN THE SD-5 LONG-TERM MONITORING NETWORK WELLS

AFCEC - Joint Base Cape Cod

Finalt Storm Drain-5 Groundwater Explanation of Significant Differences

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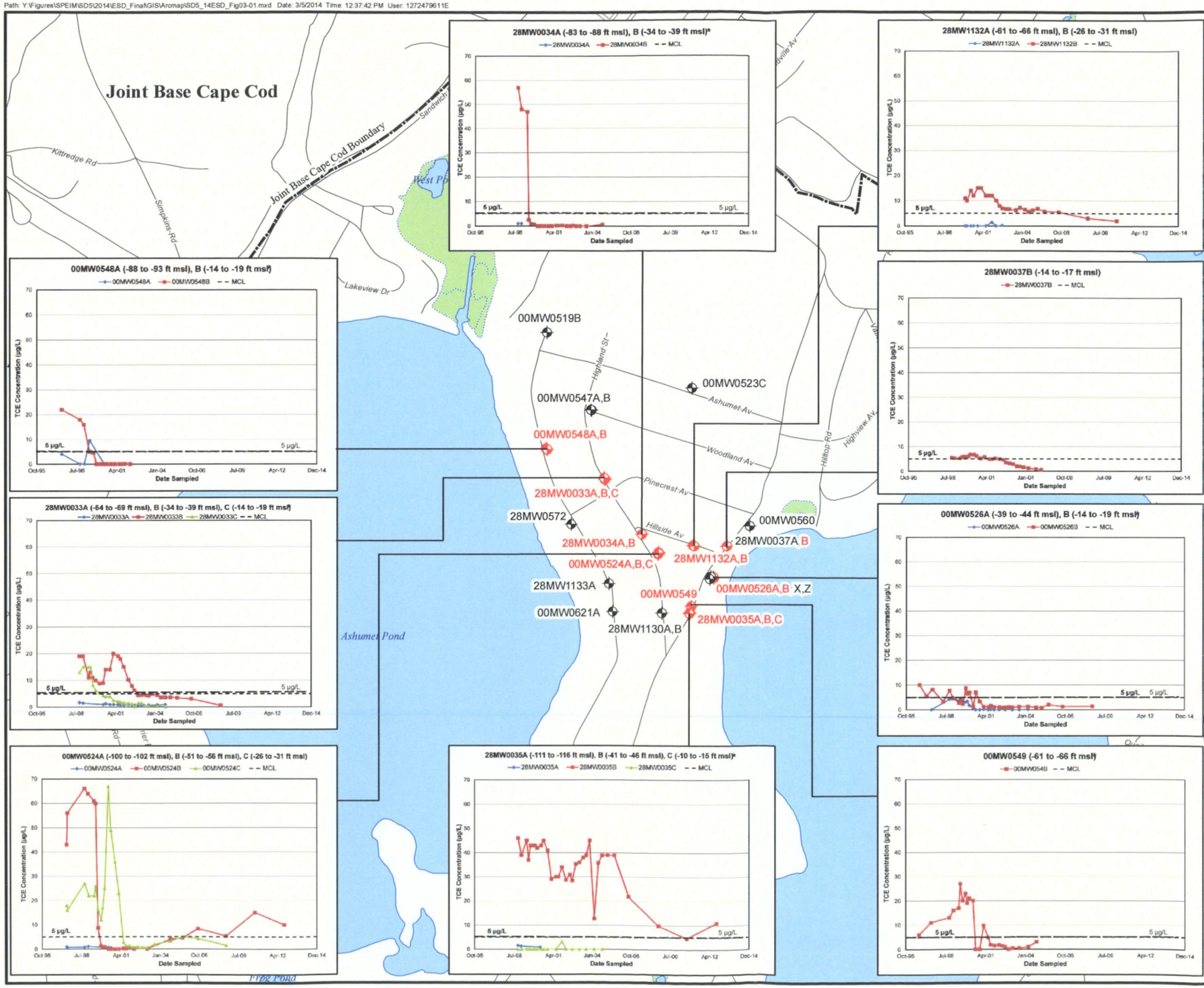

FIGURE 3-1

TCE CONCENTRATION TRENDS IN SD-5 SOUTH GROUNDWATER

AFCEC - Joint Base Cape Cod

Final Storm Drain-5 Groundwater Explanation of Significant Differences

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APPENDIX A

SD-5 South Groundwater – TCE Analytical Results (1996-2013)

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
00MW0519B	12/2/1999	ND
00MW0519B	11/28/2000	ND
00MW0519B	6/22/2001	ND
00MW0519B	3/14/2002	ND
00MW0523C	1/18/2000	ND
00MW0523C	3/2/2000	ND
00MW0523C	6/5/2000	ND
00MW0523C	8/8/2000	ND
00MW0523C	11/17/2000	ND
00MW0523C	3/26/2002	ND
00MW0524A	7/18/1997	BRL
00MW0524A	8/5/1997	BRL
00MW0524A	10/15/1998	BRL
00MW0524A	1/13/1999	1.1
00MW0524A	1/10/2000	BRL
00MW0524A	3/2/2000	BRL
00MW0524A	6/6/2000	BRL
00MW0524A	8/8/2000	BRL
00MW0524A	11/20/2000	ND
00MW0524A	2/23/2001	ND
00MW0524A	6/22/2001	BRL
00MW0524A	8/22/2001	BRL
00MW0524A	11/20/2001	BRL
00MW0524A	3/18/2002	BRL
00MW0524B	7/18/1997	**43**
00MW0524B	8/5/1997	**56**
00MW0524B	10/15/1998	**66**
00MW0524B	1/13/1999	**64**
00MW0524B	6/10/1999	**61**
00MW0524B	7/23/1999	**60**
00MW0524B	9/17/1999	**8.7**
00MW0524B	12/1/1999	1.2
00MW0524B	1/10/2000	BRL
00MW0524B	3/2/2000	BRL
00MW0524B	6/6/2000	ND
00MW0524B	8/8/2000	ND
00MW0524B	11/20/2000	ND
00MW0524B	2/27/2001	ND
00MW0524B	6/22/2001	BRL
00MW0524B	8/22/2001	BRL
00MW0524B	11/20/2001	BRL
00MW0524B	3/18/2002	ND
00MW0524B	2/13/2003	ND
00MW0524B	10/8/2004	4
00MW0524B	8/10/2005	4.5
00MW0524B	9/14/2006	**8.3**
00MW0524B	8/26/2008	**5.4**
00MW0524B	8/30/2010	**15**
00MW0524B	9/20/2012	**10**
00MW0524C	7/18/1997	**18**
00MW0524C	8/1/1997	**16**
00MW0524C	10/15/1998	**27**
00MW0524C	1/29/1999	**22**
00MW0524C	6/10/1999	**22**

