Prepared for

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FEASIBILITY STUDY
COOPER AND COMMERCE
WATER QUALITY ASSURANCE REVOLVING FUND SITE
PHOENIX, ARIZONA

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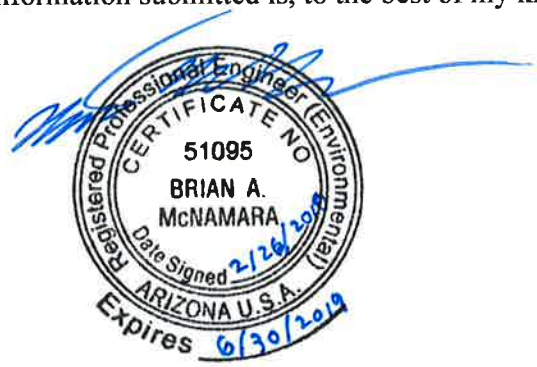
This report was prepared by the staff of Geosyntec Consultants under my supervision to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who are directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.



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Date

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
A.R.S.	Arizona Revised Statutes
AS	air sparge
AWQS	Aquifer Water Quality Standard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	contaminants of concern
EISB	Enhanced In-Situ Bioremediation
E_h	redox potential
EPA	United States Environmental Protection Agency
ERAs	Early Response Actions
ERD	enhanced reductive dechlorination
ERH	electrical resistive heating
FS	Feasibility Study
ft bgs	feet below ground surface
ft/day	feet per day
ft/ft	feet per foot
Geosyntec	Geosyntec Consultants
GETS	groundwater extraction and treatment system
gpm	gallons per minute
HGC	Hydro Geo Chem, Inc.
ISCO	in situ chemical oxidation
ISCR	in situ chemical reduction
ISTR	in situ thermal remediation
ITRC	Interstate Technology & Research Council
J&E	Johnson & Ettinger
lbs	pounds
LGAC	liquid-phase granular activated carbon
MAU	Middle Alluvial Unit
MCAQD	Maricopa County Air Quality Department
mgd	million gallons per day
mg/kg	milligrams per kilogram
MNA	Monitored Natural Attenuation

mV	millivolt
NOV	Notice of Violation
O&M	operations and maintenance
PCE	tetrachloroethene
PRAP	Proposed Remedial Action Plan
PRB	permeable reactive barrier
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROs	Remedial Objectives
RSL	Regional Screening Level
Site	Cooper and Commerce Water Quality Assurance Revolving Fund Site
SRL	Soil Remediation Level
SRP	Salt River Project
SVE	soil vapor extraction
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOG	Town of Gilbert
UAU	Upper Alluvial Unit
VGAC	vapor-phase granular activated carbon
VI	vapor intrusion
VISLs	Vapor Intrusion Screening Levels
VOCs	volatile organic compounds
WQARF	Water Quality Assurance Revolving Fund
ZVI	zero valent iron

1. INTRODUCTION

This Feasibility Study (FS) Report for the Cooper and Commerce Water Quality Assurance Revolving Fund (WQARF) Site was prepared by Geosyntec Consultants, Inc. (Geosyntec) on behalf of the Arizona Department of Environmental Quality (ADEQ). The Cooper and Commerce WQARF Site is located in Gilbert, Arizona (the Site, Figure 1).

1.1 Purpose and Scope of the Feasibility Study Report

This FS Report was prepared in accordance with Arizona Administrative Code (A.A.C.) Title 18, Environmental Quality, Chapter 16, Department of Environmental Quality WQARF Program, Article 4, 407: Feasibility Study (R18-16-407) and is based on information reported in the following documents:

- *Remedial Investigation Report Cooper Road and Commerce Avenue WQARF Site, Gilbert, Arizona* (Hydro Geo Chem, Inc. [HGC], 2015) (RI Report);
- *Early Response Action Evaluation Technical Report for Cooper Road and Commerce Avenue WQARF, Gilbert, Arizona* (HGC, 2006)*;*
- *Proposed Remedial Objectives Report, Cooper Road and Commerce Avenue WQARF Registry Site, Gilbert, Arizona* (ADEQ, 2015a) (Proposed ROs Report);
- *Feasibility Study Work Plan, Cooper Road and Commerce Avenue, WQARF Registry Site, Gilbert, Arizona* (ADEQ, 2015b); and
- *Identification of Remedial Alternatives Technical Memorandum* (Geosyntec, 2015).

Information contained in the FS Report is drawn directly from the above referenced reports without attribution other than that noted here. The detailed history of remedial investigations, early response actions (ERAs), and preliminary screening of remedial alternatives completed for the Site are presented in these referenced documents and are briefly summarized in Section 2.

The objectives of the FS are as follows:

- Identify remedial options and alternatives that will achieve the Remedial Objectives (ROs) as outlined in the Proposed ROs Report; and

- Evaluate the identified remedies, recommend alternatives, and comply with the requirements of Arizona Revised Statutes (A.R.S.) §49-282.06.

Based on the objectives stated above, the FS presents recommendations for the preferred remedy, that:

- Assure the protection of public health, welfare, and the environment;
- To the extent practicable, provide for the control, management, or cleanup of hazardous substances so as to allow for the maximum beneficial use of waters of the state;
- Is reasonable, necessary, cost-effective, and technically feasible; and
- Address any well (used for municipal, domestic, industrial, irrigation or agricultural purposes) that could produce water that would not be fit for its current or reasonably foreseeable end use without treatment.

1.2 Report Organization

The remainder of this FS Report is organized as follows:

- Section 2: "Site Background" includes Site description, Site History, the nature and extent of contamination, ERAs, and risk evaluation;
- Section 3: "Feasibility Study Scoping" presents the regulatory requirements of pertinent statutes and rules, delineates the remediation areas, and presents the ROs identified by ADEQ;
- Section 4: "Identification and Screening of Remediation Technologies" presents an evaluation and screening of various remedial technologies related to contamination in soil and groundwater, and lists the technologies that have been retained for inclusion into the reference and alternative remedies;
- Section 5: "Development of Reference Remedy and Alternative Remedies" presents the evaluation process and selection of a reference remedy, a more aggressive remedy, and a less aggressive remedy;
- Section 6: "Comparison of Reference Remedy and Alternative Remedies" presents a summary of the three remedial alternatives compared to each other based on practicability, risk, cost, and benefit, and includes a discussion of uncertainties associated with each remedy;

- Section 7: “Proposed Remedy” presents the recommended remedy and discusses how the remedy will meet the requirements of A.R.S. §49-282.06 and A.A.C. R18-16-407(I);

- Section 8: “Community Involvement” presents public participation opportunities; and

- Section 9: “References” provides a list of references cited in this report.

2. SITE BACKGROUND

This section presents a summary of the Site background, physiographic setting, the nature and extent of contamination, and a risk evaluation. Additional background details are presented in the RI Report.

2.1 Site Description

The Site is located in Gilbert, Arizona (Figure 1), and emanates from a source area identified at the former Unichem facility at 619 West Commerce Avenue in Gilbert, Arizona. The former Unichem facility occupies approximately four acres north of the Salt River Project (SRP) Western Canal. The Unichem facility produced copper sulfate from scrap metal from approximately 1977 through 1983. The main source of contamination appears to be a former drywell constructed at the Site in 1977 that may have been used for waste disposal. In accordance with the Proposed ROs Report, the contaminants of concern (COCs) identified during previous investigations include tetrachloroethene (PCE) and trichloroethene (TCE) in groundwater and PCE, arsenic, and copper in source area soils.

According to the 2012 Town of Gilbert (TOG) General Plan (TOG, 2012), the Unichem facility is zoned as General Industrial. However, the WQARF site boundaries are defined by the extent of the PCE groundwater plume exceeding the Aquifer Water Quality Standard (AWQS) of 5 micrograms per liter (µg/L). The groundwater plume underlies an area that is a mix of industrial, commercial, and residential land uses.

Soil samples collected at depths of approximately 70 feet below ground surface (ft bgs) near the source area drywell historically exceeded the Non-Residential Soil Remediation Level (SRL) for PCE of 13 milligrams per kilogram (mg/kg), with concentrations as high as 3,900 mg/kg.

During May 1989, ADEQ conducted a hazardous waste inspection of the Unichem property and collected several soil samples in the area of the drywell. Elevated cyanide concentrations observed in the soil samples triggered ADEQ to issue a Notice of Violation (NOV) in November 1989 that required Unichem to investigate potential contamination at the facility. The Site was placed on the WQARF Registry in June 2004 with an Eligibility & Evaluation Score of 33 out of a possible 120.

ERAs, initiated at the Site in 2006, included the installation and operation of an air sparge/soil vapor extraction (AS/SVE) system and a groundwater extraction and treatment system (GETS). The AS/SVE system was intended to decrease PCE

contamination in the vadose zone and groundwater at the former Unichem facility. The GETS was intended to hydraulically contain the PCE source area.

The AS/SVE system began operation in December 2008. Due to decreasing PCE mass removal rates, the AS/SVE system was shut down in August 2014. The SVE system was restarted in February 2016, operating in "pulse mode" (one month on followed by one month off). The AS/SVE system has removed approximately 4,800 pounds (lbs) of volatile organic compounds (VOCs) as of May 2017. The GETS operated from 17 September 2010 to 30 September 2014, treated over 193 million gallons of groundwater, and removed approximately 41 lbs of VOCs.

2.2 Site History

The following is a summary of Site history based on information from the RI Report.

Unichem purchased the property at 619 West Commerce Avenue in 1977 and constructed a facility to produce copper sulfate from scrap metal. Unichem discontinued operations at the Site prior to 1983. From July 1983 to March 1984, Aztec Resources, Inc. operated a gold extraction plant at the facility, using cyanide baths to extract gold from scrap materials and mine tailings. In 1988, the western portion of the facility was used as a vehicle testing station by Hamilton Testing Systems.

In 1989, ADEQ conducted a hazardous waste inspection of the Site and noted the presence of a triangular sump and drywell. An initial soil investigation was performed in 1990 by Simon Environmental Engineering that included drilling 24 soil borings to depths of up to 80 ft bgs. Maximum soil concentrations reported for PCE (1.4 mg/kg) exceeded the minimum Groundwater Protection Level (GPL) (1.3 mg/kg) but not the current Non-Residential SRL (13 mg/kg). The maximum arsenic concentration (37 mg/kg) exceeded the Non-Residential SRL (10 mg/kg) but not the minimum GPL (290 mg/kg). The maximum copper concentration (297 mg/kg) did not exceed the Non-Residential SRL of 41,000 mg/kg. Copper does not have an associated minimum GPL.

Approximately 20 cubic yards of contaminated soil were excavated from the triangular sump area in 1994. Three groundwater monitor wells (MW-101, MW-102, and MW-103) were installed at the Site to a depth of 165 ft bgs and an exploratory borehole was drilled through the center of the drywell to a depth of 99 ft bgs. Soil samples from the boreholes contained significant concentrations of PCE, with a maximum concentration of 24,000 mg/kg, collected at a depth of approximately 70 ft bgs. Groundwater samples collected from the three monitor wells contained PCE concentrations that ranged from 28 to 640 µg/L, exceeding the AWQS for PCE of 5 µg/L. A vapor extraction well (VW-104, later

referred to as SVE-104) was installed in the exploratory borehole; however, SVE was not performed at this time.

On 6 June 1995, the ADEQ Hazardous Waste Compliance Unit notified Simon New Mexico, Inc. of its intent to issue a consent order based on the violations observed during previous hazardous waste inspections. During 1996, groundwater monitoring performed at the Site detected PCE concentrations as high as 6,600 μg/L in monitor well MW-101, located north of the drywell.

In 2001, groundwater samples collected from TOG well G-9, located east of Cooper Road approximately 1,600 feet northwest of the Site, contained PCE detections above the AWQS of 5 μg/L. On 21 October 2002, the ADEQ Resource Conservation and Recovery Act (RCRA) Unit referred the Site to the ADEQ Superfund Section. In 2003, ADEQ installed two additional monitor wells, MW-104S and MW-104D to investigate groundwater impacts in the vicinity of TOG well G-9.

During soil assessments performed in 2000 and 2002, soil borings were observed to contain layers of clayey sand containing scattered green granules, presumably copper sulfate. The maximum copper concentration detected (6,200 mg/kg) was below Non-Residential SRL (41,000 mg/kg).

During 2006, ADEQ completed an ERA evaluation at the Site and installed extraction well EW-101, located northwest of the drywell, and several SVE wells. Based on the ERA evaluation, ADEQ determined the concentrations of PCE in the soil, soil vapor, and groundwater at the Site warranted operation of the AS/SVE and GETS remediation systems.

ADEQ installed six additional groundwater monitor wells off-site to assess the extent of the plume during 2007 and 2008. Concentrations of PCE indicated that the groundwater contamination extended north of Guadalupe Road.

In April 2008, ADEQ began construction of the AS/SVE and GETS ERAs. Initial start-up of the AS/SVE system occurred on 22 December 2008. The GETS began operation on 17 September 2010.

In June 2012, ADEQ drilled three borings in the immediate vicinity of the former drywell. Sample results indicated that PCE was still present at depth in the soil near the former drywell. Elevated PCE concentrations were reported in soil samples collected at 60 ft bgs (170 mg/kg) and 70 ft bgs (4,800 mg/kg). A soil sample from the same boring, collected at 30 ft bgs, had detections of arsenic (77 mg/kg) and copper (15,000 mg/kg);

however, only the arsenic detection was above the Non-Residential SRL. ADEQ installed two additional SVE wells in these borings, SVE-106 and SVE-107.

Between 2011 and 2013, ADEQ installed additional groundwater monitor wells to further delineate the extent of PCE contamination and estimate flow direction and hydraulic gradient. Shallow monitor wells were located near the center and in the southwest area of the groundwater plume. ADEQ also installed an additional deep monitor well, MW-119D, near SRP well 29E-1.5S located at the intersection of the SRP canal and Cooper Road. Initial samples from MW-119D detected PCE at concentrations at or above the AWQS, ranging from 4.2 to 7.2 µg/L.

The SVE system operated continuously through August 2014 with periodic shut downs for carbon change out and maintenance. The SVE system was shut down on 22 August 2014 due to decreasing PCE mass removal rates. The SVE system was restarted 1 February 2016, extracting from SVE-106 and SVE-107, to assess residual soil vapor contamination. The GETS was shut down on 30 September 2014 following several quarters of negligible VOC recovery.

2.3 Conceptual Site Model Summary

The following summarizes the Site hydrogeology and extent of contamination presented in the RI Report.

2.3.1 Site Hydrogeology

The Site is located within the East Salt River Valley Sub-Basin of the Phoenix Active Management Area (AMA). The sub-basin includes the Middle Alluvial Unit (MAU), the principal water-bearing unit, and the Upper Alluvial Unit (UAU), which is saturated in limited areas. The Site is directly underlain by fine-grained material, consisting of silts, clays, and sands to about 70 ft bgs, that overlies a coarse-grained sand and gravel sequence extending to a depth of approximately 270 ft bgs. The average depth to groundwater at the Site is approximately 110 ft bgs (Geosyntec, 2017). Figure 2 presents the groundwater elevations and contours for the shallow wells from the January 2017 monitoring event.

The UAU and the productive horizon in the MAU are separated by a several hundred foot thick clayey layer that serves as an aquitard. At monitor well MW-104D, the clay layer is approximately 480 feet and characterized as gravelly clay and clay. At monitor well MW-119D, the clay layer is approximately 245 feet thick and characterized primarily as a sandy lean clay. Low concentrations of PCE have been previously detected in the deep

monitor wells (e.g., MW-119D), indicating a possible hydraulic connection exists between the upper and middle aquifers at the Site. SRP well 29E-1.5S, located near MW-119D, is screened across both aquifers, possibly providing a direct conduit between the aquifers. Additionally, a downward vertical gradient exists between the two aquifers suggesting the potential for vertical migration of contaminants.

Currently, the groundwater flow direction is to the northwest, but was to the west and southwest prior to August 2012. Groundwater monitoring data does not indicate seasonal variation in flow directions. The observed fluctuations in groundwater flow may be due to regional groundwater pumping.

Although the RI Report referenced a hydraulic conductivity of 1,215 feet per day (ft/day), based on the limited pumping test performed in 2011, a review of these pumping test data indicate that the results may not be accurate for modeling over a regional scale. A 2015 groundwater model (Geosyntec, 2015) using PCE distribution and regional groundwater flow gradient from the 4th quarter 2014 groundwater monitoring event, achieved stable modeling results using a hydraulic conductivity of 450 ft/day. The groundwater model was updated in 2016 and is included in Appendix A.

2.3.2 Extent of Contamination

Site assessment activities indicated a release of PCE and TCE to the vadose zone at the former drywell that impacted groundwater below the former Unichem facility. The groundwater plume, as defined by the 5 μg/L PCE contour in January 2017, is approximately defined to the north by West Houston Avenue, to the south by the Neely Ranch Preserve, to the east by Neely Street, and to the west by McQueen Road. Figure 3 presents the PCE concentration isopleths from the January 2017 groundwater monitoring event. Based on the January 2017 groundwater monitoring results, TCE was not detected above the AWQS; however, PCE concentrations exceeded the AWQS in monitor wells MW-104S (19 μg/L), MW-104M (6.6 μg/L), MW-108 (6.9 μg/L), MW-109 (18 μg/L), MW-116 (5.3 μg/L), MW-120 (18 μg/L), MW-121 (7.8 μg/L), and G-9 (9.7 μg/L). Monitor well MW-110 had a PCE detection of 22 μg/L during the August 2016 monitoring event but was inaccessible during the January 2017 monitoring event. Metals, including arsenic and copper, were not detected above their respective AWQS.

Two additional monitor wells, MW-104M and MW-121, were installed in August and September 2016 in an attempt to delineate the western/northwestern edge and vertical extent of the PCE plume. During installation of the new wells, depth discrete groundwater samples were collected to assess the vertical extent of dissolved-phase VOC concentrations. Monitor well MW-121 was installed at the prior northwestern edge of

the plume and MW-104M was installed at the approximate center of the plume. Based on the August/September 2016 groundwater monitoring event, the vertical extent of the plume appears to be delineated. However, based on the January 2017 groundwater monitoring event, the western/northwestern edge of the PCE plume may require further delineation by the installation and sampling of additional groundwater monitoring well(s) if follow up sampling indicates an increasing trend in PCE concentrations or sustained PCE impacts above 5 µg/L.

During November 2016, two soil borings were drilled near the former drywell to assess remaining VOC concentrations present in soil and soil vapor after SVE operation (Appendix B). TCE was not detected above laboratory reporting limits in the soil and soil vapor samples. PCE detections in soil samples ranged from 12 to 77 mg/kg, exceeding the Non-Residential SRL of 13 mg/kg and the Minimum GPL of 1.3 mg/kg. Elevated PCE detections were observed in deeper soil and soil vapor samples collected from the two soil borings, ranging from approximately 65 to 70 feet. Soil vapor samples were compared to Site-specific soil vapor screening levels, calculated using the Johnson & Ettinger (J&E) subsurface vapor intrusion model, to assess potential vapor intrusion and groundwater impacts. The soil vapor results were below the Site-specific screening levels for both vapor intrusion and groundwater impacts.

Previous Site investigations indicate that while arsenic was initially considered a COC, there was no spatial pattern to the arsenic concentrations that would be consistent with a release and arsenic concentrations do not appear to be Site-related. Additionally, the RI Report and the ROs Report state that there is no spatial pattern to arsenic concentrations that would be consistent with a release and rather appears to be naturally occurring. However, a soil sample collected from a boring (B-1W) advanced in the vicinity of the former drywell contained arsenic at a concentration of 77 mg/kg at a depth of 30 ft bgs exceeding the Non-Residential SRL of 10 mg/kg. Soil samples collected above and below this depth interval from the boring were not analyzed for metals. Groundwater samples have had historic exceedances of the arsenic AWQS (10 µg/L) but were attributed to arsenic being a naturally occurring constituent that is not Site-related.

In several soil samples collected near the former drywell, green staining was observed that was presumably copper sulfate. Copper concentrations were below Non-Residential SRL (41,000 mg/kg). Copper has not been detected in groundwater samples collected at the Site at concentrations exceeding the AWQS (1,300 µg/L) since 2006.

Prior Site investigations conducted as part of the RI did not analyze soil samples collected from the vicinity of the former drywell for metals (e.g., arsenic and copper) except for at a depth of approximately 30 ft bgs. The soil sample collected from 30 ft bgs contained

arsenic and copper at concentrations exceeding the Residential and Non-Residential SRLs for arsenic and the Residential SRL for copper. Additional soil sampling in the vicinity of the former drywell is required to evaluate the vertical extent of arsenic and copper concentrations to confirm that the previously detected concentrations of arsenic and copper are isolated and do not pose a risk to on-site receptors.

2.3.3 Risk Evaluation

A risk evaluation documented in the RI Report assessed COCs and potential exposure pathways present at the Site. The soil, soil vapor, and groundwater monitoring results at the former Unichem facility, as well as the downgradient groundwater impacts to the west and north of the Site, were included in the evaluation. Four components of exposure pathways were evaluated, including source of release, retention of transport media, exposure point, and exposure route. The risk evaluation assessed COCs PCE and TCE in groundwater and PCE, arsenic, and copper in source area soils.

The risk evaluation concluded that the use of the UAU as a drinking water source would be unacceptable within the Site's boundaries. The findings were based on the highest groundwater concentrations of PCE (59 μg/L) and TCE (15 μg/L) observed at the Site in 2013. These concentrations were both detected in UAU monitoring well MW-106. The MAU is the principal water-bearing unit and is used as a drinking water source in the area of the Site, but is separated from the UAU by a several hundred foot thick clayey layer that serves as an aquitard as identified in the RI Report. No exceedances of AWQSs from wells producing drinking water from the MAU have been reported at the Site.

The risk evaluation concluded that no formal risk characterization for exposure to contaminated soil was warranted at the source property as no surface soil samples exceeded Non-Residential SRLs for analyzed compounds.

The risk evaluation concluded that any risk due to soil vapor would be negligible outside of an enclosed space due to atmospheric mixing, and that no buildings were close enough to measured soil vapor concentrations to quantitatively estimate risk. There could be a future potential for health risks caused by soil vapor intrusion were a building constructed in close proximity to measured concentrations of PCE, but the theoretical risk would vary depending on the specific location of the hypothetical building. During November 2015, a shallow soil vapor survey was performed around the main building at the Site to evaluate potential risk to current commercial workers via the vapor intrusion pathway. The evaluation was conducted following risk evaluation guidance for industrial sites. This evaluation was conducted separately from the risk evaluation included in the RI

Report. The results of the 2015 soil vapor survey indicated no excess health risk for commercial Site workers (Geosyntec, 2016).

2.4 Early Remedial Actions

ERAs for the Site were initiated in 2006 and included installation and operation of an AS/SVE system and GETS. The AS/SVE system was implemented to address PCE contamination in the vadose zone and groundwater at the former Unichem facility. The GETS was designed to provide hydraulic containment of the PCE source area. Figure 4 presents the layout of the AS/SVE system and GETS. The following is a description of the ERAs, which form the basis of the FS for the vadose zone and groundwater remediation.

2.4.1 AS/SVE System

The SVE system consists of a skid-mounted vacuum blower system with 300 standard cubic feet per minute capacity, and two 2,000-pound vapor-phase granular activated carbon (VGAC) vessels connected in series for removal of the VOCs from the extracted soil vapor. The SVE system was initially connected to two AS/SVE wells (AS/SVE-101 and AS/SVE-102) during a pilot test performed in August 2007. These SVE wells are screened from 40 to 110 ft bgs.

Additional wells were installed by ADEQ and connected to the SVE system to maximize VOC mass removal. SVE-104 (originally referred to as VW-104) was installed in 1994 within the former drywell and screened from 5 to 50 ft bgs. SVE-105 was installed in November 2010 in the area of a suspected surface spill and screened from approximately 5 to 50 ft bgs. In 2012, SVE-106 was installed approximately five feet southwest of SVE-104 and SVE-107 was installed approximately 10 feet northeast of SVE-104. SVE-106 is screened from 50 to 60 ft bgs and SVE-107 is screened from 60 to 65 ft bgs. SVE-107 was initially used as a vent well but was connected to the SVE system in August 2013. Three 0.5-inch diameter nested vapor monitoring points (VP-101, VP-102, and VP-103) were installed during April 2006 to monitor the vadose zone soil vapor and to collect information to facilitate the design of the SVE system.

The initial start-up for the AS/SVE system occurred on 22 December 2008 and the system was in continuous operation from 6 July 2009 through 22 August 2014 with periodic shut-downs for carbon change out, maintenance, and repair. The system was shut down due to decreasing PCE mass removal. After changing out the VGAC vessels, the SVE system was restarted on 1 February 2016, extracting from SVE-106 and SVE-107. The system was shut down on 3 March 2016 for rebound testing and is currently operating in “pulse

mode" (approximately one month on followed by one month off). Cumulative PCE recovery through May 2017 was approximately 4,800 lbs.

2.4.2 Groundwater Extraction and Treatment System

The groundwater extraction well EW-101 was installed in March 2006 to a total depth of 260 ft bgs and screened from 125 to 185 ft bgs. Pump tests were performed during September and October 2007. The pump intake was initially set at approximately 170 ft bgs. Discrete depth samples indicated higher PCE concentrations at 122 to 124 ft bgs. During December 2013, the pump intake was raised to 145 ft bgs in an effort to maximize VOC mass removal.

Groundwater was continuously extracted from the underlying aquifer via EW-101 at an average design flow rate of 150 gallons per minute (gpm). Two 5,000 lbs liquid-phase granular activated carbon (LGAC) vessels connected in series treat the influent water for VOC removal. The treated water then passes through a second bag filter to polish the treated water of particulate matter prior to discharge into the SRP Western Canal (used for irrigation) or a nearby TOG sanitary sewer manhole.

The GETS was started 17 September 2010 and was in operation until system shut down on 30 September 2014 due to exceedingly low VOC mass removal. Through September 2014, the GETS treated a cumulative total of over 193 million gallons of groundwater and removed approximately 41 lbs of VOCs.

3. FEASIBILITY STUDY SCOPING

The following presents the regulatory requirements of pertinent statutes and rules, delineation of the remediation areas, and the ROs identified by ADEQ.

3.1 Regulatory Requirements

Per A.R.S. §49-282.06, the following factors must be considered for selecting remedial actions:

- Population, environmental, and welfare concerns at risk;
- Routes of exposure;
- Amount, concentration, hazardous properties, environmental fate, such as the ability to bio-accumulate, persistence and probability of reaching the waters of the state, and the form of the substance present;

- Physical factors affecting environmental exposure, such as hydrogeology, climate, and the extent of previous and expected migration;

- The extent to which the amount of water available for beneficial use will be preserved by a particular type of remedial action;

- The technical practicability and cost-effectiveness of alternative remedial actions applicable to a site; and

- The availability of other appropriate federal or state remedial action and enforcement mechanisms, including funding sources established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to respond to the release.

A.A.C. R18-16-407(A) states that an FS is a process to identify a reference remedy and alternative remedies that appear to be capable of achieving ROs and to evaluate the remedies based on the comparison criteria to select a remedy that complies with A.R.S. §49-282.06.

3.2 Delineation of Remediation Areas

The following subsections discuss the delineation of impacts to the vadose zone and groundwater at the Site, as well as the uncertainties associated with the delineations.

3.2.1 Vadose Zone

The disposal practices from industrial operations at the Site resulted in soil impacted by PCE and TCE. The main source of contamination appears to be a drywell that was constructed on the property in 1977 in a triangular-shaped sump near the center of the concrete pavement that served as a foundation for the processing plant. Prior soil investigations indicate that copper concentrations in soil in the source area of the Site are below the Non-Residential SRL. The highest detected copper concentrations have been in the vicinity of the former drywell at a depth of 30 ft bgs. The RI Report considers arsenic concentrations in soils at the Site to be background with the exception of a detection of arsenic at a depth of 30 ft bgs in a boring advanced in the vicinity of the former drywell.

In November 2016, two soil borings were drilled near the former drywell to assess VOC concentrations present in the soil and soil vapor after SVE operation. A description of the field activities and soil and soil vapor results is included in Appendix B. PCE results

for the soil samples range from less than reporting limits for the shallower depths (approximately 38 to 42 ft bgs) to 12 to 77 mg/kg at depths of approximately 65 to 70 ft bgs (shallow zone water level is approximately 100 to 110 feet bgs). The analytical results of the deeper soil samples exceed the Non-Residential SRL for PCE of 13 mg/kg. Soil vapor samples were compared to Site-specific screening levels to assess for potential vapor intrusion and groundwater impacts. The soil vapor screening levels are calculated using the J&E subsurface vapor intrusion model. For vapor intrusion, the screening levels are derived from carcinogenic and non-carcinogenic EPA indoor air RSLs for commercial/industrial exposure scenarios. For potential groundwater impacts, screening levels are based on the Minimum GPLs, converted to soil vapor units. The soil vapor results are below the Site-specific screening levels for vapor intrusion and groundwater impacts.

3.2.2 Groundwater

The Site is composed of two distinct alluvial units, the UAU and MAU. The UAU lies above the MAU and the two are separated by a several hundred foot thick clayey layer that acts as an aquitard per the RI Report, limiting the ability of groundwater to flow between the alluvial units. Regular groundwater monitoring since 2014 shows that COC exceedances of AWQSs are currently limited to the UAU. TOG-15, the only TOG drinking water production well currently within the Site, is screened in the MAU and not known to be impacted from Site COCs above AWQS. Remedies described in the FS Report are therefore focused on the UAU. Cross-sectional figures from the RI Report depicting the UAU, MAU, and production well TOG-15 are included in Appendix C.

The 2016 updated groundwater model (Appendix A), based on the PCE distribution and regional groundwater flow gradient from the August/September 2016 groundwater monitoring, estimates PCE plume extent over time using a hydraulic conductivity of 450 ft/day and a storage coefficient of 0.0049. The groundwater gradient is assumed to be 0.00056 feet per feet (ft/ft) to the northwest based on the average hydraulic gradient as reported in the RI Report. The model is evaluated with a one million gallon per day (mgd) infiltration rate and a three mgd rate for the infiltration ponds located to the south of the Site. The modeled results depict slow migration of the existing PCE impacts to the northwest partially contributing to the dilution and dispersion of PCE impacts, with concentrations declining to less than 10 μg/L within approximately nine years and less than 5 μg/L within approximately 18 years.

Model results indicate that groundwater extraction from production well R-1, assuming a 300 gpm constant flow rate, would have minimal influence on regional groundwater flow direction, and would not significantly affect migration of VOCs from the Site.

However, regional groundwater gradients have fluctuated significantly over the past decade, likely due to shifts in broader groundwater production patterns in the region.

The extent of the PCE plume based on January 2017 groundwater monitoring results is presented in Figure 3. Results from the updated groundwater model are included in Appendix A.

3.3 Remedial Objectives

The ROs for the Site were developed by ADEQ pursuant to A.A.C. R18-16-406(I). ROs are established for the current and reasonably foreseeable uses of land and waters of the state that have been or are threatened to be affected by a release of a hazardous substance. Pursuant to A.A.C. R18-16-406(D), it is specified that reasonably foreseeable uses of land are those likely to occur at the Site and the reasonably foreseeable uses of water are those likely to occur within one hundred years, unless Site-specific information suggests a longer time period is more appropriate.

