Appendix A
Conceptual Site Models

APPENDIX A

Conceptual Site Models

This appendix provides additional details of the conceptual site models (CSMs) for the Travis Air Force Base (AFB) Environmental Restoration Program (ERP) groundwater sites described in Section 2.1. The CSMs are provided in the following subsections:

- Section A.1 – Sites FT004, LF007, and SD031
- Section A.2 – Sites FT005, SS029, and SS030
- Section A.3 – Site LF006
- Section A.4 – Site LF008
- Section A.5 – Site SS015
- Section A.6 – Site SS016
- Section A.7 – Site ST027B
- Section A.8 – West Industrial Operable Unit (WIOU) Sites SD033, SD034, SS035, SD036, SD037, SS041, and SD043
- Section A.9 – Site DP039

Sites that share common geological features and groundwater characteristics because of their proximity are grouped together to avoid repeating information. Discussion of these features for the Base as a whole is provided in Section 2.5. Figure A-1 shows the groundwater elevation contours across Travis AFB and can be referred to for each of the ERP sites (figures are located at the end of this appendix). Additional information about Travis AFB historical landfill Sites LF006 and LF007 can be found in the final *NEWIOU Soil, Sediment, and Surface Water ROD* (Travis AFB, 2006) and the final *RI Report for the North Operable Unit* (Radian, 1995). Information about historical landfill Site LF008 can be found in the final *Soil ROD for the WABOU* (Travis AFB, 2002) and final *WABOU RI Report* (CH2M HILL, 1997).

More detailed information about historical landfill Site LF006 can be found in the final *Site LF006 Natural Attenuation Assessment Work Plan* (CH2M HILL, 1999a).

For Site LF007, more extensive and detailed information regarding the historical landfill and Corrective Action Management Unit (CAMU) is provided in the final *LF007 Soil Remediation Design Report and Post-Construction Maintenance Plan* (CH2M HILL, 2002), the final *NEWIOU and WABOU Soil Remedial Action Report for Sites SD045, FT003, FT004, FT005, Union Creek SD001 and SD003, and LF007 Area E* (Shaw, 2008), the final *Project Summary Report for the Site LF007 Phase 2 Soil Remedial Action* (Shaw, 2004a), and the final *Project Summary Report for the LF007 Soil Remedial Action Phase 1, Landfill Cap, Corrective Action Management Unit Subgrade, Wetlands Mitigation* (Shaw, 2003).

Additional information regarding the historical Site LF008 landfill can be found in the final *Remedial Action Report for WABOU Soil Remedial Action at Site LF008* (Shaw Environmental, 2004a).

A.1 Sites FT004, LF007, and SD031 Conceptual Site Models

This subsection provides CSM descriptions for Sites FT004, LF007, and SD031. Site maps showing the contaminant distribution at each site are provided on Figures A-2 and A-3.

A.1.1 Site FT004 Description

Site FT004 covers approximately 40 acres in the northeastern portion of the East Industrial Operable Unit (EIOU) and is the former Fire Training Area No. 3 (FTA-3). The site was used for fire training exercises from 1953 to 1962. During these exercises, waste fuel, oils, and solvents were dumped onto frames or onto the ground and burned. Soil staining and stressed vegetation were observed during historical field investigations (Roy F. Weston, Inc. [Weston], 1995). The site is currently an unused, open field.

A.1.2 Site LF007 Description

Site LF007 is former Landfill 2 in the North Operable Unit (NOU); it encompasses approximately 94 acres. The landfill was operated using trench-and-cover methods beginning in the early 1950s, following the closure of Landfill 1 (Site LF006). The landfill was used primarily for the disposal of general refuse, such as wood, glass, and construction debris. Small amounts of industrial wastes and fuel sludge from tank-cleaning operations also were reported to have been disposed of at Landfill 2. Use of Landfill 2 ceased in 1974 (Radian Corporation [Radian], 1995). The approximate areal extent of the trenching activities at Site LF007 is shown on Figure A-2.

From the early 1950s until 1964, a portion of the eastern part of the landfill was used by the Defense Reutilization and Marketing Office to store excess waste materials, including oils, hydraulic fluid, and solvents, for resale or disposal. As determined by aerial photographs, a skeet range also was located at the site around 1953; however, the exact dates of operation are not known (Radian, 1995).

In addition to the Base Corrective Action Management Unit (CAMU), current Site LF007 operations include the operations at the Affiliate Radio System, the permitted hazardous waste storage facility, and a small arms range. Several large vernal pools are within the site boundaries; some extend north across the Base boundary. The land north of Site LF007, beyond the Base boundary, is privately owned and used for pasture. Until 2002, extensive seasonal ponding occurred in the eastern-central portion of the site because of the subsidence of the soil cover overlying the former landfill trenches. The elimination of the depressions caused by settling reduced seasonal surface water ponding at the landfill.

A groundwater interceptor trench was constructed upgradient (relative to groundwater movement across the site) from the CAMU to physically capture groundwater and maintain a minimum of 5 feet of separation between contaminated soil in the CAMU and groundwater. Collected groundwater is conveyed around the CAMU and discharged into an infiltration pit downgradient from the CAMU (CH2M HILL, 2002).

During the NOU Remedial Investigation [RI], Site LF007 was divided into three (3) study areas, currently designated as Subareas LF007B, LF007C, and LF007D.

A.1.3 Site SD031 Description

Site SD031, west of Site FT004, covers approximately 7.2 acres and encompasses Facility 1205 in the northeastern part of the EIOU. Facility 1205 was constructed in 1957, and operations include the maintenance and repair of diesel-powered generators. Wastes generated at the facility include oils, antifreeze, and solvents. A wash rack, just south of the facility, is still used to clean diesel engine parts; it discharges to an oil/water separator (OWS). Accidental releases in the vicinity of this wash rack appear to be the source of groundwater contamination in the area. Since the discovery of the releases, proper material handling and process controls were implemented to prevent additional releases. Historical aerial photographs taken from 1958 to 1963 indicate that Facility 1205 may have been used as an aircraft maintenance hangar during that time (CH2M HILL, 2011).

A.1.4 Sites FT004, LF007, and SD031 Geology

Sites FT004, LF007, and SD031 overlie Younger Alluvium, which was deposited after the last period of glaciation. This alluvium consists primarily of silts and clays that are low in permeability and do not transmit groundwater readily. On the eastern edge of Site LF007 lies a north-south trending subsurface ridge of Markley Sandstone, resulting in a thinning of the saturated zone toward the east.

The stratigraphy at Site LF007 also consists of fill material (municipal waste) and backfill/cover material. The fill material and municipal waste that overlie the alluvium at Site LF007 consist of sands and gravels interbedded with clay, organic matter, glass, metal, plastic, rubber, construction debris, and small amounts of industrial wastes and fuel sludge. The thickness of the fill material and municipal waste ranges from a few feet to more than 20 feet. Backfill consisting of clayey silt, sand and gravel, and organic matter overlies the fill and is about 1 to 5 feet thick. On the eastern portion of the landfill, the fill and wastes settled unevenly, which resulted in north-south trending depressions in Subarea LF007D. The depressions were eliminated in 2002 during regrading for the CAMU. The surface at Subarea LF007B and the western half of the landfill have not been affected by differential settling.

The saturated zone at Sites FT004 and SD031 ranges in thickness from approximately 20 to 35 feet. The bedrock underlying the alluvium at Sites FT004 and SD031 consists of siltstone and shale (Nortonville Shale). Depth to bedrock ranges from approximately 35 to 50 feet below ground surface (bgs). Groundwater contamination extends to bedrock. The trichloroethene (TCE) plume extends from the vicinity of MW131x04 to approximately 1,000 feet southward, where it was detected at a concentration of 2 J- (data flag; estimated value, biased low) micrograms per liter (µg/L) at well MW757x04 in 2011. Monitoring well screen intervals vary from 5 to 42 feet bgs at Site FT004 and from 5 to 35 feet bgs at Site SD031 and are adequate to monitor the vertical extent of contamination at these sites (CH2M HILL, 2012a).

The saturated zone is approximately 30 to 45 feet thick at Subarea LF007C. Depth to the shale bedrock in the vicinity of Subarea LF007C varies from 35 to 55 feet. Monitoring well

screen intervals vary from 10 to 50 feet bgs and are adequate to monitor the vertical extent of contamination at the site.

A.1.5 Sites FT004, LF007, and SD031 Surface Water

No surface water resources exist within Sites FT004 and SD031. There are several large vernal pools present within the Site LF007 boundaries; some extend north across the Base boundary (CH2M HILL, 2012a). The seasonal presence of vernal pools and ponds at Site LF007 provides additional recharge to the groundwater system during the winter.

A.1.6 Sites FT004, LF007, and SD031 Groundwater Characteristics

Information regarding the overall hydrogeologic characteristics of Sites FT004, LF007, and SD031 from the *Groundwater Sampling and Analysis Program 2010-2011 Annual Report* (2010-2011 GSAP) (CH2M HILL, 2012a) is as follows:

- Depth to groundwater typically ranges from 5 to 13 feet bgs.
- Regional groundwater flow in the vicinity of Sites FT004, SD031, and LF007 is toward the southeast.
- Local groundwater flow is radial away from a groundwater mound in the eastern portion of Site LF007. It is likely that the groundwater flow direction in the off-base portion of Subarea LF007C curves back and rejoins the regional southeasterly gradient because the regional groundwater flow direction is toward the southeast. However, the lack of data points and relatively flat horizontal gradients in the off-base area make it difficult to assess groundwater flow directions in Subarea LF007C.
- The geological features affecting local groundwater flow at Sites FT004, LF007, and SD031 are a groundwater trough, formed by the ridge of Nortonville Shale to the west and the ridge of Markley Sandstone bedrock to the east, and near-surface bedrock beneath the relatively thin alluvium in the vicinity of Site LF007.
- The horizontal hydraulic gradient is approximately 0.003 foot per foot (ft/ft) at these sites. In 2Q11, horizontal gradients in the western portion of Site LF007, away from the Site LF007 groundwater mound, were approximately 0.003 ft/ft. Horizontal gradients near the groundwater mound were approximately 0.01 ft/ft. Vertical gradients are generally negligible at Sites FT004, SD031, and LF007 and ranged from 0.01 ft/ft downward to 0.07 ft/ft upward in 2Q11.
- Groundwater elevations at Site FT004 vary seasonally by about 2 to 5 feet. Groundwater elevations at Site LF007 have a much larger seasonal variation than the rest of the Base. For example, MWEx07 typically varies by as much as 20 feet in 1 year. Other Site LF007 monitoring wells, such as MWDx07 and MWFx07, typically vary by 10 feet in 1 year. Groundwater to surface water connectivity is not present at Sites FT004 and SD031. Potential for groundwater to surface water connectivity exists at Site LF007 when vernal pools are present due to the large variation in groundwater elevation.
- Aquifer testing was performed at Sites FT004 (gravity-injection, 1988; rising head slug, 1991; falling head slug, 1991; pumping, 1998), LF007 (gravity-injection, 1988; pumping, 2001), and SD031 (pumping, 1998). The test results are summarized in the *Groundwater*

Sampling and Analysis Program 2002-2003 Annual Report (2002-2003 GSAP) (CH2M HILL, 2004). Additional aquifer testing was performed at Site LF007 in 2011 during the data gaps investigation at Subarea LF007C (CH2M HILL, 2012b).

A.1.7 Sites FT004, LF007, and SD031 Groundwater Contamination

Groundwater contamination at each site is discussed below. Table A-1 presents the current and historical maximum concentrations of the contaminants at each site (tables are located at the end of this appendix). Table A-2 presents the estimated dimensions of the contaminant plume at each site.

At Site FT004, the primary (i.e., exceeding cleanup levels) groundwater contaminant is TCE. The TCE plume at Site FT004 is currently estimated to be 950 feet long, 250 feet wide, and 30 feet thick and has an approximate volume of 1,455,170 cubic feet (ft^3). The current horizontal extent of TCE contamination is shown on Figure A-2. Vertical distribution of TCE contamination at Site FT004 is bounded by the water table along the upper portion of the aquifer and by the bedrock along the lower portion. Where bedrock was encountered during drilling the moisture content of the bedrock was generally dry or moist and did not contain groundwater. Moisture content of lithologic units is observed in the field while logging borings and includes the descriptions: dry, damp, moist, wet, and saturated. Only wet and saturated are descriptions that are used to identify when groundwater is present in the lithologic unit. A vertical cross section through Site FT004 is shown on Figure A-4.

No groundwater contaminants are present at Subarea LF007B at concentrations exceeding cleanup levels. At Subarea LF007C, the primary groundwater contaminant is TCE. The TCE plume at Subarea LF007C is currently estimated to be 620 feet long, 220 feet wide, and 25 feet thick and has an approximate volume of 485,452 ft^3. The current horizontal extent of TCE contamination is shown on Figure A-2. Vertical TCE distribution at Subarea LF007C is controlled by the bedrock along the lower portion of the aquifer with moisture contents generally dry and damp, and by the water table along the upper portion. A vertical cross section is shown on Figure A-5. At Subarea LF007D, 1,4-dichlorobenzene and benzene were previously detected at concentrations exceeding cleanup levels, but have continued to decrease. The contaminant plume at Subarea LF007D currently has an estimated volume of 248,000 ft^3 based on data collected from a single well (MW261x07), which is the only location where contaminant concentrations were detected during the 2010-2011 GSAP (CH2M HILL, 2012a). The plume volume was estimated based on a 100-foot plume radius around that well and the horizontal extent has not been provided in plan view because detections only occurred at a single location. TCE distribution at Subarea LF007D is vertically bounded by the water table along the upper portion of the aquifer and by the generally dry bedrock along the lower portion. A vertical cross section is shown on Figure A-6.

At Site SD031, the primary groundwater contaminant is 1,1-dichloroethene (DCE). The 1,1-DCE plume at Site SD031 is estimated to be 300 feet long, 150 feet wide, and 25 to 30 feet thick and has an approximate volume of 260,424 ft^3. The current horizontal extent of 1,1-DCE contamination is shown on Figure A-3. Distribution of 1,1-DCE vertically is controlled in the upper portion of the aquifer by the water table and likely controlled in the lower portion by the moist bedrock. A vertical cross section through Site SD031 is shown on Figure A-7. Although several borings at Site SD031encountered bedrock, only two of the

borings had moisture content with one being moist (MW752x04) and one being saturated (EW565x31). The boring (EW565x31) that was observed to be saturated was drilled by an air rotary casing hammer drill rig. It is difficult to discern moisture content from cuttings from air rotary casing hammer drill rigs because only rock chips are obtained for logging and it is possible for moisture to be added to the rock chips in the sampling cyclone from rock chips that were drilled in the shallower portion of the drilling run. Cores from borings that were drilled by a hollow stem auger such as MW752x31 are much more reliable to observe the moisture content because undisturbed core samples can be evaluated.

Monitoring data obtained over approximately 10 years of interim remediation (monitored natural attenuation [MNA] and groundwater extraction and treatment [GET] assessment, where applicable) have indicated that the plumes are stable, and no significant plume migration is occurring at these sites.

A.1.8 Sites FT004, LF007, and SD031 Vapor Intrusion Pathways

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. The following subsections summarize the results of this assessment for Sites FT004, LF007, and SD031.

A.1.8.1 Site FT004 Vapor Intrusion Pathway

At Site FT004 vapor intrusion poses no potentially significant concern for current use because no buildings are present at the site and the vapor intrusion pathway is incomplete.

Vapor intrusion does pose a potentially significant concern for future use at Site FT004. Shallow soil gas (SSG) concentrations exceeded industrial and residential SSG risk-based concentrations (RBCs) at one (1) or more locations. In addition, the industrial hazard index exceeded 1 at one (1) sampling location, and the residential hazard index exceeded 1 at four (4) sampling locations. In areas where groundwater concentrations exceed industrial or residential RBCs, there is a potentially significant vapor intrusion concern for future use. Additional information about vapor intrusion at Site FT004 and LUC boundaries for soil vapor under residential and industrial scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.1.8.2 Site LF007 Vapor Intrusion Pathway

At Site LF007 vapor intrusion poses no potentially significant concern for current use because no buildings are present at the site and the vapor intrusion pathway is incomplete.

Vapor intrusion does not pose a potentially significant concern for future industrial use at Site LF007 because groundwater concentrations are below industrial RBCs. It does pose a potentially significant concern for future residential risk because groundwater concentrations exceed residential RBCs. Additional information about vapor intrusion at Site LF007 and LUC boundaries for soil vapor under residential scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.1.8.3 Site SD031 Vapor Intrusion Pathway

At Site SD031 vapor intrusion poses no potentially significant concern for current or future use because groundwater concentrations are below residential and industrial RBCs.

A.1.9 Status of the Sites FT004, LF007, and SD031 Interim Remedial Actions

This subsection summarizes the status of the groundwater interim remedial actions (IRAs) at Sites FT004, LF007, and SD031. The main components of the IRA at each site are provided in Table A-3.

A.1.9.1 Status of the Site FT004/SD031 Groundwater IRA

The groundwater IRA at Sites FT004 and SD031 is a combination of GET and MNA. GET was implemented to achieve the interim remedial action objective (RAO) of source control in the higher concentration portions of the plumes. MNA assessments were implemented in the portions of the plumes not under the hydraulic influence of the GET system. All Site FT004 and SD031 extraction wells are currently offline for a rebound study. Groundwater monitoring to assess MNA is ongoing under the Groundwater Remediation and Implementation Program (GRIP).

The Site FT004/SD031 GET system began operation in 2000 and operated successfully though December 2007. Then, after a steady decline in plume concentrations, the Site SD031 extraction wells and Site FT004 extraction wells EW578x04, EW579x04, and EW580X04 were shut down for a rebound study. Site FT004 extraction wells EW576x04, EW577x04, EW621x04, EW622x04, and EW623x04 remained in operation. The results of the study are reported in the *2009 Annual Remedial Process Optimization Report for the Central Groundwater Treatment Plant, North Groundwater Treatment Plant, and South Base Boundary Groundwater Treatment Plant* (2009 Annual RPO Report) (CH2M HILL, 2010a).

No significant rebound of contaminant concentrations in the Site FT004 and SD031 wells has been observed. Therefore, the rebound study will continue for the remainder of the interim period. In addition, the Site FT004 extraction wells that had continued to pump during the initial stages of the rebound study in 2008 (EW576x04, EW577x04, EW621x04, EW622x04, and EW623x04) were also shut down in March 2009 as part of the ongoing rebound evaluation. None of the Site FT004 and SD031 extraction wells are currently pumping.

A.1.9.2 Status of the Site LF007 Groundwater IRAs

Subarea LF007B. Routine groundwater monitoring at Subarea LF007B is being conducted to assess the effectiveness of MNA.

Subarea LF007C. The Subarea LF007C GET system continues with normal seasonal operations. Groundwater extraction occurs only when dry conditions exist throughout the vernal pools to avoid adverse impact on the vernal pool habitat. The GET system typically operates between June and October.

The Subarea LF007C GET began operation in August 2004 using two (2) on-base extraction wells (EW614x07 and EW615x07). The GET system will be further optimized in 2013 when the vernal pool is dry. As described in the *Site LF007C Data Gaps Investigation Results Technical Memorandum* (CH2M HILL, 2012b), optimization measures were conducted in 2011-2012 to improve GET system performance. Additional optimization measures planned during 2013 include installing a higher capacity solar-powered groundwater pump, installing larger solar panels, and rerouting the extraction well discharge pipeline.

Subarea LF007D. Similar to Subarea LF007B, routine groundwater monitoring is being conducted at Subarea LF007D to assess the effectiveness of MNA.

A.2 Sites FT005, SS029, and SS030 Conceptual Site Models

This subsection provides the CSMs for Sites FT005, SS029, and SS030. Site maps showing the contaminant distribution at each site are provided on Figures A-8 and A-9.

A.2.1 Site FT005 Description

Site FT005, also known as FTA-4, is located within the EIOU, in the southeastern portion of Travis AFB and encompasses approximately 150 acres. 1,2-dichloroethane (DCA) is the indicator chemical for Site FT005. Concentrations of 1,2-DCA are relatively low; however, they exceed the cleanup level of 0.5 µg/L at some locations. Groundwater contaminated with 1,2-DCA has migrated approximately 2,600 feet south of the Base boundary and underlies private property.

Contamination at Site FT005 is the result of fire training exercises conducted between 1962 and approximately 1986. Historical photographs indicate that the area may have been used for munitions storage prior to 1958. From 1962 until the early 1970s, waste fuels, oils, and solvents were used as ignitable materials during fire training exercises. In the early 1970s, the use of oil and solvent was discontinued, and only contaminated fuel was used in the training. As late as 1988, airplane mockups and an airplane fuselage were observed at the site. From 1990 to 1994, the area was used as a dump site for miscellaneous wastes, such as concrete, fencing, and street sweepings. These activities ceased in 1994, and some of the debris was removed. The site is currently inactive (Weston, 1995).

A.2.2 Site SS029 Description

Site SS029 is also located in the southeastern portion of Travis AFB, south of the runway and west of Site FT005, and encompasses approximately 50 acres. Site SS029 is an open field south of Taxiway R. Site topography is relatively flat and slopes gently from the north-northwest to the south-southeast. The Main Branch of Union Creek traverses the middle of the site and flows from northeast to southwest.

Groundwater contamination at Site SS029 consists primarily of a TCE and cis-1,2-DCE plume that lies within the boundaries of Travis AFB. The source of groundwater volatile organic compound (VOC) contamination at Site SS029 is unknown. Historical photographs indicate that airplanes had been parked in the vicinity of monitoring well MW329x29, but little is known about historical activities at the site. Site SS029 was investigated initially during the EIOU RI to assess the downgradient extent of groundwater contamination originating from Site SS016 (upgradient). The data from this investigation and subsequent investigations indicated a discrete groundwater plume and source area. However, these investigations did not identify the specific source of the groundwater contamination (Weston, 1995). Subsequent investigations have confirmed that groundwater contamination that originates from Site SS016 has migrated into the northern portion of the Site SS029 plume.

A.2.3 Site SS030 Description

Site SS030 is south of Facility 1125 (a radar facility) and southwest of Site SS029, in the southeastern portion of Travis AFB and encompasses approximately 45 acres. The site boundary encompasses an area of groundwater contamination (primarily TCE) that has migrated approximately 1,300 feet south of the Base boundary and underlies private property.

MW269x30 was installed originally during the EIOU RI to evaluate groundwater quality along the southeastern Base boundary. No known historical activities indicated that groundwater contamination would be detected. However, the EIOU RI and subsequent investigations revealed TCE-contaminated groundwater. Historical activities associated with Building 1125 in the vicinity of MW269x30 are believed to be the source of the solvent contamination at Site SS030 (CH2M HILL, 2000).

A.2.4 Sites FT005, SS029, and SS030 Geology

Sites FT005, SS029, and SS030 lie above a geologic anticline that plunges to the southeast. A subsurface ridge of the more resistant Markley Sandstone, which forms part of the western limb of the anticline, runs through eastern Site SS030 and western Site SS029. The western portion of Site SS030 is underlain by the Neroly Sandstone, which is also part of the western limb of the regional anticline. Bedrock underlying the eastern portion of Sites SS029 and FT005 is primarily the older and less resistant Nortonville Shale; these two (2) sites are located near the apex of the anticline. The more resistant sandstone units form a subsurface ridge along the western side of the Site FT005, SS029, and SS030 area; while the less resistant shale forms a shallow basin in the center of the Site FT005, SS029, and SS030 area. Bedrock is relatively shallow along the western side of this area (about 5 to 30 feet bgs) and deeper in the eastern and southern portions of the sites (about 50 to 60 feet bgs in the off-base portion of Site FT005). Older alluvium overlies the shallow bedrock. This alluvium consists mainly of silts and clays with thin interbedded sand seams.

The surface topography at Site FT005 is relatively flat, sloping gently to the southeast. The geology consists of alluvium, primarily clays, silts, and sands. Low-permeability silts and clays occur between 10 and 20 feet bgs. Relatively permeable sands and silts occur from 20 feet bgs to bedrock. These permeable units are laterally discontinuous and are interlayered with semiconfining clays and silts. Bedrock in this area lies at approximately 30 to 50 feet bgs and dips to the south. Investigations in the off-base portion of Site FT005 have generally found the bedrock at 50 to 60 feet bgs.

Bedrock in the vicinity of Site SS029 ranges from 4 feet bgs in the western part of the site to about 60 feet bgs in the northeastern part of the site. A shallow bedrock valley is bounded to the southwest by the Markley Sandstone on the western flank of a bedrock anticline that reportedly outcrops along Union Creek (Weston, 1995) and to the northeast by a low bedrock ridge of Nortonville Shale. As in Site FT005, the uppermost sediments are primarily silts and clays. Relatively permeable sands and silts, which are laterally discontinuous, occur from approximately 20 to 40 feet bgs. Below the more permeable zone is clay or bedrock. Union Creek runs through the center of Site SS029, approximately perpendicular to the trend of the bedrock valley (CH2M HILL, 1999b). However, Union Creek is not a significant hydraulic barrier to plume migration at Site SS029.

The stratigraphy at Site SS030 is similar to the stratigraphy at Site SS029 and consists primarily of fine-grained alluvium overlying bedrock. The alluvium is composed of a shallow clay, a relatively permeable sandy zone, and a lower clay. The more permeable sandy zone, consisting of laterally discontinuous sand lenses, occurs about 20 feet bgs on average. Bedrock at the site ranges from 20 feet bgs to greater than 60 feet bgs.

A.2.5 Sites FT005, SS029, and SS030 Surface Water

No surface water resources exist within Sites FT005 and SS030. The Main Branch of Union Creek flows through the southern portion of Site SS029 and acts as a groundwater to surface water pathway. An upward vertical gradient in piezometer pair PZ01Sx29 and PZ01Dx29 at Site SS029 along the bank of Union Creek indicates that this portion of the creek in the south-central area of Travis AFB may be a gaining stream. Union Creek is the main groundwater to surface water pathway at Travis AFB. Discussion of surface water is provided in the final *NEWIOU Soil, Sediment, and Surface Water ROD* (TRAVIS AFB, 2006) with additional details provided in the Ecological Technical Memorandum for the NEWIOU (URS, 2005). No physical or administrative action is required for surface water at this site. The surface water at the site does not pose an unacceptable risk to ecological or human receptors (Travis AFB, 2006).

A.2.6 Sites FT005, SS029, and SS030 Groundwater Characteristics

Information regarding the overall hydrogeologic characteristics of Sites FT005, SS029, and SS030 from the 2010-2011 GSAP (CH2M HILL, 2012a) is as follows:

- Depth to groundwater typically ranges from 10 and 20 feet bgs.
- Regional groundwater flow in the vicinity of Sites FT005, SS029, and SS030 is toward the south-southeast.
- Local groundwater flow is consistent with the south-southeast regional groundwater flow direction in the vicinity of these sites.
- No geological features result in local variations to the regional groundwater flow direction at Sites FT005, SS029, and SS030.
- The average horizontal gradient across these sites is approximately 0.004 ft/ft.
- Vertical gradients are generally negligible at these sites and ranged from 0.02 ft/ft downward to 0.02 ft/ft upward over the 2010 – 2011 reporting period. Well pair MW274x05/MW321x05 had the largest downward vertical gradient (0.02 ft/ft downward) over the reporting period. The direction of the vertical gradients calculated for this well pair has historically been variable (both upward and downward gradients have been recorded). Piezometer pair PZ01Sx29/PZ01Dx29 had the largest upward vertical gradient (0.02 ft/ft upward).
- Groundwater elevations fluctuate from 2 to 5 feet per year with no long-term trend of rising or falling groundwater elevations.
- Groundwater to surface water connectivity is not present at Sites FT005 and SS030. It is present at Site SS029. Aquifer testing was performed at Sites FT005 (recovery, 1988; gravity-injection, 1988; pumping, 1991; rising head slug, 1991; falling head slug, 1991; pumping, 1999; recovery, 1999; pumping, 2002), SS029 (pumping, 1998), and SS030 (pumping, 1998). The test results are summarized in the *Groundwater Sampling and Analysis Program 2002-2003 Annual Report* (2002-2003 GSAP) (CH2M HILL, 2004).

A.2.7 Sites FT005, SS029, and SS030 Groundwater Contamination

The primary groundwater contaminants at the sites within the South IRA are 1,2-DCA at Site FT005 and TCE at Sites SS029 and SS030. Table A-1 presents the current and historical maximum concentrations of the contaminants at each site.

The combined TCE plume at Sites SS016/SS029 is currently estimated to be 5,700 feet long, 1,400 feet wide, and 25 to 40 feet thick and has an approximate volume of 41,250,708 ft^3. The vertical distribution of TCE at Site SS029 is bounded in the lower portion of the aquifer by generally dry to moist bedrock and in the upper aquifer by the water table. The combined plume was hydraulically captured by the combined site-specific IRA GET systems as indicated by monitoring data collected over approximately 10 years of interim remediation. This data indicated that some migration of the Site SS016 plume into the hydraulically downgradient Site SS029 plume was occurring. However, combined IRA GET system operations are continuing to maintain hydraulic capture of the overall plume.

The TCE plume at Site SS030 is approximately 1,400 feet long, 400 feet wide, and 20 to 40 feet thick with an estimated volume of 1,822,588 ft^3. Distribution of TCE vertically is controlled by the water table in the upper portion of the aquifer and by dry bedrock in the lower portion of the aquifer. The bedrock at Site SS030 is well cemented and causes refusal of a hollow stem auger drill rig approximately 10 feet after bedrock is encountered during drilling. Although borings EW01x30 and EW02x30 were described to have a moisture content of wet, the borings were drilled by air rotary casing hammer drill rig. Therefore, the moisture content observations for EW01x30 and EW02x30 are not considered reliable. The TCE plume was hydraulically captured by the IRA GET system during approximately 10 years of interim remediation, and system operations continue to maintain hydraulic capture of the plume.

The 1,2-DCA plume at Site FT005 is approximately 600 feet long, 400 feet wide, and 25 to 30 feet thick with a volume of 11,323,278 ft^3. Vertical distribution of 1,2-DCA is controlled by the water table in the upper portion of the aquifer and by moist bedrock in the lower portion of the aquifer. The 1,2-DCA plume is stable and was hydraulically captured by the IRA GET system during approximately 10 years of interim remediation. A recent rebound study did not indicate significant plume migration when GET system operations were discontinued. However, recently observed increases in the concentrations of COCs at some of the wells at the site indicate that continuation of GET system operation within those portions of the plume with increasing concentrations is warranted to prevent possible future migration.

The site-specific distributions of TCE for Sites SS029 and SS030 and 1,2-DCA contamination for Site FT005 are shown on Figures A-8 and A-9. Cross sections depicting the vertical distribution of contaminants at each site are shown on Figures A-10 through A-13. Table A-2 summarizes the estimated dimensions of the contaminant plume at each site.

A.2.8 Sites FT005, SS029, and SS030 Vapor Intrusion Pathways

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. The following subsections summarize the results of this assessment for Sites FT005, SS029, and SS030.

A.2.8.1 Site FT005 Vapor Intrusion Pathway

At Site FT005 vapor intrusion poses no potentially significant concern for current or future use because groundwater concentrations are below residential and industrial RBCs.

A.2.8.2 Site SS029 Vapor Intrusion Pathway

At Site SS029 vapor intrusion poses no potentially significant concern for current use because the single building at the site is not routinely occupied. SSG concentrations adjacent to the building are below industrial SSG RBCs.

Vapor intrusion does pose a potentially significant concern for future use at Site SS029. SSG concentrations exceeded industrial and residential SSG RBCs at one (1) or more locations. In addition, the industrial hazard index exceeded 1 at three (3) sampling locations, and the residential hazard index exceeded 1 at ten (10) sampling locations. In areas where groundwater concentrations exceed industrial or residential RBCs, there is a potentially significant vapor intrusion concern for future use. Additional information about vapor intrusion at Site SS029 and LUC boundaries for soil vapor under residential and industrial scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.2.8.3 Site SS030 Vapor Intrusion Pathway

At Site SS030 vapor intrusion poses no potentially significant concern for current use because no buildings are present at the site and the vapor intrusion pathway is incomplete.

Vapor intrusion does not pose a potentially significant concern for future industrial use at Site SS030 because groundwater concentrations are below industrial RBCs. It does pose a potentially significant concern for future residential risk because groundwater concentrations exceed residential RBCs. Additional information about vapor intrusion at Site SS030 and LUC boundaries for soil vapor under residential scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.2.9 Status of Sites FT005, SS029, and SS030 Interim Remedial Actions

In accordance with the North, East, and West Industrial Operable Unit (NEWIOU) Interim Record of Decision (IROD), Travis AFB implemented GET IRA systems at each of the sites that compose the South IRA. This subsection summarizes the status of those groundwater IRAs at Sites FT005, SS029, and SS030. The main components of the IRAs are summarized in Table A-4.

Groundwater extracted from each of the sites is conveyed to the South Base Boundary Groundwater Treatment Plant (SBBGWTP) for treatment via liquid-phase granular activated carbon (LGAC) before being discharged to Union Creek.

The South IRA GET system was started up on 6 July 1998. The GET systems at Sites SS029 and SS030 are active. Most of the Site FT005 GET system is currently turned off (except for two [2] extraction wells – see Section A.2.7.1) for a rebound study for the remainder of the period of interim remediation. Operation of the GET system at Site SS030 was optimized during 2010 and is under evaluation.

A.2.9.1 Status of the Site FT005 Groundwater IRA

At Site FT005, the IRA objective of migration control has been achieved, and the objective of off-base groundwater remediation has nearly been achieved. Consequently, a rebound study is under way at the site. A portion of the GET was shut down in December 2007, and the remainder was shut down in August 2009. Throughout the period of the rebound study, most Site FT005 monitoring wells and extraction wells continued to have decreasing or stable 1,2-DCA concentrations. However, in 2Q10, 1,2-DCA concentrations rebounded in three (3) extraction wells. These extraction wells (EW02x05, EW734x05, and EW735x05) were restarted in August 2010. In November 2012, the Site FT005 GET system was optimized by taking EW734x05 and EW735x05 offline.

A.2.9.2 Status of the Site SS029 Groundwater IRA

The primary interim remedial action objective (IRAO) for the Site SS029 plume is migration control. The Site SS029 IRAO has been achieved. The target area (TCE exceeding 5 µg/L) is within the 2Q11 estimated extent of hydraulic capture. TCE was not detected in the farthest downgradient monitoring wells (MW01x29, MW06x29, and MW07x29) near the Base boundary.

Upgradient Site SS029 wells MW1031x29 and MW1032x29 have exhibited recent trends of increasing COC concentrations. Both of these wells are upgradient from the Site SS029 extraction system, and increasing concentrations at these locations are the result of VOC migration from the upgradient Site SS016 plume. Available physical and analytical data indicate that the Site SS029 GET is capturing the VOC contamination that has migrated from Site SS016.

A.2.9.3 Status of the Site SS030 Groundwater IRA

The on-base migration control component of Site SS030 has been achieved. The interim objective of off-base groundwater remediation has partially been achieved. The southern and western portions of the Site SS030 plume have been remediated, and VOCs are no longer detected in these areas. TCE remains above the cleanup level only in the eastern portion of the off-base plume.

Historically, groundwater elevation contours and the increasing contaminant trends at eastern plume wells MW03x30 and MW05x30 have indicated that contamination may be escaping the Site SS030 GET in this area and flowing toward the southeast, as hydraulically influenced by the Site FT005 extraction system. However, the 2Q11 groundwater elevation contours indicate that the shutdown of most of the Site FT005 extraction wells and increasing the flow rates from the Site SS030 extraction wells improved the Site SS030 hydraulic capture. Groundwater elevation contours indicate that wells MW03x30 and MW05x30 as well as new well pair MW2001Ax30 and MW2001Bx30 are within the extent of hydraulic capture of the SS030 GET. In addition, TCE concentrations in the eastern portion of the plume have remained stable (MW03x30) or declined (MW05x30) over the last few years, indicating that the plume is no longer migrating eastward. Although the monitoring history is short at easternmost well pair MW2001Ax30/MW2001Bx30, TCE concentrations declined slightly at these wells between 2Q10 and 2Q11. Ongoing monitoring will be conducted under the GRIP to confirm the long-term concentration trends at this well pair. It is expected that TCE concentrations in this well pair will continue to decline as plume capture is maintained under aggressive groundwater pumping.

A.3 Site LF006 Conceptual Site Model

This subsection provides the CSM description for Site LF006. A site map showing the current contaminant distribution is provided on Figure A-14.

A.3.1 Site LF006 Description

Site LF006 (Landfill 1) is a former burn-and-fill landfill that encompasses approximately 32 acres in the northeastern corner of Travis AFB. Site LF006 operated between 1943 and the early 1950s. Materials disposed of and burned at Site LF006 consisted primarily of wood, paper, glass, residential debris, and construction debris; industrial wastes also were reportedly disposed of at Site LF006 (Radian, 1996a). A No Further Action determination for soil at Site LF006 was made at the conclusion of a remedial investigation of the site and is documented in the *North Industrial Operable Unit Remedial Investigation* (Radian, 1995).

A.3.2 Site LF006 Geology

The natural near-surface geology in the vicinity of Site LF006 consists mainly of alluvial fine-grained lean clays and silts. More permeable sands are encountered in deeper zones above the bedrock. The depth of the fine-grained materials ranges from 10 to 37 feet bgs. As expected in an alluvial setting, subsurface materials are heterogeneous, with sand stringers embedded within the silts and clays. The permeability of the embedded sand units varies, based on the proportions of silt and clay within the matrix. These unconsolidated materials are classified as Younger Alluvium at Travis AFB.

Beneath the unconsolidated material, the bedrock surface consists of poorly indurated, dark-gray claystone and is identified as Nortonville Shale. The claystone has been encountered in soil borings at the site at depths ranging from 33 to 40 feet bgs. The upper surface of the bedrock is typically weathered, becoming increasingly competent with depth. Nortonville Shale was extensively eroded during the Pleistocene and forms a subsurface trough in the bedrock beneath Site LF006 that extends from the northwest to southeast in this area. The trough is bounded by two (2) bedrock ridges of Domengine Sandstone to the west and Markley Sandstone to the east. These bedrock ridges also form topographic ridges in the vicinity of Site LF006.