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
00MW0524C	7/23/1999	**26**
00MW0524C	9/20/1999	**16**
00MW0524C	12/1/1999	**12**
00MW0524C	1/10/2000	**17**
00MW0524C	3/2/2000	**25**
00MW0524C	6/6/2000	**67**
00MW0524C	8/8/2000	**49**
00MW0524C	11/20/2000	**36**
00MW0524C	2/23/2001	**23**
00MW0524C	6/22/2001	2.8
00MW0524C	8/22/2001	1.4
00MW0524C	11/20/2001	1.3
00MW0524C	3/18/2002	BRL
00MW0524C	6/13/2002	BRL
00MW0524C	9/30/2002	BRL
00MW0524C	11/25/2002	BRL
00MW0524C	2/13/2003	BRL
00MW0524C	8/18/2003	1.92
00MW0524C	10/8/2004	3.2
00MW0524C	8/10/2005	5
00MW0524C	9/14/2006	4.3
00MW0524C	8/26/2008	1.6
00MW0524D	8/4/1997	ND
00MW0524E	8/4/1997	ND
00MW0525A	7/16/1997	ND
00MW0525B	7/16/1997	2
00MW0526A	7/17/1997	ND
00MW0526A	10/15/1998	4.2
00MW0526A	1/15/1999	4.9
00MW0526A	6/14/1999	3.6
00MW0526A	7/23/1999	4.6
00MW0526A	9/17/1999	3.3
00MW0526A	12/2/1999	3.1
00MW0526A	1/10/2000	3.4
00MW0526A	3/2/2000	1.7
00MW0526A	6/7/2000	BRL
00MW0526A	8/9/2000	ND
00MW0526A	11/17/2000	ND
00MW0526A	2/23/2001	BRL
00MW0526A	6/22/2001	ND
00MW0526A	8/21/2001	BRL
00MW0526A	11/14/2001	ND
00MW0526A	3/18/2002	ND
00MW0526A	8/19/2002	ND
00MW0526A	2/10/2003	ND
00MW0526A	8/6/2003	ND
00MW0526A	3/17/2004	BRL
00MW0526B	9/20/1996	**10**
00MW0526B	3/12/1997	**5.51**
00MW0526B	8/7/1997	**8.08**
00MW0526B	5/8/1998	3.23
00MW0526B	10/15/1998	**7.7**
00MW0526B	1/15/1999	4.5
00MW0526B	6/14/1999	2.7

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
00MW0526B	7/23/1999	3.9
00MW0526B	9/17/1999	2.3
00MW0526B	12/2/1999	**8.7**
00MW0526B	1/10/2000	**6.3**
00MW0526B	3/2/2000	**6.9**
00MW0526B	6/7/2000	1.3
00MW0526B	8/9/2000	**7**
00MW0526B	11/17/2000	3.3
00MW0526B	2/23/2001	1.2
00MW0526B	6/22/2001	1
00MW0526B	8/21/2001	1.5
00MW0526B	11/14/2001	1.1
00MW0526B	3/18/2002	BRL
00MW0526B	6/13/2002	BRL
00MW0526B	8/19/2002	BRL
00MW0526B	11/18/2002	BRL
00MW0526B	2/10/2003	BRL
00MW0526B	8/6/2003	1.17
00MW0526B	3/17/2004	1.2
00MW0526B	10/8/2004	BRL
00MW0526B	2/24/2005	BRL
00MW0526B	8/12/2005	2
00MW0526B	8/7/2006	1.2
00MW0526B	8/26/2008	1.3
00MW0526X	3/12/1997	ND
00MW0526X	8/8/1997	ND
00MW0526X	5/8/1998	ND
00MW0526X	10/15/1998	ND
00MW0526X	1/15/1999	ND
00MW0526Z	3/11/1997	ND
00MW0526Z	8/8/1997	ND
00MW0526Z	5/8/1998	ND
00MW0526Z	6/14/1999	BRL
00MW0526Z	7/23/1999	BRL
00MW0526Z	9/20/1999	ND
00MW0526Z	12/2/1999	ND
00MW0526Z	1/10/2000	ND
00MW0526Z	3/2/2000	ND
00MW0526Z	6/7/2000	ND
00MW0526Z	8/9/2000	ND
00MW0526Z	11/17/2000	ND
00MW0526Z	2/26/2001	ND
00MW0526Z	6/29/2001	ND
00MW0526Z	8/21/2001	ND
00MW0526Z	11/14/2001	ND
00MW0526Z	3/18/2002	ND
00MW0526Z	8/19/2002	ND
00MW0526Z	2/10/2003	ND
00MW0526Z	8/6/2003	ND
00MW0526Z	3/17/2004	ND
00MW0547A	7/16/1997	ND
00MW0547A	10/16/1998	ND
00MW0547A	1/28/1999	ND
00MW0547A	6/10/1999	ND