Reasonably foreseeable uses are those likely to occur, based on information provided by water providers, well owners, land owners, government agencies, and others. The ROs are based on land and water use study questionnaires collected in 2013 and the solicitation of proposed ROs during the comment period of the draft RI Report in 2014. The land and water use questionnaires are included in Appendix J of the RI Report. Not every use identified in the land and water use questionnaires will have a corresponding RO, based on whether or not the use is reasonably foreseeable.

The ROs are stated in the following terms: (1) protecting against the loss or impairment of each use; (2) restoring, replacing, or otherwise providing for each use; (3) when action is needed to protect or provide for the use; and (4) how long action is needed to protect or provide for the use.

3.3.1 ROs for Land Use

Based on the current zoning maps provided by the TOG, the source area is zoned as General Industrial. The PCE groundwater plume underlies an area that is a mix of industrial, commercial, and residential land uses. Responses in the land and water use study questionnaire, presented in Appendix J of the RI Report, indicate that there are no immediate plans to change the land use or zoning for the areas within and adjacent to the Site.

The ROs state that soil conditions are to be restored to the remediation standards for intended end use specified in A.A.C. R18-7-203 (specifically, background remediation standards prescribed in A.A.C. R18-7-204, predetermined remediation standards prescribed in A.A.C. R18-7-205, or Site-specific remediation standards prescribed in A.A.C. R18-7-206) that are applicable to the hazardous substances identified. This action is needed for the present time and for as long as the level of contamination in the soil threatens its intended use.

As long as soil concentrations exceed the PCE Non-Residential SRLs, remedial actions must be taken to prevent exposure to contaminants. Additionally, remedial action needs to be taken for arsenic and copper as long as the soil concentrations in place exceed the predetermined Non-Residential SRLs.

3.3.2 ROs for Groundwater Use

The Site lies within the Phoenix AMA, which was created by the Arizona Groundwater Management Code passed in 1980 and covers approximately 5,646 square miles in central Arizona. All groundwater withdrawn from any AMA must occur under a groundwater right or permit, unless groundwater is being withdrawn from an exempt well.

The TOG operates seven non-exempt wells within and near the Site, SRP owns three non-exempt wells, and ADEQ owns one, as follows:

- TOG#15 (Arizona Department of Water Resources [ADWR] 55-542431) is a drinking water supply well located approximately 2,700 feet downgradient from the former Unichem facility at the southwest corner of West Guadalupe Road and North Cooper Road, within the Site boundaries. The well is screened in the MAU (non-impacted alluvial unit) and is jointly operated by SRP and identified by SRP as well 29E-1.0S.

- A non-exempt production well (ADWR 55-541861) was formerly designated as TOG#15 but has been replaced by the well described above. The former TOG#15 well has not been pumped in roughly a decade and does not currently have a pump installed. However, the well has not been capped or abandoned, and is located approximately 4,000 feet northwest (downgradient) from the former Unichem facility.

- Non-exempt TOG drinking water supply well, TOG#14 (ADWR 55-534889), is located roughly 2,600 feet southeast of the Site, along the Union Pacific Railroad corridor between North Neely Street and North Gilbert Road. TOG#14 is not

within the Site boundary and upgradient from groundwater contamination at the Site.

- Several non-exempt wells are operated by the TOG in the Site vicinity that are used for recovery of recharged water for irrigation and recreational uses and groundwater monitoring. These are R-1 (ADWR 55-595204), located about 4,000 feet west of the former Unichem facility and currently outside of the Site boundary; G-7 and G-8 (ADWR 55-524081 and 55-524082, respectively), located just southeast of the former Unichem facility outside of the Site boundary; and G-10 (ADWR 55-539954), located outside of the Site boundary just south of the former Unichem facility. Non-exempt well R-1 is used to supply water to local recreational ponds and is located downgradient from the former Unichem facility. Non-exempt well G-10 is cross-gradient and G-7 and G-8 are upgradient. PCE was detected at a concentration of 2.1 µg/L in TOG well R-1 when sampled in August 2016, but is scheduled to be replaced in 2018. Due to groundwater contamination at the Site, TOG limits the pumping of groundwater recovery wells G-7, G-8, and G-10.

- SRP has three non-exempt groundwater supply wells used for irrigation, recreational, and municipal supply in the vicinity of the Site: 29E1.0S (TOG#15, ADWR 55-542431), 29E-1.5S (ADWR 55-617105), and 29E-2.0S (ADWR 55-617104). Based on the response in the land and water use study questionnaire sent to SRP, there are no current plans for further development of infrastructure or groundwater resources in the vicinity of the Site.

- EW-101 is the extraction well owned by ADEQ and was part of the GETS ERA.

The ROs for regional groundwater at the Site are to protect, restore, or otherwise provide a water supply for potable or non-potable use by currently impacted, municipal, domestic, agricultural/irrigation and recreational well owners within or near the Site if the current and reasonably foreseeable future uses are impaired or lost due to Site contamination. Remedial actions will be in place for as long as a need for the water exists, the resource remains unavailable, and the contamination associated with the Site prohibits or limits the use of groundwater for its intended end use.

Although shallow groundwater is not currently used as a drinking water source, future use of shallow groundwater at the Site could be as a drinking water source. As long as groundwater concentrations exceed the PCE and TCE AWQS, remedial actions must be taken at the appropriate time to prevent exposure to contaminants.

3.3.3 ROs for Surface Water Use

The land and water use evaluation section of the RI Report identified no uses of surface water in the area of the Site. Therefore, there are no ROs required for surface water.

4. IDENTIFICATION AND SCREENING OF REMEDIATION TECHNOLOGIES

This section provides a detailed discussion of the identification and screening of remediation technologies for potential implementation at the Site. Technologies are identified and screened separately for remediation of the vadose zone and groundwater.

4.1 Screening Criteria and Assumptions

Remediation technologies that would meet Site ROs and comply with requirements of A.A.C. R18-16-407 and A.R.S. §49-282.06 were identified and screened according to the following criteria:

- Contaminant treatment effectiveness;
- Constructability;
- Flexibility/expandability;
- Operations and maintenance (O&M) requirements;
- Operational hazards; and
- Cost-effectiveness

The remediation technologies that pass the technology screening were retained for use in development of the reference remedy and alternative remedies described in Section 5. The following were assumed during the identification and screening of remedial technologies:

- PCE at a concentration of 18 to 19 µg/L in groundwater near monitor wells MW-104S, MW-109, and MW-120;
- Low level TCE concentrations continue to be below the TCE AWQS of 5 µg/L;
- PCE is still present in the vadose zone near the former drywell; at approximately 70 ft bgs, soil concentrations are greater than Non-Residential SRLs; and
- Copper and arsenic were present in the vadose zone near the former drywell; at approximately 30 ft bgs, soil concentrations are greater than the Residential and Non-Residential SRLs for arsenic and the Residential SRL for copper.

4.2 Screening of Treatment Technologies

Technologies are described below that are commonly used for remediation of chlorinated hydrocarbons or metals. The basic treatment mechanisms and the suitability and limitations of the technologies are discussed. An initial screening is presented below for each technology for applicability to Site conditions, plume extent, and VOC , arsenic, and copper concentrations. Those technologies that are potentially applicable were then evaluated in detail using the technology screening criteria discussed above. The results of the initial technology screening are summarized in Table 1.

4.2.1 Soil Vapor Extraction

SVE is a well-established remedial technology for treatment of VOCs in the vadose zone. SVE involves the installation of SVE wells in impacted vadose zone soil and applying vacuum to pull soil vapors containing VOCs from the vadose zone. The extracted soil vapor can then be discharged to the atmosphere following treatment as necessary to remove VOCs, depending on the quantity emitted and local regulations.

An SVE system was operated at the Site as an ERA from July 2009 through August 2014 and removed approximately 4,600 lbs of VOCs. The SVE system consists of a skid-mounted vacuum blower and two 2,000-pound VGAC vessels connected in series for VOC removal. The SVE system extracts soil vapor through a network of six extraction wells: AS/SVE-101, AS/SVE-102, SVE-104, SVE-105, SVE-106, and SVE-107. SVE was effective at removing VOC mass from the subsurface and was shut down due to decreasing PCE mass removal rates. The SVE system was restarted in February 2016 to assess rebound conditions. As the SVE system was successful in cost effectively removing VOC mass from the vadose zone, SVE is retained as a treatment technology for remediating impacted soil and soil vapor at the Site.

4.2.2 Air Sparging

Air sparging involves using an air compressor to inject air into sparge wells, which are screened below the water table to volatilize contaminants into the unsaturated zone. Air sparging can enhance SVE remediation by increasing contaminant mass removal from the saturated zone.

Air sparging was performed in conjunction with the SVE system from July 2009 through August 2014 using wells AS/SVE-101 and AS/SVE-102. Currently, the majority of VOC mass is located in the fine-grained clayey interval above the water table, at approximately 70 ft bgs. Air sparging would provide no meaningful improvement in treatment of these

residual impacts or on the low-level VOCs currently in groundwater in the vicinity of the SVE/air sparging system. Air sparging is typically best suited to enhancing the volatilization of high concentration VOC impacts beneath the water table. All remaining groundwater VOC impacts are low concentration, dissolved phase impacts, with a deep groundwater table. Based on these factors, air sparging will not be cost-effective or improve treatment due to low groundwater concentrations and residual VOC mass in clay interval; therefore, air sparging has been eliminated from further consideration.

4.2.3 Institutional Controls

Institutional controls such as a land use restriction are commonly utilized for sites where residual soil impacts may exist and the future use of a property is likely to be commercial or industrial. Institutional controls can consist of items such as a deed restriction limiting the use of a property to non-residential development and/or the utilization of an engineering control. A.R.S. §49-152 allows for the use of an institutional control consisting of a deed restriction through the implementation of a Declaration of Environmental Use Restriction (DEUR) for facilities that have residual impacts above the Residential SRLs but below the Non-Residential SRLs. If soil impacts were to remain in place above Non-Residential SRLs, an engineering control would also need to be implemented. The use of an institutional control can be a cost-effective means of obtaining site closure. As the source area of the Site is currently zoned General Industrial and is not anticipated to change, the use of an institutional control by the implementation of a DEUR is feasible to address residual arsenic and copper impacts (and potentially VOC impacts) within the vicinity of the former drywell and is retained for further consideration.

4.2.4 Groundwater Extraction and Treatment

A groundwater extraction and treatment system (i.e., GETS) is a technology for groundwater remediation that can be effective for hydraulic containment and/or migration control for sites impacted by VOCs. Extraction and treatment systems typically utilize submersible pumps in extraction wells to extract groundwater and transfer it via conveyance piping into an aboveground treatment system. The post-treatment water is subsequently discharged to a municipal sewer, a canal or other surface water, an infiltration basin, or re-injected into the subsurface with an injection well. These systems can control the subsurface flow of impacted groundwater, mitigating migration and/or reducing the footprint of the impacts. LGAC is typically employed for VOC removal via adsorption onto the media surface.

The GETS that operated at the former Unichem facility from September 2010 through September 2014 extracted a total of 193 million gallons of groundwater and removed approximately 41 lbs of VOCs from groundwater, with exceedingly low VOC mass recovery over time.

As a dissolved-phase plume treatment alternative, GETS is not as effective due to the lower groundwater VOC concentrations, larger plume area, and additional extraction wells that would be needed to treat the remaining VOC plume. Regardless, extraction and treatment is widely used and is proven as a component for treatment of groundwater impacts. This measure is highly implementable with respect to both the design and operation of a treatment system, and is amenable to the hydrostratigraphy of the Site. Therefore, extraction and treatment is retained as a remedial measure for additional evaluation.

4.2.5 Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) uses natural processes occurring in groundwater to reduce contaminant concentrations over time. These processes include dilution, dispersion, sorption, volatilization, chemical or biological stabilization, transformation, and biological degradation. Of these processes, reductive dechlorination (using biological and/or abiotic degradation processes) is usually the most significant process for natural reduction in chlorinated VOC concentrations, including PCE and TCE, where favorable conditions are present. However, the January 2017 groundwater monitoring parameters indicate aerobic, slightly oxidizing conditions, which would limit the potential for biologically mediated reduction of PCE and TCE. Other abiotic MNA processes (e.g., dilution, dispersion, and sorption) were evaluated as part of the 2016 updated groundwater model and results predict that MNA processes will result in PCE concentrations decreasing to less than 5 μg/L within approximately 18 years without the presence of an ongoing source of new VOC impacts to groundwater. MNA is retained as a treatment technology for Site groundwater.

4.2.6 Enhanced Reductive Dechlorination

Enhanced reductive dechlorination (ERD) involves stimulation or augmentation of indigenous microbial populations to expedite the anaerobic biodegradation (reductive dechlorination) of chlorinated VOCs through injections of electron donor (e.g., sodium lactate or emulsified vegetable oil). In the presence of sufficient electron donor, natural microbial activity will produce the required anaerobic conditions conducive to reductive dechlorination. If a sufficient population of bacteria capable of completely degrading PCE and its daughter products are not naturally present, the natural bacterial population

can be augmented with a consortia of naturally-occurring bacteria capable of completely degrading PCE and its daughter products.

Successful implementation of ERD includes adequate spatial distribution of the electron donor to achieve strongly reducing conditions; a microbial community capable of complete reductive dechlorination; groundwater pH greater than 5.5 and less than 9.0; sufficient concentration of chlorinated VOCs to support the growth of the microbial culture (typically a minimum of 100 μg/L); absence of high concentrations of inhibitory constituents; and low concentrations of competing electron acceptors, such as sulfate and nitrate. If these conditions are not initially present in an aquifer, measures must be taken to alter conditions to become conducive to active reductive dechlorination. Although reduction can be ultimately stimulated in most aquifers, the greater the initial deviation from these ideal conditions, the more difficult and costly ERD will be to implement.

Groundwater at the Site is generally aerobic and would require significant amounts of electron donor to become sufficiently reducing. Given the size of the plume and the relatively low contaminant concentrations, significant amounts of bacterial culture would be required to establish the necessary bacterial population for successful ERD at the Site.

Although ERD is potentially capable of achieving the applicable ROs for the Site, there are challenges posed by the predominantly aerobic groundwater conditions, the low PCE concentrations, the low groundwater flow velocity, the depth to groundwater, and the size of the plume. ERD would be prohibitively costly as a treatment alternative for the overall plume; however, ERD may be effective as a treatment for targeted areas in combination with other treatment methodologies. Therefore, ERD is retained as a potential contingent remedial alternative should conducive future conditions warrant.

4.2.7 In Situ Chemical Reduction

In situ chemical reduction (ISCR) can abiotically reduce VOC concentrations by chemically breaking the bonds within the VOC molecules using chemical reductants, such as zero valent iron (ZVI). ZVI can also be combined with an electron donor to promote concurrent biotic and abiotic reduction of VOCs. However, this technology is most suited for high concentration source-zone remediation or permeable reactive barrier (PRB) applications. Due to the slow migration rate of the groundwater at the site, a permeable reactive barrier would have no significant impact on the overall timeline of groundwater remediation. Given the thickness of the impacted groundwater zone, and the depth to groundwater, installation of a PRB would be both technically and economically infeasible. Based on these limitations, this technology was not retained for further consideration.

4.2.8 In Situ Chemical Oxidation

In situ chemical oxidation (ISCO) relies on injection of a powerful oxidizing agent to oxidize VOCs. Several oxidants are available and have been proven effective for chlorinated VOCs, including persulfate, permanganate, and modified Fenton's reagent. These oxidants are considered effective for oxidizing PCE and its biological degradation products, TCE, cis-1,2-dichloroethene, and vinyl chloride (Interstate Technology & Research Council [ITRC], 2005). The oxidant is generally delivered to the site in concentrated formulations or as solids, mixed in the field, and then injected through injection wells or temporary injection points. It is capable of rapidly reducing high concentration VOCs and well-suited for targeted remediation of small source areas. However, these strong oxidants can be dangerous to handle and can potentially result in unintended changes to aquifer geochemistry.

Although ISCO is potentially capable of achieving the applicable ROs for the Site, there are challenges posed by the high cost of the chemical oxidant, relatively small radius of influence of each ISCO injection, size and depth of the plume, and low concentrations of VOCs. ISCO would be prohibitively costly as a treatment alternative for the overall plume; however, ISCO may be effective as a treatment for targeted areas in combination with other treatment methodologies. Therefore, ISCO is retained as a potential contingent remedial alternative should conducive future conditions warrant.

5. DEVELOPMENT OF REFERENCE REMEDY AND ALTERNATIVE REMEDIES

Using the retained remedial technologies, a Reference Remedy has been developed along with two alternative remedies (the More Aggressive and the Less Aggressive Remedies). The Reference Remedy and each alternative remedy consist of remedial strategies and actions (remedial measures) to achieve ROs for the Site.

Remedial strategies may incorporate more than one remediation technology or methodology. As provided in A.A.C. R18-16-407(F), remedial strategies for consideration may include:

- Plume remediation to achieve water quality standards for COCs in waters of the state throughout the Site;
- Physical containment to contain contaminants within definite boundaries;
- Controlled migration to control the direction or rate of migration, but not necessarily to contain migration of contaminants;
- Source control to eliminate or mitigate a continuing source of contamination;
- Monitoring to observe and evaluate the contamination at the Site through the collection of data; and
- No action.

For the vadose zone, potential remedies consider future land use and potential risk exposure through vapor intrusion or impacts to groundwater. For groundwater, each alternative remedy has been identified with consideration of the needs of the water providers (TOG and SRP) and their customers, including the quantity and quality of water, water rights, other legal constraints, and operational implications. Where remedial measures are necessary to achieve ROs, the remedial measures will remain in effect as long as required to ensure the continued achievement of those objectives.

The Reference Remedy and each alternative remedy may also include contingent remedial measures to address reasonable uncertainties regarding the achievement of ROs, or uncertain timeframes in which ROs will be achieved. The Reference Remedy and the alternative remedies are described below.

5.1 Reference Remedy

The Reference Remedy for VOCs includes a combination of continued SVE operation in the vadose zone source area and downgradient MNA for groundwater to achieve Site ROs. The Reference Remedy for arsenic and copper in source area soils includes additional assessment to delineate the vertical extent of impacts in the former drywell area, updated risk evaluation, and potential institutional controls to achieve Site ROs. The remedial strategies for the vadose zone and groundwater Reference Remedy are:

- Physical containment to contain contaminants within definite boundaries;
- Source control to eliminate or mitigate a continuing source of contamination;
- Plume remediation to achieve water quality standards for COCs in waters of the state throughout the Site; and
- Monitoring to observe and evaluate the contamination at the Site through the collection of data.

Reference Remedy for Arsenic and Copper

Pursuant to A.A.C. R18-16-407C., an analysis of alternative remedies is not required for remedies addressing only soil. Since arsenic and copper impacts were identified in the RI in the former drywell area at 30 ft bgs that were not attributed to background, this FS presents a Reference Remedy only for arsenic and copper in soil. The Reference Remedy for arsenic and copper in soil is included in the More Aggressive Alternative Remedy and the Less Aggressive Alternative Remedy for costing and comparative purposes.

Additional delineation of arsenic and copper in source area soils is needed to update the risk evaluation for these metals. Should the evaluation indicate a potential exposure pathway and risk above target carcinogenic and/or non-carcinogenic levels, the Reference Remedy for arsenic and copper in source area soils will include institutional controls consisting of a DEUR. A DEUR for arsenic and copper is compliant with A.R.S. §49-152 and A.A.C R18-7-208 for soil impacts within source area soils (i.e., former drywell area). As the source area of the site is currently zoned General Industrial and is not anticipated to change, a DEUR restricting development as residential is feasible and would meet the ROs for soil by achieving predetermined Non-Residential SRLs prescribed in A.A.C R18-7-205 or potential Site-specific remediation standards developed pursuant to A.A.C. R18-7-206.

Copper has not been detected in groundwater samples collected at the Site at concentrations exceeding the AWQS since 2006. Additionally, according the RI Report and ROs Report, arsenic concentrations in groundwater have been attributed to naturally occurring background conditions. As arsenic and copper concentrations in the prior soil sample collected at a depth of 30 ft bgs in the vicinity of the former drywell do not appear to be impacting groundwater, a risk based assessment of the soil impacts, potential alternative soil cleanup levels, and/or implementation of a DEUR are technically acceptable and have been utilized at similar sites in Arizona. Removal of arsenic and copper impacted soils at depths of up to 30 ft bgs (or more) would impact current site activities and are not technically justifiable given the apparent nature of the current impacts, lack of associated contribution to groundwater impacts, and the regulatory framework allowed by Arizona rules and regulations.

A DEUR, if warranted, is consistent with the requirements of A.R.S. §49-282.06. This Remedy assures the protection of public health and the environment by limiting the type of activities that may be conducted at a site reducing the potential for future exposure. A DEUR also provides for the management of residual impacts in place and is a reasonable, cost effective, technically feasible, and regulatory accepted alternative to other potential remedies such as the removal of the arsenic and copper impacts at depth.

Reference Remedy VOCs

The vadose zone VOC remediation area is generally limited to the area around the former drywell; therefore, the remedial measures focus on controlling residual VOC impacts and continued removal of VOC mass, as well as routine monitoring of the SVE system. The remedial measures for the vadose zone Reference Remedy for VOCs include:

- Continued operation of the existing SVE system, using VGAC to treat the extracted soil vapor;
- Continued operational monitoring to assess remedial progress and system performance; and
- Performing soil and soil vapor confirmation sampling near the former drywell.

Continued operation of the SVE system will provide source control through the removal of VOC mass in the vadose zone, which will mitigate the potential for vapor intrusion and ongoing groundwater impacts from the residual VOCs within the vadose zone. The SVE system will continue to be operated in pulse mode (approximately one month on, followed by one month off) for up to five years. SVE system optimization will be

conducted throughout the five-year period and operational schedules may be adjusted to enhance VOC removal. Operation of the current SVE system removes less than 0.5 lbs of VOCs per day and has removed over 4,800 lbs of VOCs since 2009.

As a vadose zone contingency for the VOC Reference Remedy, if VOC results from the soil and soil vapor confirmation sampling are greater than Non-Residential SRLs, minimum GPLs, or Site-specific soil vapor screening levels, then the SVE system may be expanded (similar to the More Aggressive Remedy described in Section 5.2) and/or operated for an additional five years. If the confirmation sample results are below the applicable action levels, then the SVE system will be shut down for rebound testing (similar to the Less Aggressive Remedy described in Section 5.3).

As an additional vadose zone contingency for VOCs, if soil results from the confirmation sampling are greater than Non-Residential SRLs and/or minimum GPLs, a Site-specific risk assessment may be performed to evaluate potential carcinogenic and non-carcinogenic risks via exposure pathways for commercial/industrial workers. If exposure risks are below target cancer risk of 10^{-6} and target noncancer hazard of 1, then the SVE system would be shut down for rebound testing.

Operation of the SVE system will require continued compliance with the Maricopa County Air Quality Department (MCAQD) air permit for the SVE system operation, along with quarterly SVE performance testing and reporting. O&M measurements will be used to assess system performance.

The groundwater Reference Remedy will monitor and document the natural attenuation of groundwater VOC concentrations over time through MNA. Due to the aerobic conditions in the groundwater, MNA processes such as dilution, dispersion, volatilization, and sorption are likely to be the dominant mechanisms for concentration reductions in the VOC plume over time. The remedial measures for MNA include:

- Installation of up to two downgradient groundwater monitor wells to delineate the extent of the PCE plume to the northwest/west;

- Continued semiannual groundwater monitoring of the current groundwater monitor well network and the additional downgradient well(s) to evaluate plume stability and PCE concentration trends; and

- Continued semiannual groundwater elevation measurements to evaluate flow direction and hydraulic gradient.

Semiannual groundwater monitoring of up to 30 monitor wells may be continued for up to 18 years for the current monitor well network and up to two additional downgradient monitor wells. If the PCE plume appears to be stable, the groundwater monitoring frequency may be reduced to annual and the number of monitor wells may be decreased. As a contingency, if the PCE concentrations continue to be greater than the AWQS, then an additional 10 years, or until concentrations are less than the AWQS, of groundwater monitoring will be performed. The updated 2016 groundwater model (Appendix A) indicates that PCE concentrations would decrease to less than 5 µg/L within 18 years. The groundwater model will be updated every five years to verify the timeline for PCE concentrations below AWQS.

If TOG or SRP requires restoration of production wells before PCE concentrations are below AWQS, then wellhead treatment using LGAC or modification of the production well (e.g., sleeving) may be performed to allow groundwater usage. Wellhead treatment with LGAC would be installed at a production well if monitoring results indicate PCE concentrations are greater than the AWQS and TOG or SRP requires drinking water quality out of the production well. The treated groundwater would then be pumped into the distribution system or canal system. For the Reference Remedy, additional coordination with TOG and/or SRP would be required for the design and location access of the wellhead treatment system or modification of the production well.

5.2 More Aggressive Alternative Remedy

The More Aggressive Remedy includes the Reference Remedy for arsenic and copper in soil. The More Aggressive Remedy for VOCs in soil includes all aspects of the Reference Remedy plus expansion of the current SVE system. The More Aggressive Remedy for groundwater includes the installation of a GETS to treat the PCE concentrations within the plume currently exceeding 10 µg/L. The remedial strategies for the More Aggressive Remedy include:

- Physical containment to capture contaminants within definite boundaries;
- Source control to eliminate or mitigate a continuing source of contamination;
- Plume remediation to achieve water quality standards for COCs in water of the state throughout the Site; and
- Monitoring to observe and evaluate the contamination at the Site through the collection of data.

The More Aggressive Remedy remedial measures for the vadose zone VOC impacts include:

- Continued operation of the existing SVE system, using VGAC to treat the extracted soil vapor;
- Continued operational monitoring to assess remedial progress and system performance;
- Performing soil and soil vapor confirmation sampling near the former drywell; and
- Installation of two additional SVE extraction wells with focused screen intervals and connection to the VGAC treatment system.

Installation of two additional SVE extraction wells to the VGAC treatment system is based on the soil and soil vapor confirmation sampling results being greater than the applicable action levels (Non-Residential SRLs, minimum GPLs, or Site-specific soil vapor screening levels). The current SVE treatment system, which includes two 2,000-pound VGAC vessels, will have sufficient capacity to treat the soil vapor from the additional SVE extraction well, and no added treatment equipment will be required. The expanded SVE system will be operated for up to ten years. If influent PCE concentrations are below Site-specific soil vapor screening levels, then the SVE system will be shut down for rebound testing (similar to the Less Aggressive Remedy described in Section 5.3).

The More Aggressive Remedy for groundwater includes the installation of a GETS in the vicinity of the intersection of Guadalupe Road and Cooper Road. The remedial strategies for the More Aggressive Remedy include:

- Physical containment to capture contaminants within definite boundaries;
- Source control to eliminate or mitigate a continuing source of contamination;
- Plume remediation to achieve water quality standards for COCs in water of the state throughout the Site; and
- Monitoring to observe and evaluate the contamination at the Site through the collection of data.

The groundwater remedial measures for the More Aggressive Remedy include:

- Installation of up to two downgradient groundwater monitoring wells to delineate the extent of the PCE plume to the northwest/west;
- Continued semiannual groundwater monitoring to evaluate plume stability and PCE concentration trends;
- Continued semiannual groundwater elevation measurements to evaluate flow direction and hydraulic gradient;
- Installation and operation of a GETS system consisting of three groundwater extraction wells and a centralized LGAC treatment system; and
- Groundwater monitoring to assess the effectiveness of the remedial measures and to support a strategy of MNA for the dilute fringe of the plume.

The GETS would comprise three extraction wells withdrawing approximately 100 gpm of groundwater and a LGAC treatment system with a 300 gpm capacity and discharge to a nearby SRP lateral. These wells would be located south of Guadalupe Road and west of Cooper Road, sited to capture the highest-concentration portion of the plume as is practical given the physical and logistical limitations for placement of wells in a developed area. By controlling the migration of the highest-concentration portion of the plume, the More Aggressive Remedy would reduce the mass of COCs within the regional groundwater gradient, which would contribute to the closure of the site through Monitored Natural Attenuation of the remainder of the plume. The operation of the GETS is assumed to be 16 years based on the nature of the laterally disperse (greater than approximately 0.5 square miles) and dilute plume of PCE as of January 2017 groundwater sampling results.

Contingencies for the More Aggressive Remedy include two additional groundwater extraction wells and performing a single targeted enhanced in-situ bioremediation (EISB) injection at monitoring well MW-104S. If TOG or SRP requires restoration of production wells before PCE concentrations are below AWQS, then wellhead treatment using LGAC or modification of the production well (e.g., sleeving) may be performed to allow groundwater usage as a contingency. Semiannual groundwater monitoring will be continued for up to 16 years assuming the operation of the GETS could reduce the time for PCE groundwater concentrations reducing below the AWQS of 5 µg/L by two years. If the PCE plume appears to be stable, the groundwater monitoring frequency may be reduced to annual and the number of monitor wells may be decreased. As a contingency, if the PCE concentrations continue to be greater than the AWQS, then an additional 10

years, or until concentrations are less than the AWQS, of groundwater monitoring will be performed.

5.3 Less Aggressive Alternative Remedy

The Less Aggressive Remedy includes the Reference Remedy for arsenic and copper in soil. The proposed Less Aggressive Remedy for VOCs in the source area vadose zone includes shutting down the SVE system for rebound testing and continued groundwater sampling of a reduced groundwater monitoring well network. The remedial strategies for the vadose zone Less Aggressive Remedy include:

- Plume remediation to achieve water quality standards for COCs in waters of the state throughout the Site; and
- Monitoring to observe and evaluate the contamination at the Site through the collection of data.

The vadose zone remediation area is generally limited to the area around the former drywell. As described in the Reference Remedy, soil and soil vapor confirmation sampling near the former drywell will be performed to assess residual VOC concentrations in the vadose zone after SVE operations. The remedial measures for the vadose zone Less Aggressive Remedy consist of discontinuing SVE operation based on soil and soil vapor confirmation sampling results being below the applicable action levels (Non-Residential SRLs, minimum GPLs, or Site-specific soil vapor screening levels). For costing purposes, it is assumed that the vadose zone Less Aggressive Remedy includes up to one year of quarterly rebound sampling following the SVE shut down.

The remedial measures for the groundwater Less Aggressive Remedy are similar to the Reference Remedy and include:

- Installation of up to two downgradient groundwater monitor wells to delineate the extent of the PCE plume to the northwest/west;
- Annual groundwater monitoring of a reduced groundwater monitor well network to evaluate PCE concentrations; and
- Annual groundwater elevation measurements to evaluate flow direction, hydraulic gradient, and plume stability.

As described in the Reference Remedy, MNA processes, such as dilution, dispersion, volatilization, and sorption, are likely to be the dominant mechanisms for VOC

concentration reductions over time. MNA could feasibly be conducted utilizing a reduced groundwater monitor well network given the nature of the remaining relatively dilute (less than 20 µg/L) and laterally disperse (greater than approximately 0.5 square miles) plume on a more infrequent basis (annually versus semiannually). For the Less Aggressive Remedy, annual groundwater monitoring would be conducted for one well downgradient of the original source area as a sentinel well and eight groundwater monitor wells around the periphery of the extent of PCE impacts exceeding the AWQS of 5 µg/L. Based on the January 2017 groundwater sampling results, the reduced groundwater monitor well network for MNA under the Less Aggressive Remedy would include:

- MW-117 as a sentinel well for the former source area; and
- MW-106, MW-111, MW-114, MW-113, MW-115, R-1, and two additional downgradient wells defining the extents of the PCE impacts exceeding 5 µg/L.