In the Site LF006 area, surface soil and alluvium have been disturbed or removed during the placement of landfill and backfill material. At Site LF006, landfill and backfill material encountered in soil borings ranged between 2 and 13.5 feet bgs (Radian, 1995). Waste was disposed of using trench and fill techniques over an area covering approximately 17 acres, as shown on Figure A-14. These trenches were identified during a review of historical aerial photographs and are no longer visible at the site (CH2M HILL, 1999b).

The saturated zone is approximately 20 to 30 feet thick at Site LF006, and contamination extends throughout the saturated zone to bedrock. Detectable concentrations of TCE extend from MW01Dx06/MW01Sx06 approximately 1,200 feet to the south, where it was detected at a concentration of 1.3 µg/L at well MW1731x31 in 2Q11. Site LF006 monitoring well screen intervals vary from 5 to 65 feet bgs and are adequate for monitoring the vertical extent of contamination at the site.

A.3.3 Site LF006 Surface Water

No surface water resources exist within Site LF006.

A.3.4 Site LF006 Groundwater Characteristics

Information regarding the hydrogeologic characteristics of Site LF006 from the 2010-2011 GSAP (CH2M HILL, 2012a) is described as follows:

- Depth to groundwater typically ranges from 7 to 12 feet bgs.
- Regional groundwater flow in the vicinity of Site LF006 is toward the southeast.
- Local groundwater flow in the vicinity of Site LF006 typically flows toward the southwest in the northern portion of Site LF006 and changes direction toward the southeast in the southern portion of the site.
- The geological feature affecting local groundwater flow at Site LF006 is a groundwater mound beneath Site LF007, east of Site LF006 that causes the westward component of flow typically observed in the northern portion of Site LF006.
- Groundwater flow within the southern portion of Site LF006 is redirected ultimately toward the southeast by the ridge of Domengine Sandstone to the west of the site and the subsurface trough in the Nortonville Shale. Downgradient from Site LF006, groundwater flows toward Site SD031 to the southeast.
- The horizontal gradient at Site LF006 is approximately 0.003 ft/ft.
- Generally, vertical gradients at Site LF006 are negligible and ranged from 0.003 ft/ft to 0.01 ft/ft upward in 2Q11.
- Groundwater elevations have been relatively stable at Site LF006, varying by approximately 2 to 5 feet per year, with no long-term trends.
- Groundwater to surface water connectivity is not present at Site LF006. Aquifer testing was performed at Site LF006 (gravity-injection, 1988; rising head slug, 1991; pumping, 1998). The test results are summarized in the *Groundwater Sampling and Analysis Program 2002-2003 Annual Report* (2002-2003 GSAP) (CH2M HILL, 2004).

A.3.5 Site LF006 Groundwater Contamination

The groundwater COCs at Site LF006 are TCE, 1,1-DCE, total petroleum hydrocarbon as diesel (TPH-D), and total petroleum hydrocarbon as gasoline (TPH-G). Table A-1 presents the current and historical maximum concentrations of these contaminants. TCE is the site indicator chemical. The TCE plume at the site is stable with approximate dimensions of 400 feet long, 350 feet wide, and 25 to 35 feet thick and with a volume of 662,680 ft^3 as summarized in Table A-2.

The maximum concentration of TCE detected during the 2010-2011 monitoring period was 7.1 J- µg/L at monitoring well MW1729x31. The current horizontal extent of TCE contamination is shown on Figure A-14. Vertical distribution of TCE at Site LF006 is bounded by the water table in the upper portion of the aquifer and moist bedrock in the lower portion of the aquifer. A vertical cross section is shown on Figure A-15. Low

concentrations (below the cleanup level of 6 µg/L) of cis-1,2-DCE were also detected. TPH-D and TPH-G were not detected at any Site LF006 monitoring wells sampled in 2Q11.

A.3.6 Site LF006 Vapor Intrusion Pathway

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. At Site LF006 vapor intrusion poses no potentially significant concern for current or future use because groundwater concentrations are below residential and industrial RBCs and there are no buildings present at the site.

A.3.7 Status of the Site LF006 Groundwater IRA

The groundwater IRA at Site LF006 is MNA. Groundwater monitoring is being routinely conducted to verify that the plume is stable or decreasing in concentration.

A.4 Site LF008 Conceptual Site Model

This subsection provides the CSM for Site LF008 located in the western portion of Travis AFB.

A.4.1 Site LF008 Description

Site LF008 is a historical pesticide container landfill; it encompasses approximately 8.3 acres in the western portion of Travis AFB. A site map is shown on Figure A-16.

During the 1970s, multiple burial trenches were used to dispose of approximately 30 cubic yards of pesticide containers. All of the trenches were located within Bunker A of the Weapons Storage Area, a secured area surrounded by a fence with a locked gate. An RI of the West/Annexes/Basewide Operable Unit (WABOU) in 1995-1996 used geophysical surveys, exploration trenching, and soil borings to identify the approximate locations of these burial trenches. Debris was discovered in six (6) of the nine (9) excavated trenches and included 1- and 5-gallon metal containers, plastic and paper bags, other paper and plastic debris, 1-gallon glass bottles, and two (2) 55-gallon drums (CH2M HILL, 1997).

The pesticide containers and contaminated soil were removed in 2003 by an excavation/off-base disposal remedial action in accordance with the *Soil Record of Decision for the West/Annexes/Basewide Operable Unit* (Travis AFB, 2002). After the completion of the soil remedial action at Site LF008, the *Remedial Action Summary Report* (Shaw, 2004b) concluded that the resulting site condition was protective of human health and the environment and that land use controls (LUCs) are no longer required at the site for soil.

A.4.2 Site LF008 Geology

Site LF008 lies on top of a ridge composed of weathered Tehama Formation materials. The upper 25 to 35 feet of sediments (above the water table) consist primarily of interbedded sands and silty sand. Below the water table, the deeper stratigraphy consists of highly variable silts, clays, and sands. Some of these deeper sediments are partially consolidated. Bedrock is found at a depth of approximately 65 feet bgs (CH2M HILL, 1997).

At Site LF008 the native soil has been disturbed or removed during the placement of landfill and backfill material. Approximately 3,370 cubic yards of soil (1,984 cubic yards of pesticide-contaminated soil plus additional volume for benching) was removed from

seven (7) primary excavation areas, from an approximately 6,000 square feet area during remedial activities conducted in 2003 and 2004 (Shaw, 2004b). The extent of the primary excavation areas are shown on Figure A-17. The maximum depth of the excavations was 12 feet below ground surface. Clean overburden from Site LF008 and approximately 2,000 cubic yards of fill material from the Travis AFB Clean Soil Holding Area was used to backfill the excavations (Shaw, 2004b).

The saturated zone is approximately 30 to 40 feet thick at Site LF008, and contamination extends throughout the saturated zone to bedrock. Groundwater contamination extends from extraction well EW719x08 approximately 300 feet south to extraction well EW721x08. Monitoring well screened intervals range from 21 to 65 feet bgs and are adequate to monitor the vertical extent of contamination at the site.

A.4.3 Site LF008 Surface Water

No surface water resources exist within Site LF008.

A.4.4 Site LF008 Groundwater Characteristics

The topographic ridge at Site LF008 trends from the northeast to the southwest. The regional groundwater flow direction is generally toward the southwest. This ridge acts as a groundwater divide that causes flow to move in three (3) directions locally: southeast, southwest, and west-southwest.

Other groundwater characteristics at Site LF008 from the 2010-2011 GSAP (CH2M HILL, 2012a) are described as follows:

- Depth to groundwater typically ranges from 23 to 37 feet bgs.
- Regional groundwater flow in the vicinity of Site LF008 is toward the southwest.
- Local groundwater flow in the vicinity of Site LF008 moves in three (3) directions towards the southeast, southwest, and west-southwest.
- The geological feature affecting local groundwater flow at Site LF008 is a ridge that underlies the site and trends from the northeast to the southwest. This ridge acts as a groundwater divide that impacts local groundwater flow.
- The horizontal gradient to the southwest is approximately 0.01 ft/ft.
- Large downward vertical gradients can be observed at Site LF008, which is typical for a ridge top location. There are two (2) well pairs located at Site LF008: MW01x08/MW712x08 and MW115x08/MW311x08. In 2Q11, well pair MW115x08/MW311x08 had a downward vertical gradient of 0.1 ft/ft, and well pair MW01x08/MW712x08 had a downward vertical gradient of 0.06 ft/ft.
- Groundwater elevations have an overall declining trend at Site LF008, which is not evident in other areas of the Base. The average seasonal fluctuation in groundwater elevations at this site is about 1 to 2 feet per year.
- Groundwater to surface water connectivity is not present at Site LF008. Aquifer testing was performed at Site LF008 (gravity-injection, 1988; rising head slug, 1991; falling head slug, 1991; constant rate pumping, 2000). The test results are summarized in the

Groundwater Sampling and Analysis Program 2002-2003 Annual Report (2002-2003 GSAP) (CH2M HILL, 2004).

A.4.5 Site LF008 Groundwater Contamination

Organochlorine pesticides are the groundwater contaminants at Site LF008. Historically, alpha-chlordane is the most widespread of these pesticides with plume dimensions of 195 feet long, 112 feet wide, and 35 feet thick and a volume of 233,576 ft^3 (Table A-2). The current horizontal distribution of alpha-chlordane is shown on Figure A-16. Distribution of alpha-chlordane at Site LF008 vertically is controlled by the dry and moist alluvium in the lower portion of the aquifer and by the water table in the upper portion of the aquifer. The vertical distribution of alpha-chlordane is shown on Figure A-17.

In 2Q11, alpha-chlordane was detected at concentrations exceeding the cleanup level. The cleanup level (0.1 µg/L) was exceeded at two (2) extraction wells. It was not exceeded at any other locations. Table A-1 presents the current and historical maximum concentrations of the contaminants at the site.

A.4.6 Site LF008 Vapor Intrusion Pathway

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. At Site LF008 vapor intrusion poses no potentially significant concern for current or future use because groundwater concentrations are below residential and industrial RBCs and there are no buildings present at the site.

A.4.7 Status of the Site LF008 Groundwater IRA

In accordance with the Groundwater IROD for the WABOU, GET was implemented at Site LF008 to hydraulically contain the pesticide contamination (Travis AFB, 1999). The GET IRA operated for more than 7 years.

As part of the GET IRA system implementation, three (3) extraction wells (EW719x08, EW720x08, and EW721x08) were installed around the pesticide trenches to prevent contaminated groundwater from moving away from the site. Each of the wells is conventional (i.e., vertical with no vacuum enhancement). In June 2001, the Site LF008 extraction wells were brought online. Extracted groundwater was pumped to the West Treatment and Transfer Plant (WTTP) and then transferred to the Central Groundwater Treatment Plant (CGWTP) for treatment and discharge. Because of the low permeability of the alluvial sediments, extraction rates were approximately 1 gallon per minute (gpm) for the wells at this site.

After more than 7 years of operation, the GET system had minimal impact on groundwater pesticide concentrations. Pesticide concentrations were stable, and the extent of groundwater contamination remained unchanged. This is likely because of the strong adsorption of alpha-chlordane and other pesticides to natural organic carbon or fine-grained soil particles in the subsurface and the low permeability of the saturated sediments.

Beginning in December 2008, the three (3) groundwater extraction wells were shut down to perform a rebound study. The fundamental finding of the rebound study is that no significant rebound of alpha-chlordane, or any other pesticide, is evident since the rebound study began. The rebound study will continue through the period of interim remediation.

A.5 Site SS015 Conceptual Site Model

This subsection provides the CSM for Site SS015 located in the western portion of Travis AFB. An MNA assessment has been implemented at the site in accordance with the NEWIOU Groundwater IROD (Travis AFB, 1998).

A.5.1 Site SS015 Description

Site SS015 occupies about 6.4 acres in the western-central portion of Travis AFB. The main feature at the site includes Building 554, which is a petroleum, oil, and lubricants (POL) military compound consisting of an office building, a fuel truck maintenance facility, and a large concrete truck parking area. The POL building was constructed with a vapor barrier and passive vent system to protect the building from potential vapor intrusion from an underlying plume of groundwater contamination.

Three (3) potential sources of historical groundwater contamination have existed at Site SS015:

- Former Facility 550
- Former Facility 552 (including the area at Facility 1832)
- Solvent Spill Area (SSA) east of former Facility 550

Of these, the primary source area is currently considered to be the SSA. Facilities 550 and 552 were demolished in 2004. The current infrastructure present at the site is shown on Figure A-18. Additional information about the locations of former Facilities 500 and 552 is provided in the *EIOU Remedial Investigation* (Weston, 1995).

A.5.1.1 Former Facility 550

Former Facility 550 was located south of Hangar Avenue. Beginning in 1952, the facility housed a corrosion control shop, a metals processing shop, and a fiberglass shop. Paints, paint thinners, methyl ethyl ketone, acids, and stripping wastes were used or generated at the facility. A floor drain, connected to the sanitary sewer, was used to discharge wastes from the corrosion control shop. Facility 550 was demolished in 2004.

A.5.1.2 Former Facility 552

Former Facility 552 was a fenced, bermed concrete pad located south of Hangar Avenue and immediately east of Facility 550. Historically, the facility was used as a hazardous waste collection area. Paint, chromic acid, and waste solvents generated during aircraft maintenance activities at Facility 550 were stored in Facility 552. From 1954 to 1980, radomes were stripped of paint in an area adjacent to Facility 552 (Weston, 1995). The associated Facility 1832 is a 15,000-gallon OWS that received liquids generated at a wash rack on the aircraft parking apron. In 1992, a new hazardous waste accumulation facility was constructed at the site. Facility 552 was demolished in 2004.

A.5.1.3 SSA

The SSA occupied approximately 1.4 acres east of Facility 550. Paint was stripped from aircraft in the area for an undocumented period of time. Accidental releases included an estimated 100 to 150 gallons per month of methyl ethyl ketone, toluene, or tetraethylene

glycol dimethyl ether (tetraglyme) from work trays used to collect stripping wastes. Soil was visibly stained in the SSA in aerial photographs taken before 1970 (Weston, 1995).

A.5.2 Site SS015 Geology

The geology in the vicinity of Site SS015 consists of a relatively thin cover of low permeability alluvium overlying a shallow bedrock ridge. The alluvium ranges from 0 to 19 feet in thickness and consists primarily of clays, sandy clays, and clayey sand. The bedrock ridge strikes across the site from the northwest to the southeast and plunges to the southeast. The bedrock ridge dips to the northeast. A surface outcrop of the bedrock is present to the west of the site near the intersection of Hangar Avenue and Ragsdale Street. The bedrock ridge also runs along the western side of adjacent Site SS016 and through Site ST027, where bedrock has been encountered as shallow as 2 feet bgs. The ridge is associated with a regional anticline. Site SS015 is located along the western limb of that anticline. The submerged bedrock ridge is composed of Markley Sandstone, and the basin to the east is composed of Nortonville Shale.

Bedrock at the site consists of a highly weathered Markley Sandstone and highly fractured and weathered siltstone associated with the Nortonville Shale. The Markley Sandstone is weathered to such a degree that it resembles poorly graded sand. The siltstone has a pervasive platy texture that likely increases the permeability of the siltstone.

In the central portion of Site SS015, near monitoring well MW216x15, a bedrock high is present where the bedrock is just below the ground surface. In the northeastern portion of the site, near monitoring wells MW624x15, MW2103x15, and MW2105x15 and borings 15-SB04 and 15-SB09, there is an apparent depression where bedrock is encountered as deep as 19 feet bgs. Further to the east, bedrock becomes shallow again. The local bedrock depression at Site SS015, likely an erosional feature, extends to the north/northeast.

A.5.3 Site SS015 Surface Water

No surface water resources exist within Site SS015.

A.5.4 Site SS015 Groundwater Characteristics

Groundwater characteristics at Site SS015 from the 2010-2011 GSAP (CH2M HILL, 2012a) are described as follows:

- Depth to groundwater typically ranges from 7 to 11 feet bgs.
- Regional groundwater flow in the vicinity of Site SS015 is toward the south-southeast.
- Local groundwater flow at Site SS015 appears to converge from the west, southwest, southeast, and northeast and then funnels to the north.
- The geological feature affecting local groundwater flow at Site SS015 is a northeast trending groundwater trough evident in the groundwater elevation contours. This is indicative of an area where the bedrock is highly weathered and fractured resulting in a preferential northeastern local groundwater flow direction. This area also coincides with a bedrock depression, likely an erosional feature where increased weathering of the bedrock would be expected.

- The horizontal gradient from the bedrock high to the depression is approximately 0.01 ft/ft.
- Both upward and downward vertical gradients were calculated for the site based on 2Q11 data. Well pair MW624x15/MW2103x15, which is located in the center of the bedrock depression, had an upward vertical gradient: 0.04 ft/ft. The upward vertical gradient is consistent with the well pair's location in a groundwater trough (discharge zone). A downward vertical gradient of 0.04 ft/ft was calculated for well pair MW105x15/MW306x15, which is consistent with this well pair's location on the bedrock ridge (recharge zone).
- Groundwater flow at Site SS015 is predominantly in weathered portions of the Markley Sandstone and by fracture flow in the siltstone. During the 2010 installation of several new monitoring wells, groundwater was frequently encountered within the weathered and fractured bedrock rather than in the overlying, relatively impermeable (silt and clay) alluvium. The bedrock becomes more competent with depth, which limits the vertical distribution of contamination.
- Some of the groundwater in the monitoring wells has been observed to have groundwater potentiometric heads that are between 0.5 and 11 feet above the alluvium/bedrock interface, suggesting that some of the groundwater system is partially confined. As previously mentioned, the alluvium encountered at Site SS015 is generally less permeable than the underlying highly weathered Markley Sandstone and fractured siltstone, and may locally act as a semi-confining layer.
- Groundwater elevations are relatively stable at Site SS015, varying seasonally by approximately 2 to 4 feet per year, but with no long-term trends.
- Groundwater to surface water connectivity is not present at Site SS015. Aquifer testing was performed at Site SS015 (Gravity-injection, 1988; rising head slug, 1991; falling head slug, 1991). The test results are summarized in the *Groundwater Sampling and Analysis Program 2002-2003 Annual Report* (2002-2003 GSAP) (CH2M HILL, 2004).

A.5.5 Site SS015 Groundwater Contamination

The primary groundwater contaminants at Site SS015 include TCE (parent) and daughter products cis-1,2-DCE and vinyl chloride. Contaminant distribution maps for these compounds are shown on Figures A-18, A-19, and A-20. Cross sectional views of the contaminant concentrations are shown on Figure A-21. The cis-1,2-DCE plume is approximately 360 feet long, 160 feet wide, and 10 to 15 feet thick and has a volume of 78,392 ft^3 (Table A-2). Vertical distribution of TCE and daughter products at Site SS015 is controlled by the water table in the upper portion of the aquifer and generally dry deeper bedrock (greater than 45 feet below ground surface) in the lower portion of the aquifer. The vertical distribution of TCE, cis-1,2-DCE, and vinyl chloride is shown on Figure A-21. The northeastern groundwater flow direction at the site is consistent with the observed distribution of groundwater contamination, which extends to the northeast from monitoring well MW216x15.

Table A-1 presents the current and historical maximum concentrations of the contaminants at the site. The high localized concentrations of 1,2-DCE and vinyl chloride relative to TCE

(see Figures A-18 through A-20) indicate incomplete biodegradation of TCE following the vegetable oil injection treatability study conducted in 2000 and 2001 (Parsons Engineering Science, Inc. [Parsons], 2001, 2002). However, the data also demonstrate that suitable bacterial populations are present for reductive dechlorination processes to take place (Parsons, 2002). The presence of incomplete degradation products suggests that the limited volume of vegetable oil injected a decade ago has been exhausted as a bacterial food source.

A.5.6 Site SS015 Vapor Intrusion Pathway

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. At Site SS015 vapor intrusion poses no potentially significant concern for current use because vapor intrusion has been mitigated. The existing building was constructed with a vapor barrier and a passive vent system.

Vapor intrusion does pose a potentially significant concern for future use at Site SS015 in areas where groundwater concentrations exceeded RBCs. Additional information about vapor intrusion at Site SS015 and LUC boundaries for soil vapor under residential and industrial scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.5.7 Status of the Site SS015 Groundwater IRA

The NEWIOU Groundwater IROD selected MNA assessment as the interim remedy at Site SS015. The initial MNA assessment was delayed because the site was subsequently selected for a treatability study using vegetable oil injection. A limited treatability study was then conducted at the site during 2000-2001. During this study, approximately 227 pounds of soybean oil was injected at the site in two (2) phases (June and December 2000). The treatability study was terminated early because of a military construction project at the site. Building 554 was constructed over a portion of the vegetable oil injection area. Although the vegetable oil injection treatability study was concluded prematurely, the initial results were promising and demonstrated that suitable bacterial populations were present and reductive dechlorination was occurring at the site (Parsons, 2002).

In 2009, a natural attenuation assessment was performed for Site SS015, which is documented in the *Natural Attenuation Assessment Report* (NAAR) (CH2M HILL, 2010b). The NAAR concluded that MNA alone may not be a sufficient remedy at the site because of increasing contaminant trends in some site monitoring wells. Monitoring data indicated some local plume migration in the direction of local groundwater flow towards the northeast. Therefore, in December 2010 and January 2011, a demonstration of in situ enhanced reductive dechlorination (ERD) treatment of the highest concentration portion of the plume began using emulsified vegetable oil (EVO) injection. The objective of this action was to demonstrate the viability of ERD treatment of the residual dense nonaqueous phase liquid (DNAPL) and the highest concentration portion of the plume and then rely on natural attenuation processes in the distal portion of the plume after the source of contaminants had been greatly reduced (i.e., enhanced attenuation). The EVO treatment demonstration is continuing through the period of interim remediation.

A.6 Site SS016 Conceptual Site Model

This subsection provides the CSM for Site SS016, located in the western portion of Travis AFB.

A.6.1 Site SS016 Description

Site SS016 encompasses approximately 290 acres in the center of Travis AFB, near the Base control tower. The site extends across an active aircraft parking ramp, taxiway, and runway. At the northern periphery of the site are buildings, roads, and other facilities that support airfield operations.

Site SS016 comprises two (2) groundwater contaminant source areas: the Oil Spill Area (OSA) and the Tower Area Removal Action (TARA). The locations of the OSA and TARA are shown on Figure A-22.

A.6.1.1 Oil Spill Area

The OSA is located at the northwestern corner of Site SS016 and is associated with Building 18 and an adjacent wash rack. Both were constructed in 1960 as components of a degreasing facility. Historical degreasing operations were conducted in Building 18 and at the wash rack from about 1960 through the 1990s. Degreasing operations are no longer conducted at either of the facilities.

Building 18. Historically, Building 18 housed an industrial degreasing process. Tanks in the northern portion of the building contained chemicals for the degreasing process. These tanks were located in a sub-grade floor approximately 5 feet below the surface-grade floor. The sub-grade tank area is covered by a false floor that is structurally supported by steel columns. At the northern end of the building is a collection sump that was connected to a 28,000-gallon steel-reinforced concrete underground storage tank (UST). The 28,000-gallon UST was located adjacent to the northwestern portion of the building and was divided in half by a wall. The eastern half of the UST was used as a retention tank, and the western half was used as an OWS. The OWS was removed in 1997, and the UST was removed from the building and disposed of in January 1998 (Supervisor of Shipbuilding, Conversion and Repair [SSPORTS], 1998).

The southern portion of Building 18 was also historically used as part of the degreasing process and contained additional tanks and spray booths. This area was later remodeled to house a laboratory, a bead blaster and oven room, and multiple offices.

The northern portion of Building 18 is currently used as a storage facility. The southern portion of the building is not currently used.

Historically, wastes generated at Building 18 were disposed of by different means. From about 1960 to 1968, liquid wastes flowed through a north-south pipeline that extended from tanks in Building 18 to a catch basin underlying an adjacent wash rack and subsequently to the storm drain. From 1968 through 1998, liquid wastes were disposed of through the OWS or by contracted disposal services. Some wastes may also have been sent to an on-base fire training facility.

Wash Rack. South of Building 18 was a former wash rack used to degrease jet engines. A canopy over the wash rack was constructed in 2007. The wash rack canopy included a steel frame structure supporting a sheet metal roof. Underneath the roof was a concrete pad with a collection drain near the center. The drain discharged to a catch basin that was connected to an underground stormwater drainage pipe. The connector pipe between the catch basin and the stormwater drainage pipe was constructed of vitrified clay and had been slip lined, possibly to repair a break in the clay pipe. In September 2010, the collection drain, catch basin, and the wash rack structure were removed as part of the installation of a below-grade in situ bioreactor.

Between approximately 1960 and 1968, liquid wastes from degreasing operations in Building 18 were also conveyed to the wash rack catch basin through a separate underground pipeline.

A.6.1.2 Tower Area Removal Action

In 1995, the TARA was implemented to reduce worker exposure to VOC-contaminated groundwater during installation of a new fuel hydrant system underneath the 300 Ramp. The TARA system included two (2) parallel 700-foot-long horizontal extraction wells (600 feet screened). The water in each horizontal extraction well drains to a low point where it is removed by a vertical well and conveyed to the CGWTP by underground pipeline (Radian, 1996a).

A.6.2 Site SS016 Geology

Site SS016 is near the center of Travis AFB. The geology at Site SS016 consists of a relatively thin layer of unconsolidated alluvium overlying bedrock composed of sedimentary rock. The alluvium comprises discontinuous lenses of sand, silt, and clay. Bedrock underlying the alluvium is predominantly Nortonville Shale. Along the western portion of Site SS016, Markley Sandstone has been identified beneath the unconsolidated alluvium. Structurally, the bedrock in the OSA is part of the western slope of an anticline. A southeast trending channel of deeper alluvium traverses the central portion of Site SS016 where the Nortonville Shale was more easily eroded than the Markley Sandstone (Weston, 1995).

The alluvium in the OSA source area ranges from approximately 10 to 16 feet in thickness and near Building 18 consists of interbedded clays and silts. Hydraulically downgradient and to the southeast of Building 18, beneath the parking apron, alluvium increases to a thickness of approximately 30 feet. As the alluvium thickens away from the source area, it becomes coarser grained with sand zones up to approximately 17 feet thick. However, varying amounts of clay are intermixed with the sand. This intermixed clay restricts the yield that can be locally produced from the formation, which explains why extraction wells EW605x16 and EW610x16 have lower yields (typically 5 to 6 gpm) than would be expected from a clean sand.

The upper bedrock at the OSA source area consists predominantly of a fractured and weathered siltstone associated with the Nortonville Shale. Locally, thin layers of sandstone have been observed to be interbedded in the siltstone of the Nortonville Shale. The weathered upper portion of the Nortonville Shale at the Site SS016 OSA source area has a pervasive platy texture (jointing) that if interconnected could allow groundwater flow in the

shallow bedrock. However, the Nortonville Shale at the Site SS016 OSA source area becomes less weathered and more competent with depth, indicating that less groundwater flow is present in the deeper bedrock. Contaminant concentrations decline quickly with depth in the bedrock, another indication of increased competency with depth (CH2M HILL, 2012c).

Along the western portion of Site SS016, near monitoring wells MW103x16, MW239x16, MW2020x16, MW2023x16, MW2109x16, MW2111Ax16, and MW2111Bx16, Markley Sandstone has been observed beneath the unconsolidated alluvium.

A.6.3 Site SS016 Surface Water

No surface water resources exist within Site SS016.

A.6.4 Site SS016 Groundwater Characteristics

Groundwater characteristics at Site SS016 from the 2010-2011 GSAP (CH2M HILL, 2012a) are as follows:

- Depth to groundwater typically ranges from 6 to 15 feet bgs.
- Regional groundwater flow in the vicinity of Site SS016 is toward the southeast.
- Local groundwater flow at Site SS016 is toward the southeast over much of the site. However, a southwest flow direction occurs in the eastern portion of the site (through the TARA).
- The geological feature affecting local groundwater flow at Site SS016 include is a southeast-trending groundwater trough, which traverses the central portion of Site SS016 (through the TARA). This is caused by a channel of relatively thicker alluvium. The presence of the trough increases the effectiveness of the TARA extraction wells. The trough causes groundwater to flow toward the wells, which are horizontal extraction wells oriented perpendicular to groundwater flow for maximum effectiveness.
- Horizontal gradients are approximately 0.004 ft/ft in the Site SS016 area.
- Vertical gradients at Site SS016 are generally small (≤ 0.1 ft/ft). Vertical gradients ranged from 0.03 ft/ft downward (MW2111Ax16/MW2111Bx16) to 0.005 ft/ft upward (MW327x16/MW102x16) during the 2010 – 2011 reporting period.
- Groundwater elevations have been relatively stable at Site SS016, varying by approximately 2 to 4 feet per year, but with no long-term trends.
- Groundwater to surface water connectivity is not present at Site SS016. Aquifer testing was performed at Site SS015 (gravity-injection, 1988; recovery, 1988; pumping, 1991; rising head slug, 1991; falling head slug, 1991). The test results are summarized in the *Groundwater Sampling and Analysis Program 2002-2003 Annual Report* (2002-2003 GSAP) (CH2M HILL, 2004).

A.6.5 Site SS016 Groundwater Contamination

The likely source of soil and groundwater contamination within the OSA source area is the wash rack catch basin. From 1960 to 1968, degreasing waste liquids that contained TCE were transported via pipeline from the tank room in Building 18 to the wash rack catch basin. Long-term leakage of wastewater from the catch basin likely occurred. Additional releases of wastewater from the catch basin were likely associated with jet engine degreasing operations at the wash rack. The source of the TCE release at the OSA is believed to be a break in the storm sewer drainage line immediately downgradient of the catch basin.

TCE and cis-1,2-DCE are the most frequently detected and most widely distributed groundwater contaminants at Site SS016. The current distribution of TCE is shown on Figure A-22. The distributions of cis-1,2-DCE and vinyl chloride are shown on Figures A-23 and A-24, respectively. Distribution of TCE and daughter products at Site SS016 is vertically bounded by the water table in the upper portion of the aquifer and generally dry deeper bedrock (greater than 40 feet below ground surface) in the lower portion of the aquifer. A cross section showing the vertical distribution of contamination is shown on Figure A-25.

The highest concentration of TCE observed within the OSA during the 2Q11 GSAP was at MW2112Ax16. The concentration of TCE in this sample was 40,200 µg/L. This well is located downgradient of the former wash rack catch basin. Table A-1 presents the current and historical maximum concentrations of the contaminants at the site. Table A-2 presents the estimated dimensions of the contaminant plume. The shared Sites SS016/SS029 TCE plume is discussed in Section A.2.6. In addition to MW2112Ax16, samples from four (4) additional wells had concentrations of TCE greater than 10,000 µg/L during the 2Q11 groundwater sampling event.

A.6.6 Site SS016 Vapor Intrusion Pathway

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. At Site SS016 the DNAPL source and groundwater plume do not present a significant vapor intrusion risk under current use at Facility 18, based on indoor air results and the fact that Facility 18 is not currently occupied. Only TCE concentrations slightly exceeded industrial indoor air RBCs. In addition, indoor air and subslab samples collected at adjacent Facility 16 did not indicate significant vapor intrusion concern.

Vapor intrusion does pose a potentially significant concern for future use at Site SS016 in areas where groundwater concentrations exceeded RBCs for both residential and industrial usage, particularly in the immediate vicinity of the DNAPL source area (Facility 18). In addition, exceedances of subslab RBCs indicate potential for significant vapor intrusion concern if building foundation conditions change in the future. Additional information about vapor intrusion at Site SS016 and LUC boundaries for soil vapor under residential and industrial scenarios is provided in the Vapor Intrusion Assessment Update (CH2M HILL, 2013).

A.6.7 Status of the Site SS016 Groundwater IRAs

Active groundwater IRAs are in operation within both the OSA and TARA components of Site SS016. However, IRA GET system components within the OSA have been discontinued. The main components of the IRAs are summarized in Table A-5.

A.6.7.1 Status of the OSA Component of the Site SS016 IRA

Between April 1997 and April 2010, the OSA groundwater IRA consisted of a horizontal extraction well (EW003x16) that runs through the OSA source area, a vertical 2-Phase® extraction well (TPE-W) adjacent to the southern side of the wash rack, and two (2) vertical extraction wells (EW610x16 and EW605x16) located within the aircraft parking ramp approximately 800 and 1,700 feet southeast of the wash rack.

During the period of interim remediation, soil vapor from 2-Phase® extraction well TPE-W was treated by thermal oxidation (ThOx) at a wellhead treatment unit. Treatment of groundwater removed by TPE-W, and extraction wells EW003x16 (horizontal), EW610x16 (vertical), and EW605x16 (vertical) was conducted at the CGWTP using ultraviolet oxidation (UV/Ox) until this process was discontinued in April 2010. The CGWTP now uses LGAC to treat groundwater extracted from the OSA.

During 2010, an ERD treatment demonstration using a bioreactor began within the highest concentration portion of the OSA plume. Operation of the interim 2-Phase® extraction system was discontinued because contaminant concentrations had been declining at an ever decreasing rate and had become increasingly cost-ineffective. In lieu of the inefficient and energy-intensive 2-Phase® extraction well with ThOx and UV/Ox treatment, an in situ bioreactor was installed within the footprint of the former wash rack. The bioreactor design is similar to that previously installed at Site DP039 in December 2008. The construction of the bioreactor began with the excavation of the highly contaminated soil underlying the wash rack. Then the excavation void was backfilled with organic mulch that was sprayed with EVO. Horizontal extraction well EW003x16 is used as a source of contaminated groundwater. This groundwater is continually circulated through the bioreactor to create the aquifer conditions needed for anaerobic degradation of TCE and related compounds. The ERD treatment demonstration using the bioreactor is ongoing (CH2M HILL, 2011).

Vertical extraction wells EW610x16 and EW605x16 remain in operation. Groundwater extracted by these wells continues to be conveyed by underground pipeline to the CGWTP for LGAC treatment.

A.6.7.2 Status of the TARA Component of the Site SS016 IRA

The TARA extraction system is currently operating normally, and no GET optimization measures or treatment demonstrations are planned. Since 1995, the system consists of two (2) parallel 700-foot-long horizontal extraction wells (EW001x16 and EW002x16). The groundwater extracted from both wells continues to be treated by LGAC at the CGWTP. Groundwater contamination not hydraulically captured by either the OSA or TARA extraction wells currently flows under the active aircraft runway and is captured by the hydraulically downgradient Site SS029 GET system.

A.7 Site ST027B Conceptual Site Model

This subsection provides the CSM for Site ST027B, located in the central area of Travis AFB.

A.7.1 Site ST027B Description

Site ST027B is an approximately 12-acre area located within the Travis AFB flightline. The site is bounded by aircraft parking ramps and taxiways as shown on Figure A-26. Access to the site is restricted because of military security requirements.

The site has historically been used for fuel storage and aircraft and jet engine testing. However, jet engine testing is no longer conducted. The main current function of the site is to store fuel as part of the fuel hydrant system.

Historically, fourteen 50,000-gallon USTs were present at the site and used to store jet fuel (jet propulsion fuel, grade 4 [then later, grade 8]). These tanks were removed in 1997 and 1998. Although the tanks appeared intact, soil and groundwater samples indicated that fuel hydrocarbons had impacted the subsurface. Four (4) new aboveground storage tanks (ASTs) have been constructed at Site ST027 to replace the USTs. However, none of the ASTs are located within Site ST027B. A small hazardous waste facility was in operation in the northeastern corner of the site between 1997 and 2004. A wash rack was also historically operated in the northeastern corner of the site.

Site ST027 has historically been managed as part of the Petroleum-only Contaminated (POCO) program at Travis AFB because petroleum hydrocarbons were believed to be the only contaminants present at this site. However, POCO investigations conducted in 2007 and 2008 discovered a small, previously unknown TCE plume located in the southwestern part of Site ST027, between the southern edge of the aircraft test pad and Taxiway November. This area of TCE contamination has been designated as Site ST027–Area B or Site ST027B. The TCE contamination probably originated from undocumented spills or dumping between the southern edge of the aircraft test pad and Taxiway November. Groundwater contamination within this portion of the site is now administered under the ERP. Petroleum fuel contamination found within the remainder of the site, now designated as Site ST027A, continues to be administered under the POCO program.

A.7.2 Site ST027B Geology

The subsurface at Site ST027B consists of Quaternary alluvial deposits underlain by weathered sandstone and shale, which have both been tentatively identified as part of the Markley Sandstone. The alluvial sediments above the sandstone bedrock are generally less than 30 feet thick and consist primarily of lean clay. The underlying sandstone is typically poorly consolidated and fissile in the top layers, becoming more consolidated with depth (Radian, 1996b). In the western part the site, the sandstone bedrock forms a subsurface ridge that trends and plunges south-southeast. The presence of the bedrock ridge strongly influences groundwater flow direction. The poorly consolidated nature of the Markley Sandstone has made identification of the bedrock contact uncertain.

The saturated zone is approximately 5 to 25 feet thick at Site ST027B, and contamination extends throughout the saturated zone to bedrock.

A.7.3 Site ST027B Surface Water

No surface water resources exist within Site ST027B.

A.7.4 Site ST027B Groundwater Characteristics

Groundwater characteristics at Site ST027B from the 2010-2011 GSAP (CH2M HILL, 2012a) are as follows:

- Depth to groundwater typically ranges from 8 to 15 feet bgs.
- Regional groundwater flow in the vicinity of Site ST027B is toward the southeast.
- Local groundwater flow at Site ST027B is semi-radial in the vicinity of the aircraft test pad.
- The geological feature affecting local groundwater flow at Site ST027B is a sandstone ridge present at Site SS016, which has resulted in the formation of a groundwater mound causing groundwater to flow radially outward from the center of the mound.
- Calculated groundwater gradients from recent groundwater elevation measurements are generally about 0.01 ft/ft in the vicinity of the mound and 0.004 ft/ft away from the mound.
- There are no long-term trends in groundwater elevations at Site ST027B. The average seasonal fluctuation in groundwater elevations at this site is about 3 to 5 feet per year.
- Groundwater to surface water connectivity is not present at Site ST027B. Aquifer testing was not performed at Site ST027B.

A.7.5 Site ST027B Vapor Intrusion Pathway

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. At Site ST027B vapor intrusion poses no potentially significant concern for current or future use because SSG concentrations are below residential and industrial SSG RBCs and there are no buildings present at the site. In addition, the industrial hazard indexes were less than 1.