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
00MW0547A	7/23/1999	ND
00MW0547A	9/20/1999	ND
00MW0547A	12/1/1999	ND
00MW0547A	3/7/2000	ND
00MW0547A	6/6/2000	ND
00MW0547A	8/11/2000	ND
00MW0547A	11/20/2000	ND
00MW0547A	8/24/2001	ND
00MW0547A	3/26/2002	ND
00MW0547B	10/16/1996	ND
00MW0547B	7/16/1997	ND
00MW0547B	10/16/1998	ND
00MW0547B	1/28/1999	ND
00MW0547B	1/10/2000	ND
00MW0547B	3/3/2000	ND
00MW0547B	6/7/2000	ND
00MW0547B	8/11/2000	ND
00MW0547B	11/20/2000	ND
00MW0548A	7/17/1997	**4**
00MW0548A	10/16/1998	ND
00MW0548A	1/28/1999	ND
00MW0548A	6/10/1999	**9.5**
00MW0548A	6/6/2000	ND
00MW0548A	8/11/2000	ND
00MW0548A	11/20/2000	ND
00MW0548A	2/23/2001	ND
00MW0548A	6/21/2001	ND
00MW0548A	8/24/2001	ND
00MW0548A	11/16/2001	ND
00MW0548A	3/18/2002	ND
00MW0548B	7/17/1997	**22**
00MW0548B	10/16/1998	**18**
00MW0548B	1/20/1999	**16**
00MW0548B	6/10/1999	5
00MW0548B	7/27/1999	4.8
00MW0548B	9/15/1999	4.6
00MW0548B	12/2/1999	ND
00MW0548B	3/7/2000	ND
00MW0548B	6/6/2000	ND
00MW0548B	8/11/2000	ND
00MW0548B	11/20/2000	ND
00MW0548B	2/26/2001	ND
00MW0548B	6/21/2001	ND
00MW0548B	8/24/2001	ND
00MW0548B	11/16/2001	BRL
00MW0548B	3/18/2002	ND
00MW0549	9/19/1996	**6**
00MW0549	7/16/1997	**11**
00MW0549	10/19/1998	**13**
00MW0549	2/2/1999	**16**
00MW0549	6/11/1999	**17**
00MW0549	7/23/1999	**27**
00MW0549	9/20/1999	**20**
00MW0549	12/3/1999	**23**

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
00MW0549	1/11/2000	**19**
00MW0549	3/2/2000	**21**
00MW0549	6/6/2000	**20**
00MW0549	8/8/2000	ND
00MW0549	11/20/2000	ND
00MW0549	2/26/2001	**9.8**
00MW0549	6/22/2001	4.8
00MW0549	8/24/2001	1.8
00MW0549	11/28/2001	1.5
00MW0549	3/20/2002	1.76
00MW0549	6/13/2002	1.38
00MW0549	8/22/2002	BRL
00MW0549	11/18/2002	ND
00MW0549	2/26/2003	BRL
00MW0549	8/6/2003	BRL
00MW0549	3/26/2004	1
00MW0549	10/18/2004	3
00MW0560	2/2/1999	ND
00MW0560	8/22/2001	ND
00MW0621A	1/12/2000	ND
00MW0621A	3/8/2000	ND
00MW0621A	6/7/2000	ND
00MW0621A	8/14/2000	ND
00MW0621A	11/20/2000	ND
00MW0621A	2/27/2001	ND
00MW0621A	6/27/2001	ND
00MW0621A	8/28/2001	ND
00MW0621A	11/30/2001	BRL
00MW0621A	3/18/2002	ND
00MW0621A	8/28/2002	ND
00MW0621A	3/10/2003	ND
00MW0621A	8/12/2003	ND
00MW0621A	10/18/2004	ND
00MW0621A	3/15/2005	ND
00MW0621A	3/23/2006	ND
00MW0621A	11/27/2006	ND
00MW0621A	7/2/2008	ND
00MW0621A	11/12/2010	ND
00MW0621A	11/2/2012	ND
28MW0033A	10/21/1998	1.7
28MW0033A	1/20/1999	1.5
28MW0033A	6/7/2000	1
28MW0033A	8/10/2000	1.3
28MW0033A	11/27/2000	1
28MW0033A	2/26/2001	BRL
28MW0033A	6/22/2001	BRL
28MW0033A	8/22/2001	BRL
28MW0033A	11/16/2001	BRL
28MW0033A	3/14/2002	BRL
28MW0033A	6/11/2002	BRL
28MW0033A	8/16/2002	BRL
28MW0033A	11/18/2002	BRL
28MW0033A	2/10/2003	BRL
28MW0033A	8/6/2003	BRL

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
28MW0033A	3/16/2004	BRL
28MW0033A	10/8/2004	BRL
28MW0033B	10/21/1998	**19**
28MW0033B	1/20/1999	**19**
28MW0033B	6/11/1999	**11**
28MW0033B	7/23/1999	**13**
28MW0033B	9/20/1999	**11**
28MW0033B	12/1/1999	**10**
28MW0033B	3/8/2000	**8.8**
28MW0033B	6/7/2000	**9**
28MW0033B	8/10/2000	**14**
28MW0033B	11/27/2000	**14**
28MW0033B	2/26/2001	**20**
28MW0033B	6/22/2001	**19**
28MW0033B	8/22/2001	**18**
28MW0033B	11/16/2001	**15**
28MW0033B	3/14/2002	**10.2**
28MW0033B	6/11/2002	**7.84**
28MW0033B	8/16/2002	**6.22**
28MW0033B	11/18/2002	4.49
28MW0033B	2/10/2003	4.43
28MW0033B	6/9/2003	4.43
28MW0033B	8/6/2003	4.23
28MW0033B	11/17/2003	4.8
28MW0033B	3/16/2004	4.5
28MW0033B	6/23/2004	3.6
28MW0033B	10/8/2004	3.6
28MW0033B	2/16/2005	3.6
28MW0033B	8/12/2005	3.4
28MW0033B	8/7/2006	3
28MW0033B	8/26/2008	BRL
28MW0033C	10/22/1998	**13**
28MW0033C	1/20/1999	**15**
28MW0033C	6/11/1999	**15**
28MW0033C	7/23/1999	**15**
28MW0033C	9/23/1999	**8.2**
28MW0033C	12/1/1999	**6.2**
28MW0033C	3/8/2000	**5.4**
28MW0033C	6/7/2000	4.3
28MW0033C	8/10/2000	3.9
28MW0033C	11/27/2000	4
28MW0033C	2/26/2001	2.5
28MW0033C	6/22/2001	2.1
28MW0033C	8/22/2001	1.9
28MW0033C	11/16/2001	1.6
28MW0033C	3/14/2002	1.44
28MW0033C	6/11/2002	1.19
28MW0033C	8/16/2002	BRL
28MW0033C	11/18/2002	1.5
28MW0033C	2/10/2003	1.48
28MW0033C	8/6/2003	BRL
28MW0033C	3/16/2004	BRL
28MW0033C	10/8/2004	BRL
28MW0034A	10/20/1998	1