For cost evaluation purposes, it was assumed that monitoring would be on an annual basis for 18 years based on the 2016 groundwater model (Appendix A) indicating the AWQS will be attained within approximately 18 years. As a contingency, if the PCE concentrations continue to be greater than the AWQS, then an additional 10 years, or until concentrations are less than the AWQS, of groundwater monitoring will be performed. The groundwater model will be updated every five years to verify the timeline for PCE concentrations below AWQS.

Similar to the Reference Remedy, if TOG or SRP require restoration of production wells before PCE concentrations are below AWQS, then wellhead treatment using LGAC or modification of the production well (e.g., sleeving) may be performed to allow groundwater usage. Additional coordination with TOG and/or SRP would be required for the design and location access of the wellhead treatment system.

6. COMPARISON OF REFERENCE REMEDY AND ALTERNATIVE REMEDIES

The following section compares the reference and alternative remedies to criteria described in A.A.C R18-16-407H.3. As previously noted, alternative remedies for arsenic and copper in source area soils are not included pursuant to A.A.C. R18-16-407C. The remedy for arsenic and copper is discussed under the Reference Remedy and presented on Tables 2 and 4 for evaluation purposes. The costs for the arsenic and copper Reference Remedy are incorporated in Table 2 (and Appendix D) for the Reference Remedy, More Aggressive Remedy, and Less Aggressive Remedy as the Reference Remedy for arsenic and copper is the same for each scenario.

6.1 Comparison Criteria

In accordance with A.A.C. R18-16-407E.3., the FS has been completed to identify a Reference Remedy and alternative remedies that are potentially capable of achieving ROs, and to evaluate the remedies based on the comparison criteria in order to select a remedy that complies with A.R.S. §49-282.06. A.A.C. R18-16-407H specifies that practicability, risks, costs, and benefits are the primary remedy evaluation criteria.

Practicability includes the assessment of feasibility, short- and long-term effectiveness, and the reliability of the remedial alternative. The risk criteria includes assessment of the overall protectiveness of public health and the environment in terms of fate and transport of the COCs, current and future land and water uses, exposure pathways and durations of potential exposure, changes in risk during remediation, and residual risk at the end of remediation. The cost analysis includes capital, operating, maintenance, and life cycle costs. Evaluation of benefits includes the assessment of lowered risk, reduced COC concentration or volume, decrease in liability, and preservation of existing and future uses.

Table 2 presents an evaluation of the remedy for arsenic and copper impacts in the vadose zone and the detailed evaluation of the VOC vadose zone and groundwater remedies for VOCs with respect to the comparison criteria. The following subsections detail how the remedies perform against these criteria.

For cost analyses, the estimates are conceptual and assumed to have similar margins of error between +50% and –25% (i.e., the actual costs are expected to be between 25% less than and 50% more than the estimated costs).

6.1.1 Reference Remedy

The practicability, risk, cost, and benefits for both the vadose zone and groundwater Reference Remedies are discussed in the following subsections.

6.1.1.1 Practicability

The vadose zone and groundwater Reference Remedies involve technologies that are already operating at the Site (SVE) or are known and reliable remediation technologies (risk based remediation levels and institutional controls for arsenic and copper in the vadose zone and MNA for VOC impacts in groundwater). For the vadose zone Reference Remedy, confirmation soil borings would be advanced to delineate arsenic and copper concentrations, a risk evaluation would be conducted, and institutional controls would be implemented if needed based on the additional evaluation. Risk-based cleanup standards and institutional controls are highly practicable and have been implemented at other sites as a means to manage residual impacts in place. For vadose zone VOC impacts, the SVE system will continue operating as is currently constructed, and as such is highly practicable. SVE is a known effective and reliable remedy for VOC impacts in the vadose zone.

For the groundwater Reference Remedy, MNA is a well-established technology that can be highly effective in the long-term. While the groundwater conditions are not conducive to reductive dechlorination, monitoring for abiotic MNA processes is highly feasible and will be assessed as part of the semiannual groundwater monitoring. Coordination with the TOG or SRP would be required if the contingency of wellhead treatment or modification of a production well was implemented. The groundwater Reference Remedy is considered to be highly practicable.

6.1.1.2 Protectiveness (Risk)

The vadose zone Reference Remedy is protective, as it provides source control through management of arsenic and copper impacts in place and removal of VOC mass in the vadose zone. The Reference Remedy will mitigate the risk that residual PCE in the vadose zone could act as a long-term source of groundwater contamination. The vadose zone remedy reduces potential exposure pathways and is consistent with current and future industrial land use. The groundwater Reference Remedy is protective in that it provides continued monitoring of the dissolved-phase contaminant plume and nearby TOG and SRP production wells with the contingency of wellhead treatment.

6.1.1.3 Cost

The cost of the Reference Remedy is presented in Table 3, and detailed costs are presented in Appendix D. The Reference Remedy costs include the additional delineation, risk evaluation and potential institutional controls for arsenic and copper impacts in source area vadose zone soils. The following assumptions were used for costing purposes:

- Three soil borings would be advanced in the vicinity of the former drywell for additional delineation of arsenic and copper impacts noted in the former sample collected from 30 ft bgs;
- The SVE system will be operated for a period of up to five years in a pulse mode operation;
- Three confirmation soil borings will be advanced for soil and soil vapor sampling of VOCs;
- Two additional downgradient groundwater monitoring wells would be installed to delineate the PCE plume; and
- A total of 30 wells would be used for MNA.

From Table 3, the estimated capital costs (excluding contingencies) are approximately $0.4 million. Total estimated O&M costs (excluding contingencies) are approximately $1.7 million (accounting for three percent annual inflation), based on the estimation that SVE O&M would be conducted for five years and groundwater monitoring activities would be conducted for 18 years after the capital improvements are installed. Total estimated contingency costs are approximately $8.0 million based on the assumptions included in Appendix D. Contingency costs conservatively assume wellhead treatment in lieu of extraction well modification.

6.1.1.4 Benefits

Additional soil delineation and updated risk evaluation of arsenic and copper impacts in the vadose zone would assess if a potential exposure pathway is present. The use of institutional controls would manage impacts in place and mitigate potential exposure pathways without impacting site operations in the way more intrusive remedial methods such as excavation would. The continued operation of the SVE system in the vadose zone VOC Reference Remedy is beneficial since it will remove VOC mass in the vadose zone and mitigate the potential for residual PCE to act as a long-term source of groundwater contamination, which will reduce the time to complete remediation. The groundwater

Reference Remedy is considered beneficial by providing continued monitoring of the PCE plume as a means of evaluating the effectiveness of remediation.

6.1.2 More Aggressive Remedy

The practicability, risk, cost, and benefits for implementation of the More Aggressive Remedies are discussed in the following subsections.

6.1.2.1 Practicability

The More Aggressive Remedy in the vadose zone involves expansion of the currently operating SVE system. The SVE system, including up to two additional extraction wells, is highly practicable. SVE is an effective and reliable remedy for remediation of VOC impacts in the vadose zone. Installing additional SVE wells and connecting to the current SVE system will require coordination with Skyline Steel regarding the location of the SVE wells and possible expansion of the treatment facility fencing.

For the groundwater More Aggressive Remedy, groundwater extraction and treatment and MNA monitoring are both well-established technologies that can be effective in the short- and long-term. The technologies are feasible, although the installation of three extraction wells and a treatment system may present challenges to implementation. For example, if the ideal locations of the extraction wells and the treatment system are on private property, the property owners may be averse to allowing construction of these items on their property and the long-term access that would be required for their monitoring and maintenance. If the extraction wells are instead placed in public right-of-ways, street closures may be necessary for well installation and monitoring. In addition, both private and public utilities and infrastructure would need to be avoided during siting and installation of the groundwater extraction wells and the associated conveyance piping.

6.1.2.2 Protectiveness (Risk)

The vadose zone More Aggressive Remedy is highly protective, as the remedy removes VOC mass from the subsurface and will mitigate the potential for residual PCE in the vadose zone to act as a long-term source of groundwater contamination. The remedy reduces exposure pathways and is consistent with current and future land use. Expansion of the SVE system will improve source control, as compared to the Reference Remedy.

The groundwater More Aggressive Remedy is highly protective by directly treating contaminated groundwater. Continued groundwater monitoring of portions of the plume

not addressed by groundwater treatment is protective in that it provides continued monitoring of the dissolved-phase contaminant plume and nearby TOG and SRP production wells with the contingency of wellhead treatment.

6.1.2.3 Cost

The cost of the More Aggressive Remedy is presented in Table 3, and detailed costs are presented in Appendix D. The More Aggressive Remedy costs include the additional delineation, risk evaluation and potential institutional controls for arsenic and copper impacts in source area vadose zone soils. The following assumptions were used for costing purposes:

- Three soil borings would be advanced in the vicinity of the former drywell for additional delineation of arsenic and copper impacts noted in the former sample collected from 30 ft bgs;
- Two additional SVE wells would be installed and connected to the existing SVE system;
- The expanded SVE system would be operated for a period of up to 10 years;
- Three confirmation soil borings will be advanced for soil and soil vapor sampling of VOCs;
- Two additional downgradient groundwater monitor wells would be installed to delineate the PCE plume;
- Permitting and utility clearance would be required for installation of three extraction wells and conveyance pipeline;
- The groundwater conveyance piping for the GETS would be single walled high density polyethylene installed via trenching;
- The native soil would be used to backfill above the pipes;
- The new treatment system would include a target extraction rate of approximately 300 gpm and include a concreate pad with a secondary containment berm, one sump pump, filtration, two 6,000-pound LGAC vessels, and a chain link fence for security purposes; and
- A total of 30 wells would be used for MNA.

From Table 3, the estimated capital costs (excluding contingencies) are approximately $2.4 million. Total estimated O&M costs (excluding contingencies) are approximately $5.6 million (accounting for three percent annual inflation), based on the estimation that

SVE O&M would be conducted 10 years and GETS O&M and groundwater monitoring activities would be conducted for 16 years after the capital improvements are installed. The costs for the More Aggressive Remedy are significantly higher due to the installation and operation of a GETs. Total estimated contingency costs are approximately $8.7 million based on the assumptions included in Appendix D. Contingency costs conservatively assume wellhead treatment in lieu extraction well modification.

6.1.2.4 Benefits

Expansion of the current SVE system is beneficial since it will remove VOC mass in the vadose zone and mitigate the continued migration of VOC mass into and within the groundwater. The More Aggressive Remedy of installation of GETS and groundwater monitoring is considered beneficial by providing treatment of a portion of the dissolved-phase plume and monitoring as a means for evaluating the effectiveness of remediation. Semiannual groundwater monitoring would also provide a means for evaluating the effectiveness of the remediation.

6.1.3 Less Aggressive Remedy

The practicability, risk, cost, and benefits for both the vadose zone and groundwater Less Aggressive Remedies is discussed in the following subsections.

6.1.3.1 Practicability

The vadose zone Less Aggressive Remedy involves shutting down the SVE system, which would be very feasible to implement. Reliability will be moderate, as quarterly rebound sampling will be able to identify if concentrations increase to a point where groundwater may be impacted. The effectiveness of this remedy may be low if significant residual VOC mass remains.

The groundwater Less Aggressive Remedy consists of MNA, of a reduced monitor well network on an annual basis. MNA is a well-established technology that can be highly effective in the long-term and, under the Less Aggressive Remedy, is optimized to minimize the amount of wells and frequency of monitoring. While the groundwater conditions are not conducive to reductive dechlorination, monitoring for abiotic MNA processes is highly feasible. Although, MNA with a reduced monitor well network and frequency is considered moderately reliable as additional groundwater well monitoring may have to be conducted if the sentinel well for the former source area indicated an exceedance of the AWQS.

6.1.3.2 Protectiveness (Risk)

The vadose zone Less Aggressive Remedy may not be protective if significant residual VOC mass remains in the vadose zone, because no further treatment would be performed. If rebound conditions were to occur, then the contingency would be to default back to the Reference Remedy (continued operation of the SVE system).

The groundwater Less Aggressive Remedy is protective in that it provides for continued monitoring of the dissolved-phase contaminant plume and nearby TOG and SRP production wells. A reduced monitoring frequency and well network providing a sentinel well for the former source area and groundwater monitor wells around the portion of the PCE plume exceeding the AWQSs of 5 µg/L would cost effectively allow for the continued monitoring of the PCE plume. The reduced monitor well network would not allow for the continued delineation of the interior portions of the plume currently exceeding a PCE concentration of 10 µg/L. Additionally, an expansion to the monitor well network may be needed should an exceedance of the AWQSs be measured in the former source area sentinel well.

6.1.3.3 Cost

The cost of the Less Aggressive Remedy is presented in Table 3, and detailed costs are presented in Appendix D. The Less Aggressive Remedy costs include the additional delineation, risk evaluation and potential institutional controls for arsenic and copper impacts in source area vadose zone soils. The following assumptions were used for costing purposes:

- Three soil borings would be advanced in the vicinity of the former drywell for additional delineation of arsenic and copper impacts noted in the former sample collected from 30 ft bgs;
- SVE rebound testing will be conducted for a period of up to one year;
- Three confirmation soil borings will be advanced for soil and soil vapor sampling of VOCs;
- Two additional downgradient groundwater monitor wells would be installed to delineate the PCE plume; and
- A total of nine wells would be used for MNA.

From Table 3, the estimated capital costs (excluding contingencies) are approximately $0.4 million. Total estimated O&M (monitoring) costs (excluding contingencies) are

approximately $0.7 million (accounting for three percent annual inflation), based on the assumption that SVE rebound monitoring would be conducted for up to one year and groundwater monitoring activities would be conducted for 18 years after the capital improvements are installed. Total estimated contingency costs are approximately $7.0 million based on the assumptions included in Appendix D. Contingency costs conservatively assume wellhead treatment in lieu extraction well modification.

6.1.3.4 Benefits

The vadose zone Less Aggressive Remedy provides the benefit of preserving the existing use of the source area site and returning the portion of the site that the treatment compound occupies to the property owner in a more timely fashion. Natural attenuation of potentially remaining chlorinated VOC impacts would be lengthy as natural attenuation mechanisms in the vadose zone are very slow. The groundwater Less Aggressive Remedy is considered beneficial by providing continued monitoring of the dissolved-phase plume as a means for evaluating the effectiveness of remediation with an optimized (reduced) monitor well network.

6.2 Comparison of Remedies

Comparison of the remedies is required under the A.A.C. R18-16-407(H). Table 4 presents a ranking of the comparison criteria for each of the remedies.

6.2.1 Practicability

There are four considerations for practicability as follows:

- Feasibility involves the ability to put the remedy in place;
- Short-term effectiveness represents how much the remedy removes the COCs and limits the potential for exposure in the short-term;
- Long-term effectiveness represents how much the remedy removes the COCs and limits the potential for exposure in the long-term; and
- Reliability involves whether the technologies comprising the alternative are expected to perform reliably.

For the arsenic and copper vadose zone remedy, additional characterization, updated risk evaluation, and potential institutional controls are technically acceptable and a cost effective measure to address the residual levels of these metals in place. A DEUR for arsenic and copper is compliant with A.R.S. §49-152 and A.A.C R18-7-208 for soil

impacts within source area soils (i.e., former drywell area). As the source area of the site is currently zoned General Industrial and is not anticipated to change, a DEUR restricting residential development is feasible and would meet the ROs for soil by achieving predetermined Non-Residential SRLs prescribed in A.A.C R18-7-205 or potential site-specific remediation standards developed pursuant to A.A.C. R18-7-206. Based on this and as allowed by A.A.C. R18-7-407C., alternatives were not evaluated for comparison.

Each of the remedies for VOCs in the vadose zone is considered to be technically and operationally feasible, as the remedies either rely primarily on the existing SVE system or involve shutting down the SVE system. The More Aggressive Remedy is slightly less feasible as coordination and access with the current property owner of the source area would be required. The VOC vadose zone Less Aggressive Remedy has a lower score for short- and long-term effectiveness since the remedy would consist of shutting down the SVE system and the reliability is lower than the Reference and More Aggressive Remedies if significant residual VOC mass remains.

The groundwater Reference Remedy and Less Aggressive Remedy consist of MNA monitoring and have the highest practicability, as being feasible and effective in both the short- and long-term, though the Less Aggressive Remedy is moderately reliable as an expansion to the monitor well network may be needed should an exceedance of the AWQSs be measured in the former source area sentinel well. The More Aggressive Remedy ranked lower due to the required coordination for sighting, property access, right-of-way agreements, and constructability associated with the installation of a GETS within a dilute disperse plume.

6.2.2 Risk

The vadose zone arsenic and copper Reference Remedy is considered protective as the risks evaluation of residual impacts would be completed and institutional controls utilized if needed to manage the arsenic and copper in place. The VOC vadose zone and groundwater Reference Remedies and More Aggressive Remedies are more protective than the Less Aggressive Remedies. The Less Aggressive Remedies are less protective if significant VOC mass remains in the vadose zone and/or contributes to impacts to groundwater around the source area that are not currently present. The groundwater More Aggressive Remedy is slightly more protective than the Reference Remedy due to the installation and operation of a GETS, though each of the groundwater remedies includes the contingency of wellhead treatment of contaminated groundwater. The vadose zone Less Aggressive Remedy ranked lowest for protection since it involves shutting down the SVE system and no further mass removal.

6.2.3 Cost

As previously discussed, the cost of the arsenic and copper remedy was included in the evaluation of the Reference Remedy, More Aggressive Remedy, and Less Aggressive Remedy as it would be implemented in each case. The three remedies have varying capital and O&M costs. Including the capital, O&M, and contingency costs, it is estimated that Less Aggressive Remedy would cost the least ($8.1 million), the Reference Remedy cost would be moderate ($10.2 million), and the More Aggressive Remedy would cost the most ($16.7 million).

6.2.4 Benefits

The vadose zone arsenic and copper remedy provides the benefit of managing residual impacts in place without more intrusive soil remediation methods such as excavation and removal of impacts at depth. The vadose zone Less Aggressive Remedy scored lowest for benefits since it consists of shutting down the SVE system. The Reference Remedy and More Aggressive Remedy have similar benefits in that each would continue to remove remaining VOC mass from the vadose zone through operation of the SVE system. Although it is the lowest cost, the Less Aggressive Remedy does not contain/remediate soil at the source.

The groundwater More Aggressive Remedy ranked slightly higher for beneficial use since the remedy involves the extraction and treatment of a portion of the impacted groundwater, though direct wellhead treatment is a contingency for each remedy. Each remedy also includes continued groundwater monitoring of natural attenuation processes. The Reference Remedy and Less Aggressive Remedy were similar since they both provide continued groundwater monitoring of natural attenuation processes, though the Less Aggressive Remedy, utilizing a reduced monitor well network, is slightly less beneficial if an exceedance of the AWQS is detected in the former source area sentinel well. The benefit of including groundwater treatment as part of the More Aggressive Remedy is not offset by the potential impacts associated with the installation of the GETS components (i.e., groundwater extraction wells, conveyance piping, and treatment compound).

7. PROPOSED REMEDY

The following presents the proposed remedy for both vadose zone and groundwater, as well as the basis for selecting the proposed remedy. Detailed cost information for the remedial alternatives is included in Appendix D.

7.1 Process and Reason for Selection

The remedy for arsenic and copper in vadose zone soils in the vicinity of the former drywell consists of additional delineation, updated risk evaluation, and an institutional control (DEUR, if needed). This remedy is recommended based on the lack of arsenic and copper groundwater impacts attributed to the source area and is technically practicable for non-mobile sources.

The Reference Remedy for both VOC vadose zone and groundwater are recommended as the proposed remedies at the Site. This recommendation is based on what is considered to be the best combination of remedial effectiveness, practicably, cost, and benefit for restoration and use of land and groundwater resources. The Reference Remedy for VOC in the vadose zone and groundwater scored the highest when ranking in accordance with the comparison criteria specified in A.A.C R18-16-407H.3.e (Section 6).

7.2 Achievement of Remedial Objectives

The remedy for arsenic and copper in source area soils achieves the RO for soil for the site, as provided in Section 3.3, by meeting either predetermined Non-Residential SRLs and/or Site-specific remediation standards. The Reference Remedy for PCE in the vadose zone and PCE and TCE in groundwater also achieve the ROs for the Site (Section 3.3.) Continued operation of the SVE system will provide source control for the vadose zone and will prevent potential migration to groundwater. The groundwater Reference Remedy will provide continued monitoring of the PCE plume and ongoing monitoring of TCE concentrations as a means of evaluating the effectiveness of remediation through MNA.

7.3 Achievement of Remedial Action Criteria Pursuant to A.R.S. §49-282.06

To meet the remedial action criteria listed in A.R.S. §49-282.06, it is recommended that the Reference Remedy for arsenic and copper in the vadose zone, the Reference Remedy for PCE in the vadose zone, and the Reference Remedy for PCE and TCE in groundwater be

selected as the Final Remedies for the at the Site. Based on a comparison with the More Aggressive and Less Aggressive Remedies (for VOCs), the Reference Remedies will:

- Provide for adequate protection of public health and welfare and the environment;
- Provide a thorough and timely means for continued monitoring of the existing groundwater impacts, including assessment of plume capture by extraction wells, and evaluation of the progress of remediation over time;
- To the extent practicable, provide for the control, management, and cleanup of the COCs in the groundwater;
- Provide for the beneficial use of the groundwater resource by TOG and SRP; and
- Be reasonable, cost-effective, and technically feasible.

7.4 Consistency with Water Management and Land Use Plans

The Reference Remedy for vadose zone and groundwater are consistent with water management plans and general land use plans.

7.5 Contingencies

For the vadose zone Reference Remedy, O&M measurements will be used to assess system performance and to provide feedback on optimization activities. If results from soil and soil vapor confirmation sampling indicate that VOC concentrations are greater than Non-Residential SRLs, minimum GPLs, or site-specific soil vapor screening levels, the SVE system may be expanded (as described in the More Aggressive Remedy) and/or operated for an additional five years.

For the groundwater Reference Remedy, semiannual groundwater monitoring will be used to assess the PCE plume stability and monitor VOC concentrations at the Site. If groundwater VOC concentrations are stable, the monitoring frequency may be reduced to annual monitoring for VOCs and/or the number of wells that are monitored may be decreased as described in the Less Aggressive Remedy. If future VOC concentrations and areal extent indicate that an alternate remediation technology could significantly accelerate remediation or reduce remediation costs, then an alternate remedial strategy such as ISCO or ERD, as described in Section 4.2, may be implemented at the Site. If TOG and/or SRP determine that a drinking water production well has been impacted by PCE and/or TCE above AWQS and ADEQ determines that Site COCs are responsible, then wellhead treatment using LGAC or modification of the production well may be

performed to allow for groundwater usage. The hypothetical need for and cost of wellhead treatment or well modification of a production well would be well specific and vary significantly depending on the well location and the timing of when well treatment or modifications may be needed. Although a cost estimate for wellhead treatment is provided in Appendix D, the actual cost for wellhead treatment would be further evaluated on a well specific basis, if the need arises.

For both the vadose zone and groundwater Reference Remedy, contingencies will be presented in further detail in the Proposed Remedial Action Plan (PRAP) and subsequent remedial design documents.

8. COMMUNITY INVOLVEMENT

ADEQ will issue a Notice to the Public announcing availability of FS Report on ADEQ's website at www.azdeq.gov. The notice may be mailed to the Public Mailing List for the site, water providers, the Community Advisory Board, and any other interested parties.

9. REFERENCES

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TABLES

Table 1
Remediation Technology Screening Summary
Cooper and Commerce WQARF Site
Gilbert, Arizona

Technology	Retained?	Reason for Retention or Elimination
Soil Vapor Extraction (SVE)	Yes	Retained remedial technology; has been cost-effective at removing VOC mass from vadose zone.
Air Sparging	No	Not likely to be cost-effective or improve treatment due to low groundwater concentrations and residual VOC mass in clay interval.
Institutional Controls	Yes	Retained as remedial technology; institutional controls have been cost-effective means of managing impacts in place and previously implemented.
Groundwater Extraction & Treatment System (GETS)	Yes	Effectiveness for disperse dilute plume reduced but retained as effective for control of VOCs in groundwater and as potential wellhead treatment for contingency.
Monitored Natural Attenuation (MNA)	Yes	Retained remedial technology (primarily for abiotic processes).
Enhanced Reductive Dechlorination (ERD)	Yes	Cost prohibitive for overall plume due to predominantly aerobic groundwater conditions, low VOC concentrations, and the size and depth of the plume; retained for potentially targeted treatment areas.
In Situ Chemical Reduction (ISCR)	No	Technically and economically infeasible due to thickness of impacted groundwater zone and the size and depth of the plume.
In Situ Chemical Oxidation (ISCO)	Yes	Cost prohibitive for overall plume due to relatively small radius of influences, low VOC concentrations, and size and depth of plume; retained for potentially targeted treatment areas.

Abbreviations:
VOC – Volatile Organic Compounds

Table 2
Remedy Evaluation
Cooper and Commerce WQARF Site
Gilbert, Arizona

Remedial Alternative	Vadose Zone / Groundwater	Will Alternative Meet Remedial Objectives?	Practicability			Protectiveness (Risk)	Costs	Benefits	Regulatory/Public Acceptance
			Feasibility	Short/Long Term Effectiveness	Reliability				
Reference Remedy	**Vadose Zone Arsenic/Copper Confirmation Borings** **Risk Evaluation** **Institutional Controls**	Yes	The implementation of risk based remediation levels is feasible. The use of Institutional Controls is also feasible but would require coordination with Skyline Steel.	Risk based remediation levels and the use of Institutional Controls have been utilized to effectively manage residual impacts in place by limiting potential exposure.	Risk based remediation levels and Institutional Controls are known and reliable remedies.	This remedy is protective as it limits the potential for exposure to arsenic and copper while managing the impacts in place. It is consistent with current and future land use for industrial purposes.	Only capital costs are associated with this remedy and would include additional of soil borings for additional delineation of arsenic and copper, a revised risk evaluation, and the costs associated with implementation of Institutional Controls if warranted based on the additional characterization and risk evaluation.	The reference remedy for arsenic and copper would provide for the management of residual concentrations in place without more intrusive remedial methods.	Highly Likely
	Vadose Zone VOCs Current SVE System	Yes	Very feasible, system is already constructed and operational.	SVE is a known effective remedy for VOC contamination in the vadose zone; the current system has removed significant mass but is beginning to reach asymptotic removals.	SVE is a known and reliable remediation technology.	The reference remedy is protective, as it removes VOCs from vadose zone and reduces possibility of residual VOCs acting as long-term source of groundwater contamination. It mitigates exposure pathways and is consistent with current and future land use.	Capital costs would be incurred for the confirmation soil borings, and O&M costs would be similar to current SVE system operating costs.	The reference remedy would provide continued reduction of VOC concentrations and mass in the vadose zone, which would result in lower risk.	Highly Likely
	Semiannual MNA Monitoring Existing Groundwater Well Network	Yes	MNA monitoring is very feasible as groundwater monitoring is currently conducted at the site. The locations of up to two downgradient monitoring wells would have to be selected and property access agreements may be necessary.	MNA is a known and effective remedy; continued semiannual groundwater monitoring of existing monitoring well network will assess effectiveness.	MNA is a known and reliable remediation technology.	The reference remedy is protective, in that it continues to monitor and evaluate Site contamination through the collection of data.	MNA monitoring costs would be similar to current semiannual groundwater monitoring costs; capital costs would include the installation of two groundwater monitoring wells.	MNA monitoring would provide data to evaluate VOC concentrations throughout the PCE plume and monitor for the potential need of implementing wellhead treatment as a contingency.	Moderately Likely
More Aggressive Remedy	**Vadose Zone Arsenic/Copper Confirmation Borings** **Risk Evaluation** **Institutional Controls**	Yes	The implementation of risk based remediation levels is feasible. The use of Institutional Controls is also feasible but would require coordination with Skyline Steel.	Risk based remediation levels and the use of Institutional Controls have been utilized to effectively manage residual impacts in place by limiting potential exposure.	Risk based remediation levels and Institutional Controls are known and reliable remedies.	This remedy is protective as it limits the potential for exposure to arsenic and copper while managing the impacts in place. It is consistent with current and future land use for industrial purposes.	Only capital costs are associated with this remedy and would include additional of soil borings for additional delineation of arsenic and copper, a revised risk evaluation, and the costs associated with implementation of Institutional Controls if warranted based on the additional characterization and risk evaluation.	The reference remedy for arsenic and copper would provide for the management of residual concentrations in place without more intrusive remedial methods.	Highly Likely
	Vadose Zone VOCs Expanded SVE System	Yes	Addition of a new SVE extraction point at the Site is feasible, coordination with Skyline Steel required.	SVE is a known effective remedy for VOC contamination in the vadose zone; adding SVE extraction point(s) to the current system could increase VOC mass removal observed.	SVE is a known and reliable remediation technology.	The more aggressive remedy is protective, as it removes VOCs from vadose zone and reduces possibility of residual VOCs acting as long-term source of groundwater contamination. It mitigates exposure pathways and is consistent with current and future land use.	Capital costs would include installation of additional SVE extraction well(s).	The more aggressive remedy would provide continued reduction of VOC concentrations and mass in the vadose zone, which would result in lower risk.	Highly Likely
	Groundwater Extraction and Treatment with Semiannual Groundwater Monitoring	Yes	This remedy is moderately feasible. Siting the location of three groundwater extraction wells and a treatment system would have potential challenges and require property acquisition and/or access agreements. Installation would require linear improvements potentially impacting the community during construction activities. The locations of up to two downgradient monitoring wells would have to be selected and property access agreements may be necessary.	Groundwater extraction and treatment is a well established and proven effective technology, though installation of three groundwater extraction wells will not treat the entirety of the dilute disperse plume. MNA is a known and effective remedy specifically for the remaining portions of the plume and continued semiannual monitoring will assess effectiveness.	Groundwater extraction is a known and reliable remediation technology.	The more aggressive remedy is protective, in that it continues to monitor and evaluate Site contamination, and reduces mass by groundwater extraction and treatment in the areas with the relatively higher VOC concentrations.	Capital costs include the installation of three groundwater extraction wells, a treatment system, and installation of two downgradient monitoring wells. Groundwater monitoring costs would be similar to current semiannual groundwater monitoring costs, but this remedy would include the cost of O&M of the groundwater extraction and treatment system.	Groundwater extraction and treatment would help reduce mass within the area where impacts of PCE are above 10 micrograms per liter; however, several additional extraction wells (and/or treatment systems) would be needed to treated the entirety of the PCE plume. MNA monitoring would provide data to evaluate VOC concentrations throughout the PCE plume.	Likely