A.7.6 Site ST027B Groundwater Contamination

TCE is the primary groundwater contaminant at Site ST027B. The TCE plume has dimensions of approximately 650 feet long, 400 feet wide, and 30 to 35 feet thick with a volume of 1,281,938 ft^3 (Table A-2). The plume is stable, and monitoring data have not indicated significant migration. The current distribution of TCE is shown on Figure A-26. Vertical distribution of TCE at Site ST027B is controlled by the water table in the upper portion of the aquifer and dry and moist alluvium in the lower portion of the aquifer. Historical data also suggest that TCE contamination may extend to bedrock as shown on Figure A-27.

The maximum TCE concentration detected at the site during the 2Q11 groundwater monitoring event was 435 µg/L. Other chlorinated VOCs detected at the site include 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride. Of these, only TCE, cis-1,2-DCE, and vinyl chloride were detected at concentrations exceeding cleanup levels

during the 2010-2011 monitoring period. TCE detected in monitoring well MW792x27 beyond the eastern edge of the site represents the distal part of the Site SS016 TCE plume and is not related to the ST027B TCE plume. Table A-1 presents the current and historical maximum concentrations of the contaminants at the site.

A.7.7 Status of the Site ST027B Groundwater IRA

Previously unknown Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) groundwater contamination was discovered at the site after the NEWIOU Groundwater IROD was finalized. Therefore, Site ST027B is not included in the IROD as an ERP site, and no groundwater IRA was implemented. However, the site was previously managed under the POCO program with a presumptive remedy for total petroleum hydrocarbon (TPH)-only contamination of MNA.

Following the subdivision of Site ST027 into the Sites ST027A (POCO) and ST027B (ERP), two (2) new Site ST027B monitoring wells were installed in May 2009 (MW2009x27 and MW2010x27), and one (1) new monitoring well was installed in October 2009 (MW2048x27) to further characterize the chlorinated VOC plume. These wells were incorporated into the GSAP in 2009-2010. Site ST027B continues under a program of MNA assessment as an ERP site.

A.8 WIOU Conceptual Site Models

This subsection provides the CSMs for the WIOU sites within the West IRA. These sites include ERP Sites SD033, SD034, SS035, SD036, SD037, SS041, and SD043. Figure A-28 shows each site making up the WIOU.

A.8.1 WIOU Site Descriptions

The WIOU sites are located within industrialized areas of the western-central portion of Travis AFB and collectively encompass approximately 220 acres. The West Branch of Union Creek flows through the WIOU, generally north to south, with the slope of the topography. Numerous buildings, shops, offices, freight handling and storage areas, vehicle maintenance shops, and aircraft maintenance facilities are in the WIOU. Summary descriptions of the WIOU sites are provided in the following subsections.

A.8.1.1 Site SD033 Description

Site SD033 is made up of Storm Sewer II, South Gate Area, Facilities 810 and 1917, and the West Branch of Union Creek. This site includes support areas used for management of stormwater runoff, fuel transport, aircraft maintenance, and aircraft washing, including the use of wash racks and OWS. Historical practices resulted in groundwater contamination with chlorinated VOCs, some semivolatile organic compounds (SVOCs), and petroleum-fuel hydrocarbons.

A.8.1.2 Site SD034 Description

Site SD034 includes Facility 811. This site is an active aircraft wash rack facility with OWS and overflow pond. Leaks from the OWS resulted in a layer of Stoddard solvent floating on the groundwater table. The leaking OWS was replaced in 1994. Historical practices resulted in dissolved groundwater contamination with chlorinated VOCs, SVOCs, and

petroleum-fuel hydrocarbons (including Stoddard solvent). Figure A-29 shows a more detailed view of Site SD034.

A.8.1.3 Site SD035 Description

Site SS035 includes Facilities 818/819. This site includes active facilities used for aircraft repair, painting, and washing. A wash rack with OWS was constructed in 1970. Historical practices resulted in groundwater contamination with chlorinated VOCs.

A.8.1.4 Site SD036 Description

Site SD036 includes Facilities 872/873/876 and consists of multiple-use shops, including a wash rack and OWS. Current uses include paint shops, electrical shops, landscape maintenance, paint mixing, and paint accumulation. The buildings were constructed in 1953 and are still in use. Historical practices resulted in groundwater contamination with chlorinated VOCs, some SVOCs, and petroleum-fuel hydrocarbons. A segment of the sanitary sewer system traverses the northern and eastern portions of the site. Along the eastern boundary of the site is the north-south trending West Branch of Union Creek.

A.8.1.5 Site SD037 Description

Site SD037 is made up of the sanitary sewer system; Facilities 837/838, 919, 977, and 981; the Ragsdale/V Street Area; and the Area G Ramp. This site includes support areas used for management of domestic and industrial wastewater, aircraft maintenance, heavy equipment maintenance, air cargo handling, vehicle washing, fuel transport, and waste accumulation. Operations began in the 1940s and continue through the present day. Historical waste management practices resulted in groundwater contamination with chlorinated VOCs, some SVOCs, and petroleum-fuel hydrocarbons.

Site SD037 is a large site that is located in the central portion of the WIOU and extends from north to south across the entire WIOU. The site includes Buildings 837, 838, 919, 977, and 981; the Area G Ramp; the Ragsdale/V Street Area; and the sanitary sewer system within the WIOU. Buildings 837 and 838 were constructed in 1954 and were used to maintain aircraft. Buildings 837 and 838 both had sumps and transformers that previously held polychlorinated biphenyl (PCB)-containing oil. Building 919 was constructed in 1984 and was used to maintain heavy equipment. An OWS was connected from the building to the sanitary sewer system. Located to the east of the building were a wash rack and a hazardous waste accumulation area. Building 977 was constructed in 1972 and is used as an air terminal where personnel use hydraulic equipment to load and unload cargo. In the past, leaks were reported from the Building 977 hydraulic rams. Building 981 was constructed in 1975. A waste accumulation area was located to the northeast of the facility and a vehicle wash area was located to the east of the facility. The Area G Ramp is located just to the south of Building 977 and contains a hydrant system with a pressurized fuel pipeline that is used for fueling aircraft. Releases have occurred in the Area G Ramp from surface spills or through the jet fuel distribution pipeline. The Ragsdale/V Street Area is an open grass area on the northwest corner of the intersection of Ragsdale Street and V Street where there was a release from the jet fuel distribution pipeline. The sanitary sewer system within Site SD037 includes approximately 22,000 feet of underground piping, which is used to convey domestic and industrial wastewater from facilities within the WIOU to the Fairfield-Suisun publicly owned treatment works.

A.8.1.6 Site SS041 Description

Site SS041 includes Building 905. This site includes an active entomology shop that provides pest management services for the Base. From 1983 to 1992, the shop prepared pesticides and herbicides for on-base use. A concrete washrack in the back of the building was used to clean pesticide applicator vehicles, and the overspray from the washing resulted in pesticide contamination in the soil and groundwater. A groundwater extraction system was built around the building as an interim groundwater remedial action and was connected to the WTTP. The interim groundwater action achieved a cleanup of the pesticide contaminants to below detection levels. A surface soil remedial action in 2003 achieved residential cleanup levels. Since all media of concern were addressed by these two (2) actions, Site SS041 was placed in a No Further Response Action Planned (NFRAP) status, which is documented in a 14 December 2005 consensus statement that was signed by the representatives of the lead and regulatory agencies (Travis AFB, 2005).

A.8.1.7 Site SD043 Description

Site SD043 includes Building 916. The site comprises an emergency electric power facility. Historical waste management practices resulted in a release of TCE to the groundwater at this site.

A.8.2 WIOU Geology

The sediments of the WIOU comprise approximately 30 to 110 feet of alluvium (known as the Older Alluvium) underlain by semi-consolidated to consolidated folded bedrock (known as the Neroly Sandstone). The alluvium consists of clay silt, and discontinuous lenses of sand, clayey sand, silty sand, and gravel.

The Neroly Sandstone is a finely grained sandstone that is poorly graded and interbedded with siltstone. Locally, at the alluvium/bedrock interface, the sandstone has been observed to be highly weathered and has historically been interpreted as poorly graded sand in some locations. Where the sandstone is highly weathered, it transports groundwater. However, competent bedrock, where refusal while drilling consistently occurs, is present immediately below the highly weathered alluvium-bedrock contact. During the 2009-2010 investigation, refusal during drilling occurred at several locations immediately below the alluvium-bedrock contact. Lithologic logs indicate that the Neroly Sandstone is hard to very hard and strongly cemented (CH2M HILL, 2012c).

The Neroly Sandstone is bordered on the east by the Markley Sandstone, which outcrops at the boundary between the WIOU and the EIOU, and on the west by the Tehama Formation. The center of the WIOU is underlain by a basin that reaches a depth of 110 feet bgs in the Site SD036 source area. In this area, the alluvium is as much as 110 feet thick, which is much thicker than in the rest of the WIOU (typically 40 to 60 feet thick) and appears to be associated with the incising of a paleochannel of the West Branch of Union Creek. Investigations indicate that the paleochannel trends to the south-southwest.

In the southern portion of the WIOU, the geology consists of a relatively thin cover of alluvium consisting of clay; silt; and discontinuous lenses of sand, clayey sand, and silty sand. Soil borings in the southern portion of the WIOU indicate that alluvium thicknesses range from approximately 15 to 35 feet.

The Older Alluvium consists primarily of silts and clays that are low in permeability and do not readily transmit groundwater. More permeable units, such as sands and gravels, are geographically restricted and occur as lenses rather than continuous beds. These sand and gravel lenses have been deposited by streams such as Union Creek. A particularly thick sand interval was observed in the soil boring for well MW2108Cx36, located adjacent to the West Branch of Union Creek. A 19-foot-thick interval of sand was observed from 57 to 76 feet bgs at this boring.

More focused descriptions of the geology at Sites SD036 and SD037 within the WIOU are provided in the following subsections.

A.8.2.1 Site SD036

The geology of Site SD036 consists of a relatively thick cover of fine-grained alluvium overlaying sandstone bedrock. The alluvium consists of clay, silt, and discontinuous lenses of sand, clayey sand, and silty sand. Alluvium along the western portion of the site is up to 68 feet thick at MW2107Cx36.

Along the eastern portion of Site SD036 the alluvium is thicker and appears to be associated with the incising of a paleochannel. The alluvium in this portion of the site is as thick as 110 feet at the location of MW2063x36. The paleochannel appears to trend to the south-southwest and includes the boring locations at MW2033Bx36, MW2034Bx36, MW2063x36, MW2064Bx36, MW2065x36, MW2075Bx36, MW2076Cx36, MW2077Cx36, and MW2108Cx36. The alluvium within the paleochannel ranges in depth from 93 to 110 feet bgs. It also appears that the western edge of the paleochannel is abrupt, as the depth of bedrock goes from a depth of at least 95 feet bgs in MW2034Bx36 to 68 feet bgs in MW2107Cx36.

The sand, clayey sand, and silty sand lenses are generally thin. However, at MW2108Cx36, which is located adjacent to the West Branch of Union Creek, a 19-foot-thick interval of sand was observed from 57 to 76 feet bgs. Based on the location and depth of the thick sand lens, the sand is likely associated with the paleochannel of the West Branch of Union Creek.

Bedrock at Site SD036 consists of the Neroly Sandstone, which is a finely grained sandstone that is poorly graded. Locally, at the alluvium/bedrock interface, the sandstone has been observed to be highly weathered and has consequently been historically interpreted as poorly graded sand in some locations. Where the sandstone is highly weathered, it transports groundwater.

A.8.2.2 Site SD037

The geology of Site SD037 is variable. In the northern portion of Site SD037, the geology consists of a relatively thick cover of alluvium consisting of clay; silt; and discontinuous lenses of sand, clayey sand, silty sand, and gravel. Alluvium along the eastern portion of Site SD037 is up to 60 feet thick (based on the soil boring for well MW2102Cx37). Along the western portion of Site SD037, the alluvium is thicker and appears to be associated with the incising of a paleochannel, which is also observed at neighboring Site SD036. The alluvium in the western portion of Site SD037 (near Site SD036) is as thick as 91.5 feet (MW2077Cx36). The eastern slope of the paleochannel appears to be relatively gentle. The trend of the paleochannel appears to be to the south-southwest.

In the southern portion of Site SD037, the geology consists of a relatively thin cover of alluvium consisting of clay; silt; and discontinuous lenses of sand, clayey sand, and silty sand. Soil borings in the southern portion of Site SD037 indicate alluvium thicknesses range from 15 to 33.5 feet.

Bedrock at Site SD037 consists of the Neroly Sandstone, which is a finely grained sandstone that is poorly graded and interbedded with siltstone.

A.8.3 WIOU Surface Water

No surface water resources exist within Sites SD034, SS035, SS041, and SD043. The West Branch of Union Creek flows above ground through Sites SD033, SD036, and SD037 north of the runway and is directed to a culvert under the runway before it discharges to the Main Branch of Union Creek in the southern portion of Site SD033. Low (currently below 2 µg/L) detections of TCE from surface water in the West Branch of Union Creek indicate that some contaminated groundwater discharges from the aquifer into the creek (CH2M HILL, 2012a). When groundwater elevations are high (spring), groundwater also infiltrates into the storm drain (CH2M HILL, 1999c).

Union Creek is the main groundwater to surface water pathway at Travis AFB. Discussion of surface water is provided in the final *NEWIOU Soil, Sediment, and Surface Water ROD* (TRAVIS AFB, 2006) with additional details provided in the Ecological Technical Memorandum for the NEWIOU (URS, 2005). No physical or administrative action is required for surface water at this site. The surface water at the site does not pose an unacceptable risk to ecological or human receptors (Travis AFB, 2006).

A.8.4 WIOU Groundwater Characteristics

The overall hydrogeologic characteristics of the WIOU are included from the 2010-2011 GSAP (CH2M HILL, 2012a) and describe the area as follows:

- Depth to groundwater typically ranges from 6 to 15 feet bgs.
- Regional groundwater flow in the vicinity of the WIOU is toward the south.
- Local groundwater flow for the WIOU is consistent with the regional southerly flow direction.
- The geological feature affecting local groundwater flow at Sites FT004, LF007, and SD031 include is a groundwater through, which runs along the center of the WIOU and is centered on Site SD036. This trough reflects the thick wedge of unconsolidated and relatively more permeable materials near Site SD036.
- In the WIOU, the horizontal hydraulic gradient is approximately 0.004 ft/ft.
- Vertical gradients derived from shallow/deep monitoring well pairs in the WIOU were generally negligible (less than 0.01 ft/ft) at this area over the 2010-2011 reporting period. With Vertical gradients ranged from -0.1 ft/ft downward (PZ06Sx36/PZ06Dx36) to 0.03 ft/ft upward (MW2039Ax37/MW2039Bx37 and MW2102Bx37/MW2102Cx37).
- Groundwater elevations typically vary by approximately 2 to 5 feet per year at WIOU monitoring wells with no long-term trends.

- Low (currently below 2 µg/L) detections of TCE from surface water in the West Branch of Union Creek indicate that some contaminated groundwater discharges from the aquifer into the creek. When groundwater elevations are high (spring), groundwater also infiltrates into the storm drain (CH2M HILL, 1999c).
- Groundwater to surface water connectivity is not present at Sites SD034, SS035, SS041, and SD043. It is present at Sites SD033, SD036, and SD037. Aquifer testing was performed at Sites SD033 (rising head slug, 1991; pumping, 1999), SD036 (pumping, 1999), SD037 (gravity-injection, 1988; recovery, 1988; pumping, 1996, 1998, and 1999), and SD043 (pumping, 1999). The test results are summarized in the *Groundwater Sampling and Analysis Program 2002-2003 Annual Report* (2002-2003 GSAP) (CH2M HILL, 2004).

A.8.5 WIOU Groundwater Contamination

The primary groundwater contaminants within the WIOU are TCE, tetrachloroethene (PCE), 1,1-DCE, 1,2-DCA, cis-1,2-DCE, vinyl chloride, carbon tetrachloride, bromodichloromethane, chloromethane, benzene, naphthalene, TPH-G, and TPH-D. The indicator chemical is TCE. Table A-1 presents the current and historical maximum concentrations of the contaminants at each site.

The distribution of commingled TCE contamination originating from the multiple sites within the WIOU is shown on Figure A-28, cis-1,2-DCE on Figure A-30, and vinyl chloride on Figure A-31. The TCE plume at the WIOU, which includes Sites SD033, SD034, SS035, SD036, and SD037, has approximate dimensions of 4,650 feet long, 750 feet wide, and 20 to 90 feet thick and a volume of 13,664,003 ft^3, as shown in Table A-2. The plume is stable and monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study has also indicated that significant plume migration did not occur when GET system operations were discontinued.

TCE distribution in the WIOU is vertically controlled by the water table in the upper portion of the aquifer and generally moist bedrock in the lower aquifer. Locally, hollow stem auger refusal occurs within 5 feet of encountering bedrock. At Site SD043 TCE vertical distribution is bounded by the water table in the upper portion of the aquifer and generally moist alluvium in the lower portion of the aquifer. A vertical cross section through the WIOU is shown on Figure A-32. Additional cross sections for areas of elevated TCE concentrations within Sites SD036, SD037 (vicinity of Building 837 hot spot), and SD043 are shown on Figures A-33 and A-34.

The following subsections provide more details on the nature of groundwater contamination at Site SD034, Site SD036, and the hot spot in the vicinity of Building 837 within Site SD037.

A.8.5.1 Site SD034

Site SD034 is located to the north of the main WIOU TCE plume and is discussed separately because, in addition to VOCs, floating product (i.e., Stoddard solvent) is present at the site. The source of the floating product was a leaky OWS that serviced Facility 811. The defective OWS has been replaced. Stoddard solvent was historically used to wash aircraft inside

Facility 811, and this practice is ongoing. Wastewater and solvent from the washing process drain to a sump in the facility floor and are piped to the OWS.

Stoddard solvent (a.k.a. P-D-680) is a petroleum distillate mixture of 15 percent trimethylbenzene and 85 percent n-nonane. Neither of these constituent compounds has a primary California or federal maximum contaminant level (MCL). However, Stoddard solvent is a non-aqueous medium also containing dissolved-phase COCs at concentrations above MCLs (primarily cis-1,2-DCE) (CH2M HILL, 1999d).

Passive hydroskimmers are installed in monitoring wells EW01x34, MW02x34, MW811x34, MWSSAx34, and MWSSBx34 to address the floating product at the site. In the 2Q11 survey, a significant amount of floating product (greater than 0.1 foot) was detected only at well MWSSBx34 (0.44 foot). The floating Stoddard solvent plume remains in the immediate vicinity of the release and is not migrating.

TPH-D, which includes Stoddard solvent range hydrocarbons, was detected at all four (4) Site SD034 wells during 2Q11. The maximum concentration detected was 4,700 J (data flag; estimated value) µg/L at well MW02x34.

Detections of TPH-G that occasionally occur at the site may result from the presence of the lighter range hydrocarbons of Stoddard solvent. However, TPH-G was detected at Site SD034 wells EW01x34 (31 J µg/L) and MW02x34 (12 J µg/L) during the reporting period.

A.8.5.2 Site SD036

The source of chlorinated VOC contamination at the site is likely the result of a historical break in the sanitary sewer line that traverses the site. The break has since been repaired.

Historically, liquid wastes containing TCE from facilities in the WIOU were likely flushed into the sanitary sewer system. A portion of this waste stream was likely released directly into the groundwater at Site SD036 from a damaged segment of the sanitary sewer. TCE has dissolved into groundwater from the source and migrated along small discontinuous sandy lenses downgradient to the south and southeast, following the regional groundwater gradient. Although none has been directly observed at the site, the presence of DNAPL is suggested by the high TCE concentrations detected in the source area.

Results of historical soil gas investigations indicate relatively low vadose zone TCE soil gas concentrations in the vicinity of monitoring well MW2031Bx36 (maximum detection of 150 parts per billion by volume). The concentration of TCE found in the soil gas was likely due to volatilization from the underlying groundwater plume. These soil gas data, combined with the high historical TCE concentrations in groundwater (exceeding 10,000 µg/L) in the vicinity of the sanitary sewer suggest that the TCE was released by direct discharge to groundwater from the damaged sanitary sewer. The sanitary sewer invert elevation is approximately 10 feet bgs and near the water table.

A.8.5.3 Site SD037

The highest concentrations of groundwater contamination within Site SD037 were historically at wells MW524x37 and MW2039Ax37, located west of Building 837, where TCE concentrations exceeded 1,000 µg/L. The source of chlorinated VOC contamination is likely the result of a historical break in the sanitary sewer line that traverses the site. The break

has since been repaired. TCE concentrations have declined one (1) to two (2) orders of magnitude at these wells since EVO injection was performed. Increases in cis-1,2-DCE are significant in MW2039Ax37, but not apparent in MW524x37.

Historically, liquid wastes containing TCE from facilities in the WIOU were likely flushed into the sanitary sewer system. A portion of this waste stream was released directly into the groundwater at Site SD037 from a damaged segment of the sanitary sewer. TCE has dissolved into groundwater from the source and migrated along small discontinuous sandy lenses downgradient to the south and southeast, following the regional groundwater gradient. Groundwater contamination at Site SD037 consists of a series of discontinuous groundwater plumes that extend from Building 811 in the north to Taxiway November in the south. The extent of the TCE plume is shown on Figure A-28.

In addition to TCE, concentrations of TPH-G, TPH-D, cis-1,2-DCE, benzene, PCE, carbon tetrachloride, and vinyl chloride have been detected at Site SD037 at levels above their respective cleanup levels.

A.8.6 WIOU Vapor Intrusion Pathways

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. The following subsections summarize the results of this assessment for sites within the WIOU.

A.8.6.1 Sites SD033, SS035, SD036, and SD037 Vapor Intrusion Pathway

At Sites SD033, SS035, SD036, and SD037 vapor intrusion poses no potentially significant concern for current use because few buildings directly overlie groundwater plume and soil gas, indoor air, and subslab data in and near existing buildings do not indicate significant vapor intrusion concern.

Vapor intrusion does not pose a potentially significant concern for future industrial use at Sites SD033, SS035, SD036, and SD037 with the exception of the Sites SD036 and SD037, source areas where emulsified vegetable oil has been injected to enhance biodegradation. SSG concentrations exceeded the industrial SSG RBCs at only two (2) locations. 1,2-Dichloropropane and TCE were the only VOCs that exceeded, and the exceedances were less than the 1×10^{-5} industrial cancer risk for these chemicals. In addition, the cumulative industrial cancer risk was less than 1×10^{-5}, and the industrial hazard index was less than 1 at all WIOU sample locations. Indoor air (including preferential pathway samples) and subslab data in existing buildings do not indicate significant vapor intrusion concern. However, in the Site SD036 and SD037 source areas, enhanced biodegradation has resulted in a temporary increase in daughter products cis-1,2-DCE and vinyl chloride. In areas where groundwater concentrations of these daughter products exceed industrial RBCs, there is a potentially significant vapor intrusion risk for future use.

Vapor intrusion does pose a potentially significant concern for future residential use because SSG concentrations exceeded residential SSG RBCs at ten (10) of the 22 sampling locations. In addition, the cumulative residential cancer risk was greater than 1×10^{-5} at five (5) locations and the residential hazard index exceeded 1 at three (3) locations. Additional information about vapor intrusion at Sites SD033, SS035, SD036, and SD037 and LUC boundaries for soil vapor under residential scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.8.6.2 Site SD034 Vapor Intrusion Pathway

At Site SD034 vapor intrusion poses no potentially significant concern for current use because Facility 811 is a hangar with large doors to allow aircraft to enter. The hangar doors remain open during working hours; therefore, the facility is not an enclosed space. The floating product plume consists of Stoddard solvent, use of which is ongoing within the facility.

Vapor intrusion does pose a potentially significant concern for future residential and industrial use at Site SD034 due to the presence of the floating product (Stoddard solvent). Additional information about vapor intrusion at Site SS029 and LUC boundaries for soil vapor under residential and industrial scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.8.6.3 Site SS041 Vapor Intrusion Pathway

At Site SS041 vapor intrusion was not evaluated in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013). No further actions for Site SS041, including no LUC provisions, will occur to remediate or manage COCs in groundwater. Cleanup levels for heptachlor epoxide were achieved by the interim action, which consisted of successful long-term operation of a GET system.

A.8.6.4 Site SD043 Vapor Intrusion Pathway

At Site SD043 vapor intrusion poses no potentially significant concern for current or future use because groundwater concentrations are below residential and industrial RBCs and there are no buildings present at the site.

A.8.7 Status of the WIOU Groundwater IRAs

The groundwater IRA in the WIOU is a combination of GET and MNA assessment. Free-product removal is also conducted at Site SD034. The WIOU GET system is currently turned off for a rebound study for the remainder of the period of interim remediation. The entirety of the plume continues to be monitored under the GRIP. Free-product removal at Site SD034 is intermittent, but ongoing. The main components of the WIOU IRA are summarized in Table A-6.

A.8.7.1 WIOU GET System

The WIOU GET system was started up in February 2000. Until it was shut down for a rebound study in 2010, GET was the active component of the interim remedy within the WIOU. Within the contaminant source areas, GET was used to hydraulically capture the plumes and remove contaminant mass. Outside of the source areas, GET was used to hydraulically capture the portions of the plumes where VOC concentrations exceeded 100 µg/L.

In total, 18 dual-phase extraction (DPE) wells and groundwater extraction wells have operated in the WIOU. Soil vapor from all of the DPE wells was treated at the WTTP by vapor-phase granular activated carbon (VGAC). Groundwater from all of the DPE and groundwater extraction wells was conveyed to the WTTP and then to the CGWTP for treatment.

In the southern portion of the WIOU plume, extraction well EW542x41 at Site SS041 (a component of the WIOU GET system) was decommissioned in January 2004 because of the expansion of Building 906 (URS Group, Inc. [URS], 2004).

A.8.7.2 MNA Assessment

A program of MNA assessment is continuing in the distal portions of the plumes hydraulically downgradient of the GET system. This portion of the WIOU plume has been continually monitored for the viability of MNA processes to remediate groundwater since the GET system was installed. The WIOU sites' GET systems were shut down for a rebound study in 2010.

A.8.7.3 Floating Product Removal

The GET remedy at Site SD034 is supplemented by floating product removal using passive skimmers. From 1998 through 2009, approximately 43 gallons of floating product were removed from the site. Passive skimmers are currently installed in wells EW01x34, MW02x34, MW811x34, MWSSAx34, and MWSSBx34. Floating product removal using the passive skimmers is ongoing and conducted as required.

A.8.7.4 ERD Treatment Demonstrations

During 2010, successful demonstrations of in situ ERD treatment using EVO injection were conducted within the highest concentration portions of the Site SD036 and SD037 plumes. Data obtained during the demonstration indicate that ERD processes are viable for fully degrading the TCE parent compound and daughter products. The treatment demonstrations at Sites SD036 and SD037 are ongoing.

A.9 Site DP039 Conceptual Site Model

This subsection provides the CSM for Site DP039 located in the western portion of Travis AFB.

A.9.1 Site DP039 Description

Site DP039 primarily consists of the former Travis AFB Battery and Electric Shop (Building 755) and encompasses approximately 41 acres.

Starting in 1968, Building 755 was originally used to test rocket engines, but only petroleum-based liquid fuel was used at the site as part of this testing. Afterwards, Building 755 became the Battery and Electric Shop. Prior 1978, battery acid solutions and chlorinated solvents were dumped into a sink within Building 755 and conveyed by pipeline less than 100 feet to a former rock-filled acid neutralization sump. This practice was discontinued in 1978, when the pipeline was dismantled and reconnected to the sanitary sewer line. In July 1993, the sump was excavated and disposed of off-base. The removed sump was 8 feet long, 8 feet wide, and 4 feet deep.

Building 755 was demolished in 2009. The lot is currently vacant.

A.9.2 Site DP039 Geology

Geologic data collected during Site DP039 investigations indicate that the subsurface geology at Site DP039 is highly heterogeneous, varying from clays and silts to sands with little or no horizontal continuity of layers (Older Alluvium). The subsurface at Site DP039 should be viewed as a single, complex, heterogeneous hydrogeologic system of unconsolidated sediments overlying bedrock. No clearly defined, laterally extensive layers of discrete aquifers or aquitards are present (CH2M HILL, 2001).

Relatively permeable sands and silty/clayey sands are encountered primarily as thin zones, ranging from 2 to 5 feet thick, and are not extensive. Bedrock has been identified as the Tehama Formation, which is composed of lithic sandstones and siltstones. Lithic fragments associated with the sandstone are from the Sonoma Volcanics and the Franciscan Formation (Weston, 1995). The sandstones and siltstones are moderately to highly weathered near the alluvium-bedrock contact and become more consolidated with depth.

The depth of the Tehama Formation is somewhat uncertain as the alluvium-bedrock contact is locally weathered and therefore not always easily identified in the field. However, well consolidated bedrock was encountered at several locations during the 2009 and 2010 data gaps investigation supporting the design of the EVO permeable reactive barrier (PRB). The hollow-stem auger drill rig met refusal when encountering bedrock at several locations, including MW2043Bx39, MW2057Bx39, MW2060Bx39, IW2079x39, IW2084x39, and MW2093x39. The depth where bedrock becomes competent ranges from 35 to 73 feet bgs. Based on surface exposures of the Tehama Formation and the depth of the bedrock, the bedrock plunges to the southeast and becomes progressively deeper in that direction.

The saturated zone ranges in thickness from approximately 15 to more than 50 feet. Groundwater contamination extends to the consolidated bedrock. The downgradient extent of contamination is approximately 2,400 feet. Monitoring well screened intervals vary from 11 to 73 feet bgs and are adequate to monitor the vertical extent of contamination at the site.

A.9.3 Site DP039 Surface Water

No surface water resources exist within Site DP039.

A.9.4 Site DP039 Groundwater Characteristics

Groundwater characteristics at Site DP039 are summarized from the 2010-2011 GSAP (CH2M HILL, 2012a) as follows:

- Depth to groundwater typically ranges from 7 to 26 feet bgs.
- Regional groundwater flow in the vicinity of Site DP039 is toward the southeast.
- Local groundwater flow at Site DP039 is consistent with the southeast regional flow direction.
- No geological features result in local variations to the regional groundwater flow direction at Site DP039.
- Horizontal gradients are approximately 0.005 ft/ft.

- Vertical gradients at Site DP039 are generally negligible (less than 0.1 ft/ft), and most of the vertical gradients were upward. Vertical gradients ranged from -0.02 ft/ft downward to 0.09 ft/ft upward in 2Q11.
- Groundwater elevations at Site DP039 fluctuate seasonally from about 2 to 4 feet. There are no long-term trends of rising or falling groundwater elevations.
- Groundwater to surface water connectivity is not present at Site DP039. Aquifer testing was performed at Site DP039 (pumping, 1996; recovery, 1996; pumping, 2000). The test results are summarized in the *Groundwater Sampling and Analysis Program 2002-2003 Annual Report* (2002-2003 GSAP) (CH2M HILL, 2004).

A.9.5 Site DP039 Groundwater Contamination

TCE is the most frequently detected and most widely distributed groundwater contaminant at Site DP039. The current distributions of TCE, cis-1,2-DCE, and vinyl chloride are shown on Figures A-35 through A-37, respectively. Vertically, TCE, cis-1,2-DCE, and vinyl chloride at Site DP039 are bounded by the water table in the upper portion of the aquifer and generally dry bedrock in the lower portion of the aquifer. The bedrock at Site DP039 becomes well cemented with depth and causes refusal of a hollow stem auger drill rig within 10 feet of where the discernible alluvium-bedrock interface is encountered during drilling. The vertical distribution of contamination is shown on Figure A-38. The TCE plume at the site has approximate dimensions of 1,720 feet long, 830 feet wide, and 20 to 45 feet thick with a volume of 9,614,472 ft^3 (Table A-2). The plume is stable and monitoring data obtained from a recent rebound study indicated that significant plume migration did not occur at the site as was also seen at the WIOU during the same study.

Groundwater contamination at Site DP039 consists of a large plume that extends from well EW563x39 approximately 1,750 feet downgradient (southeast) near MW759x39. Table A-1 presents the current and historical maximum concentrations of the contaminants at the site.

A.9.6 Site DP039 Vapor Intrusion Pathway

The *Vapor Intrusion Assessment Update* (CH2M HILL, 2013) evaluated vapor intrusion risk at groundwater sites across Travis AFB. At Site DP039 vapor intrusion poses no potentially significant concern for current use because SSG concentrations adjacent to the buildings overlying the groundwater plume are below industrial SSG RBCs and Indoor air and subslab VOC concentrations at former Facility 755 are also below industrial RBCs.

Vapor intrusion does pose a potentially significant concern for future use at Site DP039. SSG concentrations exceeded industrial and residential SSG RBCs at one (1) or more locations. In addition, the industrial hazard index was greater than or equal to 1 at two (2) sampling locations, and the residential hazard index exceeded 1 at five (5) sampling locations. In areas where groundwater concentrations exceed industrial or residential RBCs, there is a potentially significant vapor intrusion concern for future use. Additional information about vapor intrusion at Site SS029 and LUC boundaries for soil vapor under residential and industrial scenarios is provided in the *Vapor Intrusion Assessment Update* (CH2M HILL, 2013).

A.9.7 Status of the Site DP039 Groundwater IRA

The IRA GET system at Site DP039 was shut down in 2008. The current actions being taken at the site include a demonstration bioreactor, a phytoremediation demonstration, and an EVO PRB demonstration in the highest concentration portions of the plume, combined with natural attenuation processes in the distal portion of the plume.

A.9.7.1 Treatability Studies and Demonstration Projects

Five (5) treatability studies or demonstration projects have been conducted at the site:

- **Soil Vapor Extraction (SVE) and Vacuum Dewatering Treatability Study**. An SVE and vacuum dewatering treatability study was conducted within the Site DP039 source area from January to October 2000 to assess the effectiveness of dual-phase groundwater extraction for removing contaminant mass from the source area. The treatability study lasted approximately 6 months and was successful at removing approximately 495 pounds of VOCs. Of the contaminants removed, 99 percent came from the vapor phase. Following completion of the SVE and vacuum dewatering treatability study, a permanent DPE well was installed near the former disposal sump (EW563x39). Groundwater and vapor extraction from this well began in February 2001 and continued until February 2003. Well EW563x39 was once again brought online in October 2005 as part of a system optimization effort as described in the *DP039 Optimization Field Report* (CH2M HILL, 2007). In addition to well EW563x39 being brought back online, an additional DPE well (EW782x39) was installed immediately south of the Site DP039 source area and integrated with the existing extraction system. Operation of the expanded DPE system continued through November 2008, when it was discontinued to facilitate construction and operation of the in situ bioreactor.

- **Permeable Reactive Treatment Wall Treatability Study.** A 2-year permeable reactive treatment wall treatability study was completed at the site between 2000 and 2002. This treatability study was conducted to assess the effectiveness of using injected iron filings to provide an in situ treatment zone downgradient of the Site DP039 source area. During the study, a zero-valent iron (ZVI) filings mixture was injected into a line of boreholes to create the permeable wall. Although data collected during the study identified areas of decreased TCE concentrations within the body of the reactive wall, the overall results from the study were inconclusive. The innovative jet grouting approach used to inject the iron filings mixture into the subsurface was found to be ineffective under the conditions at Site DP039. Apparently, only a small fraction of groundwater was passing through the injected ZVI wall. More complete discussion of the permeable reactive treatment wall treatability study is available in the *Demonstration of Columnar Wall Jet Grouting of a Permeable Reactive Treatment Wall* report (MACTEC, 2002).

- **Phytoremediation Treatability Study and Treatment Demonstration.** A phytoremediation treatability study was initiated in August 1998 to assess the effectiveness of planted trees to hydraulically control and remove VOC contamination from the groundwater migrating from the Site DP039 source area. The phytoremediation study involved planting red ironbark eucalyptus trees hydraulically downgradient of the source area. An evaluation of the study in 2005 concluded that as the eucalyptus trees continue to mature, they have the potential to remediate the TCE-contaminated

groundwater at the site (Parsons, 2005). At the time of the evaluation, the root systems of the trees were found to have reached the water table, and contaminants were being removed through transpiration processes.

The most recent findings are documented in the *Phytostabilization at Travis Air Force Base, California* technical report (Parsons, 2010). Among the key findings documented in the report was that phytoremediation posed a beneficial impact to the goal of reducing groundwater contaminant concentrations. The overall TCE removal rate within the phytoremediation study area was about 1.99 pounds per year. In the future, maximum removal rates could rise to 15.4 pounds per year. The effectiveness of phytoremediation continues to be evaluated as an ongoing treatment demonstration.

- **Bioreactor Treatment Demonstration.** In November 2008, the highly contaminated soil underlying the historical disposal sump was excavated, and a bioreactor was installed to treat the residual TCE concentration in soil and groundwater with the processes of ERD. Using existing extraction well EW782X39, a solar-powered pump was installed to extract groundwater immediately downgradient of the bioreactor and recirculate the groundwater through the bioreactor. Since coming online, the initial observations of bioreactor performance have shown its ability to chemically and/or biologically break down TCE and DCE mass. Early data collection indicates that more than 75 percent of the TCE and DCE entering the bioreactor in recirculated groundwater degrades within the reactor. In areas immediately surrounding the bioreactor, concentrations of TCE have started to decrease, and concentrations of cis-1,2-DCE (the daughter product of TCE) have increased, indicating active ERD processes. The bioreactor treatment demonstration is ongoing and chlorinated VOCs are being effectively degraded within the treatment zone.
- **EVO PRB Treatment Demonstration.** Beginning in 2010, a demonstration of ERD treatment using a linear injection of EVO to create a flow-through PRB was conducted downgradient of the area of phytoremediation. This mid-portion of the plume is associated with high concentrations of dissolved solvents that migrated from the former disposal sump area. The EVO PRB is hydraulically downgradient of the area of phytoremediation and intercepts the plume at the 500-µg/L TCE isocontour. The EVO PRB treatment demonstration is ongoing and chlorinated VOCs are being effectively degraded within the treatment zone.