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
28MW0034A	1/19/1999	BRL
28MW0034B	10/21/1998	**57**
28MW0034B	1/19/1999	**48**
28MW0034B	6/11/1999	**47**
28MW0034B	7/23/1999	2.5
28MW0034B	9/20/1999	BRL
28MW0034B	12/3/1999	BRL
28MW0034B	3/8/2000	ND
28MW0034B	6/7/2000	ND
28MW0034B	8/11/2000	ND
28MW0034B	11/27/2000	ND
28MW0034B	2/27/2001	ND
28MW0034B	6/22/2001	BRL
28MW0034B	8/22/2001	BRL
28MW0034B	11/30/2001	BRL
28MW0034B	3/18/2002	ND
28MW0034B	6/27/2002	ND
28MW0034B	8/27/2002	BRL
28MW0034B	11/25/2002	ND
28MW0034B	3/10/2003	ND
28MW0034B	8/18/2003	ND
28MW0034B	10/8/2004	BRL
28MW0035A	11/2/1998	1.6
28MW0035A	1/21/1999	1.3
28MW0035A	5/17/2000	BRL
28MW0035B	11/3/1998	**46**
28MW0035B	1/26/1999	**39**
28MW0035B	6/11/1999	**45**
28MW0035B	7/27/1999	**37**
28MW0035B	9/15/1999	**43**
28MW0035B	12/2/1999	**43**
28MW0035B	1/11/2000	**43**
28MW0035B	3/2/2000	**42**
28MW0035B	6/8/2000	**43**
28MW0035B	8/10/2000	**45**
28MW0035B	11/21/2000	**41**
28MW0035B	2/27/2001	**29**
28MW0035B	6/29/2001	**30**
28MW0035B	8/30/2001	**30**
28MW0035B	11/29/2001	**34**
28MW0035B	3/19/2002	**28.7**
28MW0035B	6/28/2002	**30.9**
28MW0035B	8/26/2002	**28.4**
28MW0035B	11/26/2002	**35.3**
28MW0035B	2/26/2003	**36**
28MW0035B	6/6/2003	**38**
28MW0035B	8/21/2003	**38.9**
28MW0035B	11/20/2003	**45**
28MW0035B	3/16/2004	**12.7**
28MW0035B	6/29/2004	**35.8**
28MW0035B	10/8/2004	**38.9**
28MW0035B	2/24/2005	**39**
28MW0035B	8/17/2005	**39**
28MW0035B	8/10/2006	**21.8**

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
28MW0035B	9/12/2008	**9.8**
28MW0035B	8/30/2010	4.6
28MW0035B	9/27/2012	**11**
28MW0035C	11/3/1998	ND
28MW0035C	1/26/1999	ND
28MW0035C	6/11/1999	ND
28MW0035C	7/27/1999	ND
28MW0035C	9/15/1999	ND
28MW0035C	12/2/1999	ND
28MW0035C	1/11/2000	ND
28MW0035C	3/2/2000	ND
28MW0035C	6/8/2000	ND
28MW0035C	8/10/2000	ND
28MW0035C	11/21/2000	ND
28MW0035C	6/29/2001	ND
28MW0035C	11/29/2001	3.2
28MW0035C	3/19/2002	ND
28MW0035C	8/26/2002	ND
28MW0035C	2/26/2003	ND
28MW0035C	8/21/2003	ND
28MW0035C	3/16/2004	ND
28MW0035C	10/8/2004	ND
28MW0037A	11/2/1998	ND
28MW0037A	1/21/1999	ND
28MW0037A	6/11/1999	ND
28MW0037A	7/27/1999	ND
28MW0037A	9/21/1999	ND
28MW0037A	12/2/1999	ND
28MW0037A	1/10/2000	ND
28MW0037A	3/2/2000	ND
28MW0037A	6/8/2000	ND
28MW0037A	8/10/2000	ND
28MW0037A	11/21/2000	ND
28MW0037A	6/29/2001	ND
28MW0037A	11/29/2001	ND
28MW0037A	3/19/2002	ND
28MW0037A	8/26/2002	ND
28MW0037A	2/26/2003	ND
28MW0037A	8/21/2003	ND
28MW0037A	3/29/2004	ND
28MW0037A	10/8/2004	ND
28MW0037B	11/2/1998	**5.5**
28MW0037B	1/21/1999	**5.3**
28MW0037B	6/11/1999	**5.3**
28MW0037B	7/27/1999	**5.8**
28MW0037B	9/23/1999	**5.9**
28MW0037B	12/2/1999	**5.8**
28MW0037B	1/12/2000	**6**
28MW0037B	3/2/2000	**6.8**
28MW0037B	6/8/2000	**6.7**
28MW0037B	8/10/2000	**6.1**
28MW0037B	11/21/2000	**5.2**
28MW0037B	2/27/2001	**5.8**
28MW0037B	6/29/2001	4.9