Table 2
Remedy Evaluation
Cooper and Commerce WQARF Site
Gilbert, Arizona

Remedial Alternative	Vadose Zone / Groundwater	Will Alternative Meet Remedial Objectives?	Practicability			Protectiveness (Risk)	Costs	Benefits	Regulatory/Public Acceptance
			Feasibility	Short/Long Term Effectiveness	Reliability				
Less Aggressive Remedy	**Vadose Zone Arsenic/Copper Confirmation Borings** **Risk Evaluation** **Institutional Controls**	Yes	The implementation of risk based remediation levels is feasible. The use of Institutional Controls is also feasible but would require coordination with Skyline Steel.	Risk based remediation levels and the use of Institutional Controls have been utilized to effectively manage residual impacts in place by limiting potential exposure.	Risk based remediation levels and Institutional Controls are known and reliable remedies.	This remedy is protective as it limits the potential for exposure to arsenic and copper while managing the impacts in place. It is consistent with current and future land use for industrial purposes.	Only capital costs are associated with this remedy and would include additional of soil borings for additional delineation of arsenic and copper, a revised risk evaluation, and the costs associated with implementation of Institutional Controls if warranted based on the additional characterization and risk evaluation.	The reference remedy for arsenic and copper would provide for the management of residual concentrations in place without more intrusive remedial methods.	Highly Likely
	Vadose Zone VOCs Shutdown of Current SVE System	Yes	Very feasible, current system would be shut down.	This remedy has low effectiveness in the short term and long term.	Since the SVE system would no longer be operating under this remedy, reliability is very high.	No further active remediation would be performed, therefore the protectiveness of this remedy is unknown but would be quantified by confirmation soil borings.	Costs associated with this remedy would be rebound sampling and confirmation soil borings.	The benefit of this remedy would be preserving the existing use of the source area of the site and returning the portion of the site the treatment compound occupies to the property owner in a more timely fashion.	Moderately Unlikely
	Annual MNA Monitoring Reduced Monitoring Well Network	Yes	MNA monitoring is very feasible as groundwater monitoring is currently conducted at the site. The locations of up to two downgradient monitoring wells would have to be selected and property access agreements may be necessary. MNA monitoring of a reduced well network is feasible considering the current conditions of the plume.	MNA is a known and effective remedy including with the use of a reduced groundwater monitoring well network given the condition of the plume; annual monitoring will assess effectiveness.	MNA is a known and reliable remediation technology.	The less aggressive remedy is protective, in that it continues to monitor and evaluate Site contamination through the collection of data.	MNA monitoring costs for this remedy would be less than the current semiannual groundwater monitoring costs due to the reduced groundwater monitoring well network and annual monitoring. Capital costs include the installation of two downgradient monitoring wells.	MNA monitoring would provide data to evaluate VOC concentrations throughout the PCE plume and monitor for the potential need of implementing wellhead treatment as a contingency.	Moderately Unlikely

Abbreviations:
LGAC - liquid-phase granular activated carbon
MNA - Monitored Natural Attenuation
O&M - Operation and Maintenance
PCE = Tetrachloroethene
SRP - Salt River Project
SVE - Soil Vapor Extraction
TOG - Town of Gilbert
VOC - Volatile Organic Compound

Table 3
Remedial Alternatives Cost Summary
Cooper and Commerce WQARF Site
Gilbert, Arizona

Remedial Alternative	Vadose Zone / Groundwater	Estimated Capital Costs	Estimated O&M Costs	Total Estimated Cost	Total Remedy Estimated Cost	Potential Range	
						(-25%)	(+50%)
Reference Remedy	Vadose Zone Arsenic and Copper Additional Delineation, Risk Assessment, Institutional Controls	$136,000	$0	$136,000	$10,241,000	$7,681,000	$15,362,000
	Vadose Zone VOCs - Current SVE System	$143,000	$366,000 (for 5 years)	$509,000			
	Semiannual MNA Monitoring of Current Well Network	$139,000	$1,405,000 (for 18 years)	$1,544,000			
	Estimated Contingency Costs	--	--	$8,052,000			
More Aggressive Remedy	Vadose Zone Arsenic and Copper Additional Delineation, Risk Assessment, Institutional Controls	$136,000	$0	$136,000	$16,667,000	$12,500,000	$25,001,000
	Vadose Zone VOCs - Expanded SVE System	$164,000	$791,000 (for 10 years)	$955,000			
	Groundwater Extraction and Treatment and Semiannual MNA Monitoring	$2,127,000	$4,757,000 (for 16 years)	$6,884,000			
	Estimated Contingency Costs	--	--	$8,692,000			
Less Aggressive Remedy	Vadose Zone Arsenic and Copper Additional Delineation, Risk Assessment, Institutional Controls	$136,000	$0	$136,000	$8,095,000	$6,071,000	$12,143,000
	Vadose Zone VOCs - Shutdown of Current SVE System	$117,000	$10,000 (for 1 year)	$127,000			
	Annual MNA Monitoring of Limited Well Network	$139,000	$656,000 (for 18 years)	$795,000			
	Estimated Contingency Costs	--	--	$7,037,000			

Abbreviations:
WQARF = Water Quality Assurance Revolving Fund
O&M = operations and maintenance
% = percent
$ = United States dollars
VOCs = volatile organic compounds
SVE = soil vapor extraction
MNA = monitored natural attenuation

Notes:
Costs are rounded off to the nearest thousand
Costs are based on 2017 dollar values

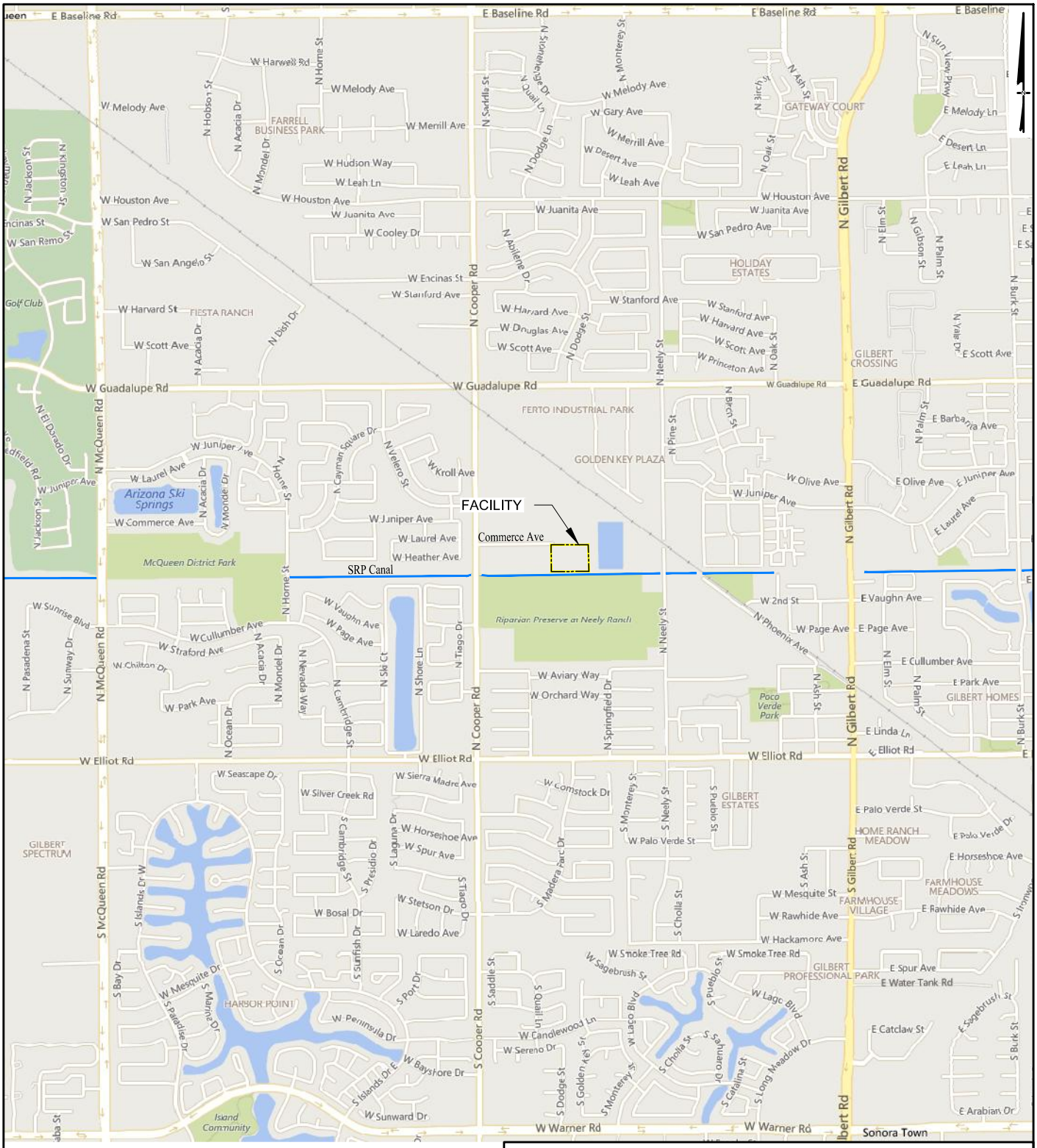
Table 4

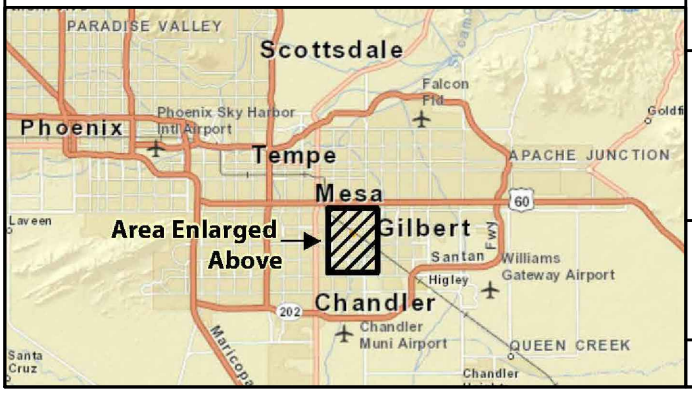
Remedial Alternative Scoring
Cooper and Commerce WQARF Site
Phoenix, Arizona

Remedial Alternative	Vadose Zone / Groundwater	Will Alternative Meet Remedial Objectives?	Practicability			Protectiveness (Risk)	Cost	Benefits
			Feasibility	Short/Long Term Effectiveness	Reliability			
Reference Remedy	Vadose Zone Arsenic/Copper Confirmation Borings Risk Evaluation Institutional Controls	Yes	High	High	High	High	Moderate to Low	High
	Vadose Zone VOCS - Current SVE System	Yes	High	High	High	High	Moderate	High
	Semiannual MNA Monitoring Existing Groundwater Well Network	Yes	High	High	High	Moderate to High	Moderate	High
More Aggressive Remedy	Vadose Zone Arsenic/Copper Confirmation Borings Risk Evaluation Institutional Controls	Yes	High	High	High	High	Moderate to Low	High
	Vadose Zone VOCs Expanded SVE System	Yes	Moderate to High	High	High	High	Moderate to High	High
	Groundwater Extraction and Treatment with Semiannual Groundwater Monitoring	Yes	Moderate to Low	High	High	High	High	Moderate
Less Aggressive Remedy	Vadose Zone Arsenic/Copper Confirmation Borings Risk Evaluation Institutional Controls	Yes	High	High	High	High	Moderate to Low	High
	Vadose Zone VOCs Shutdown of Current SVE System	Yes	High	Low	Moderate	Moderate	Low	Low
	Annual MNA Monitoring Reduced Monitoring Well Network	Yes	High	High	Moderate	Moderate	Low	Moderate

Abbreviations:
SVE - soil vapor extraction
MNA - monitored natural attenuation
VOCs - volatile organic compounds

FIGURES





2,000 1,000 0 1,000 Feet

SITE LOCATION

Cooper and Commerce WQARF Site
Gilbert, Arizona

Geosyntec consultants

Phoeni□, A□

January 2017

Figure 1

N:\GEOSYNTEC\COOPER AND COMMERCE\VICINITY MAP\CC VICINITY MAP EXHIBIT

NOTES

- Monitor Well
- Water Production Well
- Water Supply Well
- Groundwater Elevation Contours (Feet Above Mean Sea Level [ft amsl])
- 1102.27 Groundwater Elevations Estimated ft amsl
- * Not Used for Contouring Purposes
- Groundwater Flow Direction
- NM Not Measured
- Site Boundary

AERIAL IMAGE FROM BING

600' 300' 0 600 Feet

GROUNDWATER ELEVATIONS AND CONTOURS IN SHALLOW WELLS JANUARY 2017

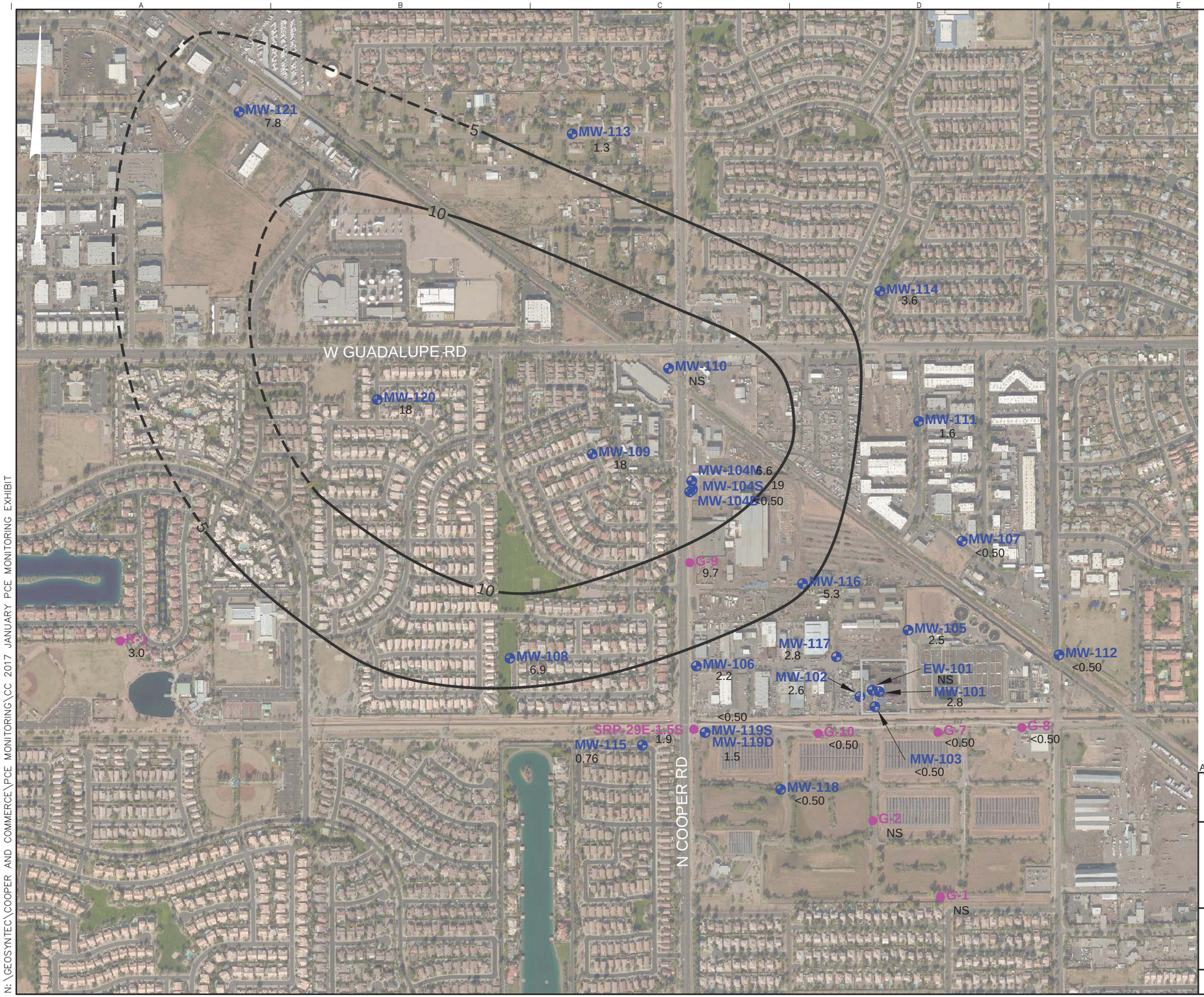
Cooper and Commerce WQARF Site
Gilbert, Arizona

Geosyntec consultants

Phoenix, AZ | June 2017

Figure: 2

N:\GEOSYNTEC\COOPER AND COMMERCE\GROUNDWATER MONITORING\CC 2017 JANUARY GROUNDWATER MONITORING EXHIBIT



N:\GEOSYNTEC\COOPER AND COMMERCE\PCE MONITORING\CC 2017 JANUARY PCE MONITORING EXHIBIT

NOTES

- Monitor Well
- Water Supply Well
- Site Boundary
- Tetrachloroethylene (PCE) Contours in micrograms per liter (µg/L)
- Estimated PCE Contours in µg/L
- **1.6** PCE Concentrations in µg/L
- **NS** Not Sampled

AERIAL IMAGE FROM BING

700' 350' 0 700 Feet

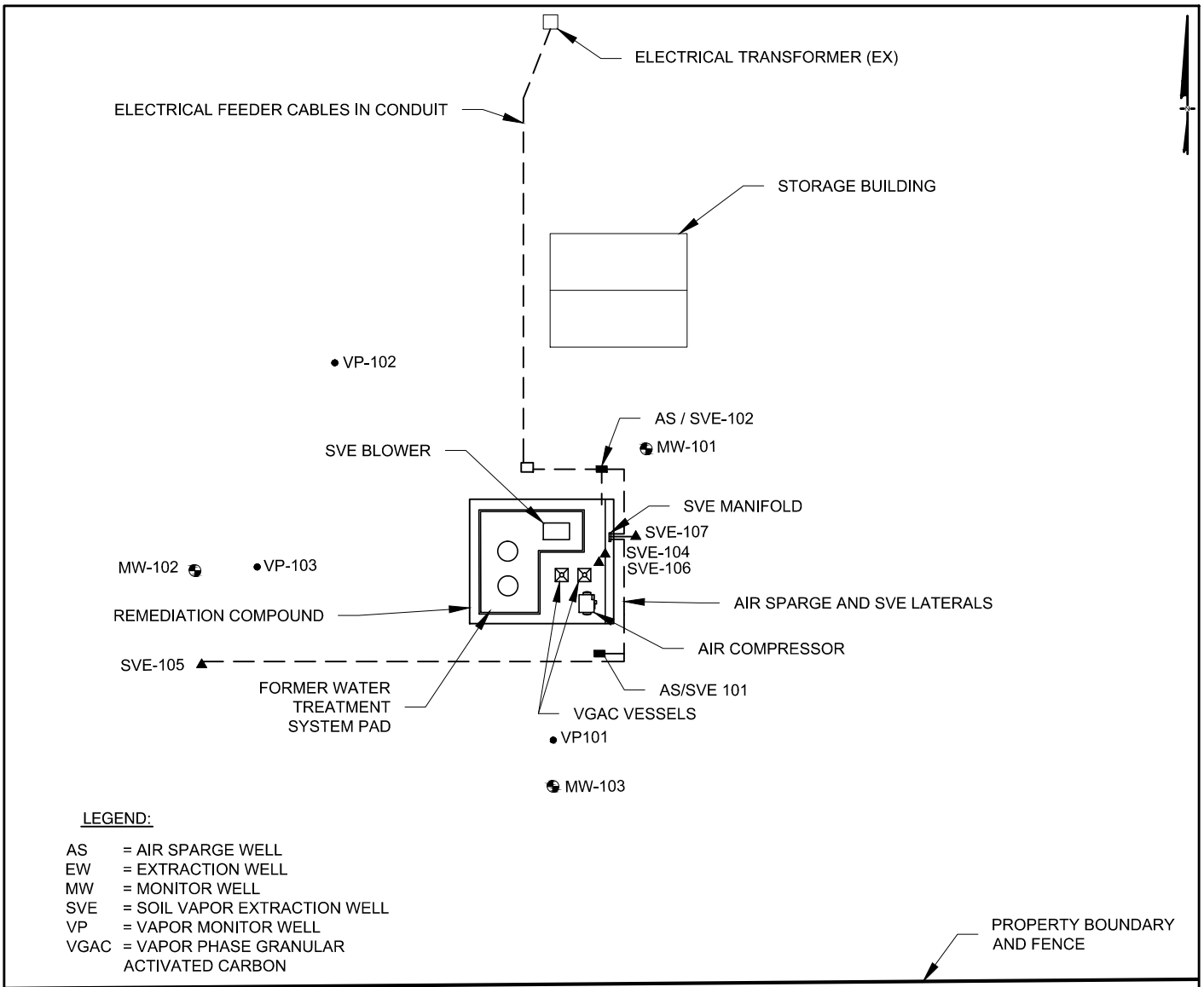
SUMMARY OF PCE CONCENTRATION ISOPLETHS JANUARY 2017

Cooper and Commerce WQARF Site
Gilbert, Arizona

Geosyntec consultants

Phoenix, AZ | June 2017

Figure: 3



PROJECT LOCATION

50 25 0 50 Feet

ERA SYSTEMS LAYOUT

Cooper Rd. and Commerce Ave. WQARF Site
Gilbert, Arizona

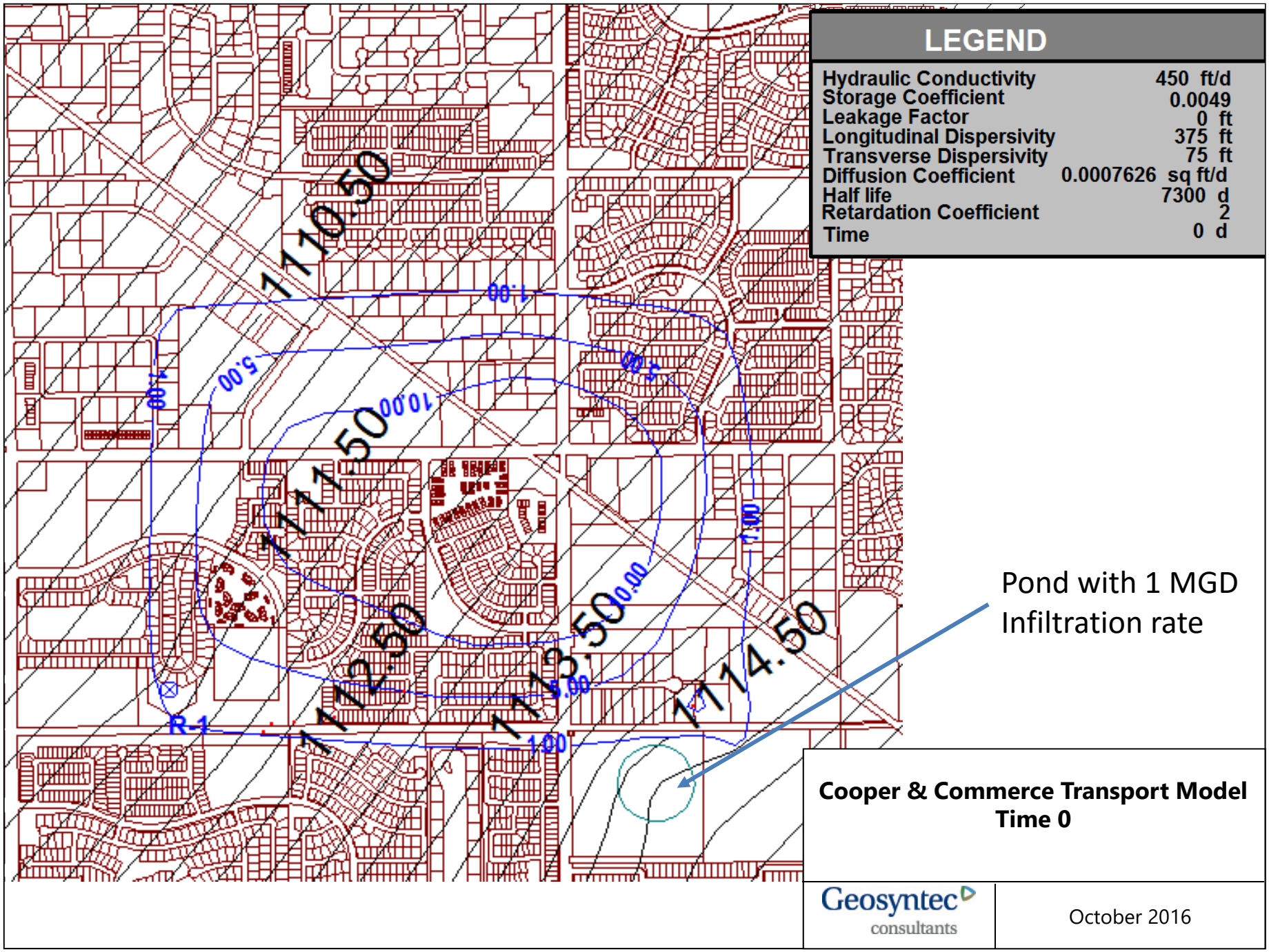
Geosyntec consultants

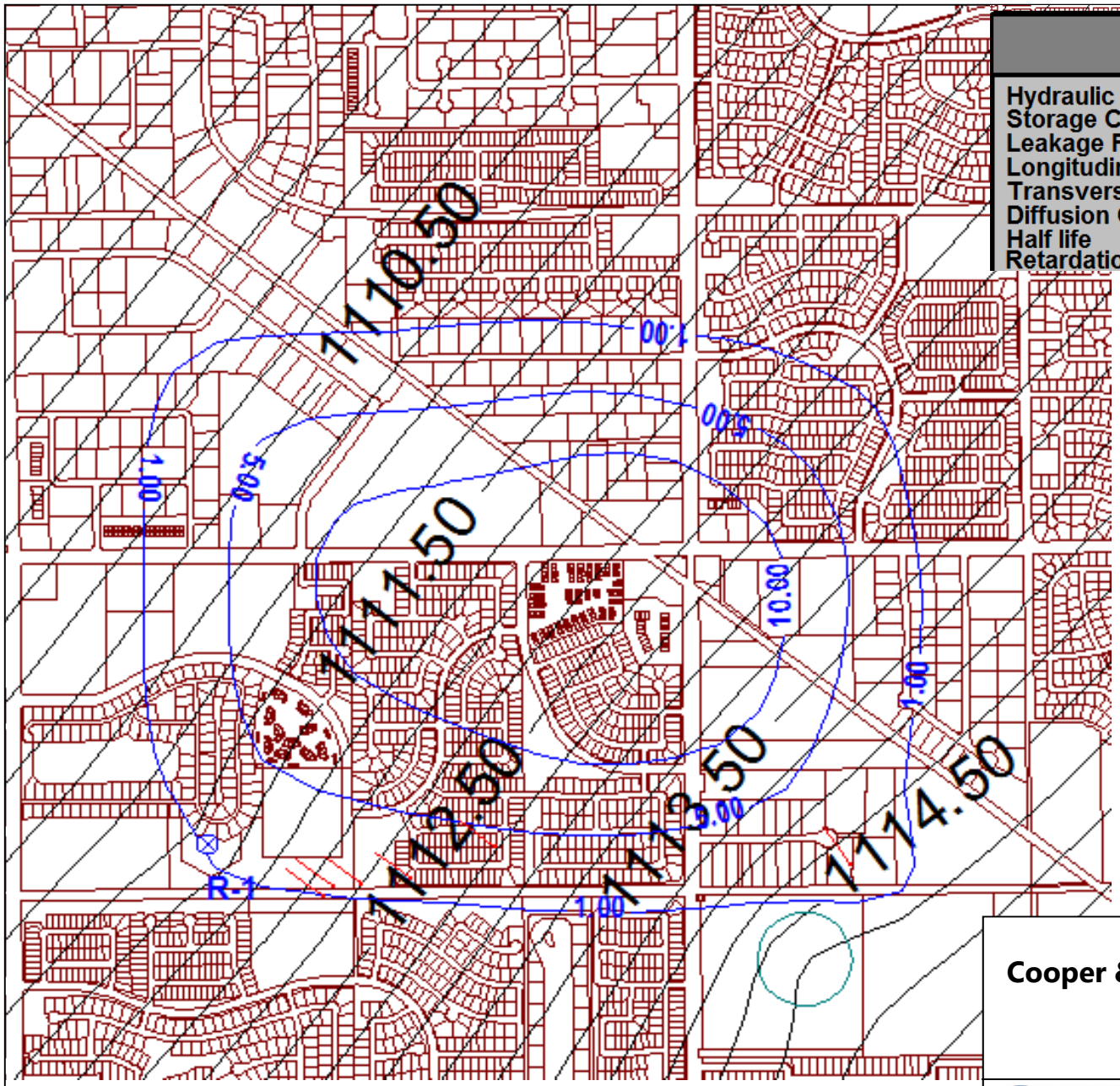
Phoenix, AZ | January 2017

Figure 4

N:\GEOSYNTEC\COOPER AND COMMERCE\SITE FIGURES\CNC SYSTEM LAYOUT EXHIBIT

APPENDIX A
Updated 2016 Groundwater Model


LEGEND
Hydraulic Conductivity 450 ft/d
Storage Coefficient 0.0049
Leakage Factor 0 ft
Longitudinal Dispersivity 375 ft
Transverse Dispersivity 75 ft
Diffusion Coefficient 0.0007626 sq ft/d
Half life 7300 d
Retardation Coefficient 2
Time 0 d
1110.50
1111.50
1112.50
1113.50
1114.50
1.00
5.00
10.00
0.00
R-1
Pond with 1 MGD
Infiltration rate
Cooper & Commerce Transport Model
Time 0
Geosyntec consultants
October 2016