Downgradient Plume EA. Concentrations of chlorinated VOCs in the relatively low concentration portion of the Site DP039 plume, located hydraulically downgradient of the EVO PRB, are being routinely monitored under the GRIP. Monitoring data indicate that the physical, chemical, and biological processes of natural attenuation are viable to remediate this portion of the plume when used in combination with the bioreactor, area of phytoremediation, and EVO PRB in the higher concentration portions of the plume located hydraulically upgradient.

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TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L) Historical Maximum[a,b] (pre-IRA)	Concentration (µg/L) Current Maximum[c] (2010 to 2011)
FT004	Historical practices during fire training exercises conducted between approximately 1953 and 1962. During this period, waste fuels, oils, and solvents were burned on open ground.	Chlorinated VOCs. Carcinogenic, toxic, and mobile.	TCE	**5,200**	**204 J-**
			cis-1,2-DCE	**60.5**	**12.6 J+**
			1,2-DCA	**5.12**	ND
			Chloroform	15	3.8
			Bromodichloromethane	5.7	0.73 J-
			1,1-DCE	**42**	0.77
			Vinyl chloride	**43.7**	**14.8**
			1,4-DCB	3.8	ND
		SVOCs	bis(2-Ethylhexyl)phthalate[d]	**21**	-[d]
		Metals	Nickel[e]	**6,270**	-[e]
					Results during shutdown of IRA GET system for rebound study.
FT005	Historical practices during fire training exercises conducted between approximately 1962 and 1987. During this period, waste fuels, oils, and solvents were burned on open ground.	Chlorinated VOCs. Carcinogenic, toxic, and mobile.	TCE	**160**	**5.6 J-**
			1,2-DCA	**14.2**	**5.8**
			cis-1,2-DCE	**19**	0.48 J-
			Chloroform	10	0.29 J-
			Bromodichloromethane	2.0	ND
		SVOCs	bis(2-Ethylhexyl)phthalate[d]	**50.3**	-[d]
		Metals	Nickel[e]	**4,270**	-[e]
					Results during shutdown of IRA GET system for rebound study.
LF006	A historical general refuse landfill that used trench and cover methods from approximately 1943 through 1950.	Chlorinated VOCs. Primarily carcinogenic, toxic, and mobile.	TCE	**30**	**6.9**
			1,1-DCE	0.64	ND
					Results after approximately a decade of MNA assessment.

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L) Historical Maximum[a,b] (pre-IRA)	Concentration (µg/L) Current Maximum[c] (2010 to 2011)
LF007B Subarea	Portion of a historical general refuse landfill that used trench and cover methods from approximately 1950 through 1970.	Chlorinated VOCs, SVOCs, pesticides/PCBs, dioxins. Primarily carcinogenic, toxic, low mobility.	Benzene	**59.3**	ND
			1,4-DCB	**43.8**	ND
			Chlorobenzene	**161**	ND
			bis(2-Ethylhexyl)phthalate[d]	**66.1**	-[e]
			Aroclors 1242 and 1248	**14.1**	ND
			2,3,7,8-TCDDeq	**0.55 pg/L**	ND
					Results after approximately a decade of MNA assessment.
LF007C Subarea	Portion of a historical general refuse landfill that used trench and cover methods from approximately 1950 through 1970.	Chlorinated VOCs. Carcinogenic, toxic, low mobility.	TCE	**49.1**	**10.3**
			Vinyl chloride	0.198	ND
			1,1-DCE	0.297	ND
			1,2-DCA	0.314	ND
			1,2-Dichloropropane	3.38	0.3 J
					Results after approximately a decade of IRA GET system operation. Optimization pending.
LF007D Subarea	Portion of a historical general refuse landfill that used trench and cover methods from approximately 1950 through 1970.	Chlorinated VOCs, SVOCs, PCBs, dioxins. Primarily carcinogenic, toxic, low mobility.	Benzene	**25.8**	**2.2**
			Vinyl chloride	**1.78**	ND
			1,4-DCB	**43.8**	**12.6**
			1,1-DCE	0.96	ND
			Chlorobenzene	**282**	30.2
			2,3,7,8-TCDDeq	**16.99 pg/L**	ND
			Aroclors 1242 and 1248	14.1	ND
			bis(2-Ethylhexyl)phthalate[d]	124	-[d]
					Results after approximately a decade of MNA assessment.
LF008	Historical disposal practices at an inactive landfill. Pesticide containers were disposed of in a series of small, unlined trenches.	Organochlorine pesticides. Carcinogenic, toxic, relatively immobile.	Alpha-chlordane	**1.7**	**0.43**
			Heptachlor	**0.29**	ND
			Heptachlor epoxide	**0.63**	**0.017 J-**
			Aldrin	**0.16**	ND
					Results during shutdown of IRA GET system for rebound study.

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L) Historical Maximum[a,b] (pre-IRA)	Concentration (µg/L) Current Maximum[c] (2010 to 2011)
SS015	Historical practices at facilities used between approximately 1964 and 1980 for solvent stripping of aircraft parts, aircraft maintenance and repair, OWS activities, and hazardous waste accumulation.	Chlorinated VOCs. Probable DNAPL within the high concentration portion of the plume. Carcinogenic, toxic, and mobile.	TCE	**563**	**226**
			cis-1,2-DCE	**7,680**	**598**
			Vinyl chloride	**3,220**	**70.6**
			1,2-DCA	0.45	0.3 J
			PCE	**105**	**3.1**
		SVOCs	bis(2-Ethylhexyl)phthalate[d]	**260**	-[d]
		Metals	Nickel[e]	**2,210**	-[e]
					Results following demonstration of ERD treatment via injection of EVO within a high concentration portion of the plume.
SS016/ SS029	Site SS016: Historical practices within flightline support areas subject to oil spills, degreasing operations, leaking OWS, equipment maintenance and repair, aircraft and vehicle maintenance, hazardous materials storage, aircraft and vehicle washing, and stormwater runoff. Most of the areas have been used from the 1940s through the present day. Site SS029: Undeveloped land near the southern Base boundary. The historical practices resulting in groundwater contamination are unknown.	Chlorinated VOCs. Probable DNAPL within the high concentration portion of the Site SS016 OSA plume. Carcinogenic, toxic, and mobile.	TCE	**210,000**	**40,200**
			cis-1,2-DCE	**19,100**	**8,230**
			Vinyl chloride	**1,530**	**812**
			Benzene	**550**	ND
			Chloroform	13	0.42 J
			1,4-DCB	**315**	**710**
			Bromodichloromethane	1.3	ND
			1,2-DCA	**9.16**	**13.4 J**
			1,1-DCE	**84**	**50.2 J**
			PCE	**105**	**108**
		SVOCs	bis(2-Ethylhexyl)phthalate[d]	**67.3**	-[d]
		Metals	Nickel[e]	**6,560**	-[e]
					Results following demonstration of ERD treatment via bioreactor within a high concentration portion of the plume.
					Portion of GET system shut down to support installation of bioreactor. Remainder of GET system remains in operation.

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L) Historical Maximum[a,b] (pre-IRA)	Concentration (µg/L) Current Maximum[c] (2010 to 2011)
ST027B	Historical practices at a former aircraft engine test stand area. The historical activities resulting in groundwater contamination are unknown. Historically managed under the POCO program and not included in any of the four (4) OU-specific RIs, two (2) OU-specific FSs, or two (2) groundwater IRODs. In 2007-2008, POCO investigations discovered a small, previously unknown TCE plume at concentrations greater than the cleanup level in the southwestern part of Site ST027. This area of TCE contamination has been designated Site ST027B.	Chlorinated VOCs. Primarily carcinogenic, toxic, and mobile.	TCE[f]	ND[f]	**435**
			Vinyl chloride[f]	ND[f]	**7.1**
			Cis-1,2-DCE[f]	ND[f]	**338**
			Benzene	0.44	0.32 J
			Toluene	0.1	ND
					Results following periods of MNA under POCO and ERP.
SS030	Undeveloped land near the southern Base boundary. Historical practices associated with Building 1125 are believed to have resulted in groundwater contamination.	Chlorinated VOCs. Carcinogenic, toxic, and mobile.	TCE	**3,860**	48.8
			Chloroform	9.3	7.4
			Bromodichloromethane	2	ND
			1,2-DCA	0.34	ND
		Metals	Nickel[e]	**1,850**	-[e]
					Results during IRA GET system operation.

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L) Historical Maximum[a,b] (pre-IRA)	Concentration (µg/L) Current Maximum[c] (2010 to 2011)
SD031	Historical practices in an area used for maintenance and repair of diesel generators, wash rack activities, OWS activities, and aircraft maintenance from approximately 1957 through the present day.	Chlorinated VOCs. Carcinogenic, toxic, and mobile.	TCE	**8,100**	7.1 J-
			Benzene	**28**	ND
			1,1-DCE	**7,300**	56.7
			cis-1,2-DCE	**3,600**	0.78 J-
			Carbon tetrachloride	**11**	ND
			Chloroform	11	0.17 J
			1,2-DCA	**5**	ND
			Vinyl chloride	**1.2**	ND
		Metals	Nickel[e]	**6,780**	-[e]
					Results during shutdown of IRA GET system for rebound study.
SD033 (component of WIOU)	Historical practices within support areas used for management of stormwater runoff, fuel transport, aircraft maintenance, and aircraft washing, including the use of wash racks and OWS.	Primarily chlorinated VOCs. Some commingled SVOCs. Primarily carcinogenic, toxic, and mobile.	TCE	**200**	**99.2**
			1,1-DCE	1.9	ND
			1,2-DCA	**1.52**	ND
			cis-1,2-DCE	**75.9**	**50**
					Results during shutdown of IRA GET system for rebound study.
SD034 (component of WIOU)	Historical practices at an aircraft wash rack facility with OWS and overflow pond. Leaks from the OWS resulted in a layer of Stoddard solvent floating on the groundwater table. The leaking OWS was replaced in 1994.	Primarily chlorinated VOCs. Free-phase Stoddard solvent (P-D-680) LNAPL consisting of 15 percent trimethyl benzene and 85 percent n-nonane floating on groundwater table. Primarily carcinogenic, toxic, and mobile.	TCE	**456**	**5.8**
			Vinyl chloride	**11**	**2.1**
			1,1-DCE	3.2	ND
			Benzene	**1.34**	0.21 J
			cis-1,2-DCE	**391**	5.7
			PCE	**41.4**	ND
			bis(2-Ethylhexyl)phthalate[d]	**3,350**	-[d]
					Results during shutdown of IRA GET system for rebound study.
SS035 (component of WIOU)	Historical practices during aircraft repair, painting, and washing. A wash rack with OWS was constructed in 1970.	Chlorinated VOCs. Carcinogenic, toxic, and mobile.	TCE	**5.3**	ND

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L) Historical Maximum[a,b] (pre-IRA)	Concentration (µg/L) Current Maximum[c] (2010 to 2011)
SD036 (component of WIOU)	Historical practices at Facilities 872/873/876. The facilities were constructed in 1953 and consist of multiple-use shops, including a wash rack and OWS. A leaking segment of an underground sanitary sewer may have released contamination. This segment of the sewer was repaired.	Primarily chlorinated VOCs. Probable DNAPL within a high concentration portion of the plume. Primarily carcinogenic, toxic, and mobile.	Vinyl chloride	**360**	**1,100**
			TCE	**18,500**	**14,400**
			1,1-DCE	3.71	**12.5 J-**
			cis-1,2-DCE	**3,870**	**6,710**
			1,2-DCA	**7.9**	**1.2**
			Benzene	**3.87**	0.59
			Bromodichloromethane	2.26	ND
			PCE	**512**	**13.3 J**
					Results following demonstration of ERD treatment via injection of EVO within a high concentration portion of the plume.
					IRA GET system component shut down for rebound study.
SD037 (component of WIOU)	Historical practices within support areas used for management of domestic and industrial wastewater, aircraft maintenance, heavy equipment maintenance, air cargo handling, vehicle washing, fuel transport, and waste accumulation. These operations began in the 1940s.	Primarily chlorinated VOCs. Probable DNAPL within a high concentration portion of the plume. Primarily carcinogenic, toxic, and mobile.	1,1-DCE	**8.2**	4.6
			1,2-DCA	**1.68**	ND
			Benzene	**4,240**	**7.6**
			Bromodichloromethane	3	ND
			Carbon tetrachloride	**40.4**	**7.6**
			PCE	**900**	**212**
			TCE	**5,800**	**1,720**
			Vinyl chloride	**430**	**26.3**
			cis-1,2-DCE	**381**	**749**
			bis(2-Ethylhexyl)phthalate[d]	**91**	-[d]
			Chloromethane	20	4.2 J
			Naphthalene	**200**	ND[g]
					Results following demonstration of ERD treatment via injection of EVO within a high concentration portion of the plume.
					IRA GET system component shut down for rebound study.

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L)	
				Historical Maximum[a,b] (pre-IRA)	Current Maximum[c] (2010 to 2011)
DP039	Historical practice conducted prior to 1978 at Building 755. Battery acid solutions and solvents were discharged from the building into an exterior sump.	Primarily chlorinated VOCs. Probable DNAPL within a high concentration portion of the plume. Carcinogenic, toxic, and mobile.	1,1-DCE	**7,900**	**2,210**
			1,2-DCA	**440**	**5.2**
			1,1,1-TCA	**26,000**	ND
			1,1,2-TCA	**240**	ND
			Bromodichloromethane	10	ND
			Methylene chloride	**3,500**	**24**
			PCE	**420**	ND
			TCE	**230,000**	**1,740**
			Acetone	**45,000**	283
					Results following demonstration of ERD treatment via bioreactor and injection of EVO PRB within higher concentration portions of the plume.
					IRA GET system component shut down to support installation of bioreactor.
SS041	Historical activities at the Base Entomology Shop (Building 905) from 1983 to 1992 to prepare pesticides and herbicides for on-base use. A concrete wash rack in the back of the building was used to clean pesticide applicator vehicles. Overspray from the washing resulted in pesticide contamination of the groundwater.	Organochlorine pesticides. Carcinogenic, toxic, relatively immobile.	Heptachlor epoxide	**0.023 J**	ND

TABLE A-1
Summary of Contaminant Sources and Maximum Concentrations
Groundwater Record of Decision, Travis Air Force Base, California

Site	Source of Contamination	Types and Characteristics of Contamination	COCs	Concentration (µg/L)	
				Historical Maximum[a,b] (pre-IRA)	Current Maximum[c] (2010 to 2011)
SD043 (component of WIOU)	Historical disposal practices from maintenance activities at an emergency electric power facility.	Chlorinated VOCs. Carcinogenic, toxic, and mobile.	TCE	**38**	0.7 IRA GET system component shut down for rebound study.

[a] Maximum historical concentration prior to implementation and long-term operation of the groundwater IRA at the site. Source: 2010-2011 GSAP (CH2M HILL, 2012a).
[b] **Bolded** concentrations are above the contaminant-specific groundwater cleanup level listed in Table 2.8-1.
[c] Current concentration after approximately a decade of IRA operation. Source: 2010-2011 GSAP (CH2M HILL, 2012a).
[d] Bis(2-Ethylhexyl)phthalate was initially identified as a COC, but in 2002 was recognized as a field and/or laboratory artifact and not representative of groundwater contamination.
[e] Nickel was initially identified as a COC, but in 2002 it was demonstrated as leaching from the stainless steel well casings used in monitoring well construction and not representative of groundwater contamination.
[f] Portion of Site ST027 formerly managed under the Travis AFB POCO program. Chlorinated VOCs regulated under CERCLA were not detected in the Area B portion of the plume (i.e., Site ST027B) until after the NEWIOU Groundwater IROD was finalized.
[g] Naphthalene was last sampled for in 2005 at Site SD037.

Notes:

µg/L = microgram(s) per liter
AFB = Air Force Base
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
COC = contaminant of concern
DCA = dichloroethane
DCB = dichlorobenzene
DCE = dichloroethene
DNAPL = dense nonaqueous phase liquid
ERD = enhanced reductive dechlorination
ERP = Environmental Restoration Program
EVO = emulsified vegetable oil
FS = feasibility study
GET = groundwater extraction and treatment
GSAP = Groundwater Sampling and Analysis Program
IRA = interim remedial action
IROD = interim record of decision
J = estimated concentration
MNA = monitored natural attenuation
ND = not detected
NEWIOU = North, East, and West Industrial Operable Unit
OU = operable unit
OWS = oil/water separator
PBR = performance-based remediation
PCB = polychlorinated biphenyl
POCO = petroleum-only contaminated
RI = remedial investigation
SVOC = semivolatile organic compound
TCDDeq = tetrachlordibenzo-p-dioxin equivalent
TCE = trichloroethene
VOC = volatile organic compound

TABLE A-2
Summary of Nature and Extent of Contamination
Groundwater Record of Decision, Travis Air Force Base, California

Site	Primary COC	Current Lateral and Vertical Extent of Contamination	Current Area and Volume of Contamination[a]	Comments
FT004	TCE	TCE plume approximate dimensions: Length: 950 feet Width: 250 feet Thickness: 30 feet	250,893 ft^2 1,455,170 ft^3	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
FT005	1,2-DCA	1,2-DCA plume approximate dimensions: Length: 600 feet Width: 400 feet Thickness: 25 to 30 feet The majority of the contaminant plume extends to off-base privately owned property.	1,258,142 ft^2 11,323,278 ft^3	Plume is stable. Plume was hydraulically captured by IRA GET system during approximately 10 years of interim remediation. A recent rebound study did not indicate significant plume migration when GET system operations were discontinued. Recently observed increases in the concentrations of COCs at some wells indicate that continuation of GET system operation within those portions of the plumes with increasing concentrations is warranted to prevent possible future migration.
LF006	TCE	TCE plume approximate dimensions: Length: 400 feet Width: 350 feet Thickness: 25 to 30 feet	110,447 ft^2 662,680 ft^3	Plume is stable. Monitoring data over approximately 10 years of MNA assessment did not indicate significant plume migration.
LF007B Subarea	1,4-DCB	No plume dimensions. Contaminant concentrations already less than cleanup levels.	0 ft^2 0 ft^3	Plume is stable. Monitoring data over approximately 10 years of interim MNA assessment did not indicate significant plume migration.

TABLE A-2
Summary of Nature and Extent of Contamination
Groundwater Record of Decision, Travis Air Force Base, California

Site	Primary COC	Current Lateral and Vertical Extent of Contamination	Current Area and Volume of Contamination[a]	Comments
LF007C Subarea	TCE	TCE plume approximate dimensions: Length: 620 feet Width: 220 feet Thickness: 25 feet The majority of the contaminant plume extends to off-base privately owned property.	110,330 ft^2 485,452 ft^3	Plume is stable. Monitoring data over approximately 10 years of interim GET system operation did not indicate significant plume migration.
LF007D Subarea	1,4-DCB and benzene	Plume is limited to a small area in the vicinity of MW261x07.	31,000 ft^{2b} 248,000 ft^{3b}	Plume is stable. Monitoring data over approximately 10 years of interim MNA assessment did not indicate significant plume migration.
LF008	Alpha-chlordane	Alpha-chlordane plume approximate dimensions: Length: 195 feet Width: 112 feet Thickness: 35 feet	33,368 ft^2 233,576 ft^3	Plume is stable. Plume was hydraulically captured by IRA GET system during approximately 10 years of interim remediation. A recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
SS015	TCE, cis-1,2-DCE, and vinyl chloride	cis-1,2-DCE plume approximate dimensions: Length: 360 feet Width: 160 feet Thickness:10 to 15 feet	55,994 ft^2 78,392 ft^3	Monitoring data over approximately 10 years of MNA assessment indicated some local plume migration in the direction of local groundwater flow towards the northeast. The plume has moved and increased in size primarily along the northeast-southwest axis as seen on Figure 2.2-8.
SS016/ SS029	TCE, cis-1,2-DCE, and vinyl chloride	Site SS016 and SS029 TCE plume approximate dimensions: Length: 5,700 feet Width: 1,400 feet Thickness: 25 to 40 feet	7,112,191 ft^2 41,250,708 ft^3	Plume is stable. Plumes were hydraulically captured by the combined site-specific IRA GET systems over approximately 10 years of interim remediation. Monitoring data indicated that some migration of the Site SS016 plume into the hydraulically downgradient Site SS029 plume was occurring. However, combined IRA GET system operations are continuing to maintain hydraulic capture of the overall plume.

TABLE A-2
Summary of Nature and Extent of Contamination
Groundwater Record of Decision, Travis Air Force Base, California

Site	Primary COC	Current Lateral and Vertical Extent of Contamination	Current Area and Volume of Contamination[a]	Comments
ST027B	TCE	TCE plume approximate dimensions: Length: 650 feet Width: 400 feet Thickness: 30 to 35 feet Formerly managed under POCO program. Chlorinated VOCs were detected after the IROD was finalized and IRAs implemented.	183,134 ft^{2c} 1,281,938 ft^{3c}	Plume is stable. Monitoring data obtained during period of POCO and ERP program management did not indicate significant plume migration.
SS030	TCE	TCE plume approximate dimensions: Length: 1,400 feet Width: 400 feet Thickness: 20 to 40 feet The majority of the contaminant plume extends onto off-base privately owned property.	455,647 ft^2 1,822,588 ft^3	Plume is stable. Plume was hydraulically captured by IRA GET system during approximately 10 years of interim remediation. IRA GET system operations are continuing to maintain hydraulic capture of the plume.
SD031	1,1-DCE	1,1-DCE plume approximate dimensions: Length: 300 feet Width: 150 feet Thickness: 25 to 30 feet	54,255 ft^2 260,424 ft^3	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
SD033 (component of WIOU)	TCE	-[d] Site contamination is within the overall WIOU plume.	-[d]	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.

TABLE A-2
Summary of Nature and Extent of Contamination
Groundwater Record of Decision, Travis Air Force Base, California

Site	Primary COC	Current Lateral and Vertical Extent of Contamination	Current Area and Volume of Contamination[a]	Comments
SD034 (component of WIOU)	TCE	-[d] Free-phase Stoddard solvent intermittently measured floating on groundwater table. Site contamination is within the overall WIOU plume.	-[d]	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
SS035 (component of WIOU)	TCE	-[d] Site contamination is within the overall WIOU plume.	-[d]	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
SD036 (component of WIOU)	TCE	-[d] Site contamination is within the overall WIOU plume.	-[d]	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
SD037 (component of WIOU)	TCE	TCE plume approximate dimensions: Length: 4,650 feet Width: 750 feet Thickness: 20 to 90 feet Site SD037 plume dimensions represent the overall WIOU plume.	1,626,667 ft^2 13,664,003 ft^3	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.
DP039	TCE	TCE plume approximate dimensions: Length: 1,720 feet Width: 820 feet Thickness: approx. 20 to 45 feet	1,144,580 ft^2 9,614,472 ft^3	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.

TABLE A-2
Summary of Nature and Extent of Contamination
Groundwater Record of Decision, Travis Air Force Base, California

Site	Primary COC	Current Lateral and Vertical Extent of Contamination	Current Area and Volume of Contamination[a]	Comments
SS041	Heptachlor epoxide	No plume dimensions. Contaminant concentrations already less than cleanup levels.	0 ft^2 [d] 0 ft^3 [d]	The IRA achieved cleanup of groundwater to concentrations below detection levels. The site has been in NFRAP status since 2005.
SD043 (component of WIOU)	TCE	- [d] Site contamination is within the overall WIOU plume.	- [d]	Plume is stable. Monitoring data obtained over approximately 10 years of interim remediation (combined GET and MNA assessment) did not indicate significant plume migration. Data obtained during a recent rebound study did not indicate significant plume migration when GET system operations were discontinued.

[a] Estimated based on the groundwater COC with greatest areal extent. Groundwater pore volume estimated from the plume area, saturated thickness, and a porosity of 20 percent.
[b] Contamination is limited to a small area in the vicinity of MW261x07. Plume areas and volumes are based on an approximate 100-foot plume radius around this well.
[c] Portion of Site ST027 formerly managed under the Travis AFB POCO program. Chlorinated VOCs regulated under CERCLA were not detected in the Area B portion of the plume (i.e., Site ST027B) until after the NEWIOU Groundwater IROD was finalized.
[d] Included in Site SD037 estimates. The plume areas and volumes for Sites SD033, SD034, SS035, SD036, SD037, and SD043 comprise the overall WIOU plume. These site contaminant plumes are inseparably commingled and are addressed as a single WIOU plume.
Site SD037 is selected as representative of the WIOU plume because the ERP site boundary has the greatest geographic extent of the component sites.

Notes:

AFB = Air Force Base
COC = contaminant of concern
DCA = dichloroethane
DCB = dichlorobenzene
DCE = dichloroethene
ERP = Environmental Restoration Program
ft^2 = square feet
ft^3 = cubic feet
GET = groundwater extraction and treatment
IRA = interim remedial action
IROD = interim record of decision
MNA = monitored natural attenuation
ND = not detected
NEWIOU = North, East, and West Industrial Operable Unit
NFRAP = No Further Response Action Planned
POCO = petroleum-only contaminated
TCE = trichloroethene
VOC = volatile organic compound
WIOU = West Industrial Operable Unit

TABLE A-3
Summary of the Sites FT004, LF007, and SD031 Interim Remedial Actions
Groundwater Record of Decision, Travis Air Force Base, California

Site Contaminant Plume	IRA Objective[a]	Implemented IRA	Primary Components	Status and Comments
FT004 Source Area	Source control	GET	DPE wells, performance monitoring wells, NGWTP air stripper/VGAC (discontinued)	Partial GET system shutdown for a rebound study in January 2008. Complete shutdown in March 2009 to continue the rebound study.
SD031 Source Area	Source control	GET	DPE wells, performance monitoring wells, NGWTP air stripper/VGAC (discontinued)	GET system shutdown for a rebound study since January 2008.
FT004/SD031	MNA[b]	Groundwater monitoring	Monitoring wells	Groundwater monitoring for assessment of MNA is ongoing.
LF007B	MNA[b]	Groundwater monitoring	Monitoring wells	Groundwater monitoring for assessment of MNA is ongoing.
LF007C	Migration control	GET	On-base groundwater extraction wells and performance monitoring wells. Treatment using air stripper/VGAC at NGWTP discontinued. Currently using LGAC treatment.	GET system is in seasonal operation. Optimization of the GET system is planned for 2013.
LF007C	Off-base remediation	GET	Off-base performance monitoring wells (groundwater extraction wells located on-base)	GET system is in seasonal operation. Optimization of the GET system is planned for 2013.
LF007D	MNA[b]	Groundwater monitoring	Monitoring wells	Groundwater monitoring for assessment of MNA is ongoing.

[a] IRA objective specified in the NEWIOU Groundwater IROD (Travis AFB, 1998).
[b] MNA assessment results are documented in the NAAR (CH2M HILL, 2010b).

Notes:

AFB = Air Force Base
DPE = dual-phase extraction
GET = groundwater extraction and treatment
IRA = interim remedial action
IROD = interim record of decision
LGAC = liquid-phase granular activated carbon
MNA = monitored natural attenuation
NAAR = Natural Attenuation Assessment Report
NEWIOU = North, East, and West Industrial Operable Unit
NGWTP = North Groundwater Treatment Plant
VGAC = vapor-phase granular activated carbon

TABLE A-4
Summary of the Sites FT005, SS029, and SS030 Interim Remedial Actions
Groundwater Record of Decision, Travis Air Force Base, California

Site Contaminant Plume	IRA Objective*	Implemented IRA	Primary Components	Status and Comments
Site SS030 On-base Source Area	Source control	GET	Interceptor trench, performance monitoring wells, LGAC groundwater treatment at SBBGWTP	Extracted groundwater flow to SBBGWTP is combination of flows from Sites SS030, SS029, and FT005. Groundwater treatment at the SBBGWTP changed from air stripping to LGAC in 2010.
Site SS030 Off-base	Off-base remediation	GET	Conventional extraction wells, performance monitoring wells, LGAC groundwater treatment at SBBGWTP	Optimization of the GET system is in progress. Extraction flow rates increased in 2010 to improve hydraulic capture of the eastern portion of the off-base plume.
Site SS029	Migration control	GET	Conventional extraction wells, performance monitoring wells, LGAC groundwater treatment at SBBGWTP	GET system is operating normally. Plume is hydraulically captured.
Site FT005 On-base	Migration control	GET	Conventional extraction wells, performance monitoring wells, LGAC groundwater treatment at SBBGWTP	All on-base and off-base extraction wells turned off for a continued rebound study in August 2009. Evidence of contaminant rebound in EW02x05 resulted in restarting this on-base extraction well in August 2010.
Site FT005 Off-base	Off-base remediation	GET	Conventional extraction wells, performance monitoring wells, LGAC groundwater treatment at SBBGWTP	All on-base and off-base extraction wells turned off for a continued rebound study in August 2009. Evidence of contaminant rebound in EW734x05, and EW735x05 resulted in restarting these off-base extraction wells in August 2010. Two (2) extraction wells (EW734x05 and EW735x05) turned off in November 2012.

* IRA objective specified in the NEWIOU Groundwater IROD (Travis AFB, 1998).

Notes:

AFB = Air Force Base
GET = groundwater extraction and treatment
IRA = interim remedial action
LGAC = liquid-phase granular activated carbon
NEWIOU = North, East, and West Industrial Operable Unit
SBBGWTP = South Base Boundary Groundwater Treatment Plant

TABLE A-5
Summary of the Site SS016 Interim Remedial Actions
Groundwater Record of Decision, Travis Air Force Base, California

Site Contaminant Plume	IRA Objective*	Implemented IRA	Primary Components	Status and Comments
OSA Source Area	Source control	GET with bioreactor optimization	One (1) horizontal extraction well (EW003x16), two (2) groundwater extraction wells (EW605x16 and EW610x16), performance monitoring wells, groundwater treatment at the CGWTP using LGAC	An in situ bioreactor was installed in September 2010.
TARA Source Area	Source control	GET	Two (2) horizontal extraction wells (EW001x16 and EW002x16), performance monitoring wells, groundwater treatment at CGWTP using LGAC	No IRA optimizations planned within the TARA portion of Site SS016.

* IRA objective specified in the NEWIOU Groundwater IROD (Travis AFB, 1998).

Notes:

AFB = Air Force Base
CGWTP = Central Groundwater Treatment Plant
GET = groundwater extraction and treatment
IRA = interim remedial action
IROD = interim record of decision
LGAC = liquid-phase granular activated carbon
NEWIOU = North, East, and West Industrial Operable Unit
OSA = Oil Spill Area
TARA = Tower Area Removal Action

TABLE A-6
Summary of the Sites SD033, SD034, SS035, SD036, SD037, SS041, and SD043 Interim Remedial Actions
Groundwater Record of Decision, Travis Air Force Base, California

Site Contaminant Plume	IRA Objective*	Implemented IRA	Primary Components	Status and Comments
SD034 Source Area	Source control	GET	DPE wells, performance monitoring wells, free-product removal with active skimmers, VGAC vapor treatment at WTTP, LGAC groundwater treatment at CGWTP via WTTP	Source control GET and vapor treatment systems turned off for a rebound study. Stoddard solvent floating-product removal is ongoing.
SD036/SD037 Source Areas	Source control	GET	DPE wells, performance monitoring wells, VGAC vapor treatment at WTTP, LGAC groundwater treatment at CGWTP via WTTP	Source control GET and vapor treatment systems turned off for a rebound study. Site SD036 and SD037 source control actions optimized during 2010 using EVO injection.
SD033/SD034/SS035/SD036/SD037	Migration control	GET	Conventional extraction wells, performance monitoring wells, VGAC vapor treatment at WTTP, UV/Ox/LGAC groundwater treatment at CGWTP via WTTP	Migration control GET and vapor treatment systems turned off for a rebound study. Free-product removal of Stoddard solvent at Site SD034 is ongoing.
SS041	Migration control	GET	Conventional extraction well, performance monitoring wells, UV/Ox/LGAC groundwater treatment at CGWTP via WTTP	Site SS041 in a No Further Remedial Action Planned status. This is documented in a 14 December 2005 consensus statement that was signed by the representatives of the lead and regulatory agencies (Travis AFB, 2005).
SD043	Migration control	GET	Conventional extraction well, performance monitoring wells, UV/Ox/LGAC groundwater treatment at CGWTP via WTTP	Migration control GET system turned off for a rebound study.
SD033/SD037	MNA assessment	Groundwater monitoring	Monitoring wells	MNA assessment is ongoing during the period of interim remediation.

* IRA objective specified in the NEWIOU and WABOU Groundwater IRODs (Travis AFB, 1998 and 1999, respectively).

Notes:

AFB = Air Force Base
CGWTP = Central Groundwater Treatment Plant
DPE = dual-phase extraction
EVO = emulsified vegetable oil
GET = groundwater extraction and treatment
IRA = interim remedial action
IROD = interim record of decision
LGAC = liquid-phase granular activated carbon
NEWIOU = North/East/West Industrial Operable Unit
UV/Ox = ultraviolet oxidation
VGAC = vapor-phase granular active carbon
WABOU = West/Annexes/Basewide Operable Unit
WTTP = West Treatment and Transfer Plant

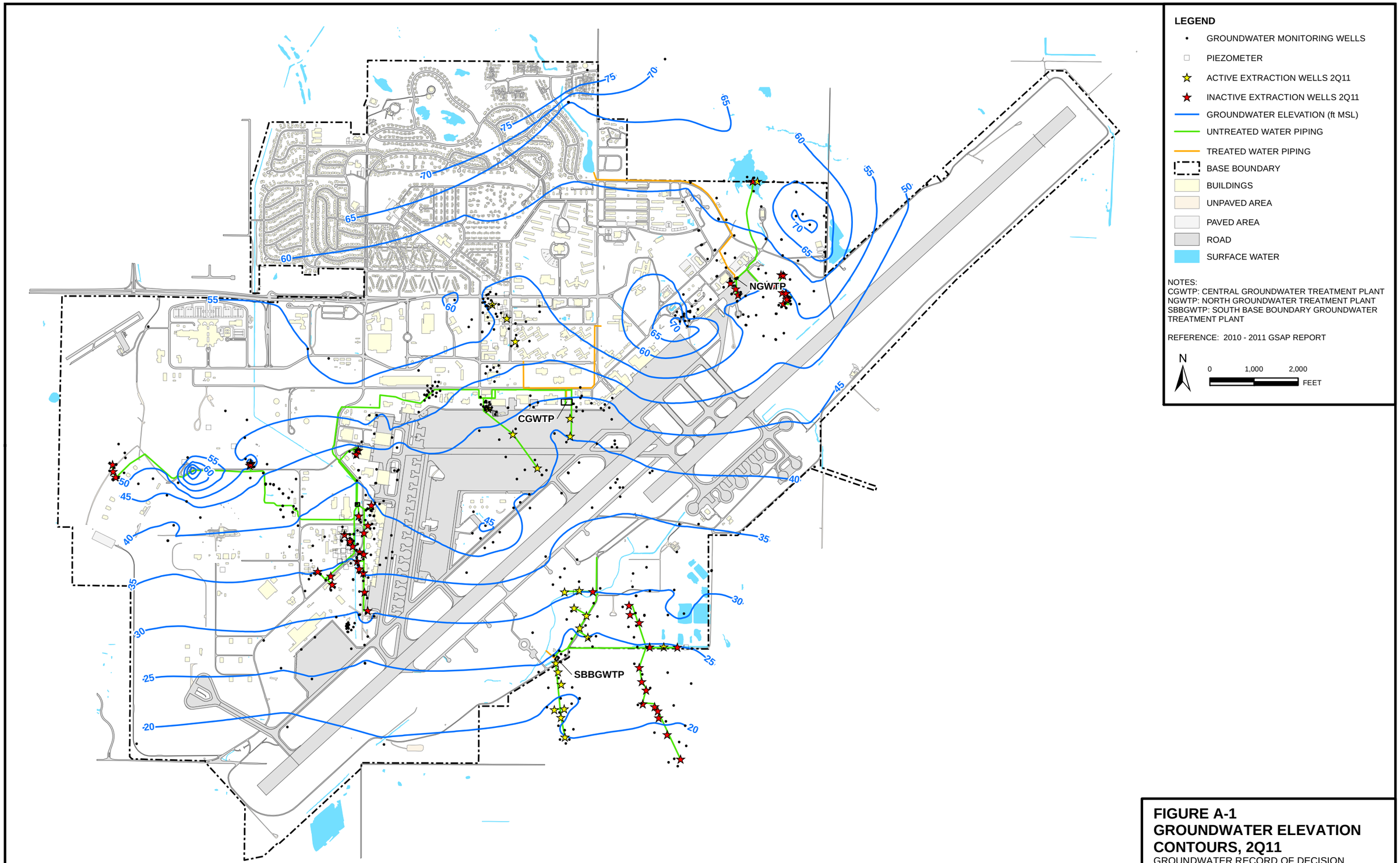
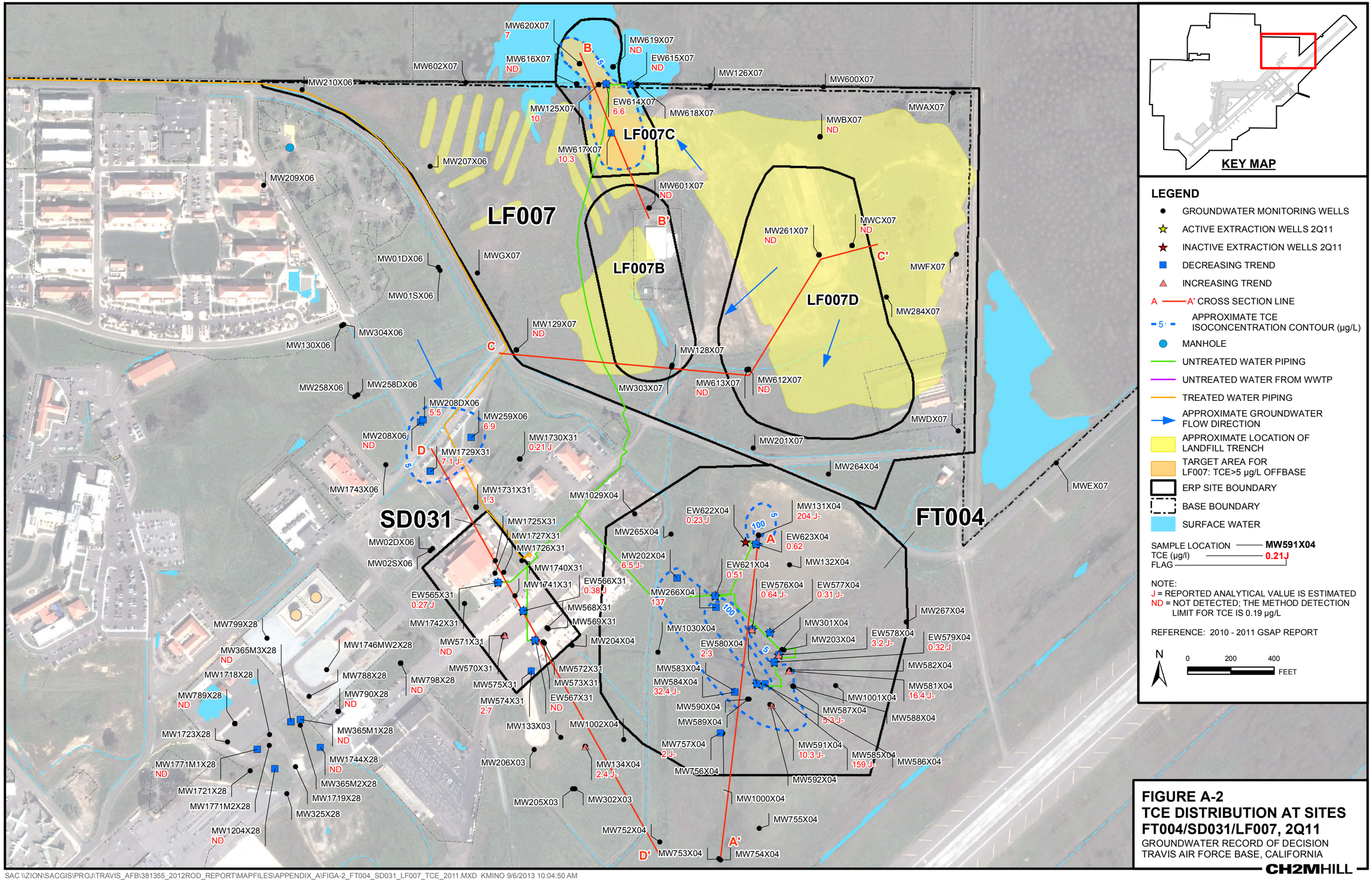