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
28MW0037B	8/30/2001	4.9
28MW0037B	11/29/2001	**5.2**
28MW0037B	3/19/2002	4.9
28MW0037B	6/28/2002	4.54
28MW0037B	8/26/2002	3.52
28MW0037B	11/26/2002	3.21
28MW0037B	2/26/2003	2.89
28MW0037B	6/6/2003	2.04
28MW0037B	8/21/2003	1.89
28MW0037B	11/20/2003	1.6
28MW0037B	3/29/2004	1.2
28MW0037B	10/8/2004	BRL
28MW0037B	2/24/2005	BRL
28MW0572	7/17/1997	ND
28MW0572	10/19/1998	ND
28MW0572	1/27/1999	ND
28MW0572	9/21/1999	ND
28MW0572	12/2/1999	ND
28MW0572	3/8/2000	ND
28MW0572	6/14/2000	ND
28MW0572	8/14/2000	ND
28MW0572	12/4/2000	ND
28MW0572	8/27/2001	ND
28MW0572	11/29/2001	BRL
28MW0572	3/22/2002	ND
28MW1130A	1/12/2000	ND
28MW1130A	3/3/2000	ND
28MW1130A	6/12/2000	ND
28MW1130A	8/11/2000	ND
28MW1130A	11/29/2000	BRL
28MW1130A	6/28/2001	BRL
28MW1130A	11/23/2001	ND
28MW1130A	3/15/2002	ND
28MW1130A	8/28/2002	ND
28MW1130B	1/12/2000	ND
28MW1130B	3/3/2000	ND
28MW1130B	6/12/2000	ND
28MW1130B	8/11/2000	ND
28MW1130B	11/29/2000	ND
28MW1130B	6/28/2001	ND
28MW1130B	11/23/2001	ND
28MW1130B	3/15/2002	ND
28MW1130B	8/28/2002	ND
28MW1130B	3/10/2003	ND
28MW1130B	6/9/2003	ND
28MW1130B	8/12/2003	ND
28MW1130B	10/18/2004	ND
28MW1132A	1/12/2000	ND
28MW1132A	3/3/2000	ND
28MW1132A	6/9/2000	ND
28MW1132A	8/14/2000	ND
28MW1132A	11/28/2000	ND
28MW1132A	6/28/2001	ND
28MW1132A	11/30/2001	1.4

Appendix A

SD-5 South Groundwater - TCE Analytical Results (1996-2013)

Final SD-5 Groundwater Explanation of Significant Differences

Location	Sample Date	TCE (µg/L) MCL = 5
28MW1132A	3/19/2002	ND
28MW1132A	8/20/2002	BRL
28MW1132B	1/12/2000	**11**
28MW1132B	3/3/2000	**10**
28MW1132B	6/9/2000	**14**
28MW1132B	8/14/2000	**12**
28MW1132B	11/28/2000	**15**
28MW1132B	2/26/2001	**15**
28MW1132B	6/28/2001	**12**
28MW1132B	8/24/2001	**12**
28MW1132B	11/30/2001	**12**
28MW1132B	3/19/2002	**10.1**
28MW1132B	6/13/2002	**7.97**
28MW1132B	8/20/2002	**6.99**
28MW1132B	11/26/2002	**6.69**
28MW1132B	2/13/2003	**6.63**
28MW1132B	8/7/2003	**6.23**
28MW1132B	11/17/2003	**7.2**
28MW1132B	3/25/2004	**6.5**
28MW1132B	6/23/2004	**5.7**
28MW1132B	10/8/2004	**6.2**
28MW1132B	2/16/2005	**6.8**
28MW1132B	8/10/2005	**5.7**
28MW1132B	8/2/2006	**5.5**
28MW1132B	8/26/2008	3.1
28MW1132B	8/30/2010	2.1
28MW1133A	1/13/2000	ND
28MW1133A	3/3/2000	ND
28MW1133A	6/9/2000	ND
28MW1133A	8/14/2000	ND
28MW1133A	11/28/2000	ND
28MW1133A	6/26/2001	ND
28MW1133A	11/30/2001	BRL
28MW1133A	3/18/2002	ND
28MW1133A	8/21/2002	ND
28MW1133A	3/18/2003	ND
28MW1133A	8/7/2003	ND
28MW1133A	10/8/2004	ND
MAMW0518A	7/18/1997	ND
MAMW0518C	7/18/1997	ND
MAMW0519B	6/14/1999	ND
MAMW0519B	7/27/1999	ND
MAMW0519B	9/21/1999	ND
MAMW0519B	6/12/2000	ND

Data Source: AFCEC, December 2013, MMR-AFCEC Data Warehouse

Note:

BOLD values indicate an MCL exceedance.

Key:

BRL = below the reporting limit

MCL = Maximum Contaminant Level

ND = nondetect

SD-5 = Storm Drain-5

TCE = trichloroethene

µg/L = micrograms per liter

APPENDIX B

SD-5 South Groundwater – Groundwater Travel Time Analysis

Appendix B
SD-5 South Groundwater - Travel Time Analysis Results
Final SD-5 Groundwater Explanation of Significant Differences

Hydraulic Gradient (ft/ft)	K (ft/day)	Effective Porosity	Groundwater Velocity (ft/day)	Travel Time from 28MW0033B to 28MW0035B (years)
0.002	15	0.3	0.1	31
0.002	50	0.3	0.3	9
0.002	100	0.3	0.7	5
0.002	150	0.3	1.0	3
0.002	200	0.3	1.3	2
0.002	250	0.3	1.7	2

Notes:

1. Hydraulic gradient from triangle 412 (28MW0033C, 00MW0547B, 00MW523A) on Figure 3-16 in the 2003 Annual SD-5 SPEIM Report (AFCEE 2004).
2. Distance from 28MW0033B to 28MW0035B is approximately 1,125 ft.