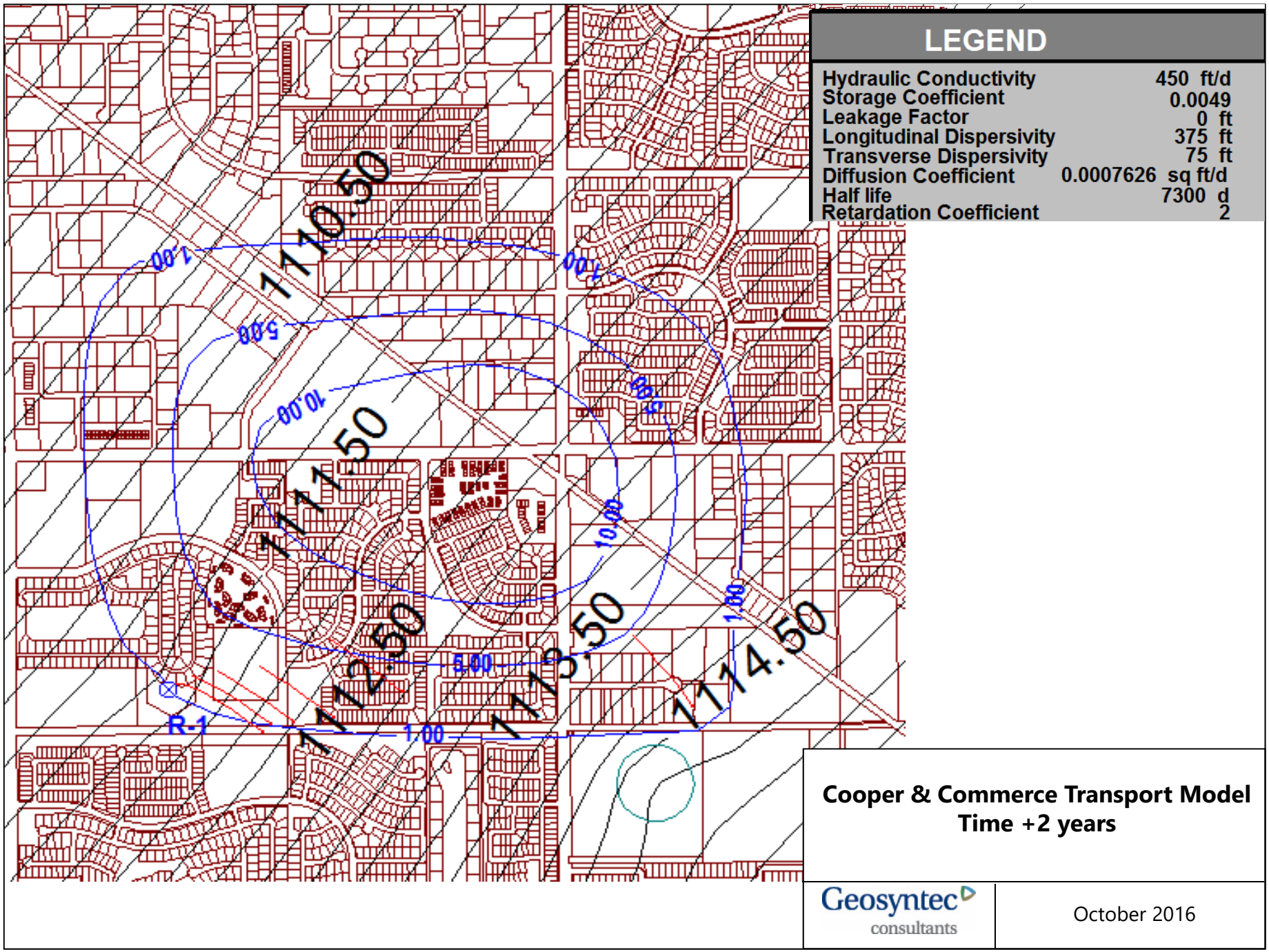
LEGEND

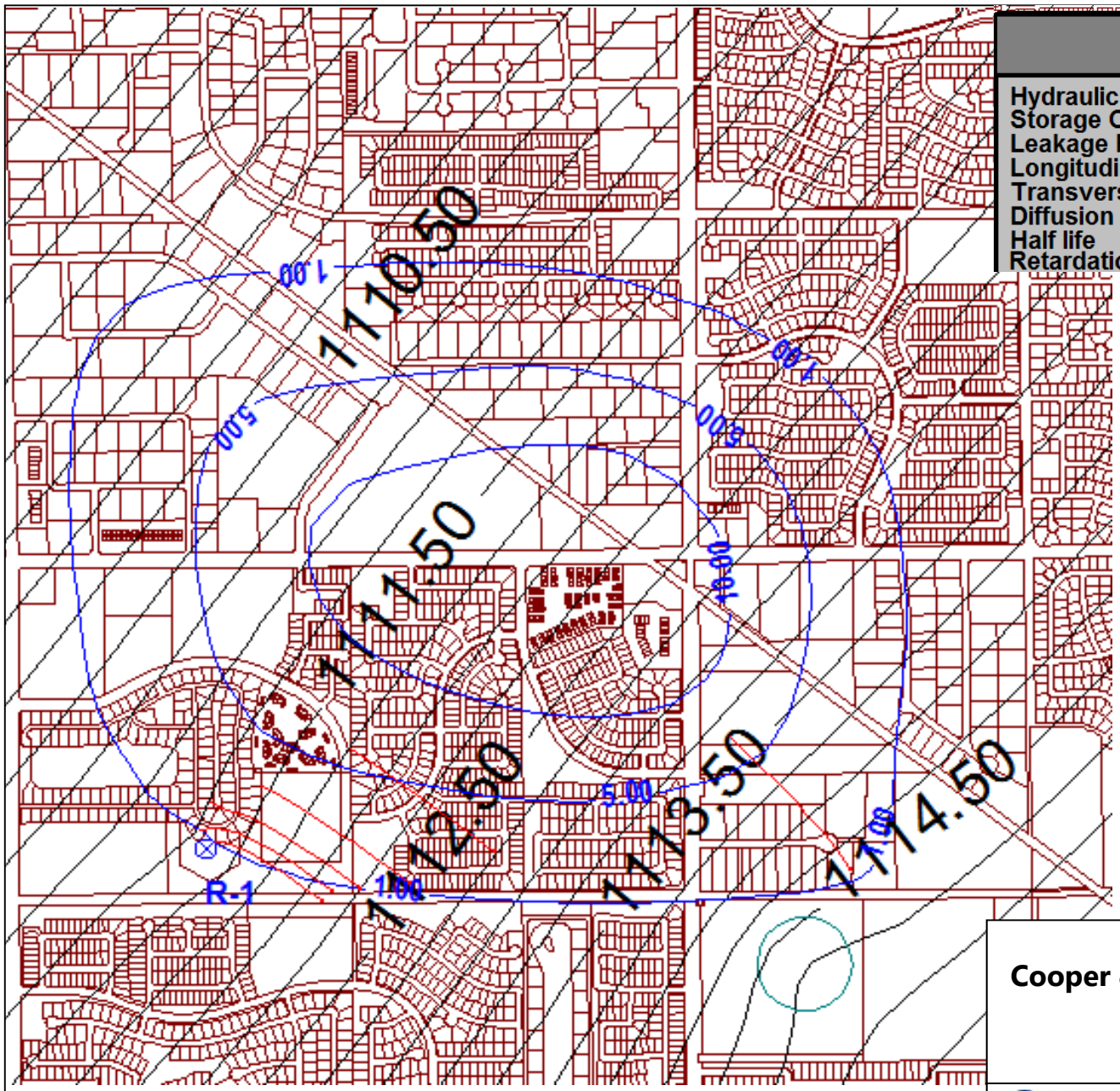
Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +1 year

Geosyntec consultants

October 2016


LEGEND
Hydraulic Conductivity 450 ft/d
Storage Coefficient 0.0049
Leakage Factor 0 ft
Longitudinal Dispersivity 375 ft
Transverse Dispersivity 75 ft
Diffusion Coefficient 0.0007626 sq ft/d
Half life 7300 d
Retardation Coefficient 2
1110.50
1111.50
1112.50
1113.50
1114.50
1.00
5.00
10.00
R-1
Cooper & Commerce Transport Model
Time +2 years
Geosyntec consultants
October 2016



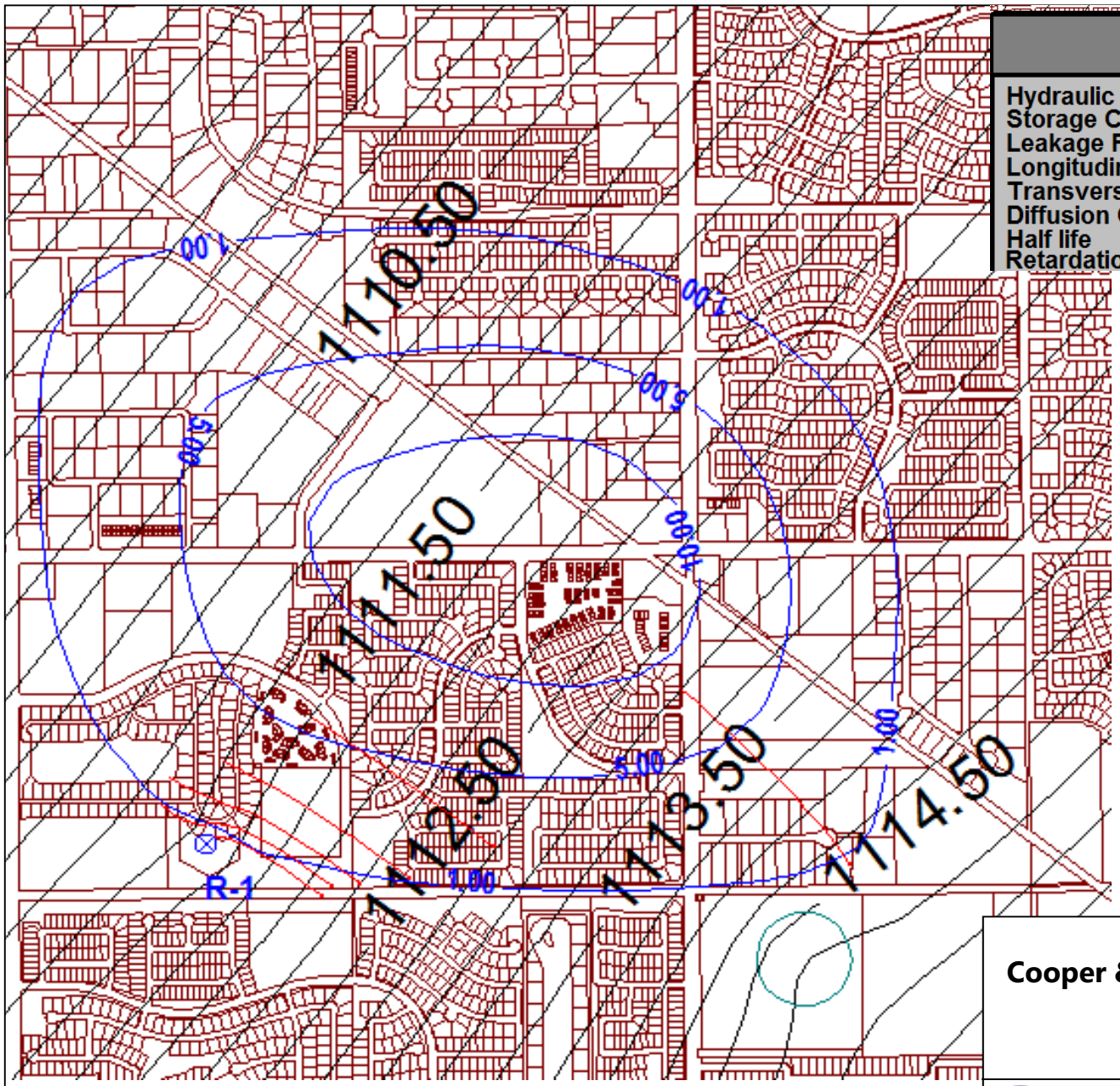
LEGEND

Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +3 years

Geosyntec consultants

October 2016



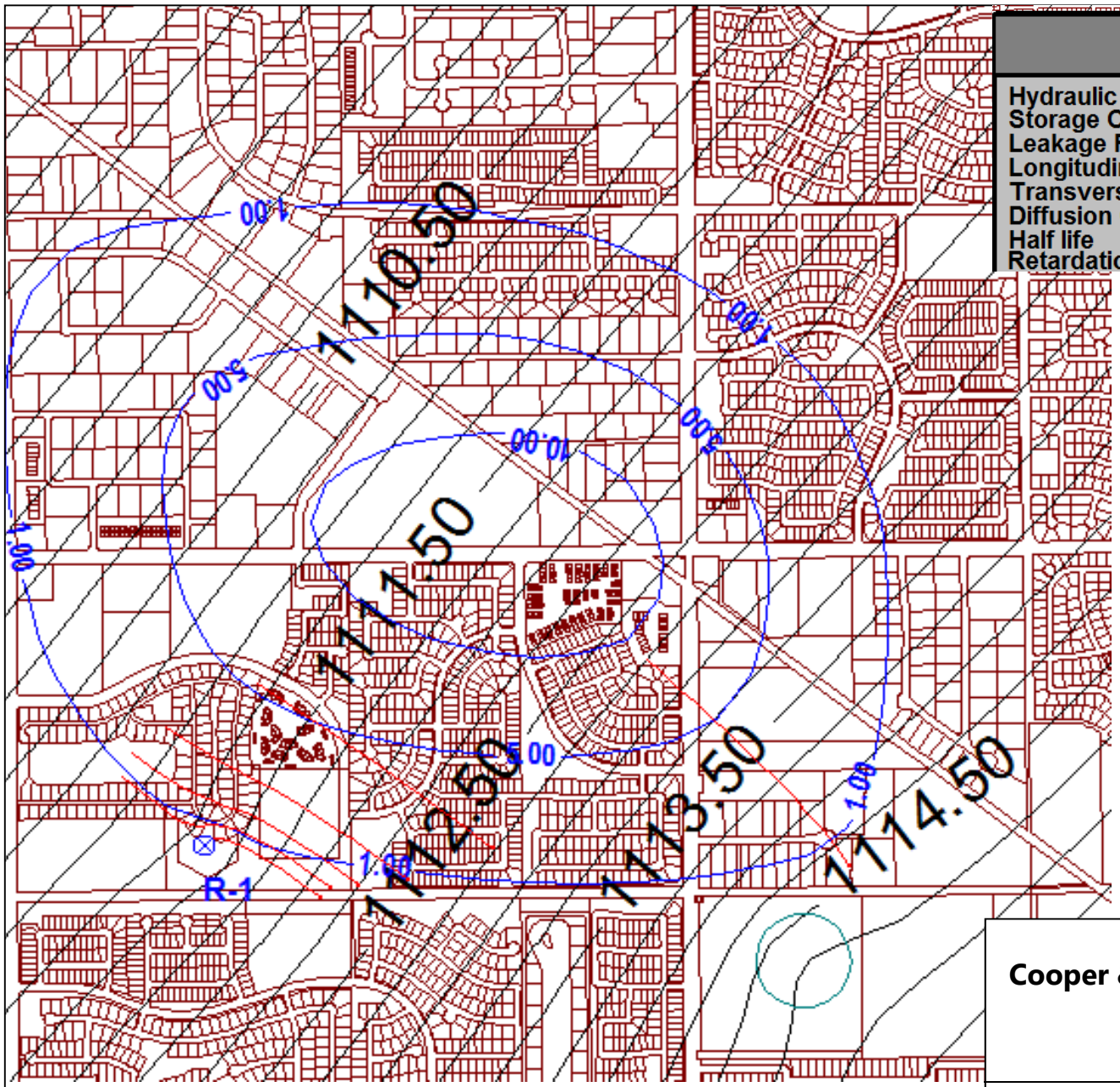
LEGEND

Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +4 years

Geosyntec consultants

October 2016



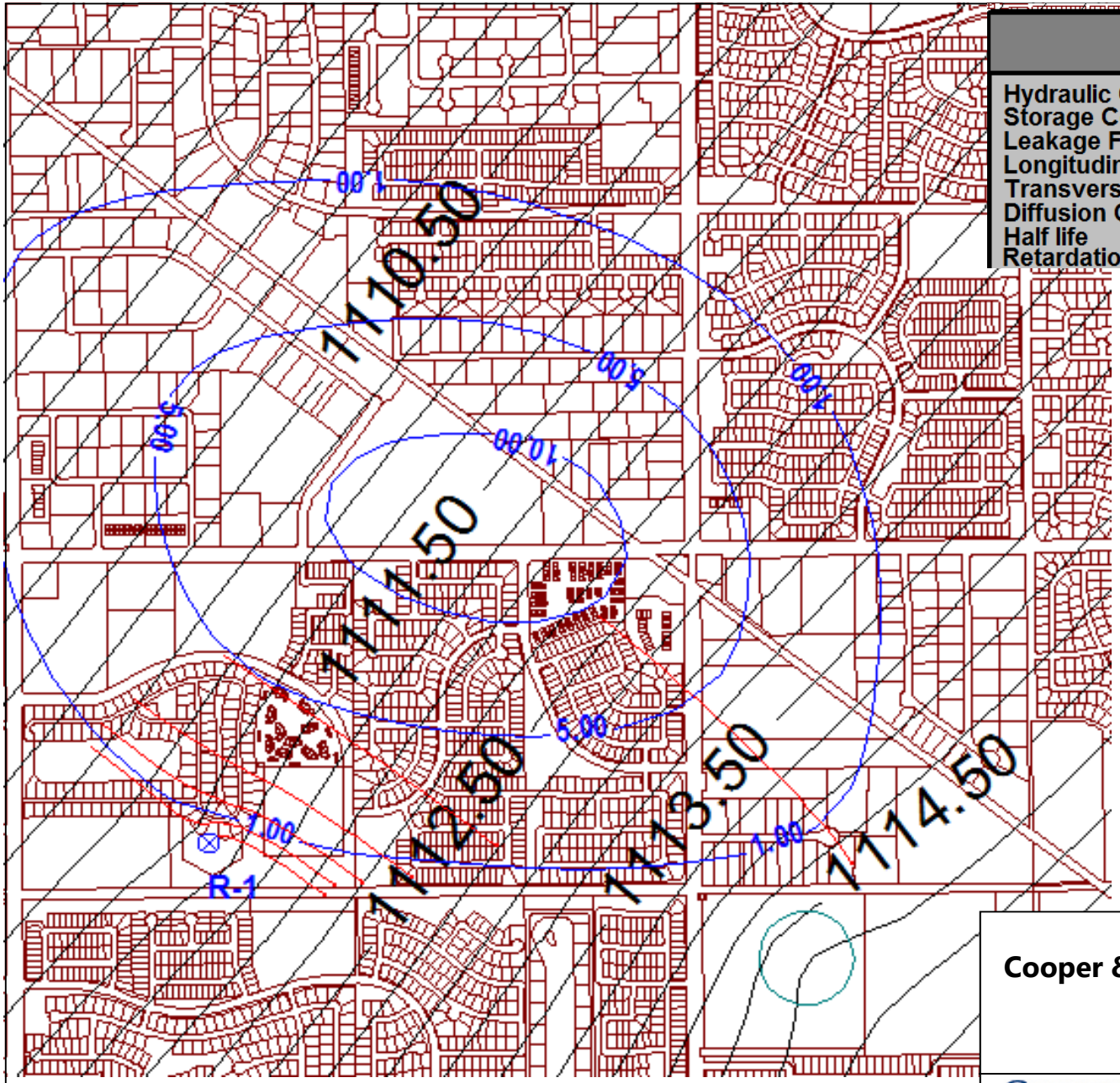
LEGEND

Hydraulic Conductivity	450 ft/d
Storage Coefficient	0.0049
Leakage Factor	0 ft
Longitudinal Dispersivity	375 ft
Transverse Dispersivity	75 ft
Diffusion Coefficient	0.0007626 sq ft/d
Half life	7300 d
Retardation Coefficient	2

Cooper & Commerce Transport Model
Time +5 years

Geosyntec consultants

October 2016



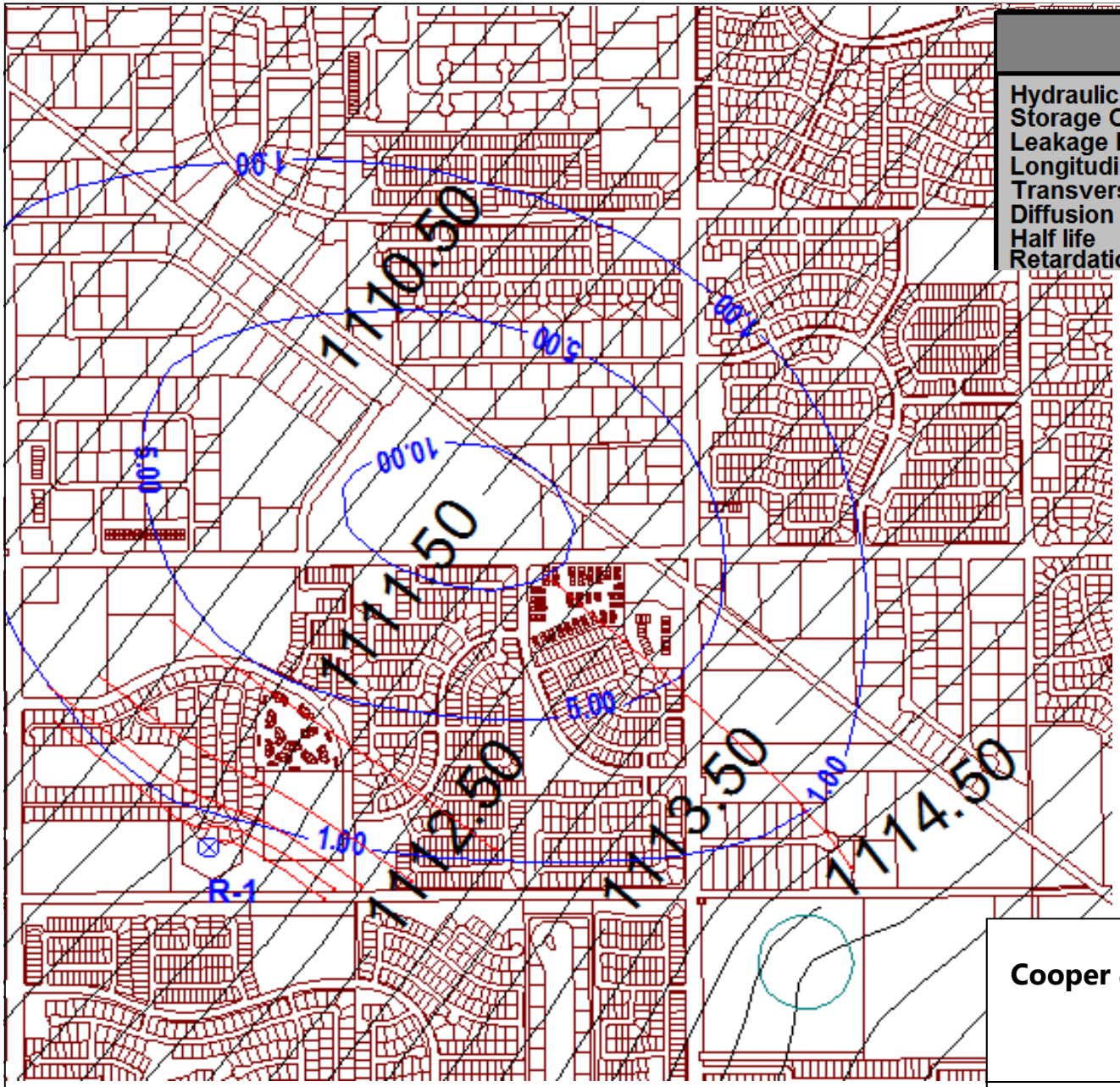
LEGEND

Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +6 years

Geosyntec consultants

October 2016



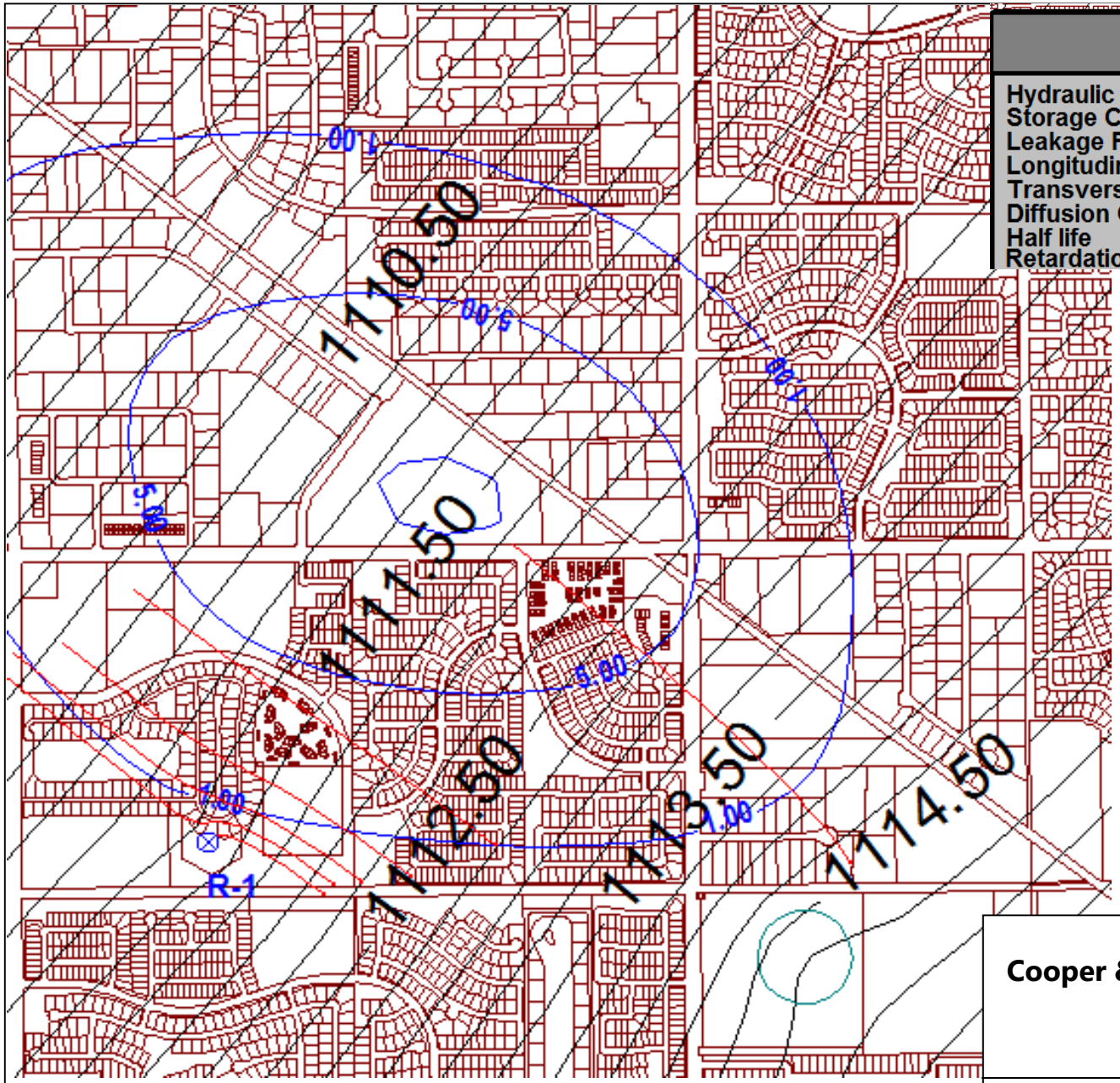
LEGEND

Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +7 years

Geosyntec consultants

October 2016



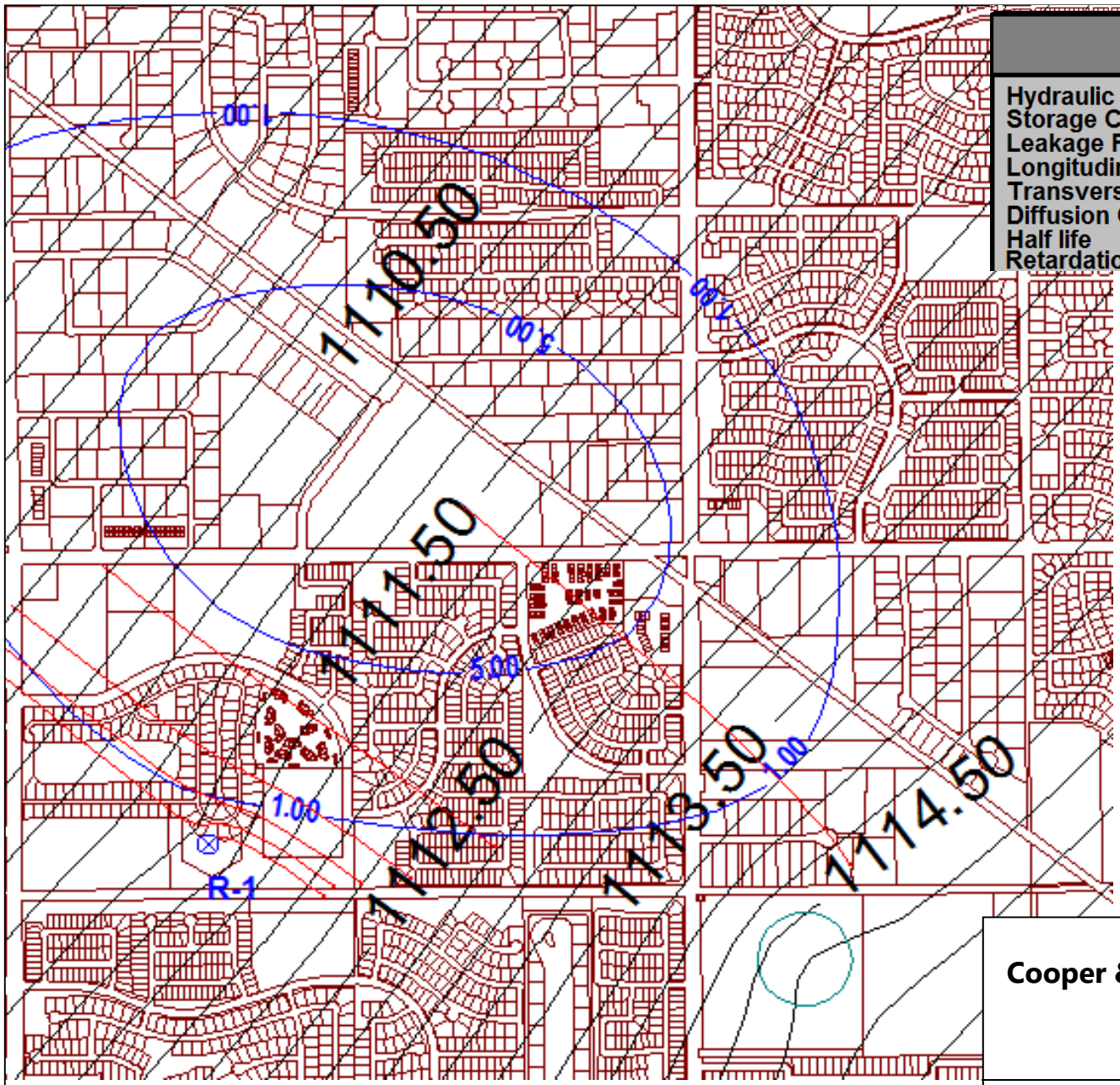
LEGEND

Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +8 years

Geosyntec consultants

October 2016



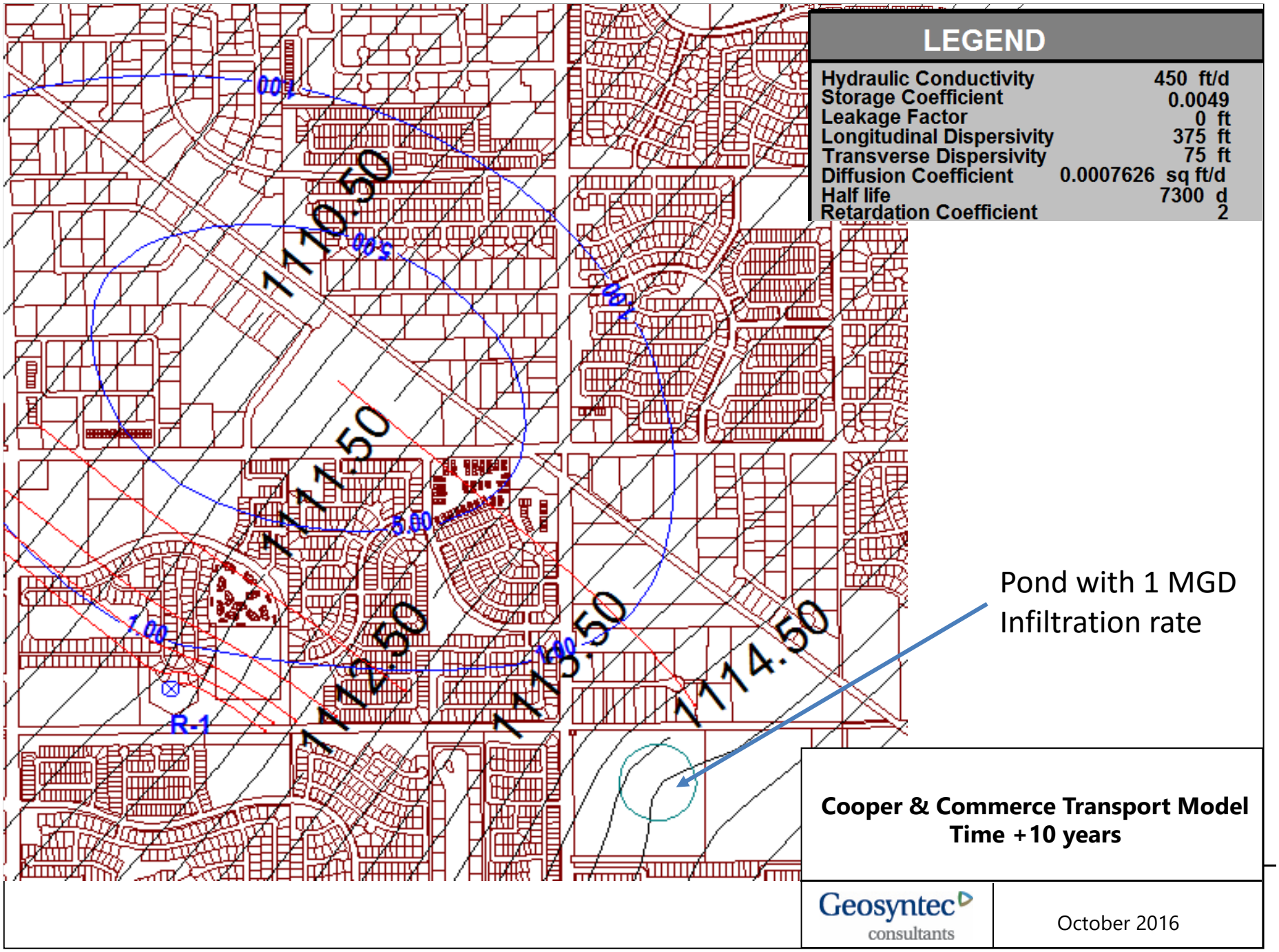
LEGEND

Hydraulic Conductivity	450	ft/d
Storage Coefficient	0.0049	
Leakage Factor	0	ft
Longitudinal Dispersivity	375	ft
Transverse Dispersivity	75	ft
Diffusion Coefficient	0.0007626	sq ft/d
Half life	7300	d
Retardation Coefficient	2	

Cooper & Commerce Transport Model
Time +9 years

Geosyntec consultants

October 2016


LEGEND
Hydraulic Conductivity 450 ft/d
Storage Coefficient 0.0049
Leakage Factor 0 ft
Longitudinal Dispersivity 375 ft
Transverse Dispersivity 75 ft
Diffusion Coefficient 0.0007626 sq ft/d
Half life 7300 d
Retardation Coefficient 2
1110.50
1111.50
1112.50
1113.50
1114.50
0.01
0.05
0.20
5.00
1.00
R-1
Pond with 1 MGD
Infiltration rate
Cooper & Commerce Transport Model
Time +10 years
Geosyntec consultants
October 2016

APPENDIX B
Technical Memorandum
for Soil Borings Near Former Drywell

Geosyntec consultants

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Phoenix, AZ 85028
PH 602.513.5812
FAX 602.513.5813
www.geosyntec.com

Memorandum

Date:	06 March 2017
To:	Kyle Johnson, Arizona Department of Environmental Quality
From:	Marla Miller, PE, Geosyntec Consultants
Subject:	Soil Borings Near Former Drywell Cooper & Commerce WQARF Site

---

Geosyntec Consultants, Inc. (Geosyntec) is pleased to submit this technical memorandum to the Arizona Department of Environmental Quality (ADEQ) presenting soil and soil vapor results from soil borings drilled near the former drywell at the Cooper and Commerce Water Quality Assurance Revolving Fund (WQARF) Site (the Site).