FIGURE A-1
GROUNDWATER ELEVATION CONTOURS, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC U:\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-1_GWELEV_2Q11.MXD MSCHROCK 5/2/2013 8:44:35 PM



KEY MAP

LEGEND

- GROUNDWATER MONITORING WELLS
- ACTIVE EXTRACTION WELLS 2Q11
- INACTIVE EXTRACTION WELLS 2Q11
- DECREASING TREND
- INCREASING TREND
- A — A' CROSS SECTION LINE
- 5' APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)
- MANHOLE
- UNTREATED WATER PIPING
- UNTREATED WATER FROM WWTP
- TREATED WATER PIPING
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- APPROXIMATE LOCATION OF LANDFILL TRENCH
- TARGET AREA FOR LF007: TCE>5 µg/L OFFBASE
- ERP SITE BOUNDARY
- BASE BOUNDARY
- SURFACE WATER

SAMPLE LOCATION — MW591X04
TCE (µg/l) — 0.21J
FLAG

NOTE:
J = REPORTED ANALYTICAL VALUE IS ESTIMATED
ND = NOT DETECTED; THE METHOD DETECTION LIMIT FOR TCE IS 0.19 µg/L

REFERENCE: 2010 - 2011 GSAP REPORT

N

0 200 400
FEET

FIGURE A-2
TCE DISTRIBUTION AT SITES FT004/SD031/LF007, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-2_FT004_SD031_LF007_TCE_2011.MXD KMINO 9/6/2013 10:04:50 AM

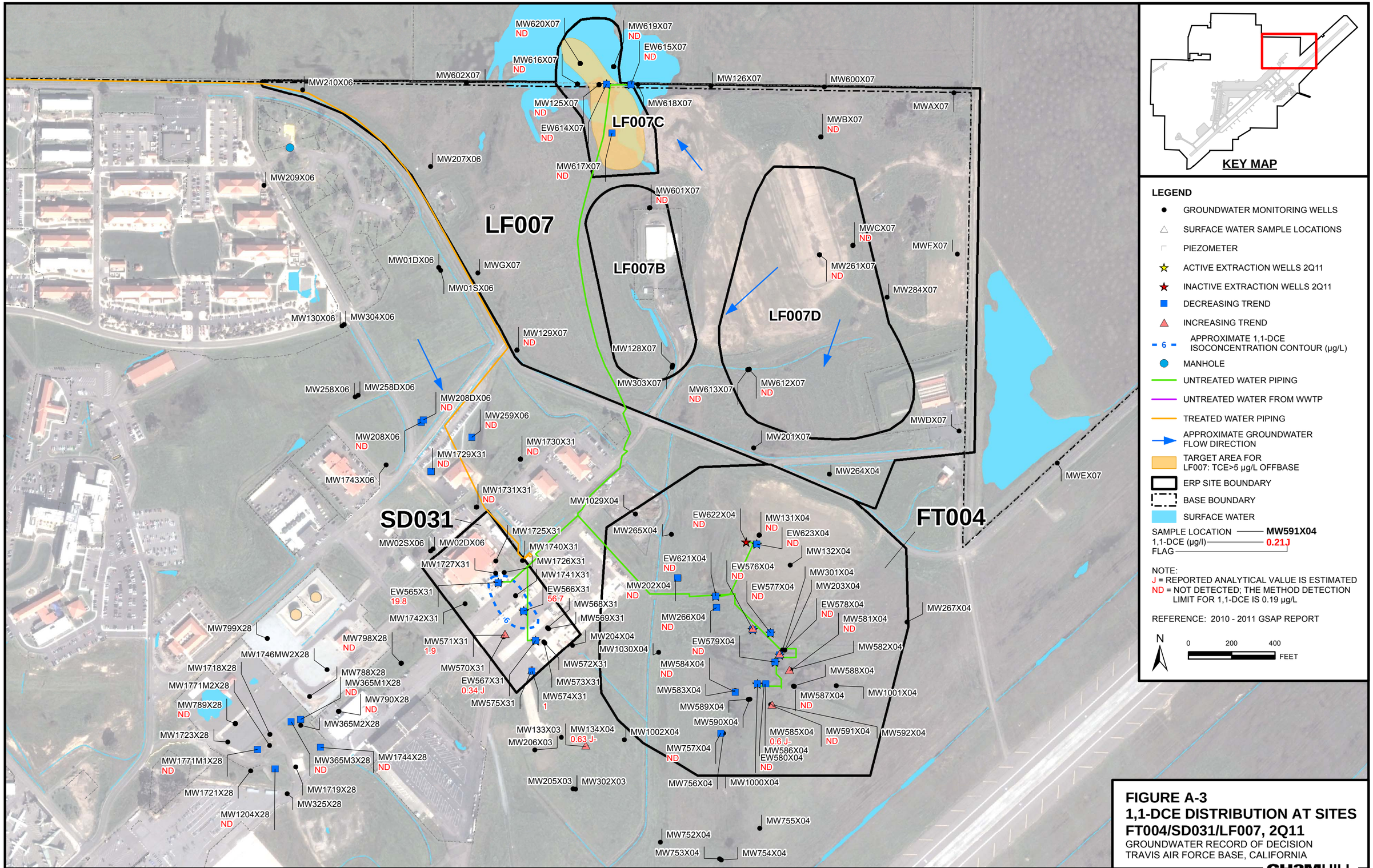
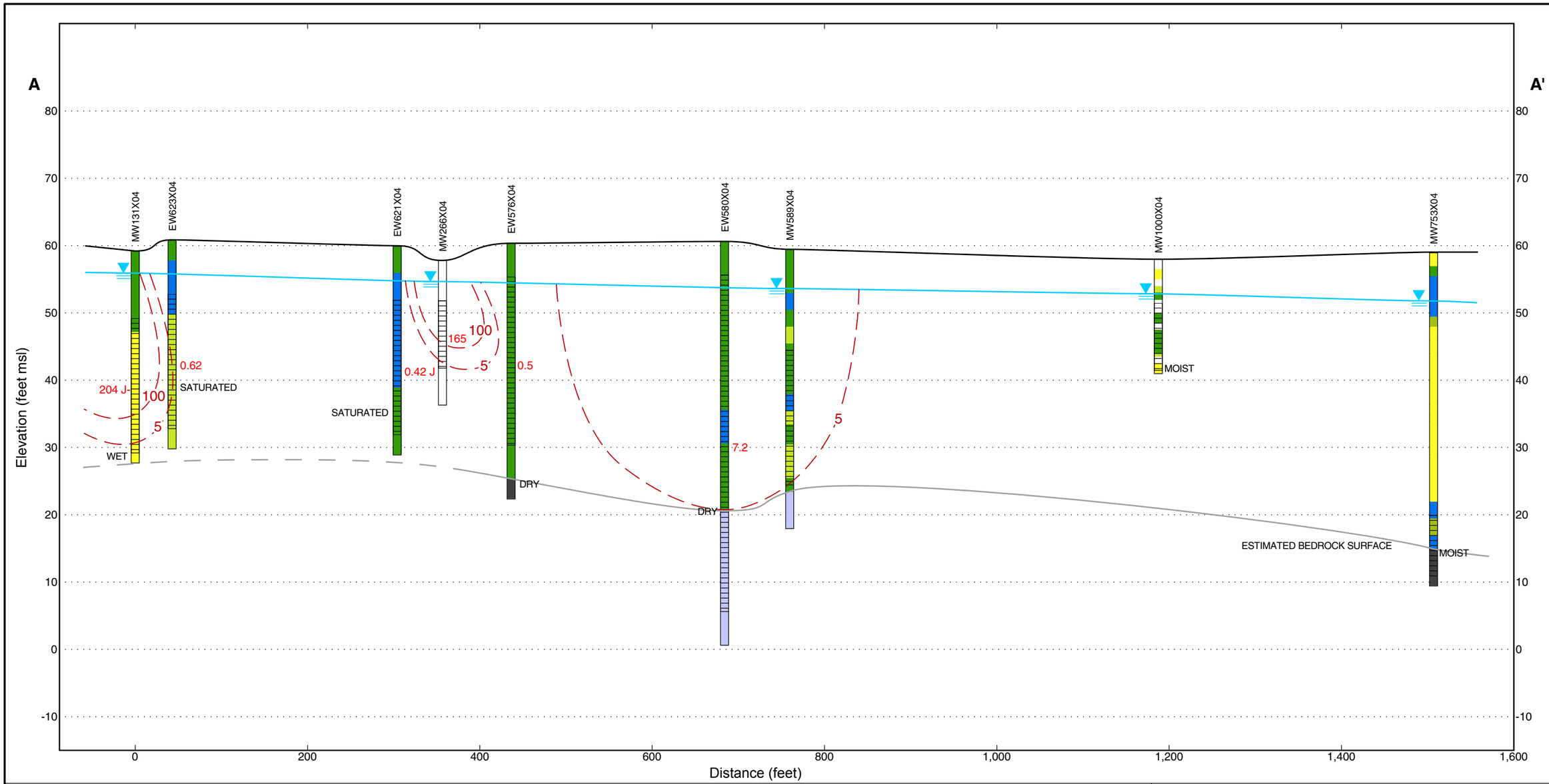


FIGURE A-3
1,1-DCE DISTRIBUTION AT SITES FT004/SD031/LF007, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC U:\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-3_FT004_SD031_LF007_DCE_2011.MXD MSCHROCK 9/1/2013 10:47:40 PM



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

5 APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 8:1 (H:V)

NOTE: SEE FIGURE A-2 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-4
SITE FT004 CROSS SECTION A–A'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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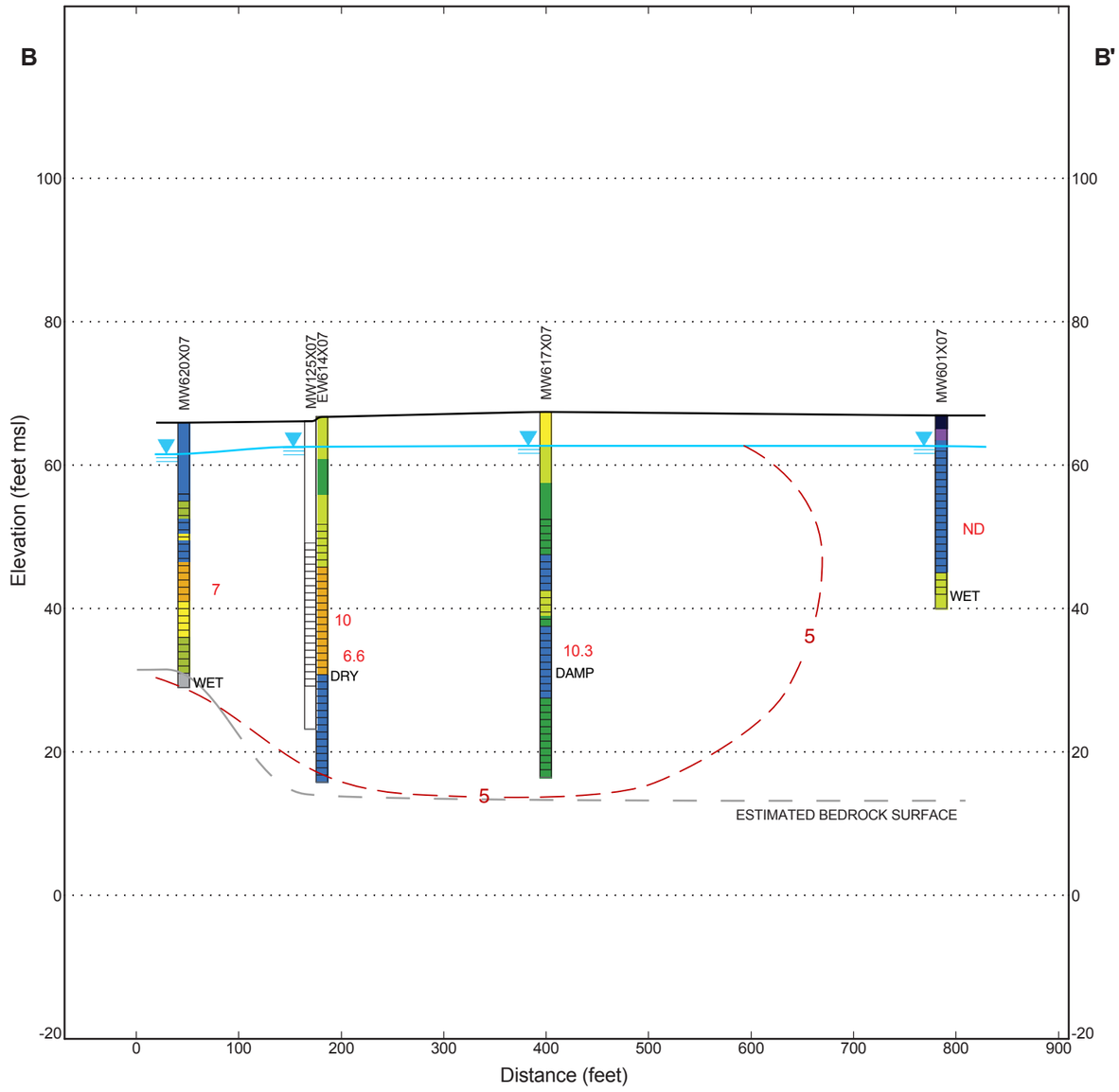
ES051412034344SAC Figure_A-4.ai 07.24.2013 tdaus



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

5 APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 7:1 (H:V)

NOTE: SEE FIGURE A-2 FOR CROSS SECTION LINE REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-5
SITE LF007C CROSS SECTION B–B'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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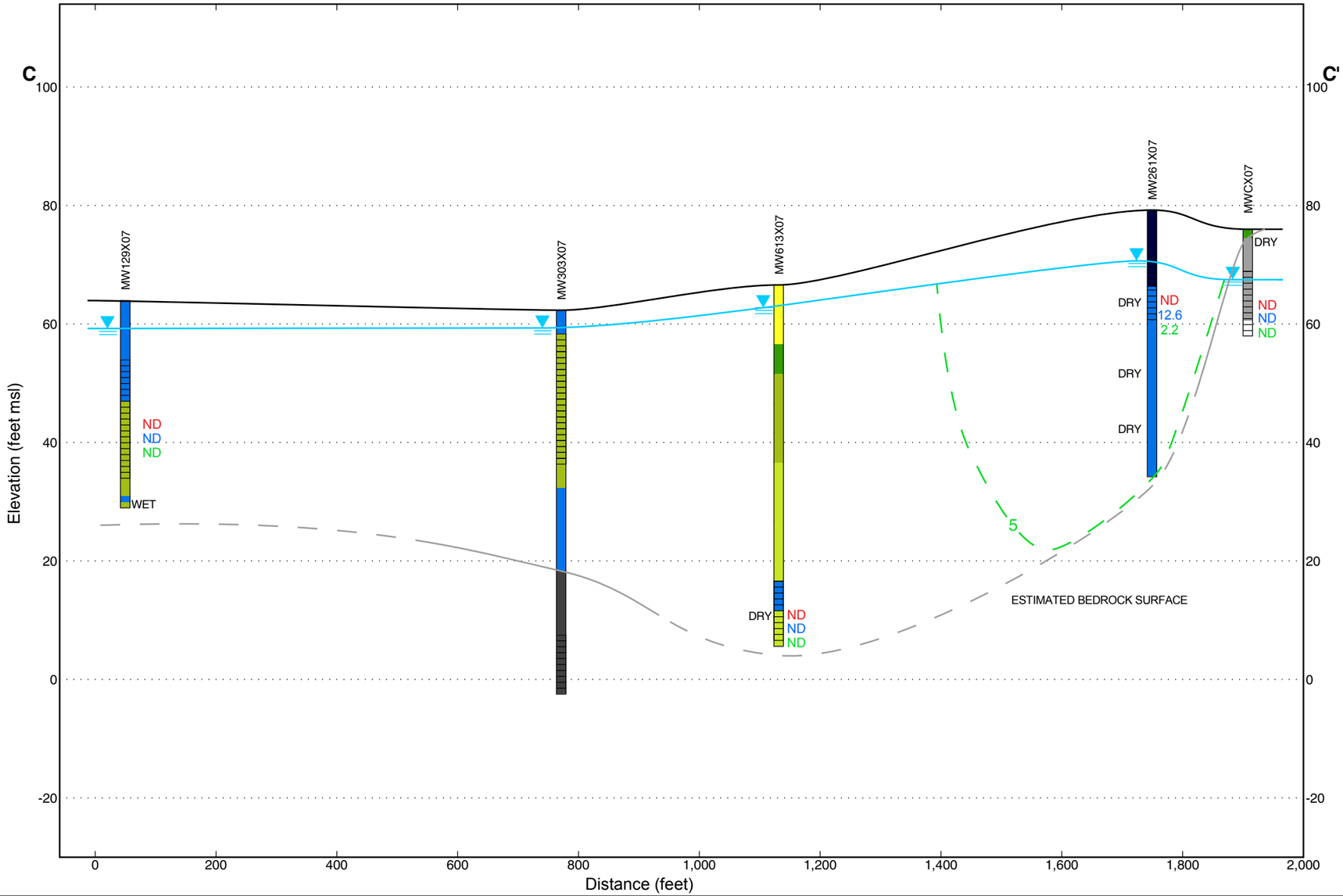
ES051412034344SAC Figure_A-5.ai 07.24.2013 tdaus



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 — TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

2.1 — 1,4-DCB CONCENTRATION (ug/L) DETECTED IN 2Q11

ND — BENZENE CONCENTRATION DETECTED IN 2Q11

5 — APPROXIMATE BENZENE ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 10:1 (H:V)

NOTE: SEE FIGURE A-2 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-6
SITE LF007D CROSS SECTION C–C'

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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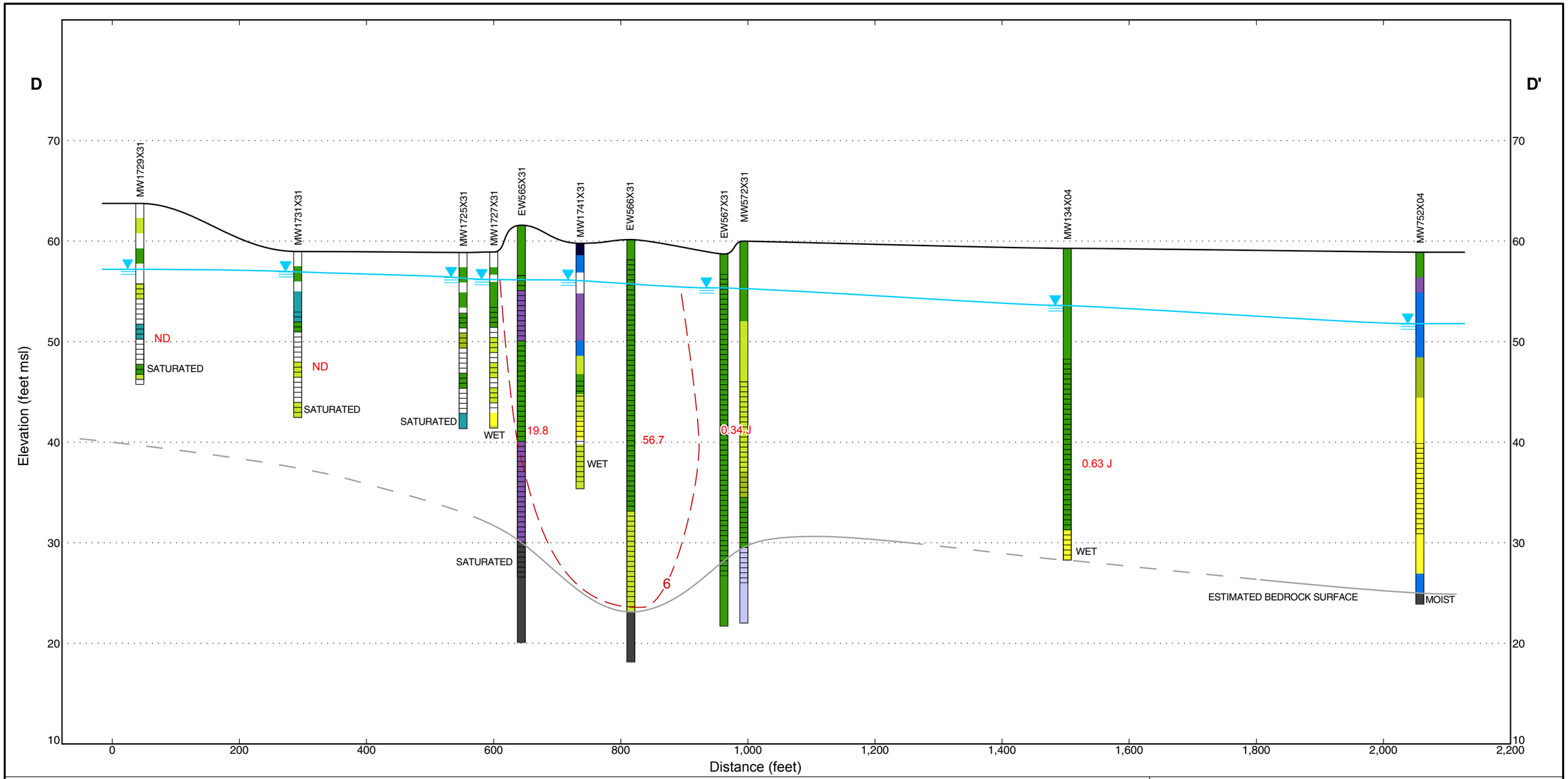

SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 — 1,1-DCE CONCENTRATION (µg/L) DETECTED IN 2Q11

– – 6 – – APPROXIMATE 1,1-DCE ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 16:1 (H:V)

ND = NOT DETECTED; THE DETECTION LIMIT FOR 1,1-DCE IS 0.5 µg/L, EXCEPT AT WELL MW134x04 WHERE IT IS 0.54 µg/L

NOTE: SEE FIGURE A-2 FOR CROSS SECTION LINE REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-7
SITE SD031 CROSS SECTION D–D'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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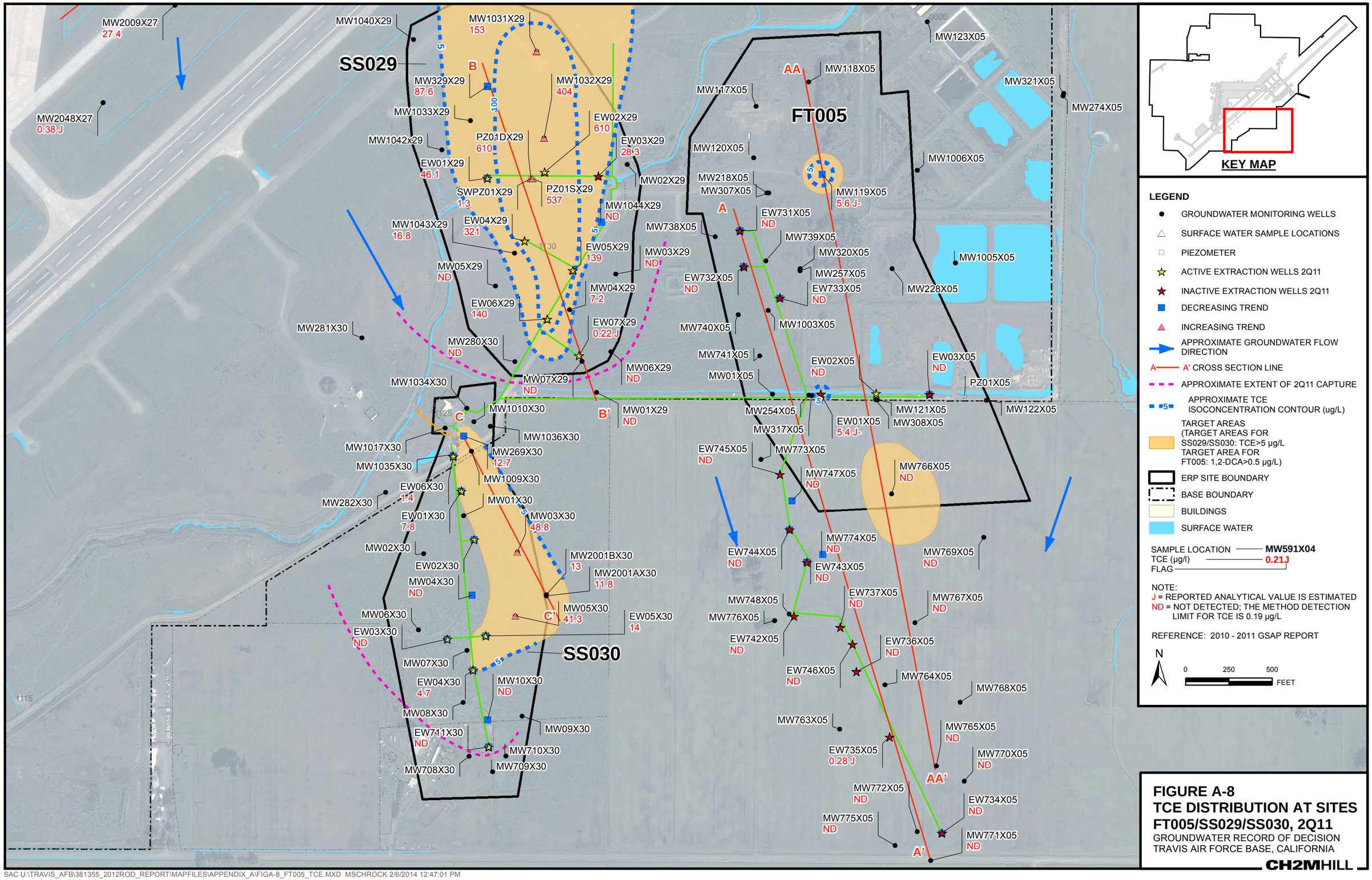


FIGURE A-8
TCE DISTRIBUTION AT SITES FT005/SS029/SS030, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC U:\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-8_FT005_TCE.MXD MSCHROCK 2/6/2014 12:47:01 PM

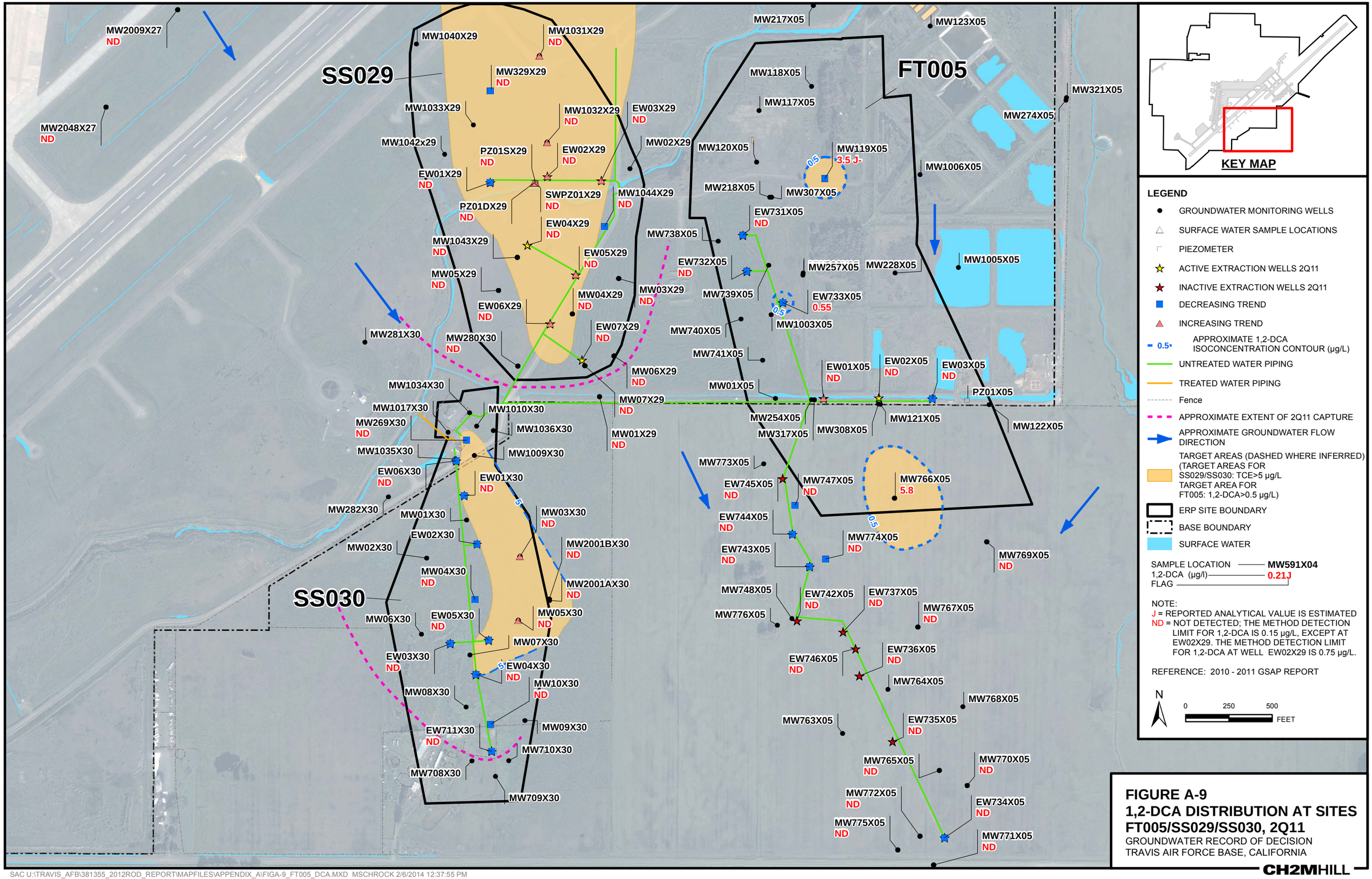
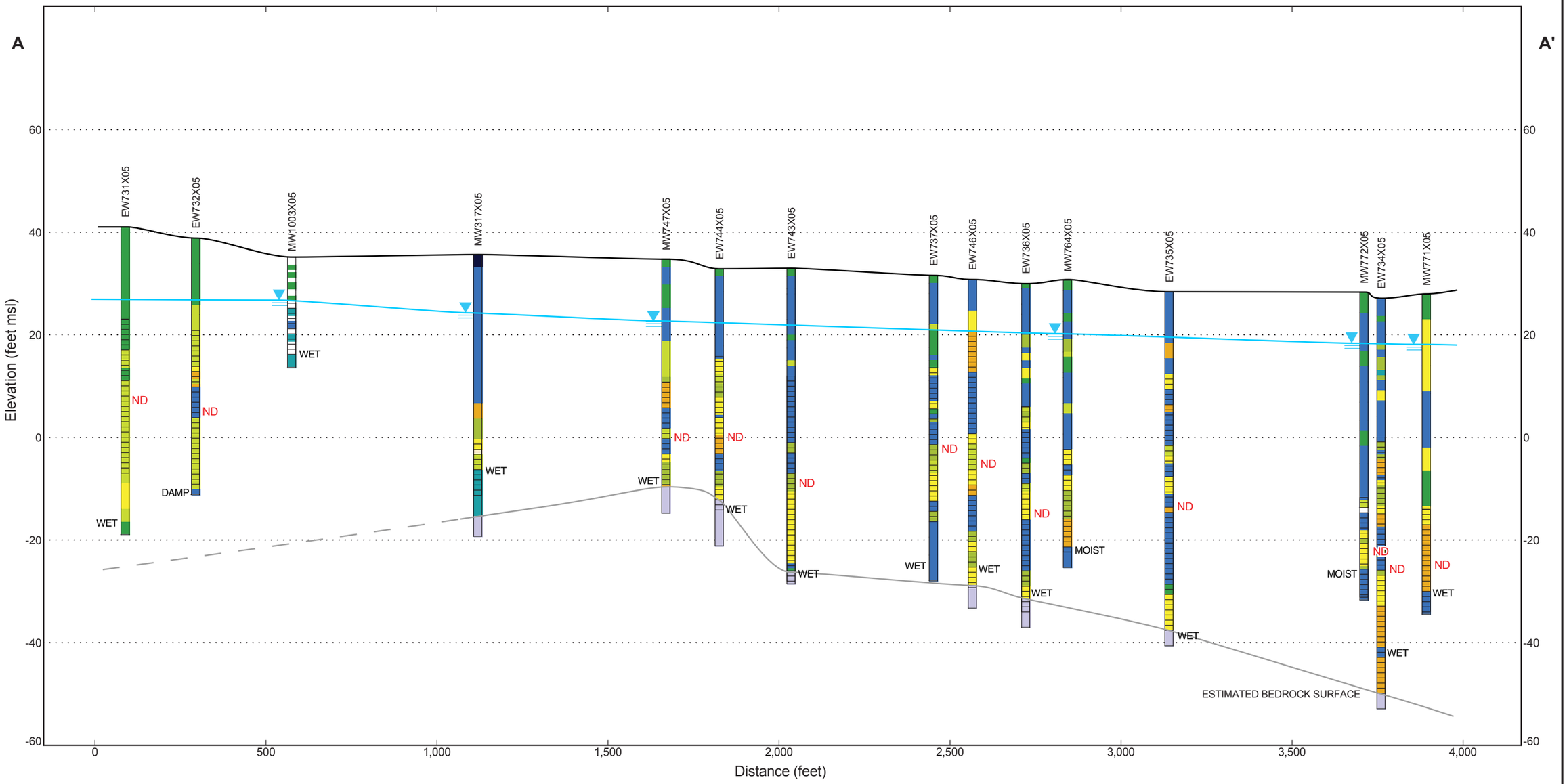


FIGURE A-9
1,2-DCA DISTRIBUTION AT SITES FT005/SS029/SS030, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC U:\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-9_FT005_DCA.MXD MSCHROCK 2/6/2014 12:37:55 PM



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7

1,2-DCA CONCENTRATION (µg/L) DETECTED IN 2Q11

SCALE EXAGGERATION - 15:1 (H:V)

NOTE: SEE FIGURE A-8 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-10
SITE FT005 CROSS SECTION A–A'

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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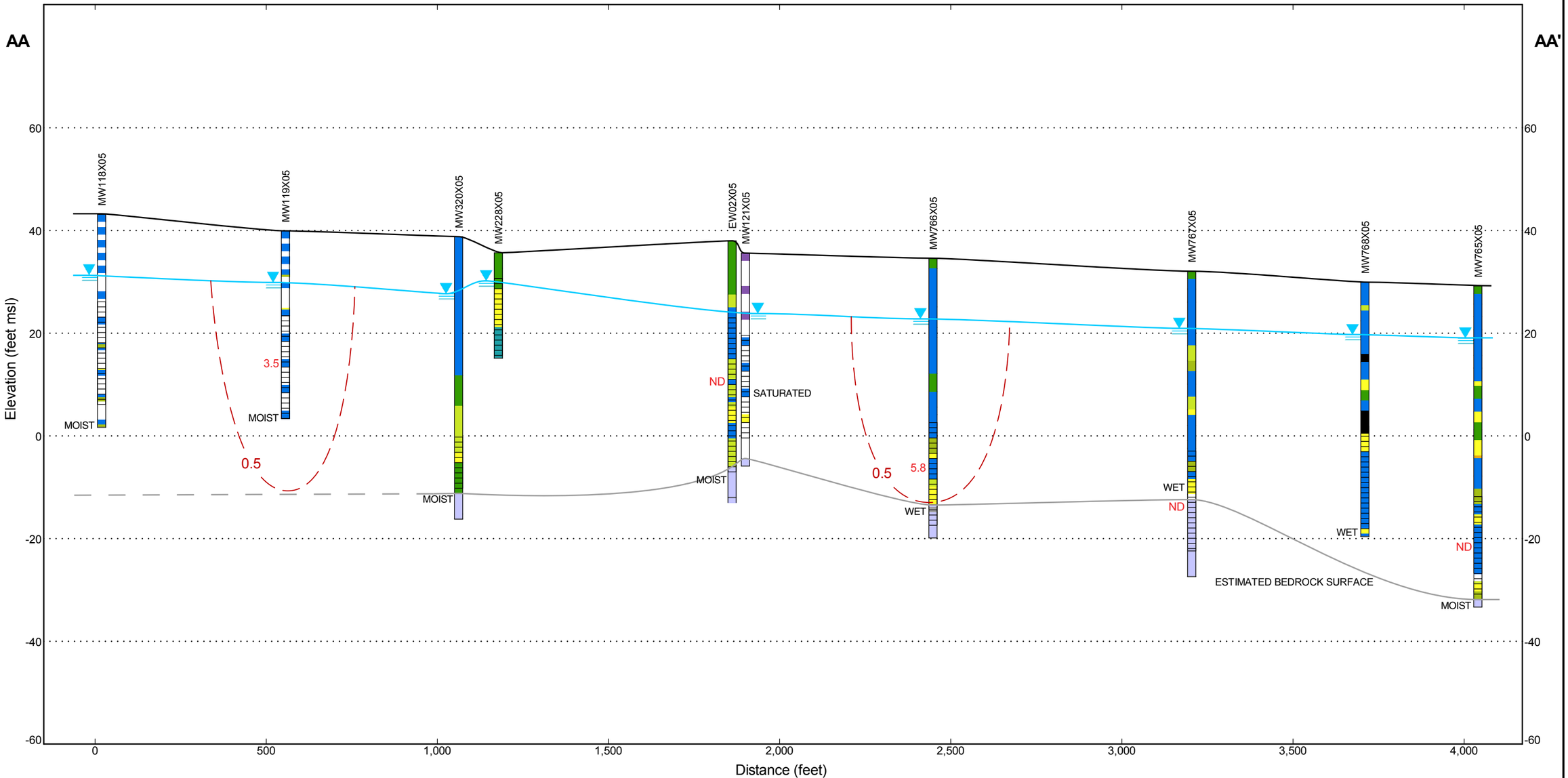
ES051412034344SAC Figure_A-10.ai 07.24.2013 tdaus