Key:

ft = feet or foot

K = hydraulic conductivity

SD-5 = Storm Drain-5

SPEIM = System Performance and Ecological Impact Monitoring

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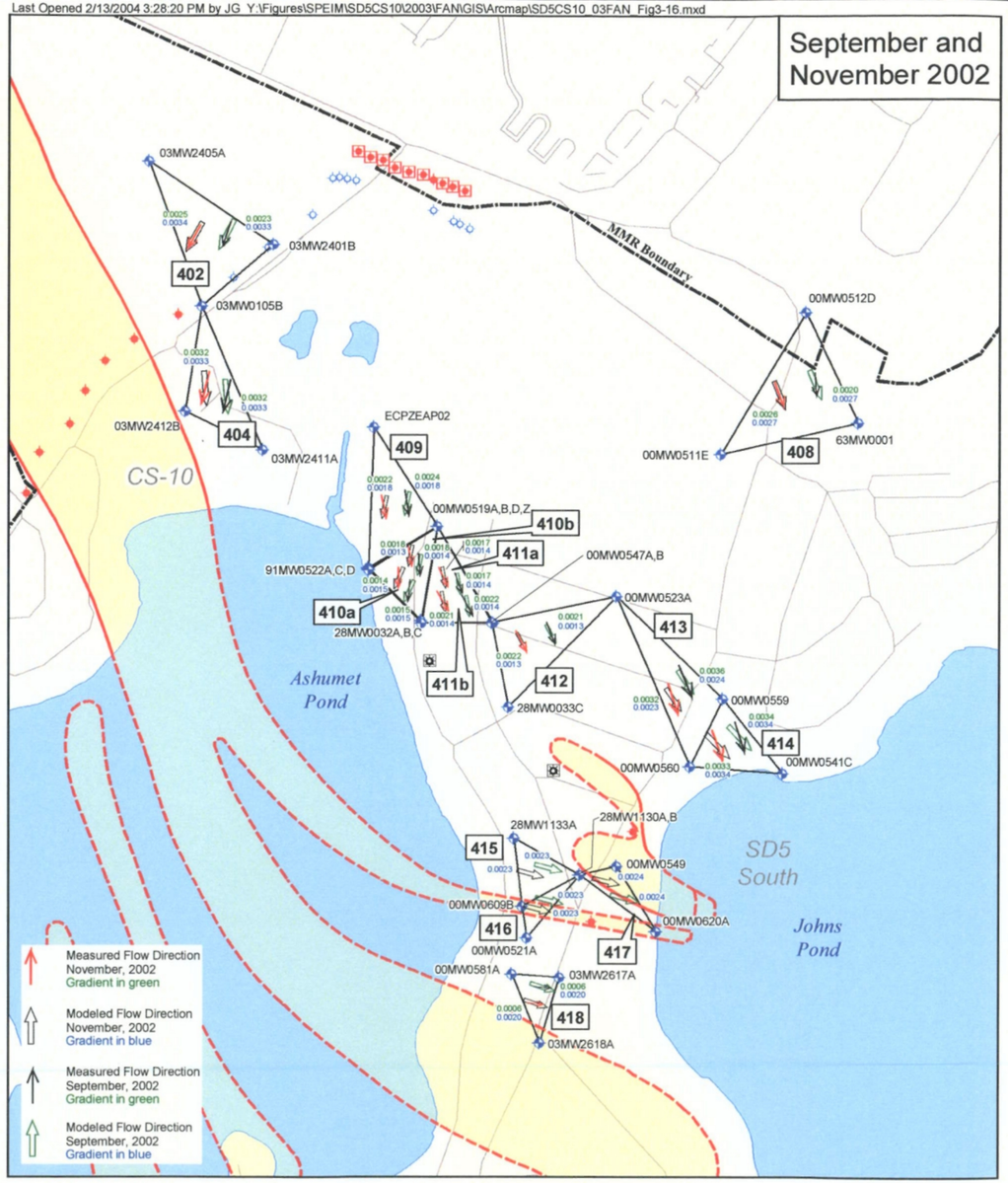