BACKGROUND AND OBJECTIVES

The main source of soil and groundwater contamination at the Site appears to be a former drywell that was used to discharge spent chemicals from metals processing activities at the former Unichem facility. During previous soil investigations, the maximum tetrachloroethene (PCE) concentration, observed at 70 feet below ground surface (ft bgs), was 24,000 milligrams per kilogram (mg/kg). An Early Response Action (ERA) consisted of a soil vapor extraction (SVE) system that operated continuously from December 2008 to August 2014. In February 2016, the SVE system was restarted in pulse mode (approximately one month on followed by one month off). In November 2016, two soil borings were drilled near the former dry well to assess volatile organic compound (VOC) concentrations present in the soil and soil vapor after SVE operation.

FIELD ACTIVITIES

Figure 1 shows the location of the two soil borings in relation to the drywell (previously located at SVE-104). The drywell was reportedly constructed to a depth of 79 feet. The two soil borings were advanced using a track-mounted sonic drill rig, angled at approximately 20 degrees from vertical, to approximately 75 feet (approximately 70.5 ft bgs). Two soil samples and three soil vapor samples were collected per boring. During drilling, intermittent green stained soil was observed from approximately 51 to 69 ft bgs and noted in the boring logs, suggesting the presence

of copper in soils at depth. Boring logs, indicating the presence of silty clays, are included in Attachment A. Field notes for the soil vapor samples are included in Attachment B.

Soil vapor samples were collected using a SimulProbe® sample collection device. Flexible tubing is connected to the top of the SimulProbe® sampler that is driven into the soil to the sampling depth and retracted slightly, exposing the intake screen. A valve and sampling tee are connected to the flexible tubing with one branch of the tee connected to a 1-liter, batch certified Summa canister and the other to a gauge board with a vacuum pump (lung box) and Tedlar sampling bag. Prior to soil vapor collection, a 'shut-in' test was conducted to demonstrate that the sample train was not leaking. The shut-in test consisted of closing the valve, applying a vacuum to the sampling apparatus, and monitoring that the vacuum did not dissipate over a period of approximately two minutes. No discernable vacuum loss was noted during the shut-in tests, indicating there were no leaks in the sampling apparatus.

Following the shut-in test, approximately three tubing volumes of soil vapor were purged at approximately 200 milliliters per minute (mL/min). During purging, the purged soil vapor was collected in a Tedlar bag that was subsequently screened in the field for total VOCs using a photoionization detector (PID). Following purging, soil vapor samples were collected in the Summa canister at a flow rate of approximately 200 mL/min for 5 minutes.

Soil vapor samples were analyzed for VOCs, using United States Environmental Protection Agency (EPA) Method TO-15, by a TestAmerica Laboratories, Inc. facility in Sacramento, California. Soil samples were analyzed for EPA Method 8260B for VOCs at the Test America Phoenix laboratory. The TestAmerica laboratories are Arizona state-certified. Appendix C presents the laboratory analytical report for the soil vapor and soil samples.

SOIL VAPOR AND SOIL SAMPLING RESULTS

Table 1 summarizes soil sample results from the two soil borings. Trichloroethene (TCE) concentrations in the soil samples were not detected above the laboratory reporting limits. PCE detections ranged from 12 to 77 mg/kg, exceeding the Non-Residential Soil Remediation Level (SRL) of 13 mg/kg and the Minimum Groundwater Protection Limit (GPL) of 1.3 mg/kg. The elevated PCE detections were observed in the deeper samples, ranging between 69 and 75 feet.

The soil vapor sample results, summarized in Table 2, were compared to screening levels to assess for potential vapor intrusion and groundwater impacts. Soil vapor screening levels were calculated using the Johnson and Ettinger (J&E) subsurface vapor intrusion model (EPA, 2004), along with updated chemical physical properties from the EPA Regional Screening Level (RSL) table

(USEPA, 2016). The J&E model uses contaminant partitioning and convective and diffusive mechanisms to estimate subsurface vapor transport into buildings.

For vapor intrusion screening levels, carcinogenic and non-carcinogenic health-protective concentrations for commercial/industrial exposure scenarios ($HPC_{C/I\text{-}risk}$ and $HPC_{C/I\text{-}haz}$, respectively) were calculated for each sample depth and detected analyte using the J&E model spreadsheets. Chemical-specific and Site-specific soil parameters are used to estimate attenuation factors that are the ratio of a predicted indoor air concentration to the measured soil vapor concentration. Based on the boring logs, Site-specific soil properties used in the spreadsheets were the J&E default values for silty clay. Table 3 presents the EPA's indoor air RSLs for commercial/industrial exposure based on a target cancer risk of 1×10^{-6} and a target noncancer hazard of 1. Table 3 also presents the depth-specific attenuation factors and the resulting analyte-specific $HPC_{C/I\text{-}risk}$ and $HPC_{C/I\text{-}haz}$ values. Calculations for these screening levels are based on the following formulas:

$$HPC_{C/I\text{-}risk} = \frac{Carcinogenic\ indoor\ air\ RSL}{Attenuation\ Factor} \qquad HPC_{C/I\text{-}haz} = \frac{Noncarcinogenic\ indoor\ air\ RSL}{Attenuation\ Factor}$$

Examples of the J&E model spreadsheets, along with the default and Site-specific model input parameters, are included in Appendix D. As presented in Table 4, the soil vapor concentrations were below the calculated $HPC_{C/I\text{-}risk}$ and $HPC_{C/I\text{-}haz}$ values. Table 4 also calculates the cumulative noncancer hazard indices (HIs) and Incremental Lifetime Cancer Risks (ILCRs) for each sample, which were below their respective target risk levels of 1 and 1×10^{-6}, respectively. The HIs ranged from 0.00001 to 0.1 while the ILCRs ranged from 2×10^{-9} to 3×10^{-7}.

To assess potential groundwater impacts, the detected soil vapor concentrations were compared to ADEQ's minimum Groundwater Protection Levels (GPLs). Table 3 presents the minimum GPLs converted from micrograms per kilogram (µg/kg) soil concentrations to micrograms per cubic meter ($\mu g/m^3$) in soil vapor using the J&E model spreadsheet and the same chemical-specific and soil physical parameters that were used to derive the soil vapor HPCs above. Table 3 also includes Non-Residential Soil Remediation Limits (RSLs) converted for comparison to the soil vapor results. The soil vapor results were below the converted minimum GPL and SRL values. An example of the J&E spreadsheet converting the soil GPLs to soil vapor concentrations is also included in Appendix D.

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CONCLUSION

The November 2016 soil vapor sample results were compared to screening levels to assess the potential for vapor intrusion and potential groundwater impact. For vapor intrusion, the screening levels were derived from carcinogenic and non-carcinogenic EPA indoor air RSLs for commercial/industrial exposure. For potential groundwater impacts, screening levels were based on the minimum GPLs, converted to soil vapor units. The soil vapor results were below the screening levels, as shown in Tables 4 and 5.

Soil sample results were compared to minimum GPLs and Non-Residential SRLs (Table 1). Results at depths greater than 65 ft bgs (sample depth of 69 feet in the angle boring) had PCE concentrations ranging from 46 to 77 mg/kg, exceeding the Non-Residential SRL for PCE of 13 mg/kg and the minimum GPL for PCE of 1.3 mg/kg.

It is recommended that the SVE system continue to be operated in pulse mode to optimize VOC mass removal and that the soil exposure pathway for commercial/industrial workers and potential groundwater impacts be evaluated for completeness in a human health risk assessment.

Tables

1 Results Summary for Soil Samples
2 Results Summary for Soil Vapor Samples
3 Site-Specific Soil Vapor Health-Protective Concentrations
4 Soil Vapor Screening for Potential Vapor Intrusion Impacts
5 Soil Vapor Screening for Potential Groundwater Impacts

Figures

1 Soil Boring Locations

Attachments

A Boring Logs
B Field Notes
C Analytical Reports

TABLE 1
Results Summary for Soil Samples
Cooper and Commerce WQARF Site

Geosyntec consultants

Soil Boring	Sample Date	Sample Depth (feet)	PCE (mg/kg)	TCE (mg/kg)
		Non-Residential SRLs	**13**	**65**
		Minimum GPLs	**1.3**	**0.61**
SB-1	11/18/2016	45	<0.095	<0.095
	11/18/2016	75	**77**	<0.15
SB-2	11/18/2016	40	<0.14	<0.14
	11/18/2016	69	**46**	<0.11
	11/18/2016	69 (FD)	**12**	<0.13

Notes:
PCE = tetrachloroethene
TCE = trichloroethene
mg/kg = micrograms per kilogram
SRLs = Soil Remediation Levels, Arizona Adminstrative Code R18-7-2, Appendix A
GPLs = Groundwater Protection Limits from the September 1996 Screening Method to Determine Soil Concentrations Protective of Groundwater Quality
< - Value is non-detect below the laboratory reporting limit
FD = field duplicate
Bold value indicates value exceeds the non-residential SRL and/or minimum GPL.
Sample depth is listed from top of angle boring drilled at 20 degrees from vertical.

TABLE 2
Results Summary for Soil Vapor Samples
Cooper and Commerce WQARF Site

Geosyntec consultants

Soil Boring	SB1			SB2			
Sample Depth (ft in boring)	45	60	75	40	60	70	70 (FD)
Sample Depth (ft bgs)	42.3	56.4	70.5	37.6	56.4	65.8	65.8 (FD)
Volatile Organic Compounds ($\mu g/m^3$)							
Acetone	160	<12	<830	520	<24,000	<3,800	<3,800
Benzene	13	<1.3	<89	88	<2,600	<410	<410
2-Butanone	34	<2.4	<170	140	<4,700	<750	<760
Chloroform	7.6	<1.5	<100	<17	<2,900	<460	<470
Toluene	15	<1.5	<110	85	<3,000	<480	<490
TCE	<7.6	<2.1	<150	<24	<4,300	<680	<690
PCE	<9.6	<2.7	11,000	190	290,000	34,000	48,000

Notes:
PCE = tetrachloroethene
TCE = trichloroethene
ft = feet
ft bgs = feet below ground surface
$\mu g/m^3$ = micrograms per cubic meter
< - Value is non-detect below the laboratory reporting limit
FD = field duplicate; highest result between sample and field duplicate were used for vapor intrusion and groundwater impact assessments
Soil borings were angled at approximately 20 degrees from vertical.
Sample depths are listed as both feet in angled boring and vertical feet below ground surface

TABLE 3
Site-Specific Soil Vapor Health-Protective Concentrations
Cooper and Commerce WQARF Site

Geosyntec consultants

Parameters	EPA Indoor Air Regional Screening Level		40 foot samples			45 foot samples			60 ft samples		
	Carcinogenic RSLs ($\mu g/m^3$)	Noncarcinogenic RSLs ($\mu g/m^3$)	Attenuation Factor	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Attenuation Factor	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Attenuation Factor	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)
Volatile Organic Compounds											
Acetone	NA	1.4E+05	1.28E-04	NA	1.09E+09	1.15E-04	NA	1.22E+09	8.74E-05	NA	1.60E+09
Benzene	1.6E+00	1.3E+02	1.05E-04	1.52E+04	1.24E+06	9.40E-05	1.70E+04	1.38E+06	7.16E-05	2.24E+04	1.82E+06
2-Butanone	NA	2.2E+04	1.10E-04	NA	2.01E+08	9.82E-05	NA	2.24E+08	7.48E-05	NA	2.94E+08
Chloroform	5.3E-01	4.3E+02	9.07E-05	5.84E+03	4.74E+06	8.12E-05	6.53E+03	5.30E+06	6.17E-05	8.58E+03	6.96E+06
Toluene	NA	2.2E+04	9.17E-05	NA	2.40E+08	8.21E-05	NA	2.68E+08	6.24E-05	NA	3.52E+08
TCE	3.0E+00	8.8E+00	8.13E-05	3.69E+04	1.08E+05	7.27E-05	4.13E+04	1.21E+05	5.52E-05	5.43E+04	1.59E+05
PCE	4.7E+01	1.8E+02	6.03E-05	7.80E+05	2.99E+06	5.39E-05	8.73E+05	3.34E+06	4.08E-05	1.15E+06	4.41E+06

TABLE 3
Site-Specific Soil Vapor Health-Protective Concentrations
Cooper and Commerce WQARF Site

Geosyntec consultants

Parameters	EPA Indoor Air Regional Screening Level		70 foot samples			75 foot samples		
	Carcinogenic RSLs ($\mu g/m^3$)	Noncarcinogenic RSLs ($\mu g/m^3$)	Attenuation Factor	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Attenuation Factor	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)
Volatile Organic Compounds								
Acetone	NA	1.4E+05	7.55E-05	NA	1.85E+09	7.07E-05	NA	1.98E+09
Benzene	1.6E+00	1.3E+02	6.17E-05	2.59E+04	2.11E+06	5.78E-05	2.77E+04	2.25E+06
2-Butanone	NA	2.2E+04	6.45E-05	NA	3.41E+08	6.04E-05	NA	3.64E+08
Chloroform	5.3E-01	4.3E+02	5.32E-05	9.95E+03	8.08E+06	4.98E-05	1.06E+04	8.63E+06
Toluene	NA	2.2E+04	5.38E-05	NA	4.09E+08	5.04E-05	NA	4.37E+08
TCE	3.0E+00	8.8E+00	4.76E-05	6.30E+04	1.85E+05	4.45E-05	6.73E+04	1.98E+05
PCE	4.7E+01	1.8E+02	3.52E-05	1.34E+06	5.12E+06	3.29E-05	1.43E+06	5.47E+06

Notes:

Carcinogenic Indoor Air RSLs based on target cancer risk (TR) = 1E-06 for commercial/industrial expo

Noncarcinogenic Indoor Air RSLs based on target noncancer hazard index (HI) = 1 for commerical/industrial exposure

Attenuation Factors were calculated using the J&E model spreadsheet SG-ADV (Ver 3.1, 02/04); assuming a future building scenario with engineered fil

$HPC_{C/I\text{-}risk}$ = Soil Vapor Health-Protective Concentrations for cancer-endpoint, commercial/industrial exposure; calculated as Carcinogenic Indoor Air RSL / Attenuation Factor

$HPC_{C/I\text{-}haz}$ = Soil Vapor Health-Protective Concentrations for non-cancer-endpoint, commercial/industrial exposures; calculated as Noncarcinogenic Indoor Air RSL / Attenuation Factor

Attenuation factors, $HPC_{C/I\text{-}risk}$, and $HPC_{C/I\text{-}haz}$ are calculated for each sample depth

$\mu g/m^3$ = micrograms per cubic meter

RSLs = Regional Screening Level

TCE = Trichloroethene

PCE = Tetrachloroethene

NA = Not applicable

TABLE 4
Soil Vapor Screening for Potential Vapor Intrusion Impacts
Cooper and Commerce WQARF Site

Geosyntec consultants

Parameters	SB1-45			SB1-60			SB1-75		
	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Conc. ($\mu g/m^3$)	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Conc. ($\mu g/m^3$)	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Conc. ($\mu g/m^3$)
Volatile Organic Compounds									
Acetone	NA	1.22E+09	160	NA	1.60E+09	<12	NA	1.98E+09	<830
Benzene	1.70E+04	1.38E+06	13	2.24E+04	1.82E+06	<1.3	2.77E+04	2.25E+06	<89
2-Butanone	NA	2.24E+08	34	NA	2.94E+08	<2.4	NA	3.64E+08	<170
Chloroform	6.53E+03	5.30E+06	7.6	8.58E+03	6.96E+06	<1.5	1.06E+04	8.63E+06	<100
Toluene	NA	2.68E+08	15	NA	3.52E+08	<1.5	NA	4.37E+08	<110
TCE	4.13E+04	1.21E+05	<7.6	5.43E+04	1.59E+05	<2.1	6.73E+04	1.98E+05	<150
PCE	8.73E+05	3.34E+06	<9.6	1.15E+06	4.41E+06	<2.7	1.43E+06	5.47E+06	11,000
Cumulative Risks									
Hazard Index (HI)	0.00001			NC			0.002		
Incremental Lifetime Cancer Risk (ILCR)	2E-09			NC			8E-09		

TABLE 4
Soil Vapor Screening for Potential Vapor Intrusion Impacts
Cooper and Commerce WQARF Site

Geosyntec consultants

Parameters	SB2-40			SB2-60			SB2-70		
	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Conc. ($\mu g/m^3$)	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Conc. ($\mu g/m^3$)	$HPC_{C/I\text{-}risk}$ ($\mu g/m^3$)	$HPC_{C/I\text{-}haz}$ ($\mu g/m^3$)	Conc. ($\mu g/m^3$)
Volatile Organic Compounds									
Acetone	NA	1.09E+09	520	NA	1.60E+09	<24,000	NA	1.85E+09	<3,800
Benzene	1.52E+04	1.24E+06	88	2.24E+04	1.82E+06	<2,600	2.59E+04	2.11E+06	<410
2-Butanone	NA	2.01E+08	140	NA	2.94E+08	<4,700	NA	3.41E+08	<760
Chloroform	5.84E+03	4.74E+06	<17	8.58E+03	6.96E+06	<2,900	9.95E+03	8.08E+06	<470
Toluene	NA	2.40E+08	85	NA	3.52E+08	<3,000	NA	4.09E+08	<490
TCE	3.69E+04	1.08E+05	<24	5.43E+04	1.59E+05	<4,300	6.30E+04	1.85E+05	<690
PCE	7.80E+05	2.99E+06	190	1.15E+06	4.41E+06	290,000	1.34E+06	5.12E+06	48,000
Cumulative Risks									
Hazard Index (HI)	0.0001			0.1			0.01		
Incremental Lifetime Cancer Risk (ILCR)	6E-09			3E-07			4E-08		

Notes:

$HPC_{C/I\text{-}risk}$ = Soil Vapor Health-Protective Concentrations for cancer-endpoint, commercial/industrial exposures

$HPC_{C/I\text{-}haz}$ = Soil Vapor Health-Protective Concentrations for non-cancer-endpoint, commercial/industrial exposures

$\mu g/m^3$ = micrograms per cubic meter

NA = Not applicable

Hazard Index (HI) = $\sum (C_{sg,i} / HPC_{C/I\text{-}haz,i})$ x target noncancer hazard index of 1

Incremental Lifetime Cancer Risk (ILCR) = $\sum (C_{sg,i} / HPC_{C/I\text{-}risk,i})$ x target cancer risk of 1E-06

$C_{sg,i}$ = soil vapor concentration

Nondetected results were not included in the HI and ILCR calculations

NC = Not Calculated

Cummulative ILCR estimates for commercial/industrial workers were compared to a target cancer risk of 1E-05

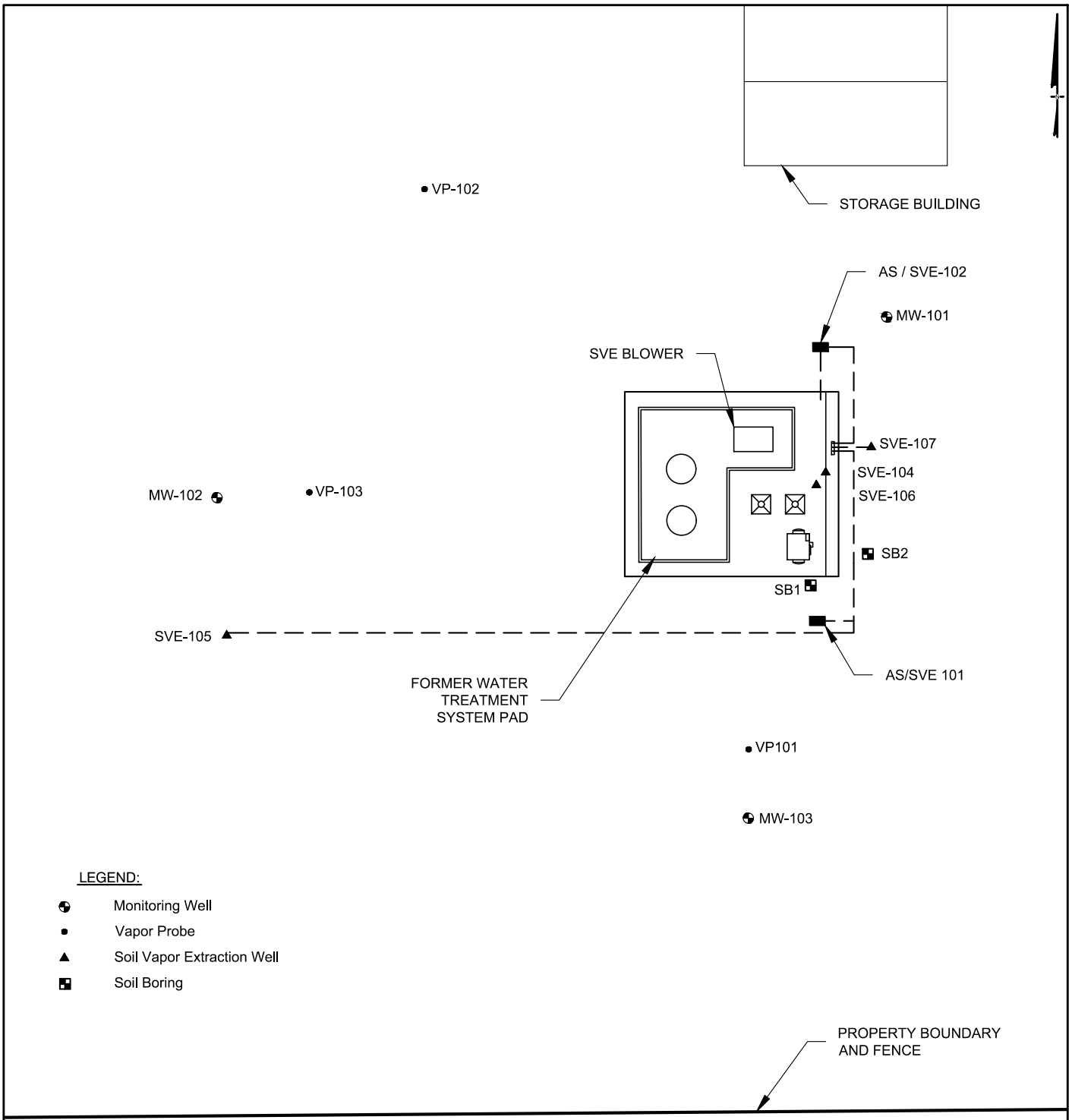
Cummulative HI estimates were compared to target noncancer risk of 1

TABLE 5
Soil Vapor Screening for Potential Groundwater Impacts
Cooper and Commerce WQARF Site

Geosyntec consultants

Parameters	Non-Residential SRL (µg/kg)	Converted SRL (µg/m^3)	Minimum GPL (µg/kg)	Converted GPL (µg/m^3)	SB1-45	SB1-60	SB1-75	SB2-40	SB2-60	SB2-70
Volatile Organic Compounds by EPA TO-15 (µg/m^3)										
Acetone	5.40E+07	5.43E+08	NA	NC	160	<12	<830	520	<24,000	<3,800
Benzene	1.40E+03	1.22E+06	7.10E+02	6.21E+05	13	<1.3	<89	88	<2,600	<410
2-Butanone	3.40E+07	4.87E+08	NA	NC	34	<2.4	<170	140	<4,700	<760
Chloroform	2.00E+04	1.33E+07	NA	NC	7.6	<1.5	<100	<17	<2,900	<470
Toluene	6.50E+05	4.51E+08	4.00E+05	2.77E+08	15	<1.5	<110	85	<3,000	<490
Trichloroethene	6.50E+04	6.77E+07	6.10E+02	6.35E+05	<7.6	<2.1	<150	<24	<4,300	<690
Tetrachloroethene	1.30E+04	2.41E+07	1.30E+03	2.41E+06	<9.6	<2.7	11,000	190	290,000	48,000

Notes:
Non-Residential SRL = Soil Remediation Levels for non-residential exposure scenarios
Minimum GPL = Minimum Groundwater Protection Levels, Table 3 from 1996 A Screening Method to Determine Soil Concentrations Protective of Groundwater Qualit
SRLs and GPLs were converted to soil vapor units (µg/m^3) using a J&E model spreadsheet (SL-Screen, Ver 3.1, 02/04) and the following soil properties (for silty clay):
bulk density = 1.38 g/cm^3, total porosity = 0.481 cm^3/cm^3, water-filled porosity = 0.216 cm^3/cm^3, and fraction organic carbon = 0.001
µg/kg = micrograms per kilogram
µg/m^3 = micrograms per cubic meter
NA = Not applicable
NC = Not Calculated
"<" = Analyte not detected above the listed reporting limi



PROJECT LOCATION

30 15 0 30 Feet

SOIL BORING LOCATIONS

Cooper Rd. and Commerce Ave. WQARF Site
Gilbert, Arizona

Geosyntec consultants

Phoenix, AZ | March 2017

Figure 1

N:\GEOSYNTEC\COOPER AND COMMERCE\SITE FIGURES\CNC SYSTEM LAYOUT EXHIBIT

ATTACHMENT A
Boring Logs

Geosyntec consultants

BORING LOG

Project No.:	SP0146B-03-04	Page	1 of 3
Site Name:	Cooper + Commerce	Date Start & Complete:	11/17/16 - 11/17/16
Boring I.D.:	SB-1	Borehole Diameter:	6 inch
Geologist/Eng.:	Rebecca Brand	Borehole Depth:	75 ft.
Drilling Company:	Cascade	Depth to Water:	
Drilling Method:	Sonic		
Comments:	Angle Boring 20° off vertical. Soil samples analyzed for 8260B		

Depth	USCS Symbol	Lithologic Description	Date & Time	Comments
0		AB Backfill		
3	CH	Fat Clay. Brown (7.5YR 4/4)(0,2,98) High plasticity. High to very high dry strength. Fine-medium sand. Moist.		
4		Caliche nodules present at 4'		
5	CL	Silty Clay. Brown (7.5YR 4/4) (0,0,100). Low to Medium plasticity. Low dry strength. Moist.		
7	CH	Fat Clay. Brown (7.5YR 4/4)(0, 2,98) High plasticity. High to very high dry strength. Fine-Medium sand. Moist		
10	CL	Silty Clay Brown (7.5YR 4/4) (0,0,100) Low to Medium plasticity. Low dry strength. Moist		
12	CH	Fat Clay. Brown (7.5YR 4/4)(0,3,97) High plasticity. High to very high dry strength. Fine-Med. sand. Moist.		

Reviewed by: Rebecca Brand R.G.# 5195

Geosyntec consultants

BORING LOG

Project No.: SP0146B
Site Name: Cooper + Commerce
Comments:

Page 2 of 3
Boring ID SB-1

Depth	USCS Symbol	Lithologic Description	Date & Time	Comments
14	CL	Silty Clay. Brown (7.5YR 5/4), (0,5,95) Low to Medium Plasticity. Low dry strength. Fine sand. Moist.		
20		Similar to Above		
21	ML	Silt. Light yellowish brown (10YR 6/4) (0,2,98). Nonplastic. Low Dry Strength Fine sand. Moist.		
25		Caliche nodules present		
30		Similar to Above. Brown (7.5YR 4/4) No caliche nodules present.		
34	CL	Silty Clay. Brown (7.5YR 4/4) (0,2,98) Low to Medium Plasticity Low dry strength. Fine sand. Moist		
45	CH	Fat Clay with gravel. Brown (7.5YR 4/4) (15, 2, 83). High Plasticity. High to very high dry strength. Fine gravel. Moist		Soil Sample collected SB1-45-1117 2016 Soil Vapor sample collected SB1-45-1117 2016

Reviewed by: Rebecca Rust R.G.# 51952

Geosyntec consultants

BORING LOG

Project No.: SP0146B
Site Name: Coop + Commerce
Comments:

Page 3 of 3
Boring ID SB-1

Depth	USCS Symbol	Lithologic Description	Date & Time	Comments
47	CH	Fat Clay. Brown (7.5YR 4/4) (2,1,97) High Plasticity. High to very high dry strength. Trace fine gravel + sand. Caliche nodules up to 2" Moist.		
50		Similar to Above	ft bgs	intermittent Bright green staining observed from 55-68 Staining particularly noted on caliche nodules.
60		similar to Above		Soil vapor sample collected SB1-60-11172016
68	CH	Fat Clay with gravel. Brown (7.5YR 4/4) (15, 2, 83) High Plasticity. High to very high dry strength. Fine-medium gravel Trace fine sand.		
71	GP	Poorly graded gravel with clay. Brown (7.5YR 4/4) (83, 2, 15). Sub angular to angular gravel. Trace sand. Wet.		
75		Similar to Above End of boring.		Soil Sample collected SB-1-75-11172016 soil vapor sample collected SB1-75-11172016

Reviewed by: Richard Rad R.G.# 51952

Geosyntec consultants

BORING LOG

Project No.:	SP0146B-03-04	Page	1 of 3
Site Name:	Cooper + Commerce	Date Start & Complete:	11/18/16 - 11/18/16
Boring I.D.:	SB-2	Borehole Diameter:	6 inches
Geologist/Eng.:	Rebecca Brand	Borehole Depth:	70
Drilling Company:	Cascade	Depth to Water:	
Drilling Method:	Sonic		

Comments: Angle Boring 20° from vertical. Soil samples collected for 8260B.