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 1,2-DCA CONCENTRATION (µg/L) DETECTED IN 2Q11

--0.5-- APPROXIMATE 1,2-DCA ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 15:1 (H:V)

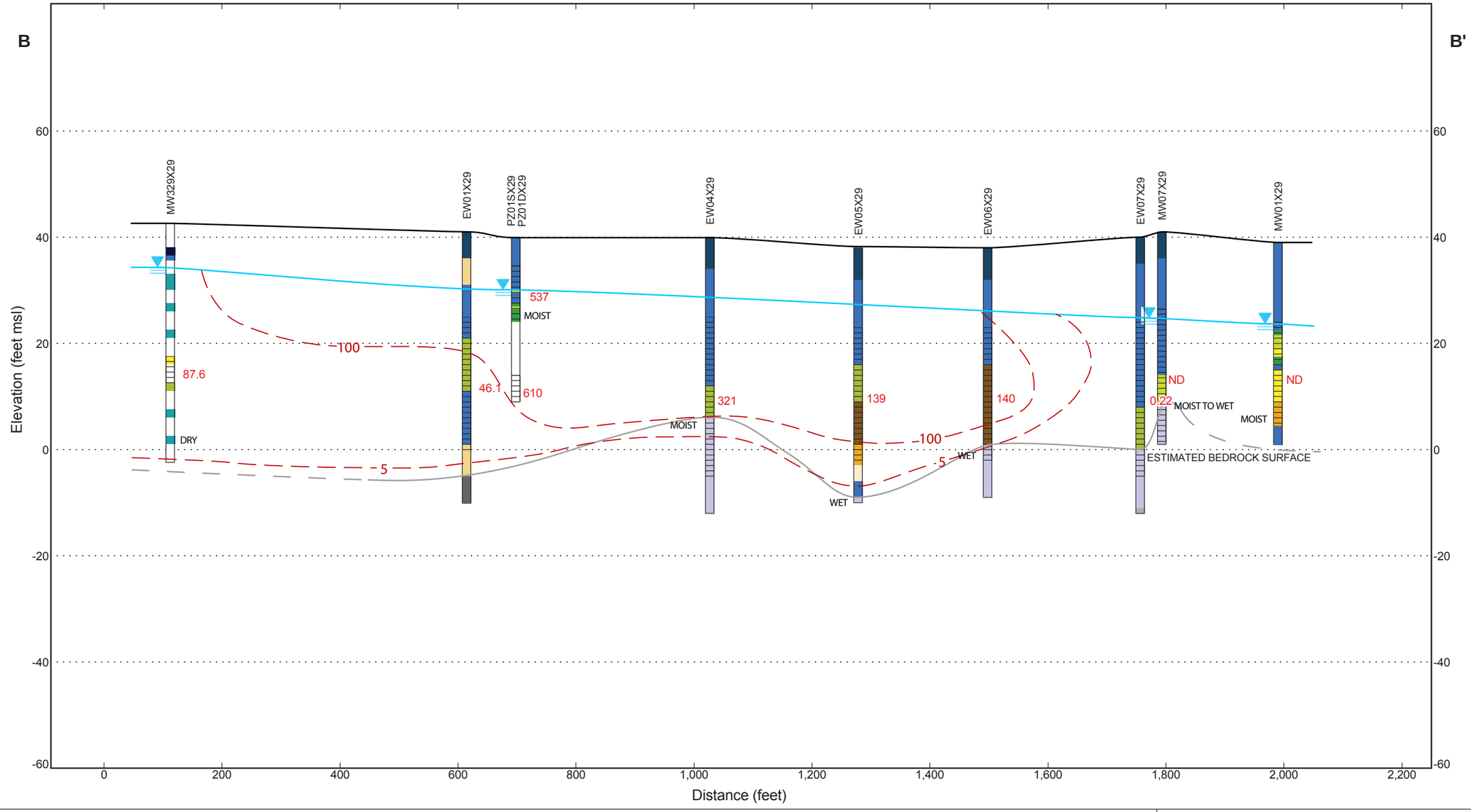
NOTE: SEE FIGURE A-8 FOR CROSS SECTION LINE REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- POORLY GRADED SAND (SP)
- SILTY SAND (SM)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-11
SITE FT005 GEOLOGIC CROSS SECTION AA-AA'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

5 APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 9:1 (H:V)

NOTE: SEE FIGURE A-8 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-12
SITE SS029 CROSS SECTION B–B'

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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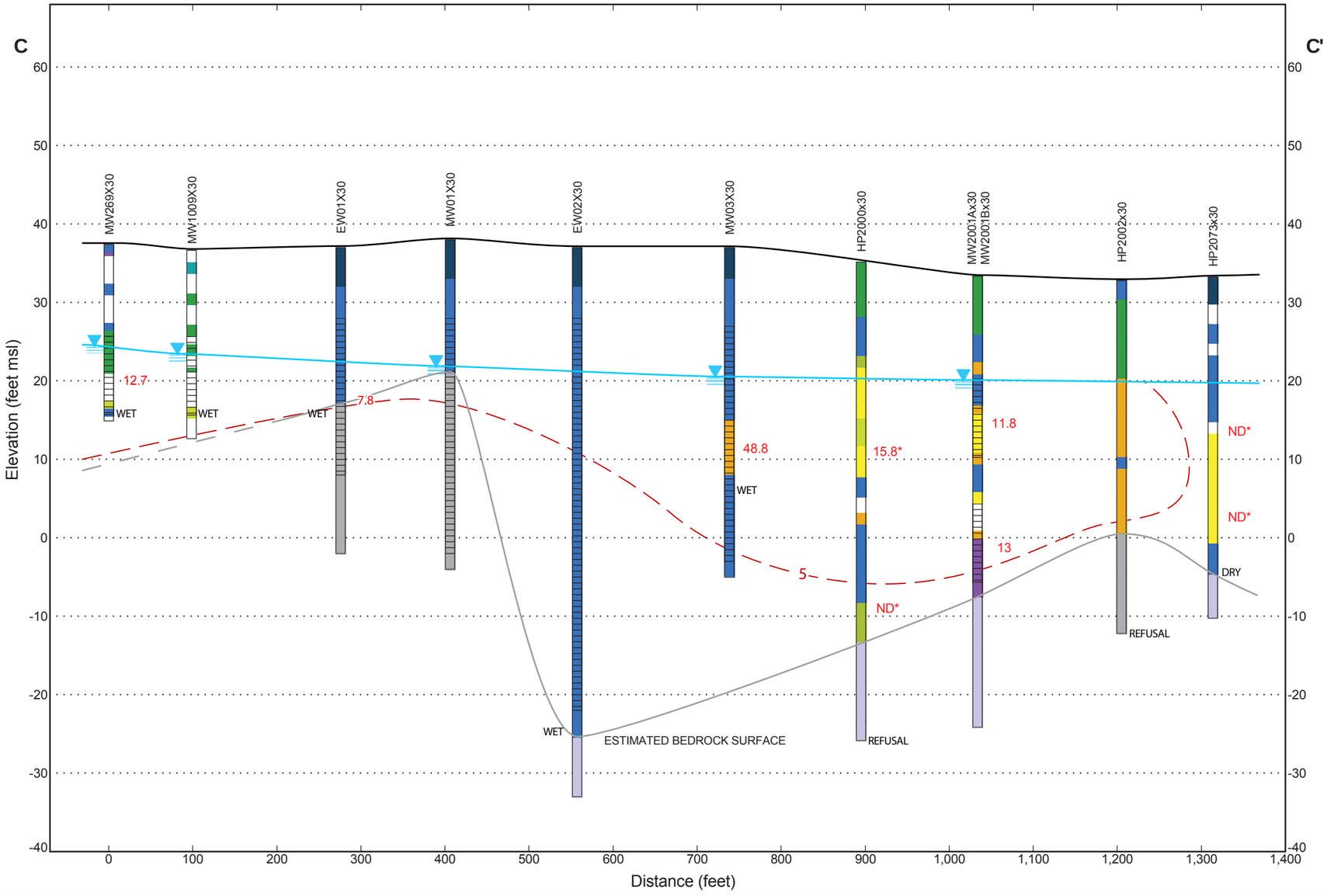
ES051412034344SAC Figure_A-12.ai 09.05.2013 tdaus/it



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

--5-- APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)

* DATA FROM 2010 HYDROPUNCH GROUNDWATER SAMPLE

SCALE EXAGGERATION - 9:1 (H:V)

NOTE: SEE FIGURE A-8 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-13
SITE SS030 CROSS SECTION C–C'

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

\\YOSEMITE\PROJ\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\2011\2010_2011_GSAP\TRAVIS_2011_GASP.GPJ;
ES051412034344SAC Figure_A-13.ai 09.05.2013 tdaus/it

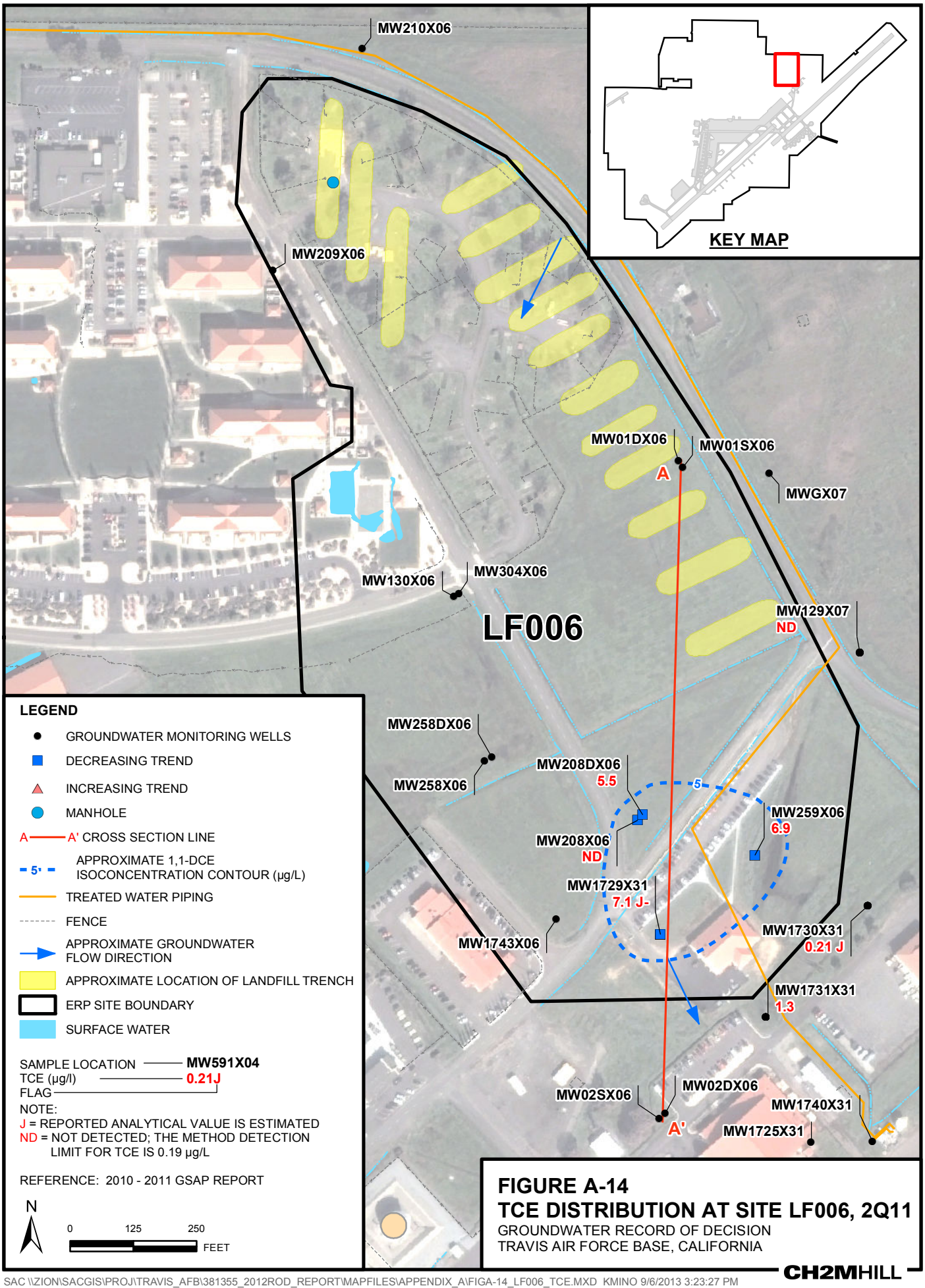
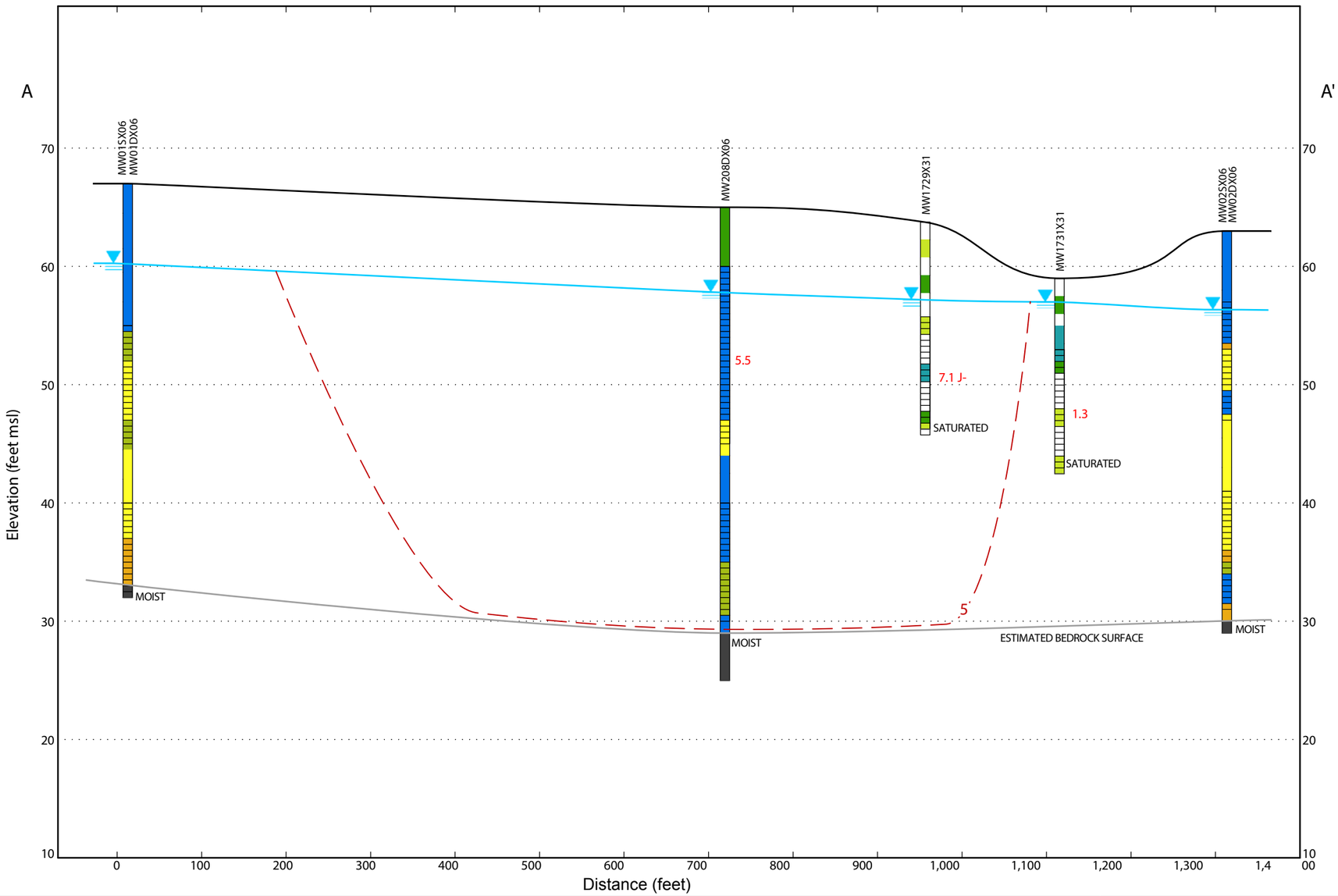


FIGURE A-14
TCE DISTRIBUTION AT SITE LF006, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-14_LF006_TCE.MXD KMINO 9/6/2013 3:23:27 PM



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

SCALE EXAGGERATION - 14:1 (H:V)

NOTE: SEE FIGURE A-13 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

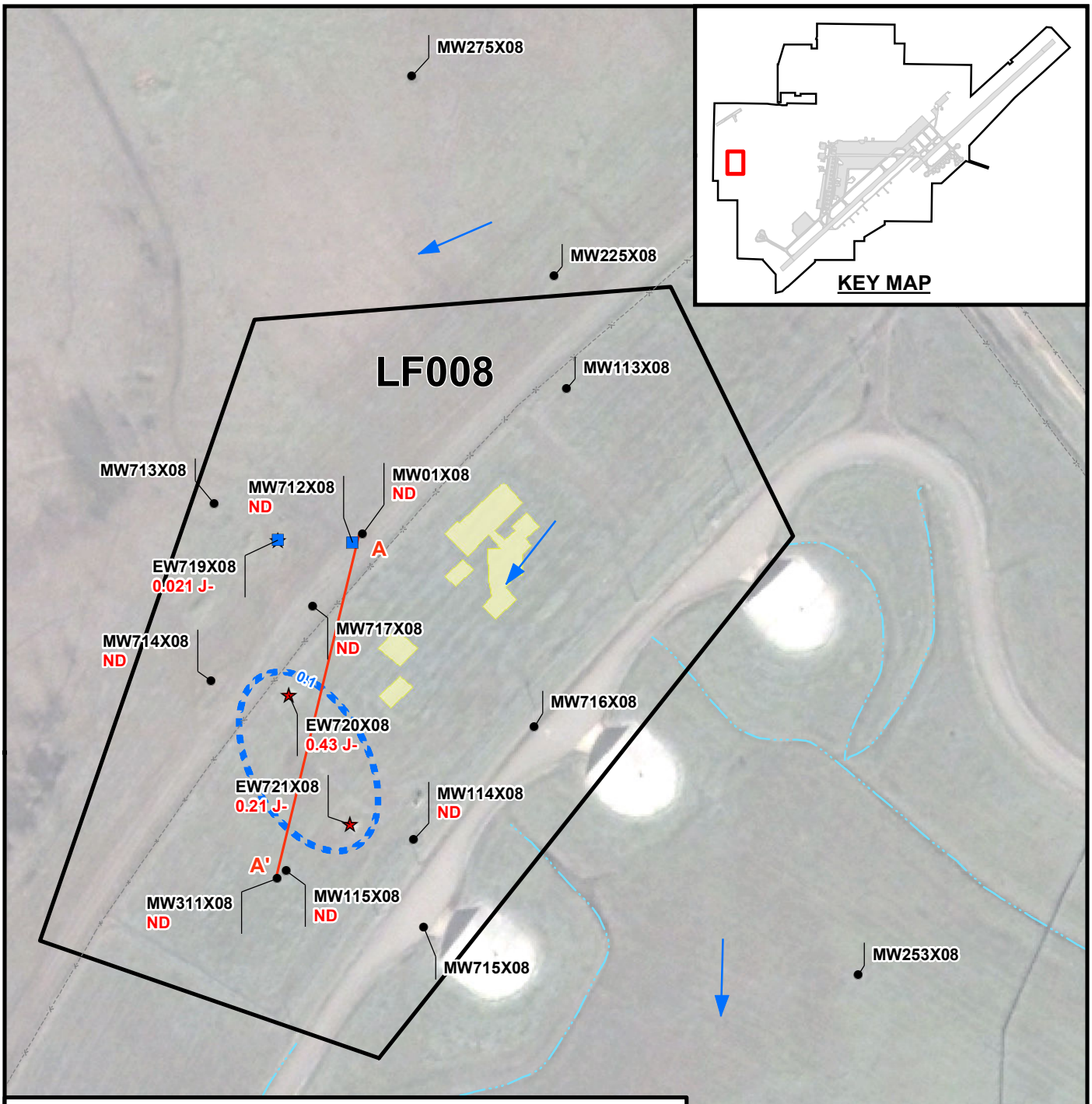
SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-15
SITE LF006 CROSS SECTION A–A'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

A:\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\FFS\GP J\TRAVIS_2010_SAMPLING_EVENT.GPJ;
ES051412034344SAC Figure_A-15.ai 09.05.2013 tdaus/it



LEGEND

- GROUNDWATER MONITORING WELLS
- INACTIVE EXTRACTION WELLS 2Q11
- DECREASING TREND
- A — A' CROSS SECTION LINE
- FENCE
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 0.1 APPROXIMATE ALPHA-CHLORDANE ISOCONCENTRATION CONTOUR (µg/L)
- PRIMARY EXCAVATION AREA FOR SOIL REMOVAL ACTION*
- ERP SITE BOUNDARY
- SURFACE WATER

SAMPLE LOCATION — MW591X04
ALPHA-CHLORDANE (µg/l) 0.21J
FLAG

NOTES:
ND = NOT DETECTED; THE METHOD DETECTION LIMIT FOR ALPHA-CHLORDANE IS 0.0031 µg/L

REFERENCE: 2010 - 2011 GSAP REPORT

*REFERENCE: FINAL LF008 SOIL REMEDIAL ACTION REPORT (2004)

N

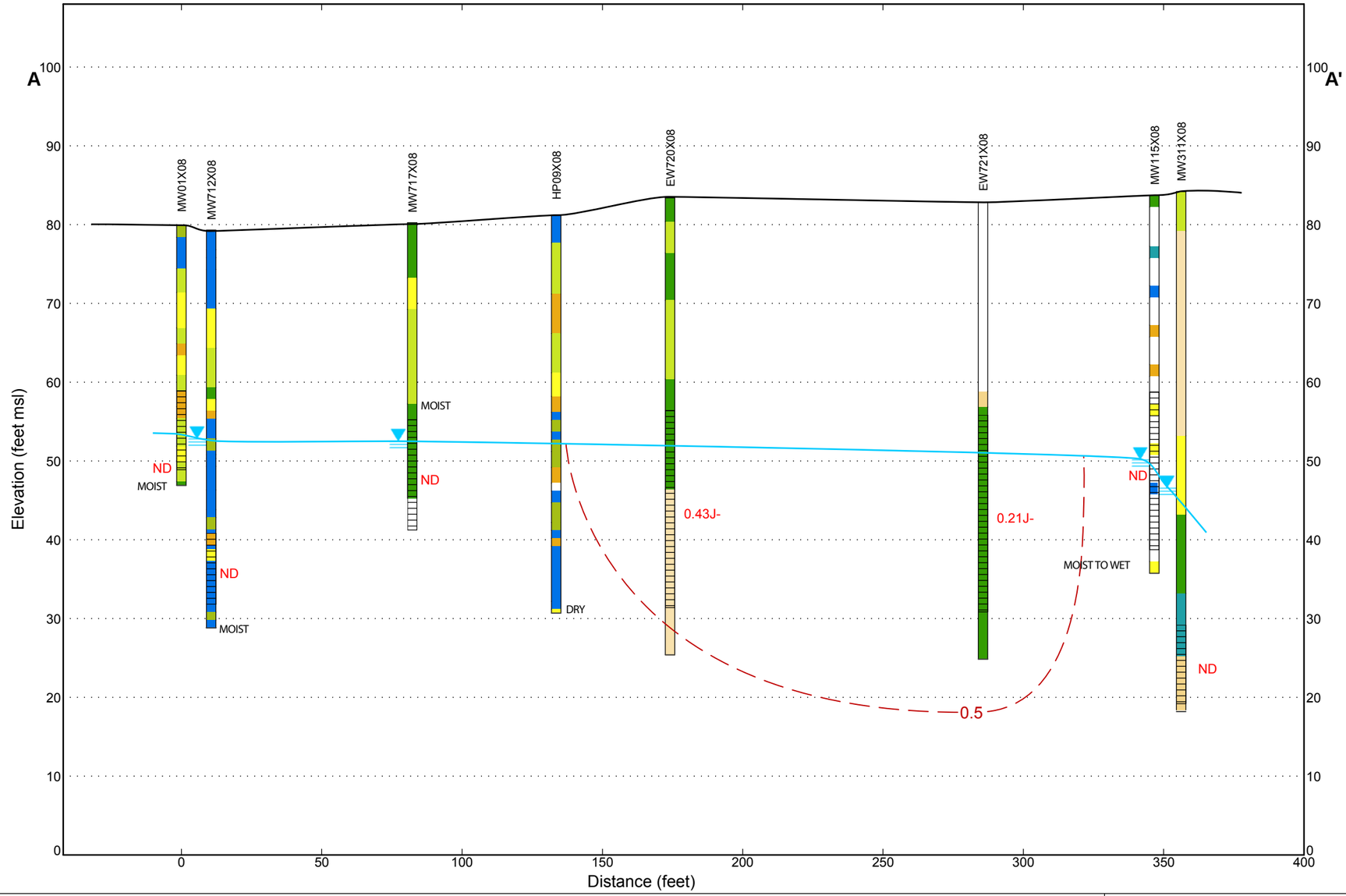
0 75 150 FEET

FIGURE A-16
ALPHA-CHLORDANE DISTRIBUTION AT SITE LF008, 2Q11

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-16_LF008_CHLORDANE.MXD KMINO 9/10/2013 1:14:44 PM



SOIL AND LITHOLOGY

- SCREEN INTERVAL
- APPROXIMATE SECOND QUARTER 2010 GROUNDWATER ELEVATION (ft MSL)
- 0.69 — ALPHA-CHLORDANE CONCENTRATION (µg/L) DETECTED IN 2010
- −−0.5−− APPROXIMATE ALPHA-CHLORDANE ISOCONCENTRATION CONTOUR (µg/L) BASED ON MAX 2010 DETECTION

SCALE EXAGGERATION - 3:1 (H:V)

NOTE: SEE FIGURE A-15 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-17
SITE LF008 CROSS SECTION A–A'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

\\YOSEMITE\PROJ\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\FFS\GPJ\TRAVIS_2010_SAMPLING_EVENT.GPJ;
ES051412034344SAC Figure_A-17_V2.ai 08.30.2013 tdaus

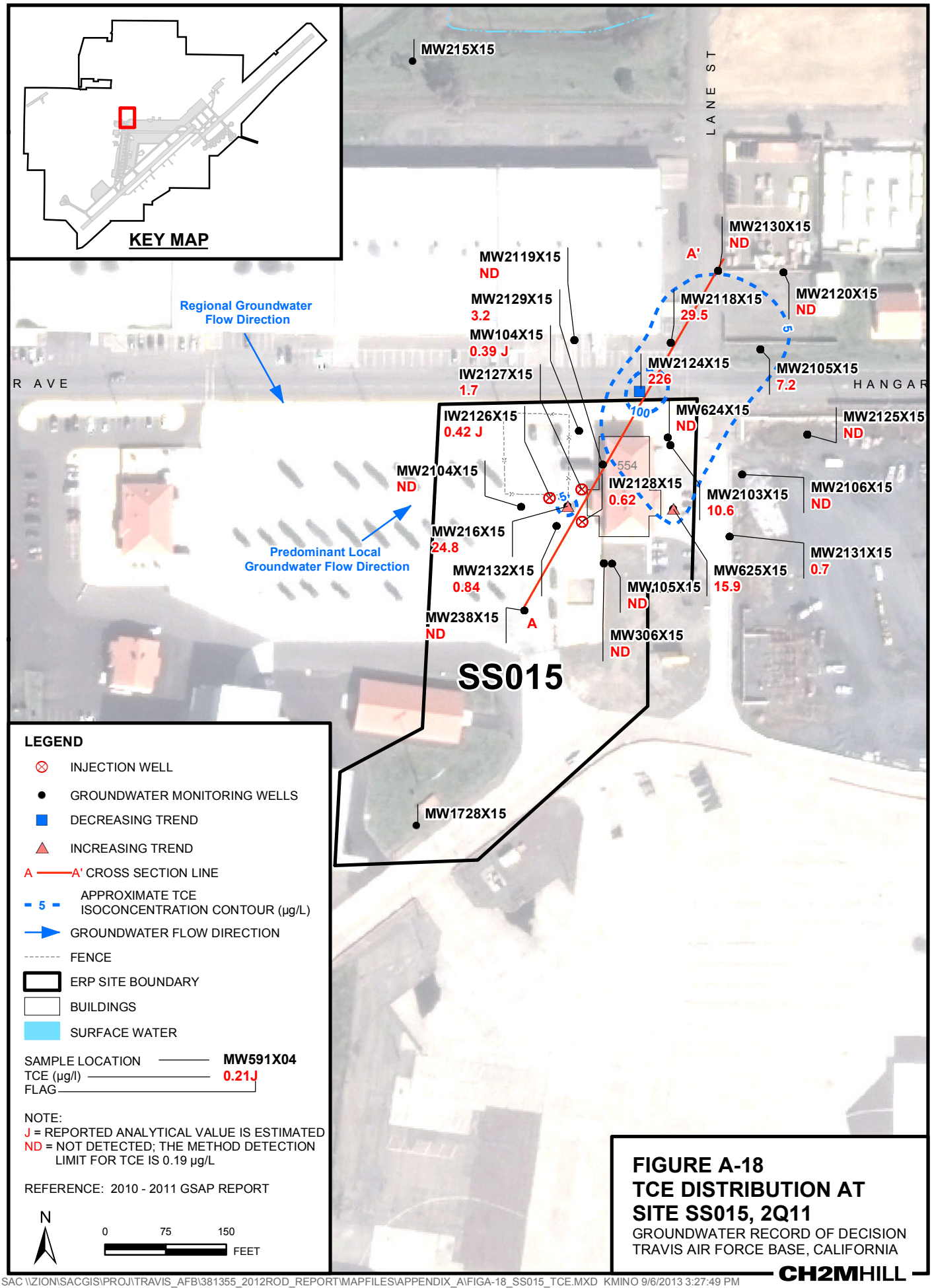


FIGURE A-18
TCE DISTRIBUTION AT SITE SS015, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-18_SS015_TCE.MXD KMINO 9/6/2013 3:27:49 PM

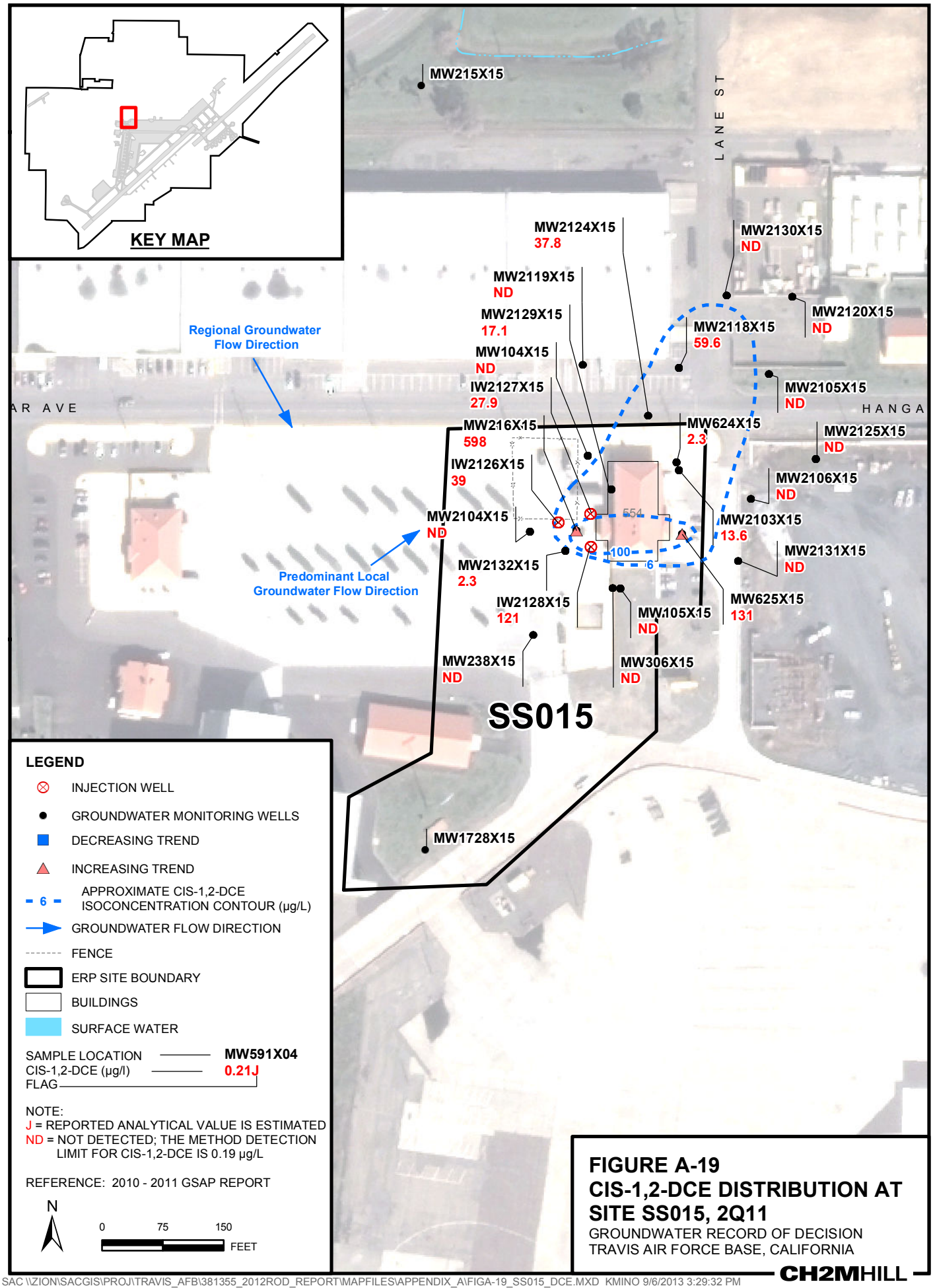


FIGURE A-19
CIS-1,2-DCE DISTRIBUTION AT SITE SS015, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-19_SS015_DCE.MXD KMINO 9/6/2013 3:29:32 PM