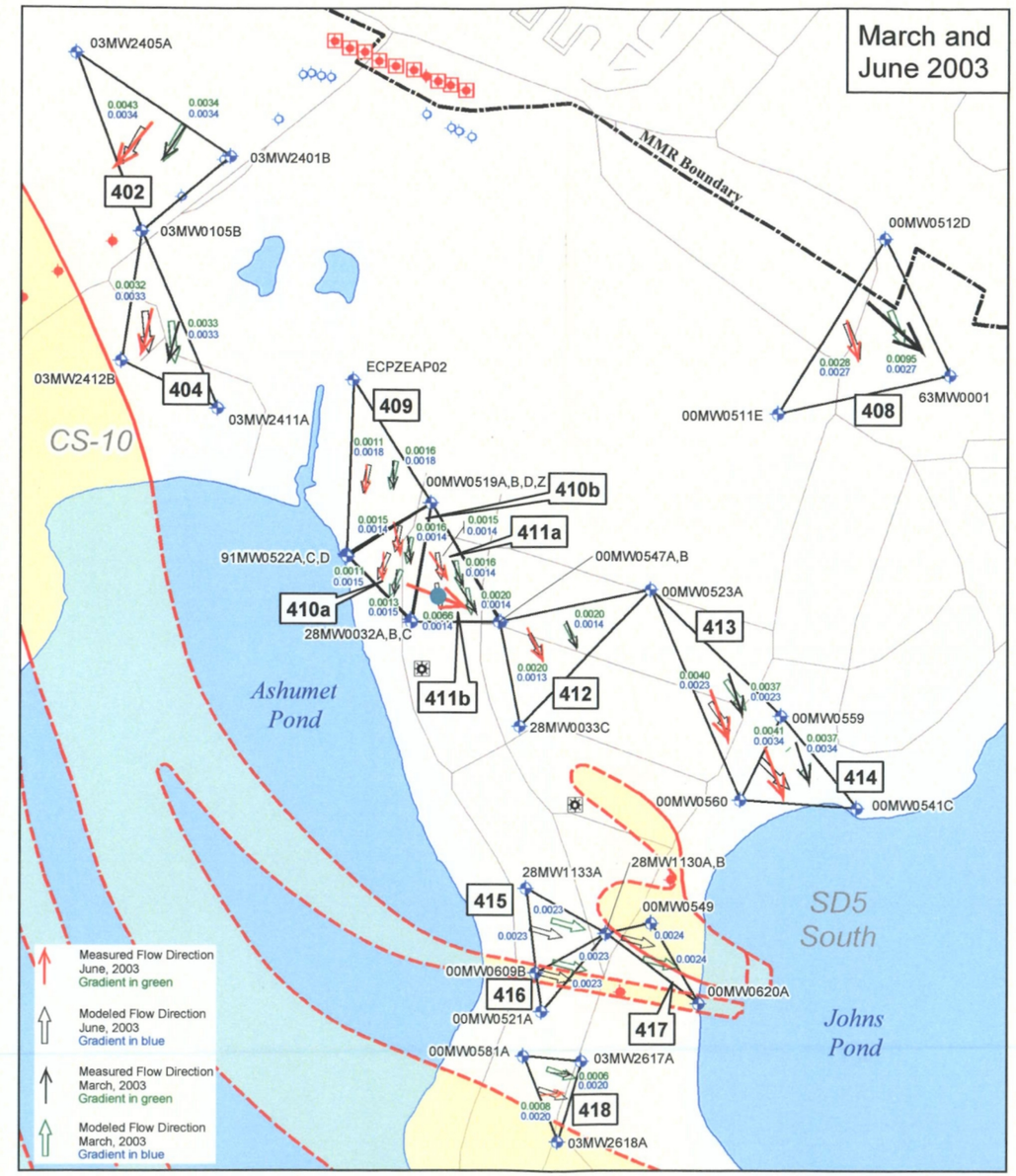

Legend

- Extraction Well
- Extraction Well (Non-operational)
- Reinjection Well
- Peripheral Network Well
- Recirculation Well (Non-operational)
- MMR Boundary
- Plume Boundary (Dashed where inferred)
- 412 Triangular Elements for Determining Hydraulic Gradients

Size of flow direction arrow proportional to gradient magnitude.

.0006 — .0066...

Data Source: AFCEE, MMR-AFCEE Data Warehouse

N

0 550 1,100 Feet

FIGURE 3-16

SD-5 SOUTH PERIPHERAL HYDRAULIC MONITORING WELL NETWORK AND OBSERVED VS. MODEL-PREDICTED GRADIENTS

AFCEE - Massachusetts Military Reservation

Final SD-5 and CS-10 2003 Annual SPEIM Report

CH2MHILL

APPENDIX C

MassDEP Concurrence Letter

Draft Press Release

This fall, EPA will be continuing its work at the Joint Base Cape Cod Superfund Site on Cape Cod Massachusetts with an updated estimate of aquifer restoration for the SD-5 groundwater plume. The change in the restoration is recorded in an Explanation of Significant Differences, or an ESD.

The final plume cleanup plan for SD-5 was selected in EPA's Record of Decision (ROD) in September 2006. The selected remedy was long-term monitoring with land use controls. An interim remedy for SD-5 groundwater plume was selected in 1995, and operated from August 1997 to February 2004. This interim remedy, groundwater extraction and treatment system was composed of a ten-extraction well fence which captured the northern half of the SD-5 plume, and of two recirculating wells and an extraction well to address the southern half.

To control the source of the groundwater contamination buildings/hangers were demolished and leaching wells, drainage structures and soil were removed between 1990 and 2003. A total of 6,500 tons of soil was removed and transported off-site for disposal. In addition, a soil vapor extraction system operated from August 2002 to March 2003, and removed 5 pounds of Volatile Organic Compounds.

In 2006, when the cleanup plan was selected it was predicted that contamination levels would decrease to an acceptable level by approximately 2008. That goal was achieved in the SD-5 North, however contamination exceedences remain in two wells which are screened in the lower conductivity zones of the aquifer. Based on these findings, the updated estimate of the aquifer restoration is 2022 instead of 2008.

Although the restoration estimate has been revised, the area surrounding the groundwater plume remains protective of human health and the environment due to land use controls.

Site Background:

The Joint Base Cape Cod is a 22,000-acre property that has been used for military training activities since 1911. The base is located over an aquifer that is the sole source of drinking water for residents of Cape Cod. Two environmental cleanup programs (one implemented by the Army, the other by the Air Force) are addressing the areas of soil and groundwater contamination that have resulted from activities on site. The U.S. Air Force is addressing contamination from the Otis Air Force Base primarily in the southern portion of JBCC under the Federal Superfund Program. The U.S. Army is addressing contamination at Camp Edwards in the northern portion of JBCC as required by EPA under the authority of the Safe Drinking Water Act. Both cleanup programs are progressing with oversight from the EPA and the MassDEP.

EXPLANATION OF SIGNIFICANT DIFFERENCES SUMMARY

INSTALLATION RESTORATION PROGRAM
STORM DRAIN-5 GROUNDWATER PLUME
MASSACHUSETTS MILITARY RESERVATION
CAPE COD, MASSACHUSETTS

Remedial Project Manager:	Robert Lim
Section Chief:	Lynne Jennings
ORC Contacts:	Bill Walsh-Rogalski
Community Involvement Coordinator:	Kate Melanson

BACKGROUND: This Explanation of Significant Differences (ESD) has been prepared to document a change to the selected remedy for SD-5 groundwater plume (See Figure 2-1). This former groundwater plume is located on the Joint Base Cape Cod (JBCC) formerly known as the Massachusetts Military Reservation, located on Cape Cod, Massachusetts. A summary the changes documented in this ESD is provided below.

A Record of Decision for SD-5 groundwater site was finalized in September 2006. The selected remedy was long-term monitoring with land use controls. An interim remedy for SD-5 groundwater plume was selected in 1995, and operated from August 1997 to February 2004. This interim remedy, groundwater extraction and treatment system was composed of a ten-extraction well fence which captured the northern half of the SD-5 plume at a peak flowrate of 355 gallons per minute, and of two recirculating wells and an extraction well to address the southern half.