Depth	USCS Symbol	Lithologic Description	Date & Time	Comments
0		AB Backfill		
3	CH	Fat Clay. Brown (7.5YR 4/4) (0,1,99) High Plasticity. High to very high dry strength. Fine sand. Moist		
5		caliche laying present.		
6	CL	Silty Clay. Brown (7.5YR 4/4) (0,0,100) low to Medium plasticity. Low dry strength. Moist.		
8	CH	Fat Clay. Brown (7.5YR 4/4) (0,1,99) High plasticity. High to very high dry strength. Fine sand. Moist.		
10	CL	Silty Clay. Brown (7.5YR 4/4) (0,1,99) Low to Medium plasticity. Low dry strength. Moist.		

Reviewed by: Rebecca Brand R.G.# 51952

Geosyntec consultants

BORING LOG

Project No.: SP0146B-
Site Name: Cooper + Commerce
Comments:

Page 2 of 3
Boring ID SB-2

Depth	USCS Symbol	Lithologic Description	Date & Time	Comments
12	CH	Fat clay. Brown (7.5YR 4/4)(0,3,97) High plasticity. High to very high dry strength. Fine sand. Moist.		
14	CL	Silty Clay. Brown (7.5YR 4/4)(0,5,95) Low to Medium plasticity. Low dry strength. Fine sand. Moist. Caliche layers present.		
20	ML	Silt. Brown (7.5YR 4/4)(0,2,98) Nonplastic Low Dry Strength. Fine sand. Moist.		
23		Caliche layers present.		
25		No caliche layers present		
27	ML	Similar to above. Light Yellowish Brown (10YR 6/4)		
30				
34	CL	Silty Clay Brown. (7.5YR 4/4)(0,2,98) Low to Medium Plasticity. Low dry strength. Fine sand. Moist		
40				Soil sample collected SB-2-40-11182016 Soil vapor sample collected SB-2-40-11182016

Reviewed by: Reece Brand R.G.# 5195Z

Geosyntec consultants

BORING LOG

Project No.: SP01468-
Site Name: Cooper + Commerce
Comments:

Page 3 of 3
Boring ID SB-2

Depth	USCS Symbol	Lithologic Description	Date & Time	Comments
50	CH	Fat clay. Brown (7.5YR 4/4) (5, 1, 94) High Plasticity. High to very high dry strength. Trace fine gravel. Moist Caliche nodules upto 2" present.		51-69 ft bgs Bright green intermittent staining observed. Staining particularly noted on caliche nodules
60				Soil vapor sample collected SB2-60-1118 2016
61	CH	~~Fat clay~~ with gravel. Brown (7.5YR 4/4) (15, 2, 83) High plasticity. High to very high dry strength. Fine to Medium gravel. Trace fine sand. Wet.		
65	GP	Poorly Graded gravel with clay. Brown (7.5YR 4/4) (83, 2, 15) Sub angular to angular gravel. Trace sand. Wet.		
69		End of Boring.		Soil Samples collected SB2-69-11182016 SB2-69-11182016Dup
70		Sample pushed ahead to 70ft bgs		Soil vapor sample collected SB2-70-11182016 SB2-70-11182016Dup

Reviewed by: Ricca Bent R.G.# 51952

ATTACHMENT B
Field Notes

Geosyntec consultants

Name: R. Fifield

Date: 11-17-16 Page 1 of 1

DAILY FIELD REPORT

Project No.: SPO 146B

Project Description: DRILL 2 SOIL BORINGS

Site Name:

Weather: COOL

0600 LV DAPHNE BOX ICR TRUCK TO SITE

0645 AT SITE, FIND JOHN ALLEN, STILL EAST OF COMPOUND NOT MOVED YET

0800 CASCADE ONSITE H&S MEETING DISCUSS TRAFFIC

0900 SET UP DRILLING EQUIPMENT

0930 GROGER ARRIVES TO TALLEY

0957 START DRILLING

1050 AT = 35'

1100 AT = 45' SET UP SIMI PROBE TOOL GROGER ON SITE COLLECT 45' SOIL SAMPLE SB1-45-11172016 CASCADE OFF SITE - LUNCH

1130 DRILLING

1300 AT 55' STOP DRILLING HOOK UP HOSE FOR WATER SUPPLY, HELP PUSH SOIL OUT OF CORE BARREL.

1319 AT 59' SET UP SIMI PROBE FOR 60' VAPOR SAMPLE

1401 COLLECT SB1-60-11172016 VAPOR SAMPLE

1445 AT 75' ~ 72' CORE IS WET COLLECT SB1-75-11172016 SOIL SAMPLE CASCADE INSTALLING S.P. NOW

1513 COLLECT SB1-75-11172016 VAPOR SAMPLE NOTE POSSIBLE MOISTURE IN SAMPLE

1545 GROGER OFF SITE CASCADE REPLACING SPINDLE

1630 OFF SITE

Signature: Robert Fifield Date: 11-17-16

Hours: 9 on-site 1.5 travel 10.5 total

Geosyntec consultants

Name: R. Fifield + R. Brand
Date: 11/18/16 Page 1 of 1

DAILY FIELD REPORT

Project No.: SP0146B-03-04 Project Description: Drill SB-2
Site Name: Cooper + Commerce Weather:

0630 - Leave for site.
0700 - Arrive onsite. Sonic track rig set up on SB-2.
0715 - Helper from Cascade arrives, Eric. Hemel.
0750 - Driller, Brigham, and his helper Jesus arrive. Install a new threading on the drill head.
0825 - H+S Meeting. Discuss slips, trips, falls, traffic and steel beams being moved. R. Brand logging B-1.
0835 - Begin drilling SB-2. Angle boring 20° angle from vertical. R. Fifield collecting soil vapor + soil samples.
1030 - Drilled SB-2 to 40 ft bgp. collect a soil sample and a soil vapor sample. (used methanol extraction for soil VOCs)
1058 - Simulprobe didn't open drill deeper. Try again.
1213 - Drilled SB-2 to 60 ft bgs.
1300 - Kyle Johnson arrives onsite.
1320 - Drilled SB-2 to 70 ft bgs. collect a soil vapor sample. Kyle leaves.
1330 - collect a soil sample from SB-2 at 69 ft bgs. for VOCs. (used methanol extraction for soils-VOCs) Green staining present in the 69 ft sample.
1400 - Break for lunch
1435 - Back on-site. R. Brand logging B-2.
1600 - Grouted both borings with neat cement. Clean up site. Leave for Test America
1644 - Drop soil vapor + soil samples off at TestAmerica.
1530 - Arrive back at the office.

Signature: Reen Brand Date: 11/18/16

Hours: 8.5 on-site 2 travel 10.5 total

Geosyntec consultants

TAILGATE SAFETY MEETING

Project Name: COOPER
Client:
Site Address:

Date: 11-18-16
Project No.: SP0146B

Items discussed in this meeting:

FORKLIFT TRAFFIC
TRUCK TRAFFIC
SLIPS & TRIPS

Recommended PPE:

LEVEL D

Hospital Location/Directions:

IN TWA

Attendance/Signatures:

Print Name/Company	Signature
ROBERT FIFIELD	
Rebecca Brand	
Jesus M Villalobos	
Brigham Bamford	
ELSE HEMEL	
KYLE JOHNSON	

Project Manager

Date

11811 N Tatum Blvd Suite P-186
Phoenix, AZ 85028
tel 602.513.5812 fax 602.513.5813

SOIL GAS PROBE MEASUREMENTS

Geosyntec consultants

Project Name: COOPER
Project Number: SP0146B Phase: 03 Task: 04
Field Personnel: ROBERT FIELDS GEORGE HICKMAN
Date: 11-17-16 Weather: COOL
Air Temperature: 70° Atmospheric Pressure:

Field tubing blank (ppmv by PID)	0	Time	1131
Shut-In Test: Performed at 0 in H_2O; ■ Pass □ Fail		Time	1205
Initial Well Pressure/Vacuum (prior to purge)	NR	Time	NL

PID Model and Serial No.: TIGER
PID Lamp: 10.6 Tracer Gas: ISO.
Tracer Gas Detector Model and Serial No.:
GEM 2000 Landfill Gas Meter Serial No.:

Probe or Location ID: SB1-45-11172016
Surface Type: Asphalt (e.g., asphalt, concrete, dirt, grass)
Subsurface Type: Silty Sand / Clay (e.g., sand, clay)
GPS Coordinates: 33.27N 111.48W
Surface Thickness: 6
Probe Depth: 45'

PROBE PURGE AND LEAK TEST

Start Time	End Time	Elapsed Time (min)	Bag Volume (mL)	Purge Rate (mL/Min)	Total Vol (mL)	Well Head Vacuum (in H_2O)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOCs by PID (ppmv)	Tracer Gas (%) min	Tracer Gas (%) max	Tracer Gas (%) Sample
1206	1211	5	1	200 RKF 1000		0.11	NR	NR	NR	NR	NR	NR	NR

SAMPLE

Start Time	End Time	Sample ID	Summa Canister ID	Regulator ID	Initial Vacuum (in Hg)	Final Vacuum (in Hg)	Tracer Gas (%) min	Tracer Gas (%) max
1213	1218	SB1-45-11172016	34000986	7564	30	8.5	NR	NR

Comments

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SOIL GAS PROBE MEASUREMENTS

Geosyntec consultants

Project Name: Cooper
Project Number: 9001468 Phase: 03 Task: 04
Field Personnel: Roberts, F. Field / George Weber
Date: 11-17-16 Weather: Sunny
Air Temperature: 73° Atmospheric Pressure:

Field tubing blank (ppmv by PID)	0	Time	1131
Shut-In Test: Performed at 1.0 in H_2O; ☛ Pass ☐ Fail		Time	1351
Initial Well Pressure/Vacuum (prior to purge)	NR	Time	NR

PID Model and Serial No.: TIGER
PID Lamp: 10.6 Tracer Gas: 150
Tracer Gas Detector Model and Serial No.:
GEM 2000 Landfill Gas Meter Serial No.:

Probe or Location ID: SB-1-60-11172016
Surface Type: Asphalt (e.g., asphalt, concrete, dirt, grass)
Subsurface Type: silty sand / Clay (e.g., sand, clay)

GPS Coordinates: 33°21'27"N 111°48'9"W 1200' EVA
Surface Thickness: 6"
Probe Depth: 60'

PROBE PURGE AND LEAK TEST

Start Time	End Time	Elapsed Time (min)	Bag Volume (mL)	Purge Rate (mL/Min)	Total Vol (mL)	Well Head Vacuum (in H_2O)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOCs by PID (ppmv)	Tracer Gas (%) min	Tracer Gas (%) max	Tracer Gas (%) Sample
1354	1930	630		200 RF 1000		20	NR	NR	NR	NR	NR	NR	NR

SAMPLE

Start Time	End Time	Sample ID	Summa Canister ID	Regulator ID	Initial Vacuum (in Hg)	Final Vacuum (in Hg)	Tracer Gas (%) min	Tracer Gas (%) max
1401 10	1406	SB-1-60-11172016	34000963	7445	30	8.0	NR	NR

Comments

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SOIL GAS PROBE MEASUREMENTS

Geosyntec consultants

Project Name: Cooper
Project Number: SP0146B Phase: 03 Task: 04
Field Personnel: Robert Fifield / George Hitchborn
Date: 11-17-2016 Weather: Sunny
Air Temperature: _____ Atmospheric Pressure: _____

Field tubing blank (ppmv by PID)	0	Time	1131

Shut-In Test Performed at 2.0 in H_2O ☒ Pass ☐ Fail		Time	1503

Initial Well Pressure/Vacuum (prior to purge)	NR	Time	NR

PID Model and Serial No.: TIGER
PID Lamp: 10.6 Tracer Gas: 150
Tracer Gas Detector Model and Serial No.: _____
GEM 2000 Landfill Gas Meter Serial No.: _____

Probe or Location ID: SB1-75-11172016
Surface Type: Asphalt (e.g., asphalt, concrete, dirt, grass)
Subsurface Type: Silty Sand & Clay (e.g., sand, clay)

GPS Coordinates: 33.2127 N 111.489 W
Surface Thickness: 6"
Probe Depth: 75'

PROBE PURGE AND LEAK TEST

Start Time	End Time	Elapsed Time (min)	Bag Volume (mL)	Purge Rate (mL/Min)	Total Vol (mL)	Well Head Vacuum (in H_2O)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOCs by PID (ppmv)	Tracer Gas (%)		
											min	max	Sample
1504	1512	8		1000 PMF 500		22	NR	NR	NR	NR	NR	NR	NR

SAMPLE

Start Time	End Time	Sample ID	Summa Canister ID	Regulator ID	Initial Vacuum (in Hg)	Final Vacuum (in Hg)	Tracer Gas (%)	
							min	max
1513	1518	SB1-75-11172016	3400 1541	7555	30	5.0	NR	NR

Comments: MAY HAVE MOISTURE IN SAMPLE

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SOIL GAS PROBE MEASUREMENTS

Geosyntec consultants

Project Name: Cooper + Commerce
Project Number: SP0146B Phase: 03 Task: 04
Field Personnel: R. Fifield + R. Brand
Date: 11/18/16 Weather:
Air Temperature: Atmospheric Pressure:

Field tubing blank (ppmv by PID)	0	Time	0930
Shut-In Test: Performed at 8.0 in ~~H2O~~ inHg; ☒ Pass ☐ Fail		Time	0948
Initial Well Pressure/Vacuum (prior to purge)	NR	Time	NR

PID Model and Serial No.: TIGER
PID Lamp: 10.6 Tracer Gas: 150
Tracer Gas Detector Model and Serial No.:
GEM 2000 Landfill Gas Meter Serial No.:

Probe or Location ID: SB2-40-11182016
Surface Type: ASPHALT (e.g., asphalt, concrete, dirt, grass)
Subsurface Type: Silty clay (e.g., sand, clay)
GPS Coordinates:
Surface Thickness: 6"
Probe Depth: 40

PROBE PURGE AND LEAK TEST

Start Time	End Time	Elapsed Time (min)	Bag Volume (mL)	Purge Rate (mL/Min)	Total Vol (mL)	Well Head Vacuum (in H_2O)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOCs by PID (ppmv)	Tracer Gas (%) min	Tracer Gas (%) max	Tracer Gas (%) Sample
0953	0958	5	1,000	200	1,000	0.5	NA	NA	NA	1.6	NA	NA	NA

SAMPLE

Start Time	End Time	Sample ID	Summa Canister ID	Regulator ID	Initial Vacuum (in Hg)	Final Vacuum (in Hg)	Tracer Gas (%) min	Tracer Gas (%) max
0958	1004	SB2-40-11182016	34000770	7121	30	4	NA	NA

Comments

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SOIL GAS PROBE MEASUREMENTS

Geosyntec consultants

Project Name: Cooper + Commerce
Project Number: SP01463 Phase: 03 Task: 04
Field Personnel: R. Brand + R. Fifield
Date: 11/18/16 Weather:
Air Temperature: Atmospheric Pressure:

Field tubing blank (ppmv by PID)	0	Time	0930

PID Model and Serial No.: ~~SB2-60-111820~~ TIGER
PID Lamp: 10.6 Tracer Gas: 150
Tracer Gas Detector Model and Serial No.:
GEM 2000 Landfill Gas Meter Serial No.:

Shut-In Test: Performed at 5 in ~~H2O~~ Hg; ☒ Pass ☐ Fail		Time	1204
Initial Well Pressure/Vacuum (prior to purge)	NR	Time	NR

Probe or Location ID: SB2-60-111820116
Surface Type: Asphalt (e.g., asphalt, concrete, dirt, grass)
Subsurface Type: Fat clay (e.g., sand, clay)
GPS Coordinates:
Surface Thickness: 6"
Probe Depth: 60

PROBE PURGE AND LEAK TEST

Start Time	End Time	Elapsed Time (min)	Bag Volume (mL)	Purge Rate (mL/Min)	Total Vol (mL)	Well Head Vacuum (in H_2O)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOCs by PID (ppmv)	Tracer Gas (%)		
											min	max	Sample
1206	1213	7	1,000	~~200~~ 150	1,400	0.5	NA	NA	NA	4.0	NA	NA	NA

SAMPLE

Start Time	End Time	Sample ID	Summa Canister ID	Regulator ID	Initial Vacuum (in Hg)	Final Vacuum (in Hg)	Tracer Gas (%)	
							min	max
1213	1218	SB2-60-111820116	34000762	7127	30	7	NA	NA

Comments

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SOIL GAS PROBE MEASUREMENTS

Geosyntec consultants

Project Name: Cooper + Commerce
Project Number: SP0146B Phase: 03 Task: 04
Field Personnel: R. Brand + R. Fifield
Date: 11/18/16 Weather:
Air Temperature: Atmospheric Pressure:

Field tubing blank (ppmv by PID)	0	Time	0930
Shut-In Test: Performed at 5 in ~~H_2O~~ ☒ Pass ☐ Fail Ng		Time	1305
Initial Well Pressure/Vacuum (prior to purge)	NR	Time	NR

PID Model and Serial No.: TIGER
PID Lamp: 10.6 Tracer Gas: 150
Tracer Gas Detector Model and Serial No.:
GEM 2000 Landfill Gas Meter Serial No.:

Probe or Location ID: SB2-70-11182016
Surface Type: ~~ABAB~~ Asphalt (e.g., asphalt, concrete, dirt, grass)
Subsurface Type: Poorly Graded Gravel with clay (e.g., sand, clay)
GPS Coordinates:
Surface Thickness: 6"
Probe Depth: 70

PROBE PURGE AND LEAK TEST

Start Time	End Time	Elapsed Time (min)	Bag Volume (mL)	Purge Rate (mL/Min)	Total Vol (mL)	Well Head Vacuum (in H_2O)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOCs by PID (ppmv)	Tracer Gas (%) min	Tracer Gas (%) max	Tracer Gas (%) Sample
1312	1320	8	1,000	200	1,600	2.4	NA	NA	NA	7.0	NA	NA	NA

SAMPLE

Start Time	End Time	Sample ID	Summa Canister ID	Regulator ID	Initial Vacuum (in Hg)	Final Vacuum (in Hg)	Tracer Gas (%) min	Tracer Gas (%) max
1320	1325	SB2-70-11182016	34000667	7239	30	7	NA	NA
1320	1325	SB2-70-11182016 DUP	34000993	7481	30	6.5	NA	NA

Comments	
	Many large moisture in sampler

ATTACHMENT C
Analytical Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-23751-1
Client Project/Site: Cooper & Commerce SP0146B

For:
Geosyntec Consultants, Inc.
11811 N Tatum Blvd
Ste P186
Phoenix, Arizona 85028

Attn: Marla Miller

Authorized for release by:
12/5/2016 1:55:23 PM

Camille Murray, Project Manager I
(949)261-1022
camille.murray@testamericainc.com

Table of Contents

Qualifiers

Air - GC/MS VOA

Qualifier	Qualifier Description
T2	Cited ADHS licensed method does not contain this analyte as part of the method compound list.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-23751-1

Laboratory: TestAmerica Sacramento

Narrative

Job Narrative
320-23751-1

Comments
No additional comments.

Receipt
The samples were received on 11/22/2016 9:50 AM; the samples arrived in good condition, properly preserved and, where required, on ice.

Receipt Exceptions

The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): SB2-40-11182016 (320-23751-4). The container label lists SB2-45-11182016, while the COC lists SB2-40-11182016.

Air - GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

VOA Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB1-45-11172016 — Lab Sample ID: 320-23751-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	67	T2	18		ppb v/v	3.53		TO-15	Total/NA
Benzene	4.0		1.4		ppb v/v	3.53		TO-15	Total/NA
2-Butanone (MEK)	11		2.8		ppb v/v	3.53		TO-15	Total/NA
Chloroform	1.6		1.1		ppb v/v	3.53		TO-15	Total/NA
Toluene	4.0		1.4		ppb v/v	3.53		TO-15	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	160	T2	42		ug/m3	3.53		TO-15	Total/NA
Benzene	13		4.5		ug/m3	3.53		TO-15	Total/NA
2-Butanone (MEK)	34		8.3		ug/m3	3.53		TO-15	Total/NA
Chloroform	7.6		5.2		ug/m3	3.53		TO-15	Total/NA
Toluene	15		5.3		ug/m3	3.53		TO-15	Total/NA

Client Sample ID: SB1-60-11172016 — Lab Sample ID: 320-23751-2

No Detections.

Client Sample ID: SB1-75-11172016 — Lab Sample ID: 320-23751-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	1600		28		ppb v/v	70		TO-15	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	11000		190		ug/m3	70		TO-15	Total/NA

Client Sample ID: SB2-40-11182016 — Lab Sample ID: 320-23751-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	220	T2	57		ppb v/v	11.3		TO-15	Total/NA
Benzene	28		4.5		ppb v/v	11.3		TO-15	Total/NA
2-Butanone (MEK)	47		9.0		ppb v/v	11.3		TO-15	Total/NA
Tetrachloroethene	29		4.5		ppb v/v	11.3		TO-15	Total/NA
Toluene	23		4.5		ppb v/v	11.3		TO-15	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	520	T2	130		ug/m3	11.3		TO-15	Total/NA
Benzene	88		14		ug/m3	11.3		TO-15	Total/NA
2-Butanone (MEK)	140		27		ug/m3	11.3		TO-15	Total/NA
Tetrachloroethene	190		31		ug/m3	11.3		TO-15	Total/NA
Toluene	85		17		ug/m3	11.3		TO-15	Total/NA

Client Sample ID: SB2-60-11182016 — Lab Sample ID: 320-23751-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	43000		800		ppb v/v	2010		TO-15	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	290000		5500		ug/m3	2010		TO-15	Total/NA

Client Sample ID: SB2-70-11182016 — Lab Sample ID: 320-23751-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	5000		130		ppb v/v	317		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: SB2-70-11182016 (Continued) — Lab Sample ID: 320-23751-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	34000		860		ug/m3	317		TO-15	Total/NA

Client Sample ID: SB2-70-11182016 DUP — Lab Sample ID: 320-23751-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	7100		130		ppb v/v	322		TO-15	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	48000		870		ug/m3	322		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: SB1-45-11172016
Date Collected: 11/17/16 12:18
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-1
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**67**	**T2**	18		ppb v/v			12/02/16 02:30	3.53
Benzene	**4.0**		1.4		ppb v/v			12/02/16 02:30	3.53
Benzyl chloride	ND		2.8		ppb v/v			12/02/16 02:30	3.53
Bromodichloromethane	ND	T2	1.1		ppb v/v			12/02/16 02:30	3.53
Bromoform	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Bromomethane	ND		2.8		ppb v/v			12/02/16 02:30	3.53
2-Butanone (MEK)	**11**		2.8		ppb v/v			12/02/16 02:30	3.53
Carbon disulfide	ND		2.8		ppb v/v			12/02/16 02:30	3.53
Carbon tetrachloride	ND		2.8		ppb v/v			12/02/16 02:30	3.53
Chlorobenzene	ND		1.1		ppb v/v			12/02/16 02:30	3.53
Dibromochloromethane	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Chloroethane	ND		2.8		ppb v/v			12/02/16 02:30	3.53
Chloroform	**1.6**		1.1		ppb v/v			12/02/16 02:30	3.53
Chloromethane	ND		2.8		ppb v/v			12/02/16 02:30	3.53
1,2-Dibromoethane (EDB)	ND		2.8		ppb v/v			12/02/16 02:30	3.53
1,2-Dichlorobenzene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,3-Dichlorobenzene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,4-Dichlorobenzene	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Dichlorodifluoromethane	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,1-Dichloroethane	ND		1.1		ppb v/v			12/02/16 02:30	3.53
1,2-Dichloroethane	ND		2.8		ppb v/v			12/02/16 02:30	3.53
1,1-Dichloroethene	ND		2.8		ppb v/v			12/02/16 02:30	3.53
cis-1,2-Dichloroethene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
trans-1,2-Dichloroethene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,2-Dichloropropane	ND		1.4		ppb v/v			12/02/16 02:30	3.53
cis-1,3-Dichloropropene	ND		1.4		ppb v/v			12/02/16 02:30	3.53
trans-1,3-Dichloropropene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
Ethylbenzene	ND		1.4		ppb v/v			12/02/16 02:30	3.53
4-Ethyltoluene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
Hexachlorobutadiene	ND		7.1		ppb v/v			12/02/16 02:30	3.53
2-Hexanone	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
Methylene Chloride	ND		1.4		ppb v/v			12/02/16 02:30	3.53
4-Methyl-2-pentanone (MIBK)	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Styrene	ND		1.4		ppb v/v			12/02/16 02:30	3.53
1,1,2,2-Tetrachloroethane	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Tetrachloroethene	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Toluene	**4.0**		1.4		ppb v/v			12/02/16 02:30	3.53
1,2,4-Trichlorobenzene	ND		7.1		ppb v/v			12/02/16 02:30	3.53
1,1,1-Trichloroethane	ND		1.1		ppb v/v			12/02/16 02:30	3.53
1,1,2-Trichloroethane	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Trichloroethene	ND		1.4		ppb v/v			12/02/16 02:30	3.53
Trichlorofluoromethane	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
1,2,4-Trimethylbenzene	ND	T2	2.8		ppb v/v			12/02/16 02:30	3.53
1,3,5-Trimethylbenzene	ND	T2	1.4		ppb v/v			12/02/16 02:30	3.53
Vinyl acetate	ND		2.8		ppb v/v			12/02/16 02:30	3.53
Vinyl chloride	ND		1.4		ppb v/v			12/02/16 02:30	3.53

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB1-45-11172016
Date Collected: 11/17/16 12:18
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-1
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
m,p-Xylene	ND		2.8		ppb v/v			12/02/16 02:30	3.53
o-Xylene	ND		1.4		ppb v/v			12/02/16 02:30	3.53

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**160**	**T2**	42		ug/m3			12/02/16 02:30	3.53
Benzene	**13**		4.5		ug/m3			12/02/16 02:30	3.53
Benzyl chloride	ND		15		ug/m3			12/02/16 02:30	3.53
Bromodichloromethane	ND	T2	7.1		ug/m3			12/02/16 02:30	3.53
Bromoform	ND		15		ug/m3			12/02/16 02:30	3.53
Bromomethane	ND		11		ug/m3			12/02/16 02:30	3.53
2-Butanone (MEK)	**34**		8.3		ug/m3			12/02/16 02:30	3.53
Carbon disulfide	ND		8.8		ug/m3			12/02/16 02:30	3.53
Carbon tetrachloride	ND		18		ug/m3			12/02/16 02:30	3.53
Chlorobenzene	ND		4.9		ug/m3			12/02/16 02:30	3.53
Dibromochloromethane	ND		12		ug/m3			12/02/16 02:30	3.53
Chloroethane	ND		7.5		ug/m3			12/02/16 02:30	3.53
Chloroform	**7.6**		5.2		ug/m3			12/02/16 02:30	3.53
Chloromethane	ND		5.8		ug/m3			12/02/16 02:30	3.53
1,2-Dibromoethane (EDB)	ND		22		ug/m3			12/02/16 02:30	3.53
1,2-Dichlorobenzene	ND	T2	8.5		ug/m3			12/02/16 02:30	3.53
1,3-Dichlorobenzene	ND	T2	8.5		ug/m3			12/02/16 02:30	3.53
1,4-Dichlorobenzene	ND		8.5		ug/m3			12/02/16 02:30	3.53
Dichlorodifluoromethane	ND	T2	7.0		ug/m3			12/02/16 02:30	3.53
1,1-Dichloroethane	ND		4.3		ug/m3			12/02/16 02:30	3.53
1,2-Dichloroethane	ND		11		ug/m3			12/02/16 02:30	3.53
1,1-Dichloroethene	ND		11		ug/m3			12/02/16 02:30	3.53
cis-1,2-Dichloroethene	ND	T2	5.6		ug/m3			12/02/16 02:30	3.53
trans-1,2-Dichloroethene	ND	T2	5.6		ug/m3			12/02/16 02:30	3.53
1,2-Dichloropropane	ND		6.5		ug/m3			12/02/16 02:30	3.53
cis-1,3-Dichloropropene	ND		6.4		ug/m3			12/02/16 02:30	3.53
trans-1,3-Dichloropropene	ND	T2	6.4		ug/m3			12/02/16 02:30	3.53
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	9.9		ug/m3			12/02/16 02:30	3.53
Ethylbenzene	ND		6.1		ug/m3			12/02/16 02:30	3.53
4-Ethyltoluene	ND	T2	6.9		ug/m3			12/02/16 02:30	3.53
Hexachlorobutadiene	ND		75		ug/m3			12/02/16 02:30	3.53
2-Hexanone	ND	T2	5.8		ug/m3			12/02/16 02:30	3.53
Methylene Chloride	ND		4.9		ug/m3			12/02/16 02:30	3.53
4-Methyl-2-pentanone (MIBK)	ND		5.8		ug/m3			12/02/16 02:30	3.53
Styrene	ND		6.0		ug/m3			12/02/16 02:30	3.53
1,1,2,2-Tetrachloroethane	ND		9.7		ug/m3			12/02/16 02:30	3.53
Tetrachloroethene	ND		9.6		ug/m3			12/02/16 02:30	3.53
Toluene	**15**		5.3		ug/m3			12/02/16 02:30	3.53
1,2,4-Trichlorobenzene	ND		52		ug/m3			12/02/16 02:30	3.53
1,1,1-Trichloroethane	ND		5.8		ug/m3			12/02/16 02:30	3.53
1,1,2-Trichloroethane	ND		7.7		ug/m3			12/02/16 02:30	3.53
Trichloroethene	ND		7.6		ug/m3			12/02/16 02:30	3.53
Trichlorofluoromethane	ND	T2	7.9		ug/m3			12/02/16 02:30	3.53
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	11		ug/m3			12/02/16 02:30	3.53
1,2,4-Trimethylbenzene	ND	T2	14		ug/m3			12/02/16 02:30	3.53

Client Sample ID: SB1-45-11172016

Lab Sample ID: 320-23751-1

Date Collected: 11/17/16 12:18

Matrix: Air

Date Received: 11/22/16 09:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,3,5-Trimethylbenzene	ND	T2	6.9		ug/m3			12/02/16 02:30	3.53
Vinyl acetate	ND		9.9		ug/m3			12/02/16 02:30	3.53
Vinyl chloride	ND		3.6		ug/m3			12/02/16 02:30	3.53
m,p-Xylene	ND		12		ug/m3			12/02/16 02:30	3.53
o-Xylene	ND		6.1		ug/m3			12/02/16 02:30	3.53