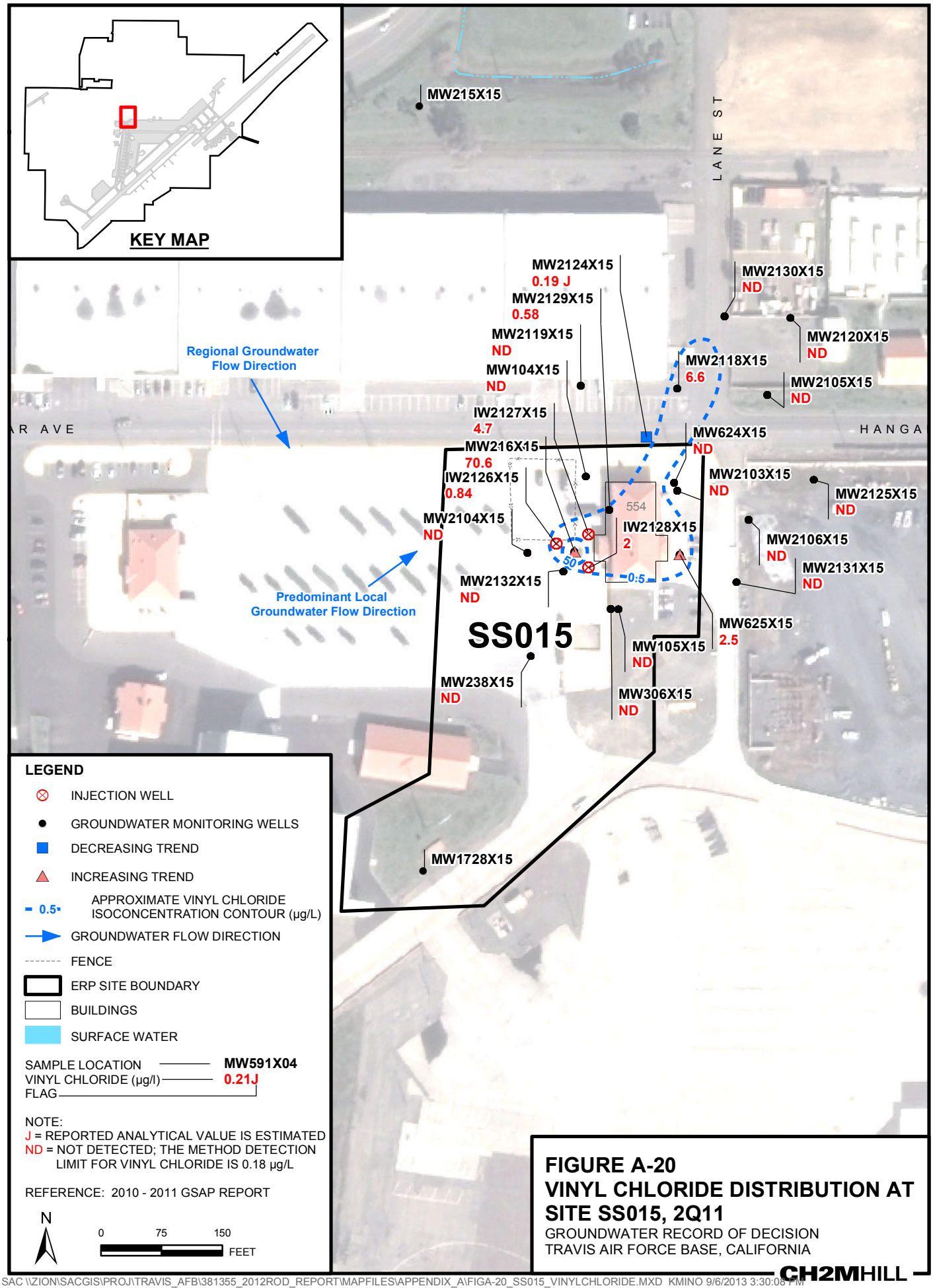
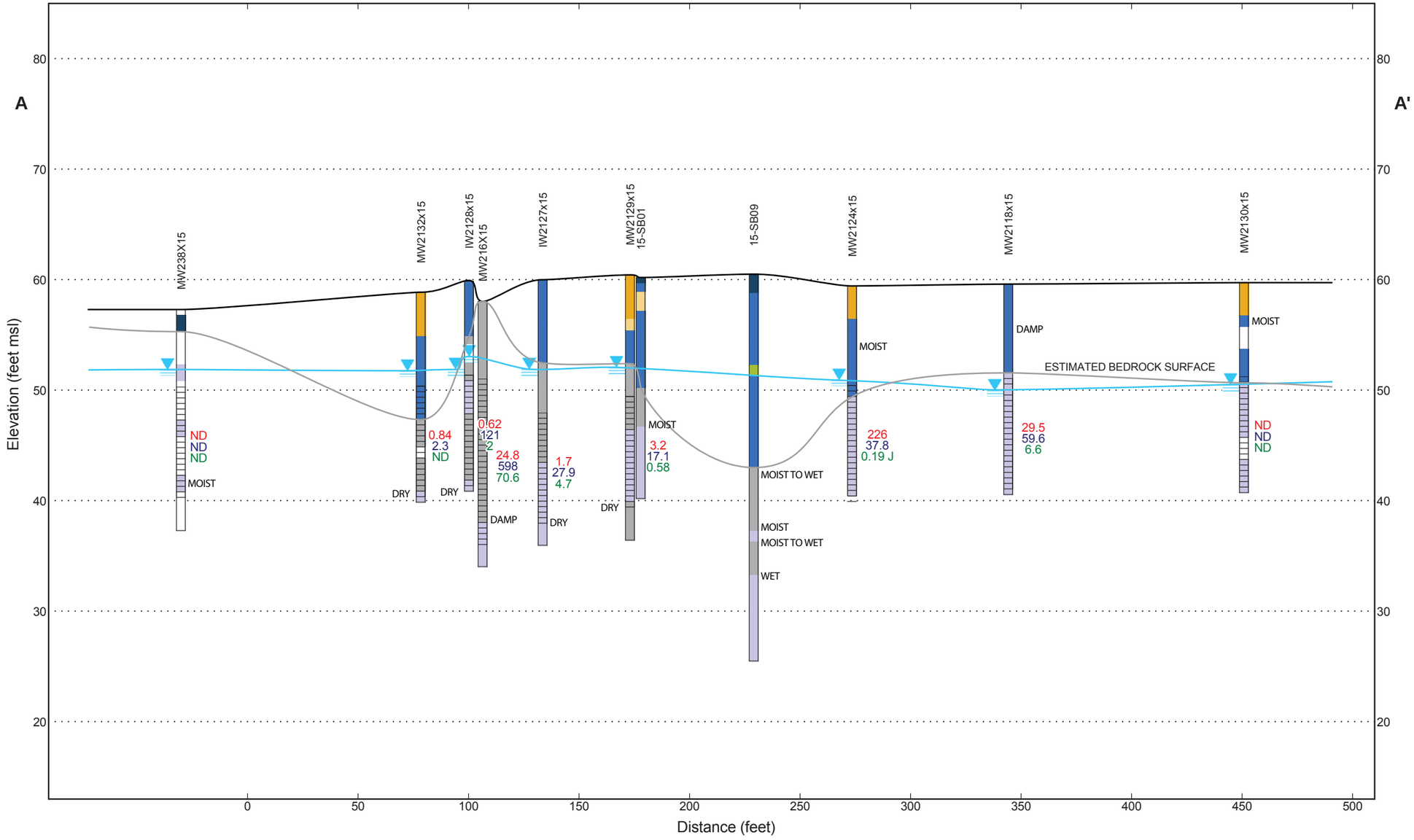


FIGURE A-20
VINYL CHLORIDE DISTRIBUTION AT SITE SS015, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

327 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

41 CIS-1,2-DCE (µg/L) CONCENTRATION DETECTED IN 2Q11

1.8 VINYL CHLORIDE (µg/L) CONCENTRATION DETECTED IN 2Q11

NOTES:

1) SOME BORING LOGS HAVE BEEN REINTERPRETED BASED ON RECENT FIELD OBSERVATIONS
2) SEE FIGURE A-17 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

SCALE EXAGGERATION - 5:1 (H:V)

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- POORLY GRADED SAND (SP)
- SILTY SAND (SM)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-21
SITE SS015 CROSS SECTION A–A'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

\\YOSEMITE\PROJ\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\2011\2010_2011_GSAP\TRAVIS_2011_GASP.GPJ SS015_A_2011_GSAP.GDW

ES051412034344SAC Figure_A-21.ai 09.05.2013 tdaus/it

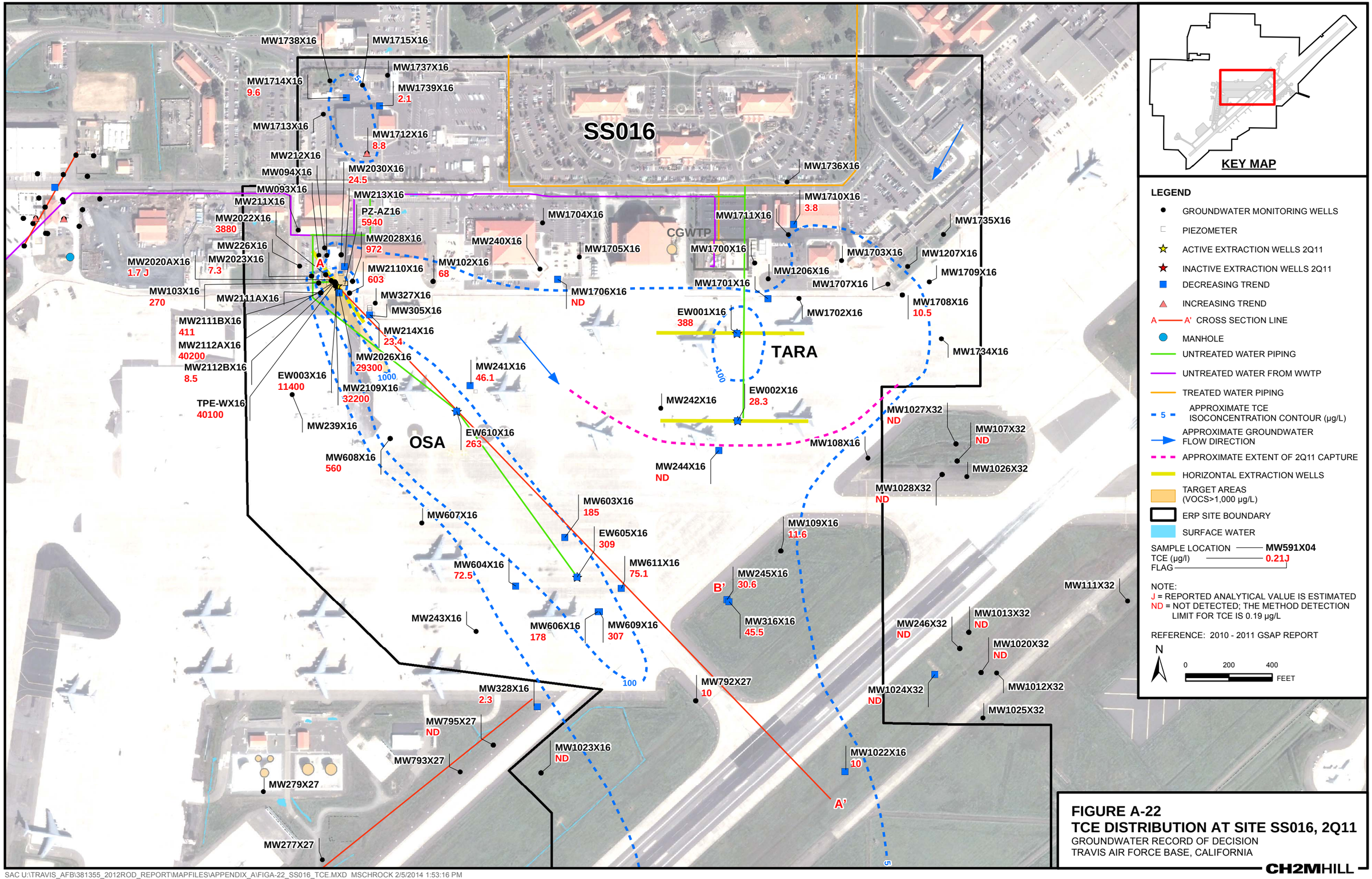


FIGURE A-22
TCE DISTRIBUTION AT SITE SS016, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC U:\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-22_SS016_TCE.MXD MSCHROCK 2/5/2014 1:53:16 PM

MW2119X15 ND
MW104X15 ND
MW2124X15 37.8
MW2120X15 ND
MW2118X15 59.6
MW2105X15 ND
MW624X15 2.3
MW2103X15 13.6
MW2125X15 ND
MW2106X15 ND
MW105X15 ND
MW625X15 131
MW306X15 ND
MW216X15 598
MW238X15 ND
MW2104X15 ND
MW1738X16
MW1715X16
MW1737X16
MW1714X16 7.2
MW1739X16 0.79 J
MW1713X16
MW1712X16 5.7
MW2020AX16 48.2
MW212X16
MW2112BX16 21.6
MW094X16
MW2030X16 2.9
MW211X16
MW213X16
MW2028X16 129
MW093X16
MW2112AX16 8230
MW226X16
PX-AX16 1550
MW2023X16 101
MW102X16 14.2 J-
MW2022X16 30.6
MW327X16
MW305X16
MW103X16 94.6
MW214X16 1.6
MW2111AX16
MW2111BX16 88.3
MW2110X16 138
TPE-WX16 9710
MW239X16
MW2109X16 768
MW2026X16 973
EW003X16 3180
MW608X16 36.1
MW241X16 9.2
EW610X16 60.4
MW240X16
MW1706X16 ND
MW1704X16
MW1705X16
MW1736X16
MW1710X16 1.4
MW1711X16
CGWTP
MW1700X16
MW1206X16
MW1701X16
EW001X16 132
MW1702X16
MW1735X16
MW1703X16
MW1207X16
MW1707X16
MW1709X16
MW1708X16 0.27 J
MW1734X16
MW242X16
EW002X16 8 J-
MW244X16 ND
MW108X16
MW1027X32 ND
MW107X32 ND
MW1028X32 ND
MW1026X32
MW607X16
MW603X16 14.4
EW605X16 19.1
MW611X16 7.7
MW604X16 6.7
MW109X16 8.6
MW245X16 4.9
MW316X16 8.9
MW111X32
MW243X16
MW606X16 13.9
MW609X16 25
MW246X32 ND
MW1013X32 ND
MW1020X32 ND
MW1012X32
MW1024X32 ND
MW1025X32
MW328X16 0.45 J-
MW792X27 ND
MW795X27 ND
MW793X27
MW1023X16 ND
MW1022X16 3.1
MW279X27
MW277X27

SS016

SS016

100

6

KEY MAP

LEGEND

- GROUNDWATER MONITORING WELLS
- PIEZOMETER
- ACTIVE EXTRACTION WELL 2Q11
- INACTIVE EXTRACTION WELL 2Q11
- DECREASING TREND
- INCREASING TREND
- MANHOLE
- UNTREATED WATER PIPING
- UNTREATED WATER FROM WWTP
- TREATED WATER PIPING
- APPROXIMATE EXTENT OF 2Q11 CAPTURE
- 6 APPROXIMATE CIS-1,2-DCE ISOCONCENTRATION CONTOUR (µg/L)
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- HORIZONTAL EXTRACTION WELLS
- ERP SITE BOUNDARY
- SURFACE WATER

SAMPLE LOCATION —— MW591X04
CIS, 1-2-DCE (µg/l) —— 0.21J
FLAG

NOTE:
J = REPORTED ANALYTICAL VALUE IS ESTIMATED
ND = NOT DETECTED; THE METHOD DETECTION LIMIT FOR cis-1,2-DCE IS 0.19 µg/L

REFERENCE: 2010 - 2011 GSAP REPORT

N
0 200 400
FEET

FIGURE A-23
CIS- 1,2-DCE DISTRIBUTION AT SITE SS016, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-23_SS016_DCE.MXD KMINO 9/6/2013 3:31:46 PM

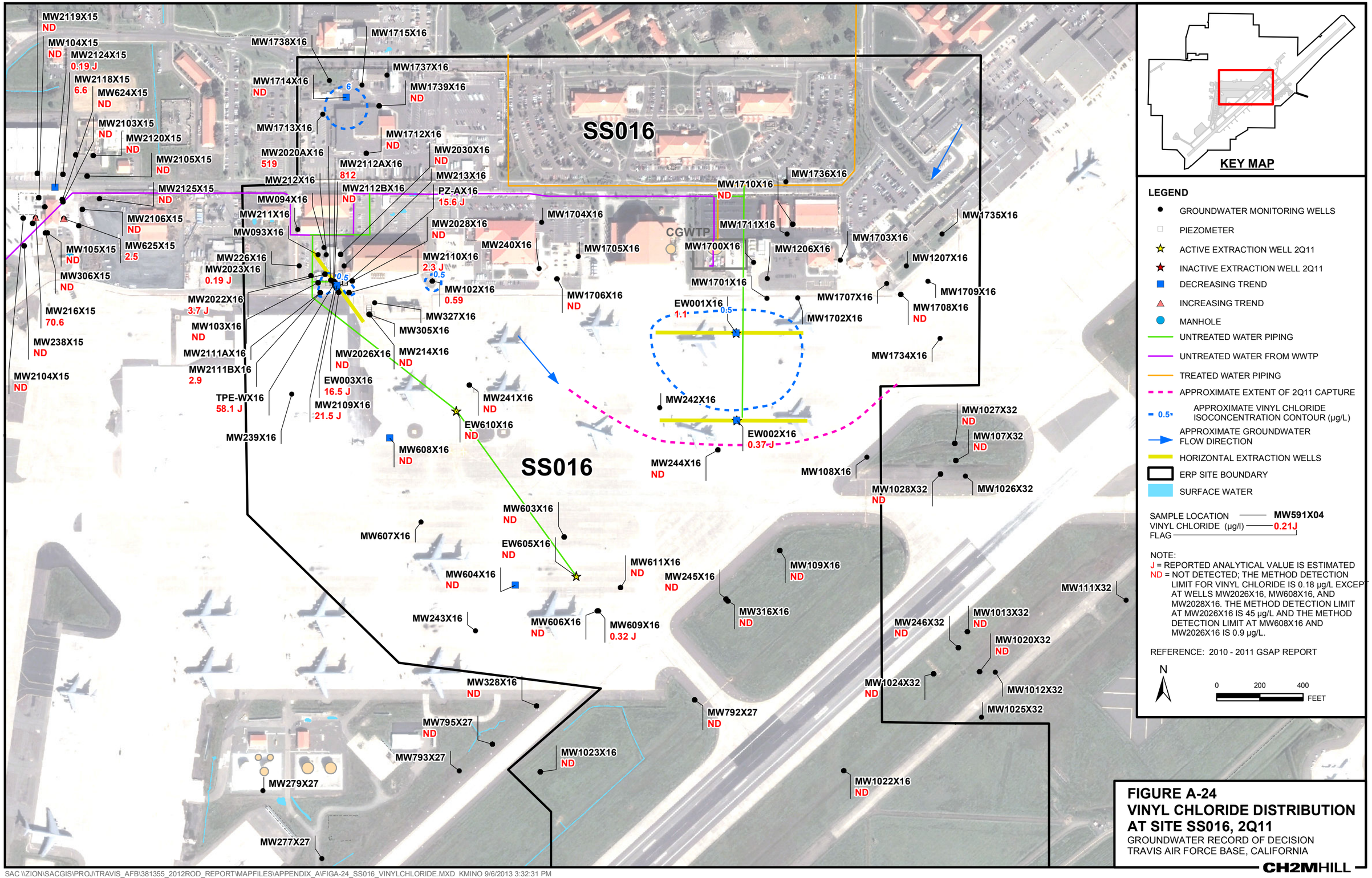
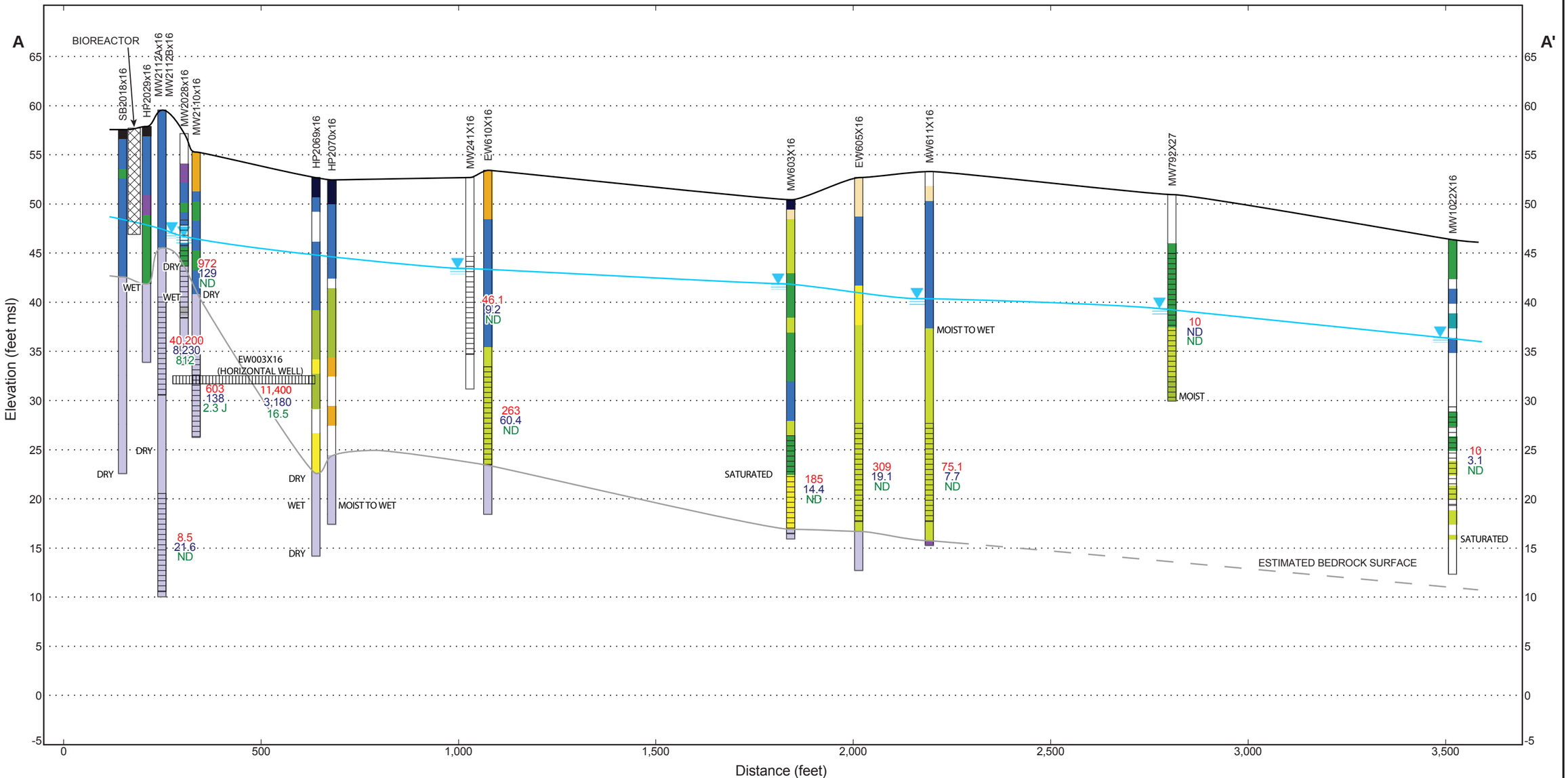


FIGURE A-24
VINYL CHLORIDE DISTRIBUTION AT SITE SS016, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-24_SS016_VINYLCHLORIDE.MXD KMINO 9/6/2013 3:32:31 PM



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

2.1 CIS-1,2-DCE CONCENTRATION (µg/L) DETECTED IN 2Q11

ND VC CONCENTRATION (µg/L) DETECTED IN 2Q11

SCALE EXAGGERATION - 25:1 (H:V)

NOTE: SEE FIGURE A-21 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-25
SITE SS016 CROSS SECTION A–A'

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

\\YOSEMITE\PROJ\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\2011\2010_2011_GSAP\TRAVIS_2011_GASP.GPJ;
ES051412034344SAC Figure_A-25.ai 09.05.2013 tdaus/it

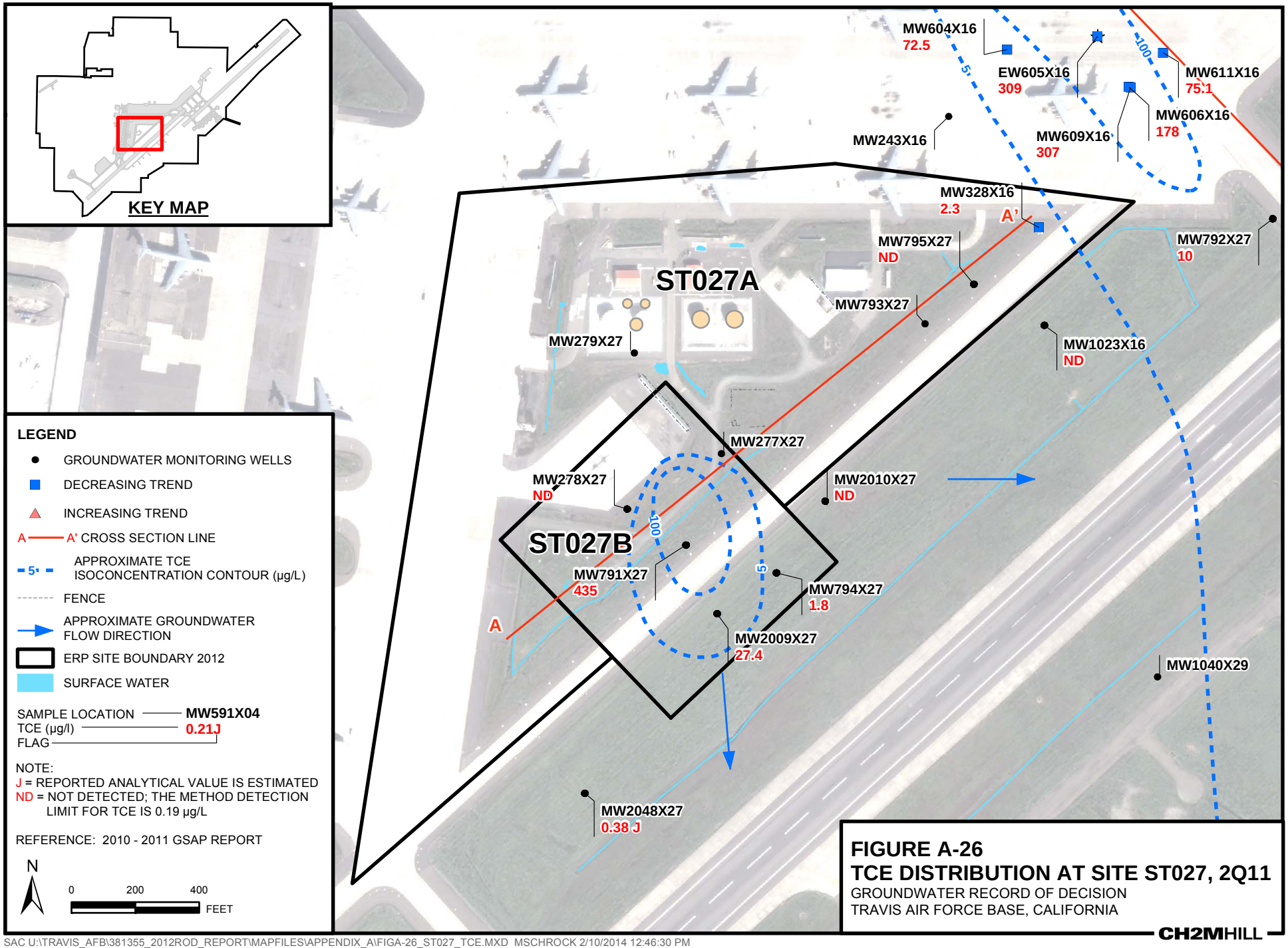
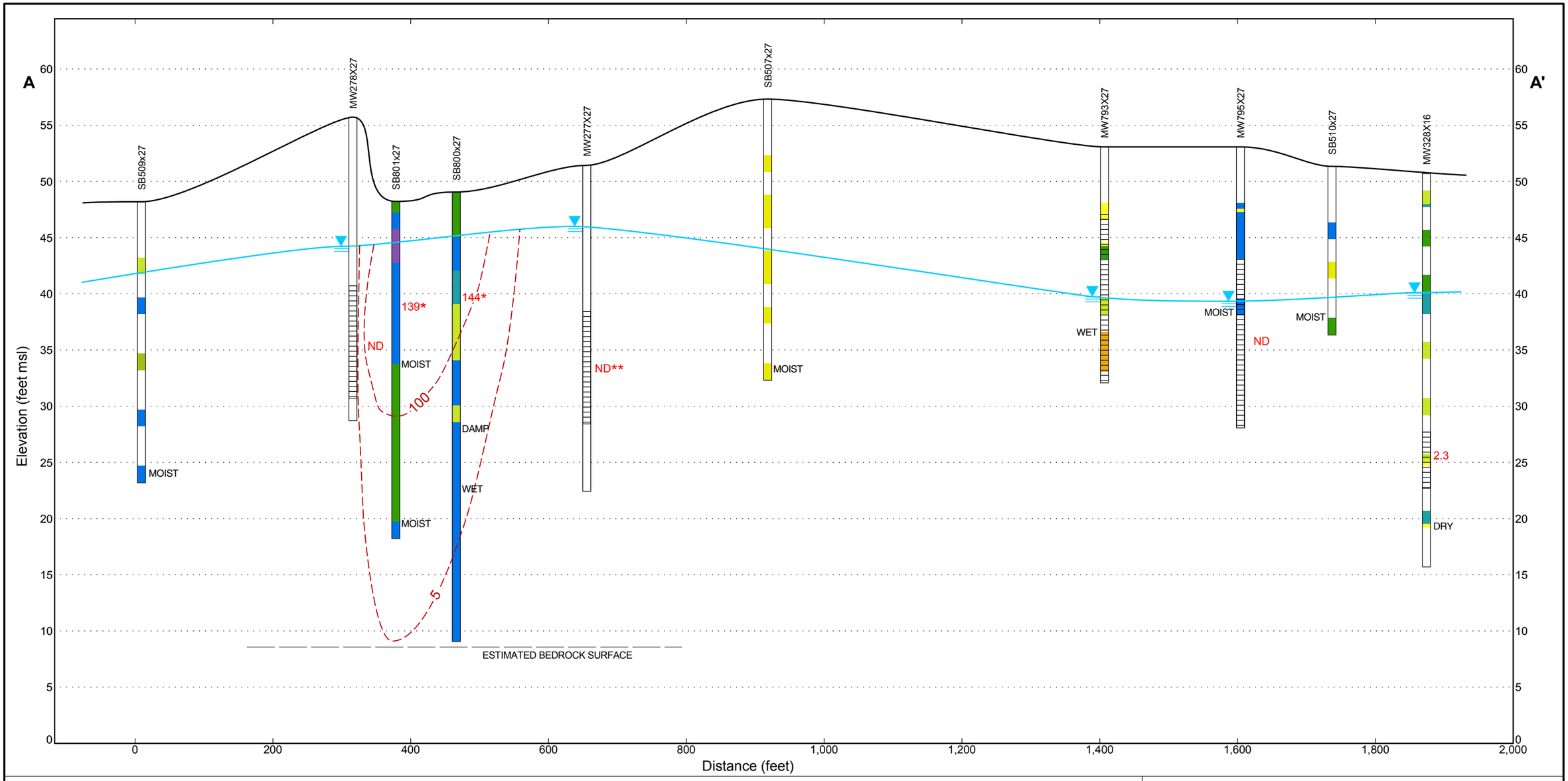


FIGURE A-26
TCE DISTRIBUTION AT SITE ST027, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC U:\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-26_ST027_TCE.MXD MSCHROCK 2/10/2014 12:46:30 PM



SCREEN INTERVAL

APPROXIMATE SECOND QUARTER 2010 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2010

5 APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L) BASED ON MAX 2010 DETECTION

* HYDROPUNCH SAMPLES COLLECTED IN 2009

** SAMPLE COLLECTED SECOND QUARTER 2008

NOTE: SEE FIGURE A-25 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

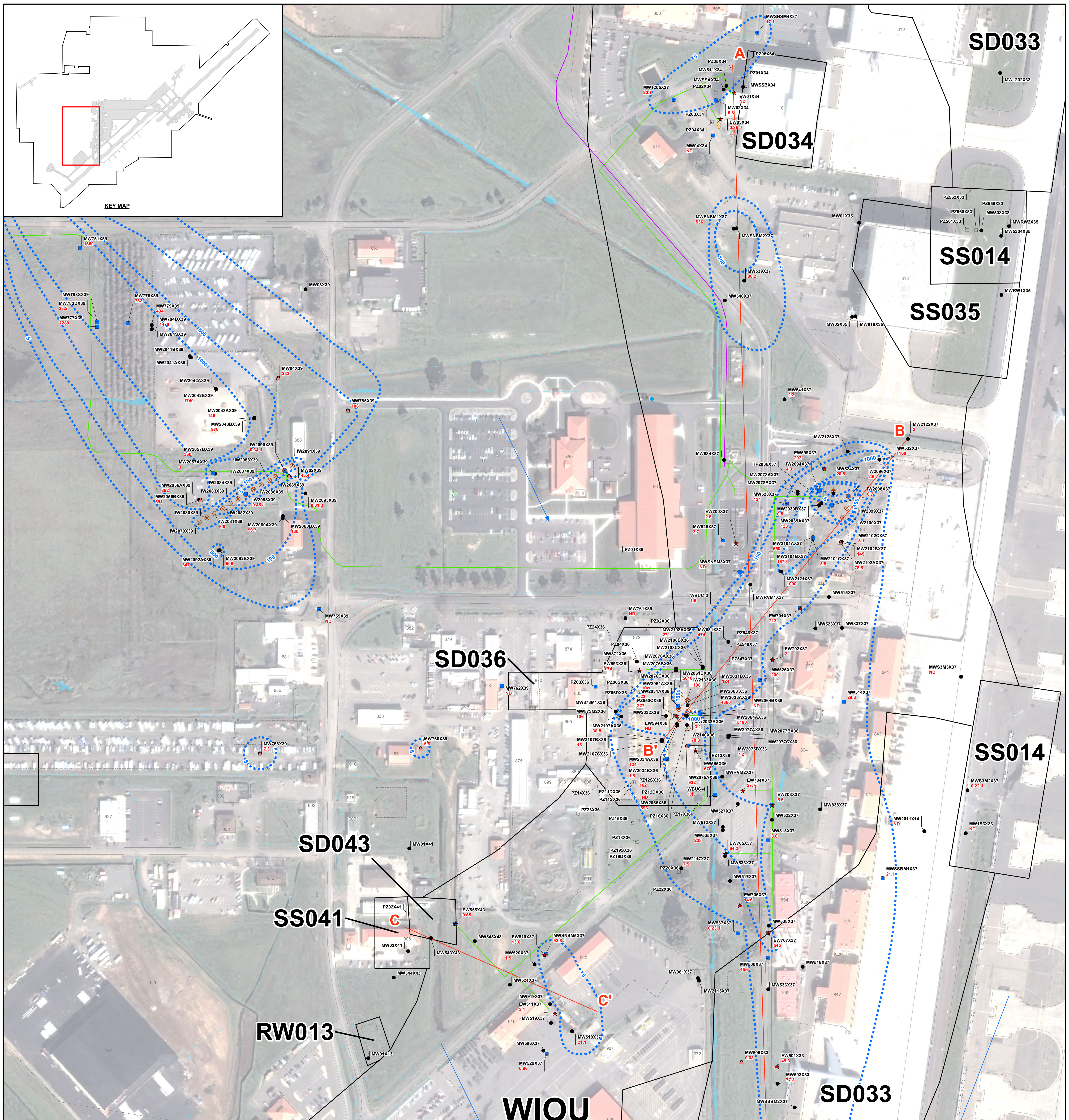
SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-27
SITE ST027B CROSS SECTION A–A'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

\\YOSEMITE\PROJ\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\FFS\GPJ\TRAVIS_2010_SAMPLING_EVENT.GPJ;
ES051412034344SAC Figure_A-27.ai 09.30.2013 tdaus



LEGEND

- GROUNDWATER MONITORING WELLS
- SURFACE WATER SAMPLE LOCATION
- INJECTION WELLS
- PIEZOMETER
- INACTIVE EXTRACTION WELLS 2Q11
- DECREASING TREND
- INCREASING TREND
- 5 APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)
- GROUND WATER FLOW DIRECTION
- A — A' CROSS SECTION LINE
- UNTREATED WATER PIPING
- UNTREATED WATER FROM WWTP
- FENCE
- SURFACE WATER
- BUILDING
- NEW AIRCRAFT HANGAR
- UNPAVED AREA
- PAVED AREA
- ROAD
- ERP SITE BOUNDARY

SAMPLE LOCATION — MW591X04
TCE (µg/L) — 0.21J
FLAG

NOTE:
J = REPORTED ANALYTICAL VALUE IS ESTIMATED
ND = NOT DETECTED; THE METHOD DETECTION LIMIT FOR TCE IS 0.19 µg/L EXCEPT AT WELL EW594X36 WHERE IT IS 1.9 µg/L.