Source control actions including the demolition of buildings/hangers and removal of leaching wells, drainage structures and soil were conducted between 1990 and 2003. A total of 6,500 tons of soil was removed and transported off-site for disposal. In addition, a soil vapor extraction system operated from August 2002 to March 2003, and removed 5 pounds of VOCs.

This ESD amends the estimate of aquifer restoration timeframe presented in the ROD from 2006. There is no change to the remedy which is long-term monitoring and land use controls. Modeling completed at the time of the ROD predicted TCE concentrations in the SD-5 area would decrease below the MCL by approximately 2008. This has been achieved in SD-5 North, however there are two monitoring wells in SD-5 South where TCE remains above the MCL. These two monitoring wells are located in zones of the aquifer with lower conductivity. Based on longer travel times in lower conductivity zones, the updated estimate of aquifer restoration is 2022 instead of 2008.

Although this remedy restoration estimate has been revised, the area surrounding the groundwater plume remain protective of human health and the environment due to land use controls.

ISSUES: There are no specific issues as a result of this ESD.

PUBLIC INVOLVEMENT/COMMENTS: Updates on these changes were presented in past MMRCT meetings. There is no public involvement on these sites.

MEDIA/CONGRESSIONAL INVOLVEMENT: There has been no Congressional or media involvement related to this ESD.

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

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DEVAL L. PATRICK
Governor

MAEVE VALLELY BARTLETT
Secretary

DAVID W. CASH
Commissioner

September 30, 2014

James T. Owens III, Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region I
5 Post Office Square Suite 100
Boston, MA 02109-3912

RE: **BOURNE**
Release Tracking Number: 4-0000037
Joint Base Cape Cod (JBCC)
Storm Drain-5 Groundwater Explanation of Significant Differences, Concurrence

Dear Mr. Owens:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the document entitled **"Final Storm Drain-5 Groundwater Explanation of Significant Differences"** (ESD), dated August 2014. The ESD was prepared by CH2M Hill for the Air Force Civil Engineer Center (AFCEC) Installation Restoration Program (IRP) at the Joint Base Cape Cod (JBCC), formerly the Massachusetts Military Reservation (MMR). The ESD was completed to document changes to the estimated aquifer restoration timeframe that was presented in the 2006 Storm Drain-5 Record of Decision (SD-5 ROD).

The selected remedy presented in the SD-5 ROD was Long Term Monitoring (LTM) with land use controls (LUCs) to prevent on-base and off-base human health exposure to residual areas of trichloroethylene (TCE) contaminated groundwater. The groundwater contamination at SD-5 has not been delineated as a contiguous plume since 2005 due to its limited extent. The estimated aquifer restoration timeframe presented in the SD-5 ROD was 2008, the year that TCE concentrations within the entire SD-5 groundwater area were predicted by a groundwater model to be below the Federal Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L). The SD-5 LTM program is ongoing and the LUCs continue to function as intended. However, the timeframe to achieve aquifer restoration for the SD-5 groundwater will be longer than predicted primarily due to the presence of contaminants in low conductivity aquifer materials. The estimated aquifer restoration timeframe has been amended in the ESD from 2008 to 2022 using historical TCE concentration data and approximations of groundwater velocities for the plume.

MassDEP concurs with the ESD. The ESD documents an increase in the estimated aquifer restoration time frame for SD-5 groundwater from 2008 to 2022. There is no fundamental change to the groundwater remedy identified in the SD-5 ROD, which is LTM and LUCs. The ESD does not fundamentally alter the groundwater remedy selected in the SD-5 ROD with respect to scope, performance, or cost. Long term monitoring and LUCs will continue to provide the necessary data to manage potential exposure risks, determine when Response Action Objectives have been met and to evaluate remediation optimization

This information is available in alternate format. Call Michelle Waters-Ekanem, Diversity Director, at 617-292-5751. TDD# 1-866-539-7622 or 1-617-574-6868
MassDEP Website: www.mass.gov/dep

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opportunities. The ESD modified groundwater remedy is protective of human health and the environment and complies with Commonwealth of Massachusetts requirements that are legally applicable or relevant and appropriate to the remedial action.

MassDEP's concurrence with the ESD is based upon representations made to MassDEP by the AFCEC and assumes that all information provided is substantially complete and accurate. Without limitation, if MassDEP determines that any material omissions or misstatements exist, if new information becomes available, if LUCs are not properly implemented, monitored and/or maintained or if conditions within any of the IRP groundwater plumes change, resulting in potential or actual human exposure or threats to the environment, MassDEP reserves its authority under M.G.L. c. 21E, CERCLA, the MCP, the NCP and any other applicable law or regulation to require further response actions including, without limitation, additional investigation, remedial measures, and the implementation of LUCs. MassDEP will review relevant information as it becomes available, including, without limitation, new regulatory requirements or changes in the environmental conditions, to determine if additional investigative and/or remedial measures are necessary for the protection of public health, safety, welfare or the environment.

Please incorporate this letter into the Administrative Record for Storm Drain-5 groundwater. If you have any questions regarding this matter, please contact Leonard J. Pinaud, Chief, State & Federal Site Management, Bureau of Waste Site Cleanup, in the MassDEP's Southeast Regional Office at (508) 946-2871 or Millie Garcia-Serrano, Deputy Regional Director for the Bureau of Waste Site Cleanup in MassDEP's Southeast Regional Office at (508) 946-2727.

Sincerely,

Benjamin Ericson
Assistant Commissioner
Bureau of Waste Site Cleanup

BE/lp

File : 4-0000037 SD-5 ESD Concurrence Letter 09-2014

Ec: Gary Moran, Deputy Commissioner
Philip Weinberg, Regional Director
Millie Garcia-Serrano, Deputy Regional Director
Leonard J. Pinaud, Chief, State & Federal Site Management
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MassDEP Southeast Region
MMR Plume Cleanup Team
Upper Cape Boards of Selectmen
Upper Cape Boards of Health
Lara Goodine [RAONR ADQREG]