REFERENCE: 2010 - 2011 GSAP REPORT

N

0 132 264 396 FEET

FIGURE A-28
TCE DISTRIBUTION AT THE WIOU, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-28_WIOU_TCE.MXD KMINO 9/6/2013 3:34:35 PM

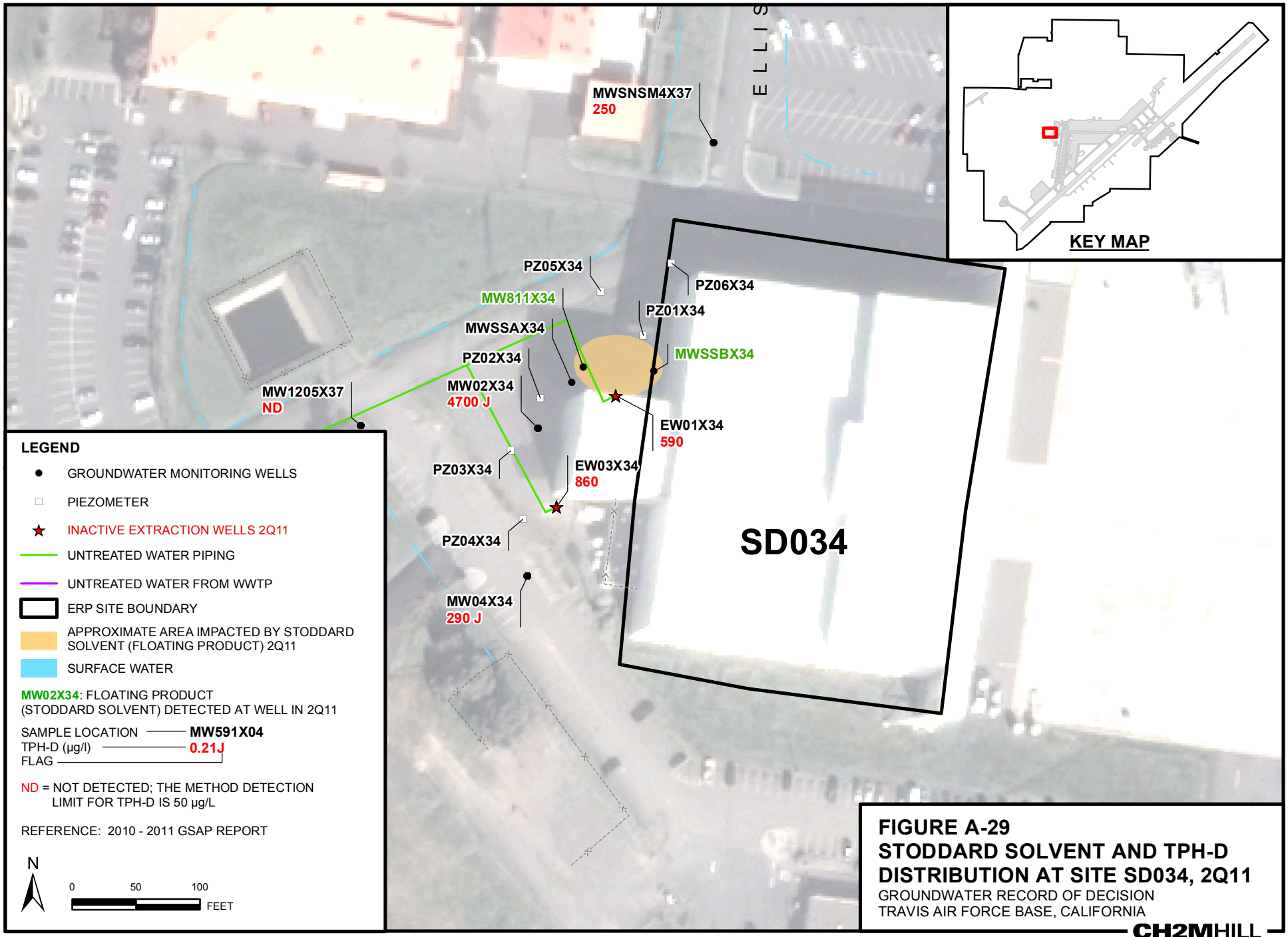
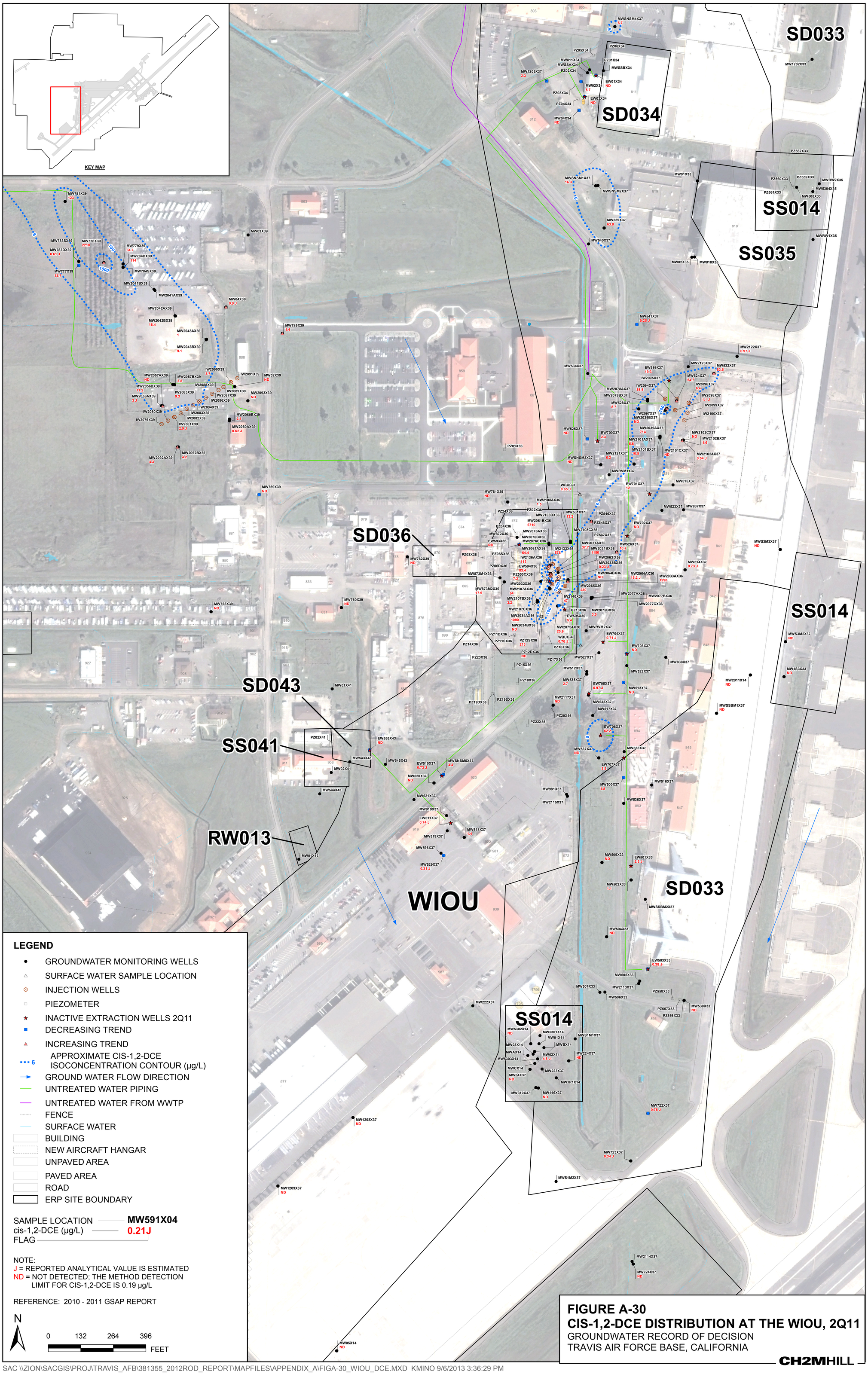


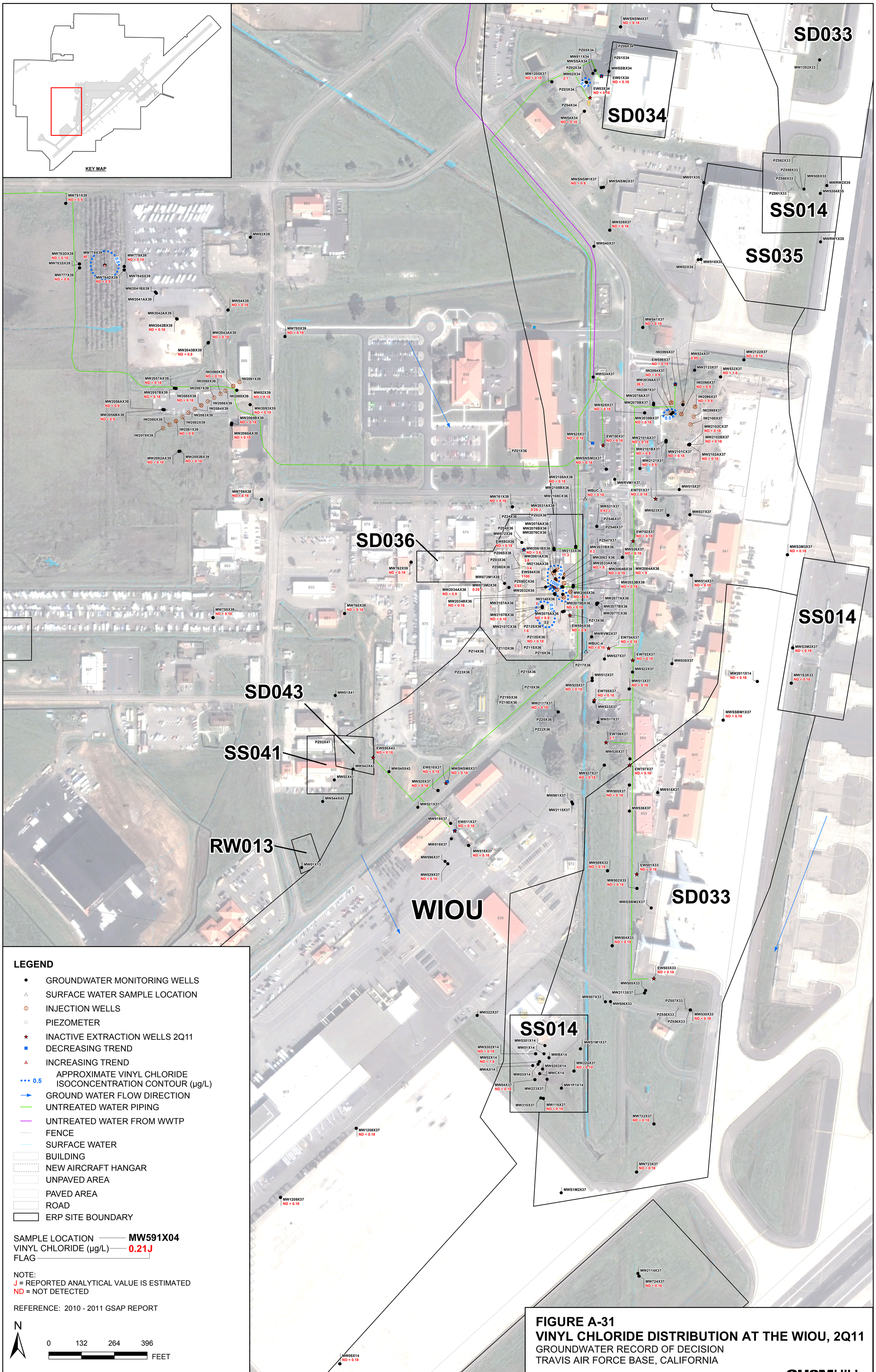
FIGURE A-29
STODDARD SOLVENT AND TPH-D DISTRIBUTION AT SITE SD034, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

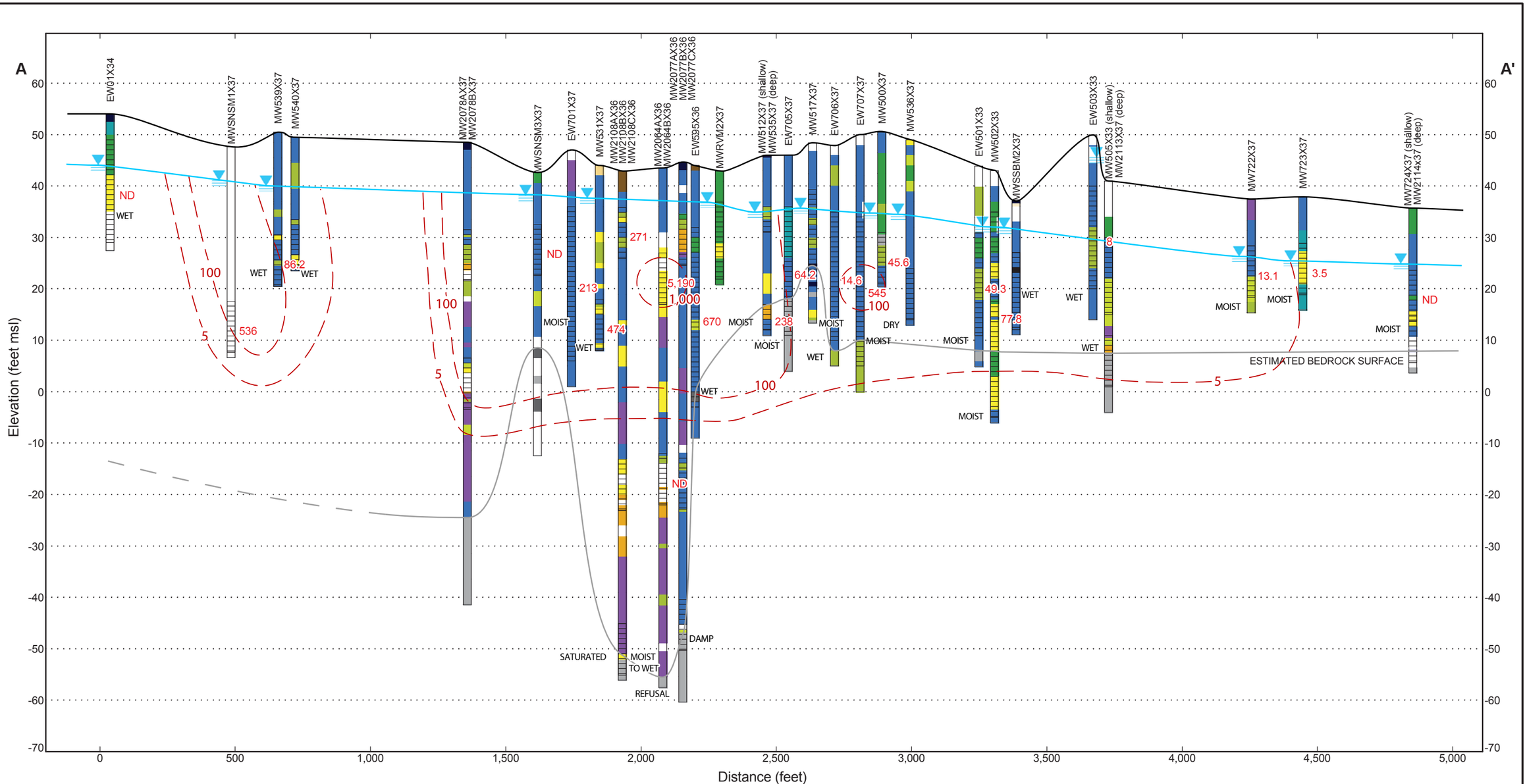
SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-29_SD034_TPH-D.MXD KMINO 9/6/2013 3:35:38 PM



SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-30_WIOU_DCE.MXD KMINO 9/6/2013 3:36:29 PM



SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-31_WIOU_VINYLCHLORIDE.MXD KMINO 9/6/2013 3:37:47 PM



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L)

SCALE EXAGGERATION - 19:1 (H:V)

NOTE: SEE FIGURE A-27 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

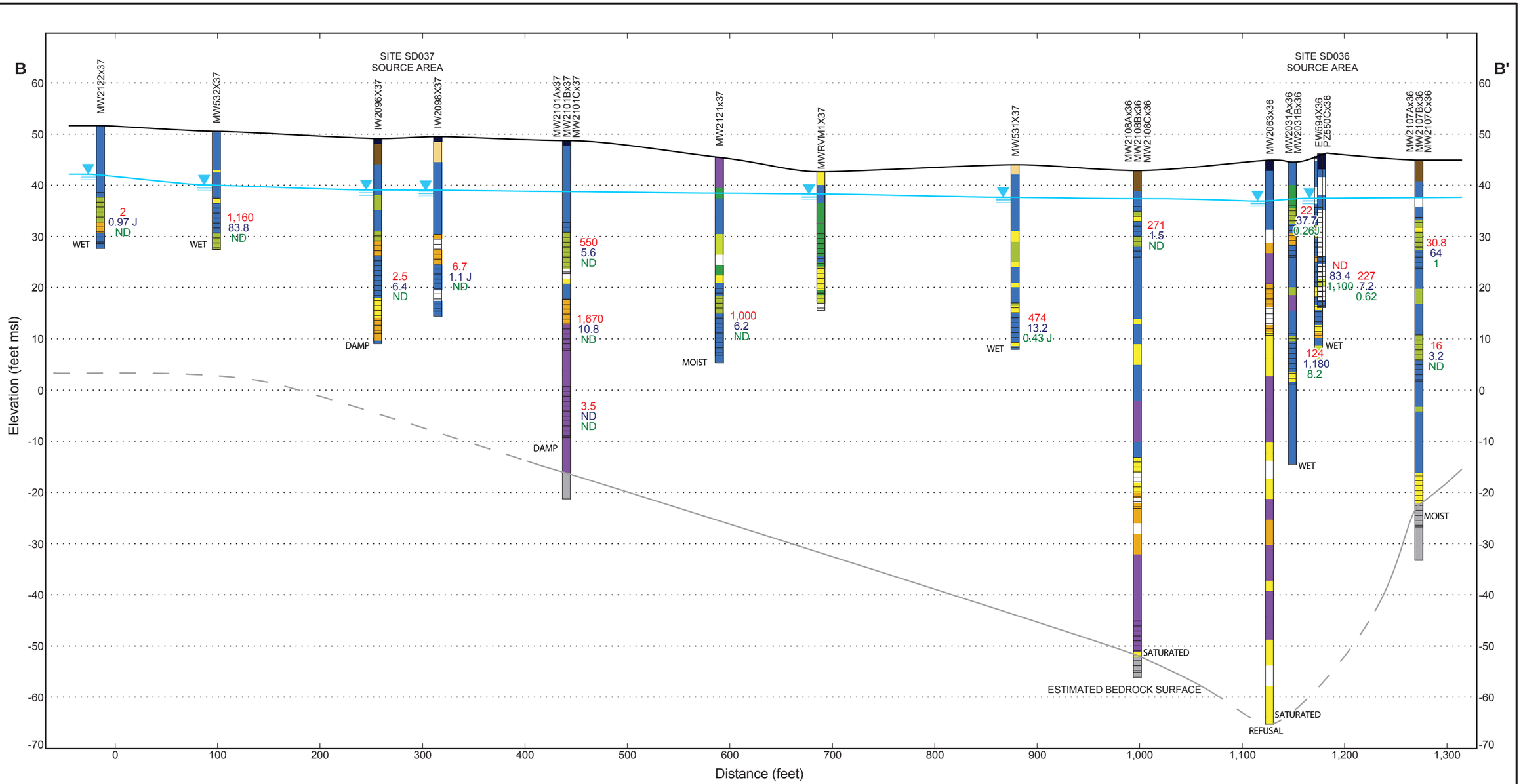
SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-32
WIOU CROSS SECTION A–A'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

\\YOSEMITE\PROJ\TRAVISAIRFORCEBASE\COMMONFILES\GINT FILES\2011\2010_2011_GSAP\TRAVIS_2011_GASP.GPJ;
ES051412034344SAC Figure_A-32.ai 09.05.2013 tdaus/it



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

2.1 CIS-1,2-DCE CONCENTRATION (µg/L) DETECTED IN 2Q11

ND VC CONCENTRATION (µg/L) DETECTED IN 2Q11

SCALE EXAGGERATION - 5:1 (H:V)

NOTE: SEE FIGURE A-27 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-33
SITE SD036/SD037 CROSS SECTION B–B'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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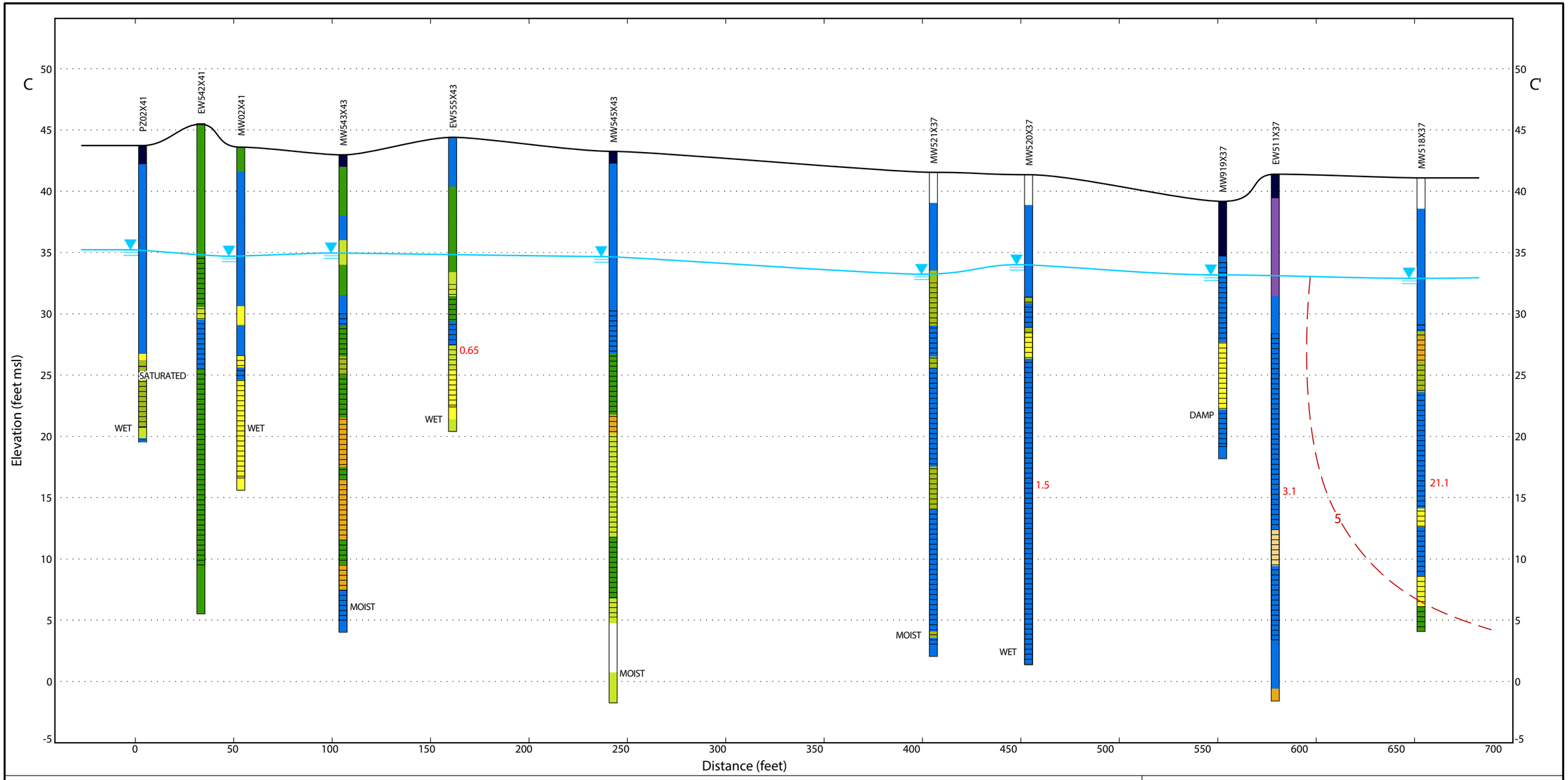
ES051412034344SAC Figure_A-33.ai 09.05.2013 tdaus/it



SOIL AND LITHOLOGY

SCREEN INTERVAL

APPROXIMATE SECOND QUARTER 2010 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2010

– – 5 – – APPROXIMATE TCE ISOCONCENTRATION CONTOUR (µg/L) BASED ON MAX 2010 DETECTION

SCALE EXAGGERATION - 6:1 (H:V)

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

NOTE: SEE FIGURE A-27 FOR CROSS SECTION LINE
REFERENCE: 2010 - 2011 GSAP REPORT

FIGURE A-34
SITE SS041/SD043 CROSS SECTION C–C'
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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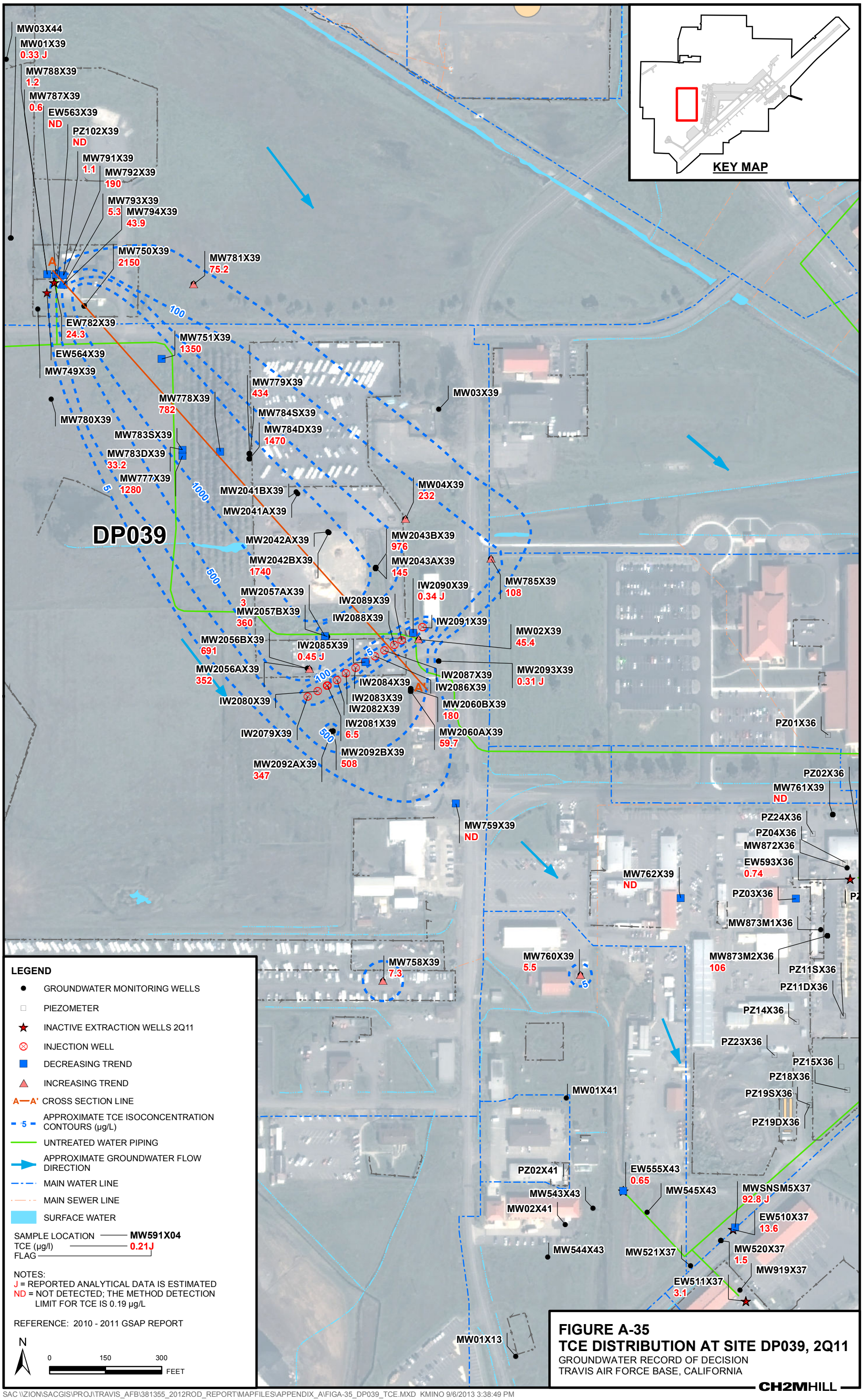


FIGURE A-35
TCE DISTRIBUTION AT SITE DP039, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-35_DP039_TCE.MXD KMINO 9/6/2013 3:38:49 PM

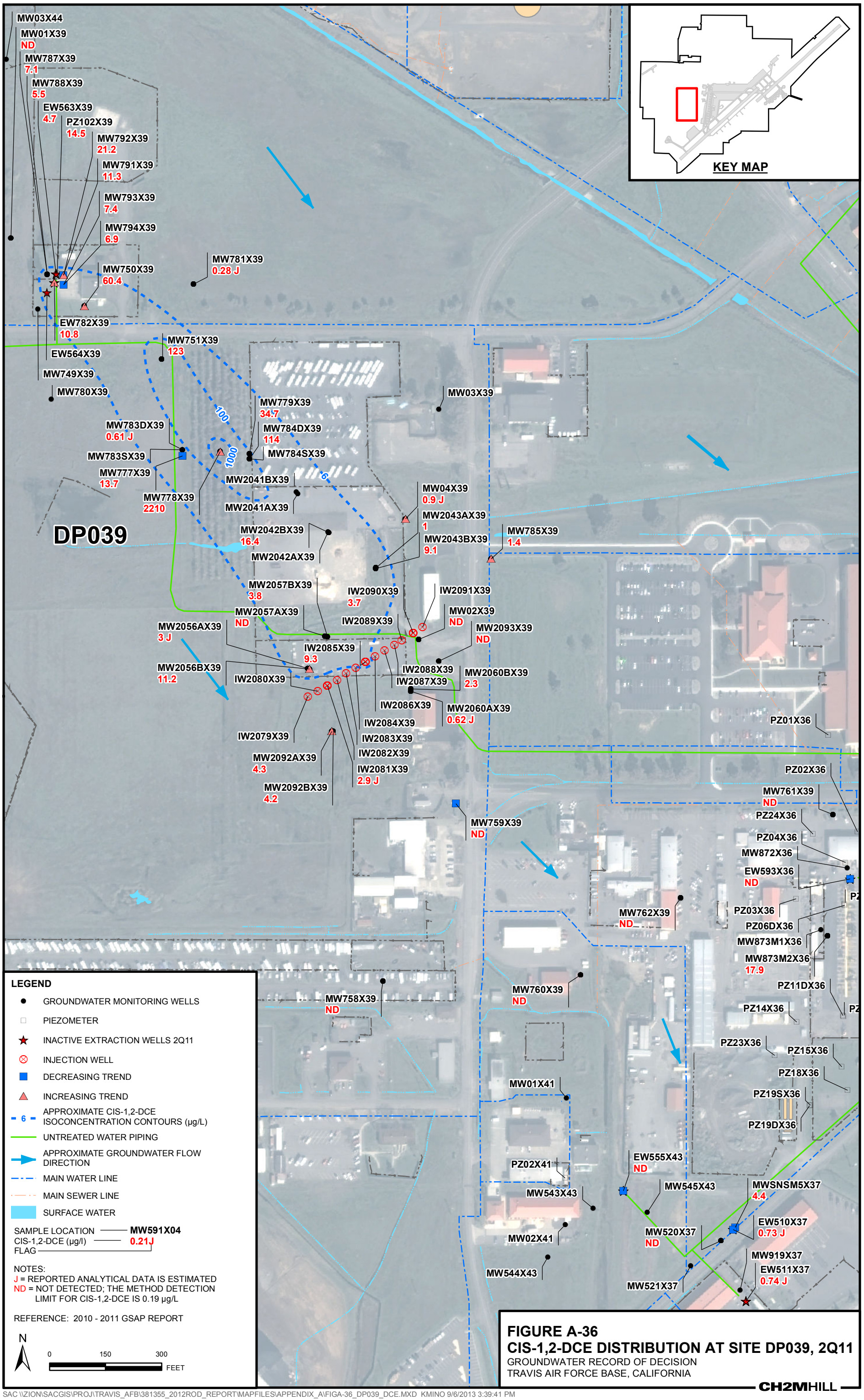


FIGURE A-36
CIS-1,2-DCE DISTRIBUTION AT SITE DP039, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-36_DP039_DCE.MXD KMINO 9/6/2013 3:39:41 PM

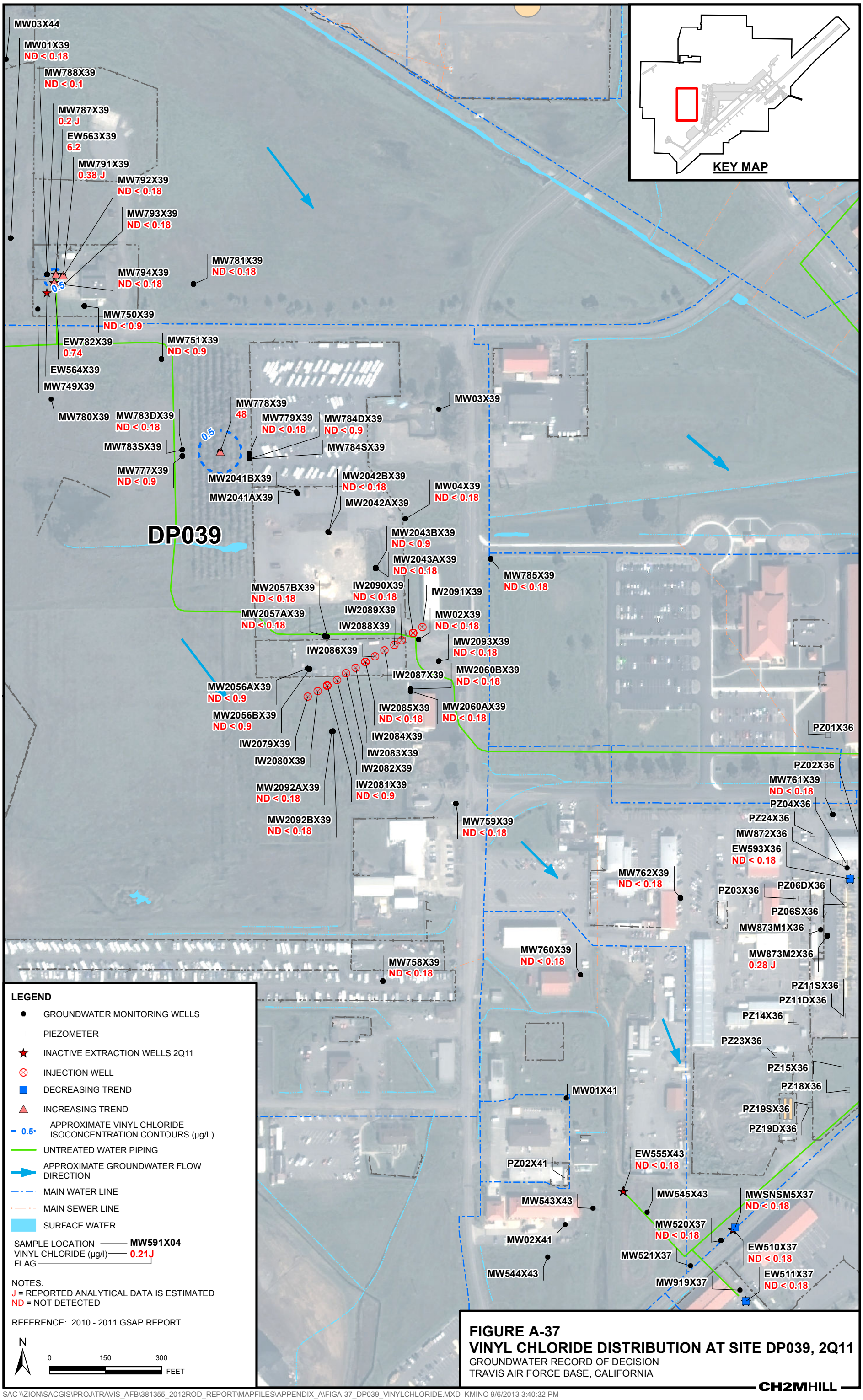
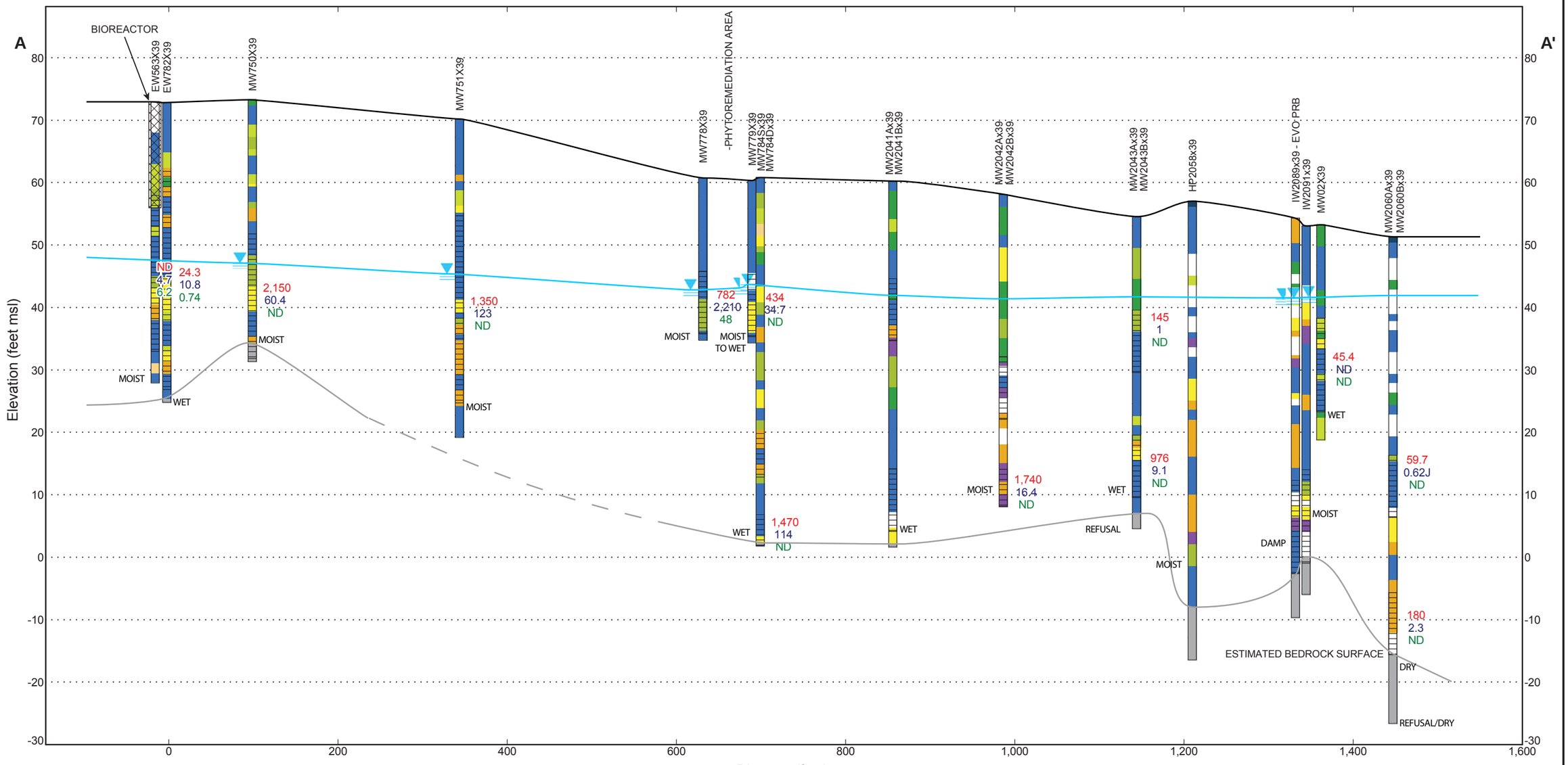


FIGURE A-37
VINYL CHLORIDE DISTRIBUTION AT SITE DP039, 2Q11
GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

SAC \\ZION\SACGIS\PROJ\TRAVIS_AFB\381355_2012ROD_REPORT\MAPFILES\APPENDIX_A\FIGA-37_DP039_VINYLCHLORIDE.MXD KMINO 9/6/2013 3:40:32 PM



SCREEN INTERVAL

APPROXIMATE 2Q11 GROUNDWATER ELEVATION (ft MSL)

6.7 TCE CONCENTRATION (µg/L) DETECTED IN 2Q11

2.1 CIS-1,2-DCE CONCENTRATION (µg/L) DETECTED IN 2Q11

ND VC CONCENTRATION (µg/L) DETECTED IN 2Q11

SCALE EXAGGERATION - 7:1 (H:V)

NOTE: SEE FIGURE A-34 FOR CROSS SECTION LINE

REFERENCE: 2010 - 2011 GSAP REPORT

SOIL AND LITHOLOGY

- NO SAMPLE/NO RECOVERY
- FILL/ASPHALT
- TOPSOIL/ORGANIC SOIL
- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- WELL GRADED SAND (SW)
- SILTY SAND (SM)
- POORLY GRADED SAND (SP)
- CLAYEY SAND (SC)
- SILT (ML)
- ELASTIC SILT (MH)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTSTONE
- SANDSTONE
- SHALE
- ALLUVIUM (NO DATA)

FIGURE A-38
SITE DP039 GEOLOGIC A–A' CROSS SECTION

GROUNDWATER RECORD OF DECISION
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

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ES051412034344SAC Figure_A-38.ai 09.05.2013 tdaus/it