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*102*		*70 - 130*		*12/02/16 02:30*	*3.53*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*12/02/16 02:30*	*3.53*
Toluene-d8 (Surr)	*95*		*70 - 130*		*12/02/16 02:30*	*3.53*

Client Sample ID: SB1-60-11172016

Lab Sample ID: 320-23751-2

Date Collected: 11/17/16 14:06

Matrix: Air

Date Received: 11/22/16 09:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	5.0		ppb v/v			12/02/16 03:30	1
Benzene	ND		0.40		ppb v/v			12/02/16 03:30	1
Benzyl chloride	ND		0.80		ppb v/v			12/02/16 03:30	1
Bromodichloromethane	ND	T2	0.30		ppb v/v			12/02/16 03:30	1
Bromoform	ND		0.40		ppb v/v			12/02/16 03:30	1
Bromomethane	ND		0.80		ppb v/v			12/02/16 03:30	1
2-Butanone (MEK)	ND		0.80		ppb v/v			12/02/16 03:30	1
Carbon disulfide	ND		0.80		ppb v/v			12/02/16 03:30	1
Carbon tetrachloride	ND		0.80		ppb v/v			12/02/16 03:30	1
Chlorobenzene	ND		0.30		ppb v/v			12/02/16 03:30	1
Dibromochloromethane	ND		0.40		ppb v/v			12/02/16 03:30	1
Chloroethane	ND		0.80		ppb v/v			12/02/16 03:30	1
Chloroform	ND		0.30		ppb v/v			12/02/16 03:30	1
Chloromethane	ND		0.80		ppb v/v			12/02/16 03:30	1
1,2-Dibromoethane (EDB)	ND		0.80		ppb v/v			12/02/16 03:30	1
1,2-Dichlorobenzene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,3-Dichlorobenzene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,4-Dichlorobenzene	ND		0.40		ppb v/v			12/02/16 03:30	1
Dichlorodifluoromethane	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,1-Dichloroethane	ND		0.30		ppb v/v			12/02/16 03:30	1
1,2-Dichloroethane	ND		0.80		ppb v/v			12/02/16 03:30	1
1,1-Dichloroethene	ND		0.80		ppb v/v			12/02/16 03:30	1
cis-1,2-Dichloroethene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
trans-1,2-Dichloroethene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,2-Dichloropropane	ND		0.40		ppb v/v			12/02/16 03:30	1
cis-1,3-Dichloropropene	ND		0.40		ppb v/v			12/02/16 03:30	1
trans-1,3-Dichloropropene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
Ethylbenzene	ND		0.40		ppb v/v			12/02/16 03:30	1
4-Ethyltoluene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
Hexachlorobutadiene	ND		2.0		ppb v/v			12/02/16 03:30	1

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB1-60-11172016
Date Collected: 11/17/16 14:06
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-2
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
Methylene Chloride	ND		0.40		ppb v/v			12/02/16 03:30	1
4-Methyl-2-pentanone (MIBK)	ND		0.40		ppb v/v			12/02/16 03:30	1
Styrene	ND		0.40		ppb v/v			12/02/16 03:30	1
1,1,2,2-Tetrachloroethane	ND		0.40		ppb v/v			12/02/16 03:30	1
Tetrachloroethene	ND		0.40		ppb v/v			12/02/16 03:30	1
Toluene	ND		0.40		ppb v/v			12/02/16 03:30	1
1,2,4-Trichlorobenzene	ND		2.0		ppb v/v			12/02/16 03:30	1
1,1,1-Trichloroethane	ND		0.30		ppb v/v			12/02/16 03:30	1
1,1,2-Trichloroethane	ND		0.40		ppb v/v			12/02/16 03:30	1
Trichloroethene	ND		0.40		ppb v/v			12/02/16 03:30	1
Trichlorofluoromethane	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
1,2,4-Trimethylbenzene	ND	T2	0.80		ppb v/v			12/02/16 03:30	1
1,3,5-Trimethylbenzene	ND	T2	0.40		ppb v/v			12/02/16 03:30	1
Vinyl acetate	ND		0.80		ppb v/v			12/02/16 03:30	1
Vinyl chloride	ND		0.40		ppb v/v			12/02/16 03:30	1
m,p-Xylene	ND		0.80		ppb v/v			12/02/16 03:30	1
o-Xylene	ND		0.40		ppb v/v			12/02/16 03:30	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	12		ug/m3			12/02/16 03:30	1
Benzene	ND		1.3		ug/m3			12/02/16 03:30	1
Benzyl chloride	ND		4.1		ug/m3			12/02/16 03:30	1
Bromodichloromethane	ND	T2	2.0		ug/m3			12/02/16 03:30	1
Bromoform	ND		4.1		ug/m3			12/02/16 03:30	1
Bromomethane	ND		3.1		ug/m3			12/02/16 03:30	1
2-Butanone (MEK)	ND		2.4		ug/m3			12/02/16 03:30	1
Carbon disulfide	ND		2.5		ug/m3			12/02/16 03:30	1
Carbon tetrachloride	ND		5.0		ug/m3			12/02/16 03:30	1
Chlorobenzene	ND		1.4		ug/m3			12/02/16 03:30	1
Dibromochloromethane	ND		3.4		ug/m3			12/02/16 03:30	1
Chloroethane	ND		2.1		ug/m3			12/02/16 03:30	1
Chloroform	ND		1.5		ug/m3			12/02/16 03:30	1
Chloromethane	ND		1.7		ug/m3			12/02/16 03:30	1
1,2-Dibromoethane (EDB)	ND		6.1		ug/m3			12/02/16 03:30	1
1,2-Dichlorobenzene	ND	T2	2.4		ug/m3			12/02/16 03:30	1
1,3-Dichlorobenzene	ND	T2	2.4		ug/m3			12/02/16 03:30	1
1,4-Dichlorobenzene	ND		2.4		ug/m3			12/02/16 03:30	1
Dichlorodifluoromethane	ND	T2	2.0		ug/m3			12/02/16 03:30	1
1,1-Dichloroethane	ND		1.2		ug/m3			12/02/16 03:30	1
1,2-Dichloroethane	ND		3.2		ug/m3			12/02/16 03:30	1
1,1-Dichloroethene	ND		3.2		ug/m3			12/02/16 03:30	1
cis-1,2-Dichloroethene	ND	T2	1.6		ug/m3			12/02/16 03:30	1
trans-1,2-Dichloroethene	ND	T2	1.6		ug/m3			12/02/16 03:30	1
1,2-Dichloropropane	ND		1.8		ug/m3			12/02/16 03:30	1
cis-1,3-Dichloropropene	ND		1.8		ug/m3			12/02/16 03:30	1
trans-1,3-Dichloropropene	ND	T2	1.8		ug/m3			12/02/16 03:30	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	2.8		ug/m3			12/02/16 03:30	1

Client Sample ID: SB1-60-11172016

Lab Sample ID: 320-23751-2

Date Collected: 11/17/16 14:06

Matrix: Air

Date Received: 11/22/16 09:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	ND		1.7		ug/m3			12/02/16 03:30	1
4-Ethyltoluene	ND	T2	2.0		ug/m3			12/02/16 03:30	1
Hexachlorobutadiene	ND		21		ug/m3			12/02/16 03:30	1
2-Hexanone	ND	T2	1.6		ug/m3			12/02/16 03:30	1
Methylene Chloride	ND		1.4		ug/m3			12/02/16 03:30	1
4-Methyl-2-pentanone (MIBK)	ND		1.6		ug/m3			12/02/16 03:30	1
Styrene	ND		1.7		ug/m3			12/02/16 03:30	1
1,1,2,2-Tetrachloroethane	ND		2.7		ug/m3			12/02/16 03:30	1
Tetrachloroethene	ND		2.7		ug/m3			12/02/16 03:30	1
Toluene	ND		1.5		ug/m3			12/02/16 03:30	1
1,2,4-Trichlorobenzene	ND		15		ug/m3			12/02/16 03:30	1
1,1,1-Trichloroethane	ND		1.6		ug/m3			12/02/16 03:30	1
1,1,2-Trichloroethane	ND		2.2		ug/m3			12/02/16 03:30	1
Trichloroethene	ND		2.1		ug/m3			12/02/16 03:30	1
Trichlorofluoromethane	ND	T2	2.2		ug/m3			12/02/16 03:30	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	3.1		ug/m3			12/02/16 03:30	1
1,2,4-Trimethylbenzene	ND	T2	3.9		ug/m3			12/02/16 03:30	1
1,3,5-Trimethylbenzene	ND	T2	2.0		ug/m3			12/02/16 03:30	1
Vinyl acetate	ND		2.8		ug/m3			12/02/16 03:30	1
Vinyl chloride	ND		1.0		ug/m3			12/02/16 03:30	1
m,p-Xylene	ND		3.5		ug/m3			12/02/16 03:30	1
o-Xylene	ND		1.7		ug/m3			12/02/16 03:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*99*		*70 - 130*		*12/02/16 03:30*	*1*
1,2-Dichloroethane-d4 (Surr)	*87*		*70 - 130*		*12/02/16 03:30*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*12/02/16 03:30*	*1*

Client Sample ID: SB1-75-11172016

Lab Sample ID: 320-23751-3

Date Collected: 11/17/16 15:18

Matrix: Air

Date Received: 11/22/16 09:50

Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	350		ppb v/v			12/02/16 04:23	70
Benzene	ND		28		ppb v/v			12/02/16 04:23	70
Benzyl chloride	ND		56		ppb v/v			12/02/16 04:23	70
Bromodichloromethane	ND	T2	21		ppb v/v			12/02/16 04:23	70
Bromoform	ND		28		ppb v/v			12/02/16 04:23	70
Bromomethane	ND		56		ppb v/v			12/02/16 04:23	70
2-Butanone (MEK)	ND		56		ppb v/v			12/02/16 04:23	70
Carbon disulfide	ND		56		ppb v/v			12/02/16 04:23	70
Carbon tetrachloride	ND		56		ppb v/v			12/02/16 04:23	70
Chlorobenzene	ND		21		ppb v/v			12/02/16 04:23	70
Dibromochloromethane	ND		28		ppb v/v			12/02/16 04:23	70
Chloroethane	ND		56		ppb v/v			12/02/16 04:23	70
Chloroform	ND		21		ppb v/v			12/02/16 04:23	70
Chloromethane	ND		56		ppb v/v			12/02/16 04:23	70

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB1-75-11172016
Date Collected: 11/17/16 15:18
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-3
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		56		ppb v/v			12/02/16 04:23	70
1,2-Dichlorobenzene	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,3-Dichlorobenzene	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,4-Dichlorobenzene	ND		28		ppb v/v			12/02/16 04:23	70
Dichlorodifluoromethane	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,1-Dichloroethane	ND		21		ppb v/v			12/02/16 04:23	70
1,2-Dichloroethane	ND		56		ppb v/v			12/02/16 04:23	70
1,1-Dichloroethene	ND		56		ppb v/v			12/02/16 04:23	70
cis-1,2-Dichloroethene	ND	T2	28		ppb v/v			12/02/16 04:23	70
trans-1,2-Dichloroethene	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,2-Dichloropropane	ND		28		ppb v/v			12/02/16 04:23	70
cis-1,3-Dichloropropene	ND		28		ppb v/v			12/02/16 04:23	70
trans-1,3-Dichloropropene	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	28		ppb v/v			12/02/16 04:23	70
Ethylbenzene	ND		28		ppb v/v			12/02/16 04:23	70
4-Ethyltoluene	ND	T2	28		ppb v/v			12/02/16 04:23	70
Hexachlorobutadiene	ND		140		ppb v/v			12/02/16 04:23	70
2-Hexanone	ND	T2	28		ppb v/v			12/02/16 04:23	70
Methylene Chloride	ND		28		ppb v/v			12/02/16 04:23	70
4-Methyl-2-pentanone (MIBK)	ND		28		ppb v/v			12/02/16 04:23	70
Styrene	ND		28		ppb v/v			12/02/16 04:23	70
1,1,2,2-Tetrachloroethane	ND		28		ppb v/v			12/02/16 04:23	70
Tetrachloroethene	**1600**		28		ppb v/v			12/02/16 04:23	70
Toluene	ND		28		ppb v/v			12/02/16 04:23	70
1,2,4-Trichlorobenzene	ND		140		ppb v/v			12/02/16 04:23	70
1,1,1-Trichloroethane	ND		21		ppb v/v			12/02/16 04:23	70
1,1,2-Trichloroethane	ND		28		ppb v/v			12/02/16 04:23	70
Trichloroethene	ND		28		ppb v/v			12/02/16 04:23	70
Trichlorofluoromethane	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	28		ppb v/v			12/02/16 04:23	70
1,2,4-Trimethylbenzene	ND	T2	56		ppb v/v			12/02/16 04:23	70
1,3,5-Trimethylbenzene	ND	T2	28		ppb v/v			12/02/16 04:23	70
Vinyl acetate	ND		56		ppb v/v			12/02/16 04:23	70
Vinyl chloride	ND		28		ppb v/v			12/02/16 04:23	70
m,p-Xylene	ND		56		ppb v/v			12/02/16 04:23	70
o-Xylene	ND		28		ppb v/v			12/02/16 04:23	70

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	830		ug/m3			12/02/16 04:23	70
Benzene	ND		89		ug/m3			12/02/16 04:23	70
Benzyl chloride	ND		290		ug/m3			12/02/16 04:23	70
Bromodichloromethane	ND	T2	140		ug/m3			12/02/16 04:23	70
Bromoform	ND		290		ug/m3			12/02/16 04:23	70
Bromomethane	ND		220		ug/m3			12/02/16 04:23	70
2-Butanone (MEK)	ND		170		ug/m3			12/02/16 04:23	70
Carbon disulfide	ND		170		ug/m3			12/02/16 04:23	70
Carbon tetrachloride	ND		350		ug/m3			12/02/16 04:23	70
Chlorobenzene	ND		97		ug/m3			12/02/16 04:23	70
Dibromochloromethane	ND		240		ug/m3			12/02/16 04:23	70

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB1-75-11172016 — **Lab Sample ID: 320-23751-3**
Date Collected: 11/17/16 15:18 — **Matrix: Air**
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloroethane	ND		150		ug/m3			12/02/16 04:23	70
Chloroform	ND		100		ug/m3			12/02/16 04:23	70
Chloromethane	ND		120		ug/m3			12/02/16 04:23	70
1,2-Dibromoethane (EDB)	ND		430		ug/m3			12/02/16 04:23	70
1,2-Dichlorobenzene	ND	T2	170		ug/m3			12/02/16 04:23	70
1,3-Dichlorobenzene	ND	T2	170		ug/m3			12/02/16 04:23	70
1,4-Dichlorobenzene	ND		170		ug/m3			12/02/16 04:23	70
Dichlorodifluoromethane	ND	T2	140		ug/m3			12/02/16 04:23	70
1,1-Dichloroethane	ND		85		ug/m3			12/02/16 04:23	70
1,2-Dichloroethane	ND		230		ug/m3			12/02/16 04:23	70
1,1-Dichloroethene	ND		220		ug/m3			12/02/16 04:23	70
cis-1,2-Dichloroethene	ND	T2	110		ug/m3			12/02/16 04:23	70
trans-1,2-Dichloroethene	ND	T2	110		ug/m3			12/02/16 04:23	70
1,2-Dichloropropane	ND		130		ug/m3			12/02/16 04:23	70
cis-1,3-Dichloropropene	ND		130		ug/m3			12/02/16 04:23	70
trans-1,3-Dichloropropene	ND	T2	130		ug/m3			12/02/16 04:23	70
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	200		ug/m3			12/02/16 04:23	70
Ethylbenzene	ND		120		ug/m3			12/02/16 04:23	70
4-Ethyltoluene	ND	T2	140		ug/m3			12/02/16 04:23	70
Hexachlorobutadiene	ND		1500		ug/m3			12/02/16 04:23	70
2-Hexanone	ND	T2	110		ug/m3			12/02/16 04:23	70
Methylene Chloride	ND		97		ug/m3			12/02/16 04:23	70
4-Methyl-2-pentanone (MIBK)	ND		110		ug/m3			12/02/16 04:23	70
Styrene	ND		120		ug/m3			12/02/16 04:23	70
1,1,2,2-Tetrachloroethane	ND		190		ug/m3			12/02/16 04:23	70
Tetrachloroethene	**11000**		190		ug/m3			12/02/16 04:23	70
Toluene	ND		110		ug/m3			12/02/16 04:23	70
1,2,4-Trichlorobenzene	ND		1000		ug/m3			12/02/16 04:23	70
1,1,1-Trichloroethane	ND		110		ug/m3			12/02/16 04:23	70
1,1,2-Trichloroethane	ND		150		ug/m3			12/02/16 04:23	70
Trichloroethene	ND		150		ug/m3			12/02/16 04:23	70
Trichlorofluoromethane	ND	T2	160		ug/m3			12/02/16 04:23	70
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	210		ug/m3			12/02/16 04:23	70
1,2,4-Trimethylbenzene	ND	T2	280		ug/m3			12/02/16 04:23	70
1,3,5-Trimethylbenzene	ND	T2	140		ug/m3			12/02/16 04:23	70
Vinyl acetate	ND		200		ug/m3			12/02/16 04:23	70
Vinyl chloride	ND		72		ug/m3			12/02/16 04:23	70
m,p-Xylene	ND		240		ug/m3			12/02/16 04:23	70
o-Xylene	ND		120		ug/m3			12/02/16 04:23	70

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*12/02/16 04:23*	*70*
1,2-Dichloroethane-d4 (Surr)	*89*		*70 - 130*		*12/02/16 04:23*	*70*
Toluene-d8 (Surr)	*100*		*70 - 130*		*12/02/16 04:23*	*70*

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-40-11182016
Date Collected: 11/18/16 10:04
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-4
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**220**	**T2**	57		ppb v/v			12/02/16 05:15	11.3
Benzene	**28**		4.5		ppb v/v			12/02/16 05:15	11.3
Benzyl chloride	ND		9.0		ppb v/v			12/02/16 05:15	11.3
Bromodichloromethane	ND	T2	3.4		ppb v/v			12/02/16 05:15	11.3
Bromoform	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Bromomethane	ND		9.0		ppb v/v			12/02/16 05:15	11.3
2-Butanone (MEK)	**47**		9.0		ppb v/v			12/02/16 05:15	11.3
Carbon disulfide	ND		9.0		ppb v/v			12/02/16 05:15	11.3
Carbon tetrachloride	ND		9.0		ppb v/v			12/02/16 05:15	11.3
Chlorobenzene	ND		3.4		ppb v/v			12/02/16 05:15	11.3
Dibromochloromethane	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Chloroethane	ND		9.0		ppb v/v			12/02/16 05:15	11.3
Chloroform	ND		3.4		ppb v/v			12/02/16 05:15	11.3
Chloromethane	ND		9.0		ppb v/v			12/02/16 05:15	11.3
1,2-Dibromoethane (EDB)	ND		9.0		ppb v/v			12/02/16 05:15	11.3
1,2-Dichlorobenzene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,3-Dichlorobenzene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,4-Dichlorobenzene	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Dichlorodifluoromethane	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,1-Dichloroethane	ND		3.4		ppb v/v			12/02/16 05:15	11.3
1,2-Dichloroethane	ND		9.0		ppb v/v			12/02/16 05:15	11.3
1,1-Dichloroethene	ND		9.0		ppb v/v			12/02/16 05:15	11.3
cis-1,2-Dichloroethene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
trans-1,2-Dichloroethene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,2-Dichloropropane	ND		4.5		ppb v/v			12/02/16 05:15	11.3
cis-1,3-Dichloropropene	ND		4.5		ppb v/v			12/02/16 05:15	11.3
trans-1,3-Dichloropropene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
Ethylbenzene	ND		4.5		ppb v/v			12/02/16 05:15	11.3
4-Ethyltoluene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
Hexachlorobutadiene	ND		23		ppb v/v			12/02/16 05:15	11.3
2-Hexanone	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
Methylene Chloride	ND		4.5		ppb v/v			12/02/16 05:15	11.3
4-Methyl-2-pentanone (MIBK)	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Styrene	ND		4.5		ppb v/v			12/02/16 05:15	11.3
1,1,2,2-Tetrachloroethane	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Tetrachloroethene	**29**		4.5		ppb v/v			12/02/16 05:15	11.3
Toluene	**23**		4.5		ppb v/v			12/02/16 05:15	11.3
1,2,4-Trichlorobenzene	ND		23		ppb v/v			12/02/16 05:15	11.3
1,1,1-Trichloroethane	ND		3.4		ppb v/v			12/02/16 05:15	11.3
1,1,2-Trichloroethane	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Trichloroethene	ND		4.5		ppb v/v			12/02/16 05:15	11.3
Trichlorofluoromethane	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
1,2,4-Trimethylbenzene	ND	T2	9.0		ppb v/v			12/02/16 05:15	11.3
1,3,5-Trimethylbenzene	ND	T2	4.5		ppb v/v			12/02/16 05:15	11.3
Vinyl acetate	ND		9.0		ppb v/v			12/02/16 05:15	11.3
Vinyl chloride	ND		4.5		ppb v/v			12/02/16 05:15	11.3

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-40-11182016
Date Collected: 11/18/16 10:04
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-4
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
m,p-Xylene	ND		9.0		ppb v/v			12/02/16 05:15	11.3
o-Xylene	ND		4.5		ppb v/v			12/02/16 05:15	11.3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	**520**	**T2**	130		ug/m3			12/02/16 05:15	11.3
Benzene	**88**		14		ug/m3			12/02/16 05:15	11.3
Benzyl chloride	ND		47		ug/m3			12/02/16 05:15	11.3
Bromodichloromethane	ND	T2	23		ug/m3			12/02/16 05:15	11.3
Bromoform	ND		47		ug/m3			12/02/16 05:15	11.3
Bromomethane	ND		35		ug/m3			12/02/16 05:15	11.3
2-Butanone (MEK)	**140**		27		ug/m3			12/02/16 05:15	11.3
Carbon disulfide	ND		28		ug/m3			12/02/16 05:15	11.3
Carbon tetrachloride	ND		57		ug/m3			12/02/16 05:15	11.3
Chlorobenzene	ND		16		ug/m3			12/02/16 05:15	11.3
Dibromochloromethane	ND		39		ug/m3			12/02/16 05:15	11.3
Chloroethane	ND		24		ug/m3			12/02/16 05:15	11.3
Chloroform	ND		17		ug/m3			12/02/16 05:15	11.3
Chloromethane	ND		19		ug/m3			12/02/16 05:15	11.3
1,2-Dibromoethane (EDB)	ND		69		ug/m3			12/02/16 05:15	11.3
1,2-Dichlorobenzene	ND	T2	27		ug/m3			12/02/16 05:15	11.3
1,3-Dichlorobenzene	ND	T2	27		ug/m3			12/02/16 05:15	11.3
1,4-Dichlorobenzene	ND		27		ug/m3			12/02/16 05:15	11.3
Dichlorodifluoromethane	ND	T2	22		ug/m3			12/02/16 05:15	11.3
1,1-Dichloroethane	ND		14		ug/m3			12/02/16 05:15	11.3
1,2-Dichloroethane	ND		37		ug/m3			12/02/16 05:15	11.3
1,1-Dichloroethene	ND		36		ug/m3			12/02/16 05:15	11.3
cis-1,2-Dichloroethene	ND	T2	18		ug/m3			12/02/16 05:15	11.3
trans-1,2-Dichloroethene	ND	T2	18		ug/m3			12/02/16 05:15	11.3
1,2-Dichloropropane	ND		21		ug/m3			12/02/16 05:15	11.3
cis-1,3-Dichloropropene	ND		21		ug/m3			12/02/16 05:15	11.3
trans-1,3-Dichloropropene	ND	T2	21		ug/m3			12/02/16 05:15	11.3
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	32		ug/m3			12/02/16 05:15	11.3
Ethylbenzene	ND		20		ug/m3			12/02/16 05:15	11.3
4-Ethyltoluene	ND	T2	22		ug/m3			12/02/16 05:15	11.3
Hexachlorobutadiene	ND		240		ug/m3			12/02/16 05:15	11.3
2-Hexanone	ND	T2	19		ug/m3			12/02/16 05:15	11.3
Methylene Chloride	ND		16		ug/m3			12/02/16 05:15	11.3
4-Methyl-2-pentanone (MIBK)	ND		19		ug/m3			12/02/16 05:15	11.3
Styrene	ND		19		ug/m3			12/02/16 05:15	11.3
1,1,2,2-Tetrachloroethane	ND		31		ug/m3			12/02/16 05:15	11.3
Tetrachloroethene	**190**		31		ug/m3			12/02/16 05:15	11.3
Toluene	**85**		17		ug/m3			12/02/16 05:15	11.3
1,2,4-Trichlorobenzene	ND		170		ug/m3			12/02/16 05:15	11.3
1,1,1-Trichloroethane	ND		18		ug/m3			12/02/16 05:15	11.3
1,1,2-Trichloroethane	ND		25		ug/m3			12/02/16 05:15	11.3
Trichloroethene	ND		24		ug/m3			12/02/16 05:15	11.3
Trichlorofluoromethane	ND	T2	25		ug/m3			12/02/16 05:15	11.3
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	35		ug/m3			12/02/16 05:15	11.3
1,2,4-Trimethylbenzene	ND	T2	44		ug/m3			12/02/16 05:15	11.3

Client Sample ID: SB2-40-11182016

Lab Sample ID: 320-23751-4

Date Collected: 11/18/16 10:04
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,3,5-Trimethylbenzene	ND	T2	22		ug/m3			12/02/16 05:15	11.3
Vinyl acetate	ND		32		ug/m3			12/02/16 05:15	11.3
Vinyl chloride	ND		12		ug/m3			12/02/16 05:15	11.3
m,p-Xylene	ND		39		ug/m3			12/02/16 05:15	11.3
o-Xylene	ND		20		ug/m3			12/02/16 05:15	11.3

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*101*		*70 - 130*		*12/02/16 05:15*	*11.3*
1,2-Dichloroethane-d4 (Surr)	*92*		*70 - 130*		*12/02/16 05:15*	*11.3*
Toluene-d8 (Surr)	*97*		*70 - 130*		*12/02/16 05:15*	*11.3*

Client Sample ID: SB2-60-11182016

Lab Sample ID: 320-23751-5

Date Collected: 11/18/16 12:18
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	10000		ppb v/v			12/02/16 06:09	2010
Benzene	ND		800		ppb v/v			12/02/16 06:09	2010
Benzyl chloride	ND		1600		ppb v/v			12/02/16 06:09	2010
Bromodichloromethane	ND	T2	600		ppb v/v			12/02/16 06:09	2010
Bromoform	ND		800		ppb v/v			12/02/16 06:09	2010
Bromomethane	ND		1600		ppb v/v			12/02/16 06:09	2010
2-Butanone (MEK)	ND		1600		ppb v/v			12/02/16 06:09	2010
Carbon disulfide	ND		1600		ppb v/v			12/02/16 06:09	2010
Carbon tetrachloride	ND		1600		ppb v/v			12/02/16 06:09	2010
Chlorobenzene	ND		600		ppb v/v			12/02/16 06:09	2010
Dibromochloromethane	ND		800		ppb v/v			12/02/16 06:09	2010
Chloroethane	ND		1600		ppb v/v			12/02/16 06:09	2010
Chloroform	ND		600		ppb v/v			12/02/16 06:09	2010
Chloromethane	ND		1600		ppb v/v			12/02/16 06:09	2010
1,2-Dibromoethane (EDB)	ND		1600		ppb v/v			12/02/16 06:09	2010
1,2-Dichlorobenzene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,3-Dichlorobenzene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,4-Dichlorobenzene	ND		800		ppb v/v			12/02/16 06:09	2010
Dichlorodifluoromethane	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,1-Dichloroethane	ND		600		ppb v/v			12/02/16 06:09	2010
1,2-Dichloroethane	ND		1600		ppb v/v			12/02/16 06:09	2010
1,1-Dichloroethene	ND		1600		ppb v/v			12/02/16 06:09	2010
cis-1,2-Dichloroethene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
trans-1,2-Dichloroethene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,2-Dichloropropane	ND		800		ppb v/v			12/02/16 06:09	2010
cis-1,3-Dichloropropene	ND		800		ppb v/v			12/02/16 06:09	2010
trans-1,3-Dichloropropene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	800		ppb v/v			12/02/16 06:09	2010
Ethylbenzene	ND		800		ppb v/v			12/02/16 06:09	2010
4-Ethyltoluene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
Hexachlorobutadiene	ND		4000		ppb v/v			12/02/16 06:09	2010

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-60-11182016 — **Lab Sample ID: 320-23751-5**
Date Collected: 11/18/16 12:18 — **Matrix: Air**
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	ND	T2	800		ppb v/v			12/02/16 06:09	2010
Methylene Chloride	ND		800		ppb v/v			12/02/16 06:09	2010
4-Methyl-2-pentanone (MIBK)	ND		800		ppb v/v			12/02/16 06:09	2010
Styrene	ND		800		ppb v/v			12/02/16 06:09	2010
1,1,2,2-Tetrachloroethane	ND		800		ppb v/v			12/02/16 06:09	2010
Tetrachloroethene	**43000**		800		ppb v/v			12/02/16 06:09	2010
Toluene	ND		800		ppb v/v			12/02/16 06:09	2010
1,2,4-Trichlorobenzene	ND		4000		ppb v/v			12/02/16 06:09	2010
1,1,1-Trichloroethane	ND		600		ppb v/v			12/02/16 06:09	2010
1,1,2-Trichloroethane	ND		800		ppb v/v			12/02/16 06:09	2010
Trichloroethene	ND		800		ppb v/v			12/02/16 06:09	2010
Trichlorofluoromethane	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	800		ppb v/v			12/02/16 06:09	2010
1,2,4-Trimethylbenzene	ND	T2	1600		ppb v/v			12/02/16 06:09	2010
1,3,5-Trimethylbenzene	ND	T2	800		ppb v/v			12/02/16 06:09	2010
Vinyl acetate	ND		1600		ppb v/v			12/02/16 06:09	2010
Vinyl chloride	ND		800		ppb v/v			12/02/16 06:09	2010
m,p-Xylene	ND		1600		ppb v/v			12/02/16 06:09	2010
o-Xylene	ND		800		ppb v/v			12/02/16 06:09	2010

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	24000		ug/m3			12/02/16 06:09	2010
Benzene	ND		2600		ug/m3			12/02/16 06:09	2010
Benzyl chloride	ND		8300		ug/m3			12/02/16 06:09	2010
Bromodichloromethane	ND	T2	4000		ug/m3			12/02/16 06:09	2010
Bromoform	ND		8300		ug/m3			12/02/16 06:09	2010
Bromomethane	ND		6200		ug/m3			12/02/16 06:09	2010
2-Butanone (MEK)	ND		4700		ug/m3			12/02/16 06:09	2010
Carbon disulfide	ND		5000		ug/m3			12/02/16 06:09	2010
Carbon tetrachloride	ND		10000		ug/m3			12/02/16 06:09	2010
Chlorobenzene	ND		2800		ug/m3			12/02/16 06:09	2010
Dibromochloromethane	ND		6800		ug/m3			12/02/16 06:09	2010
Chloroethane	ND		4200		ug/m3			12/02/16 06:09	2010
Chloroform	ND		2900		ug/m3			12/02/16 06:09	2010
Chloromethane	ND		3300		ug/m3			12/02/16 06:09	2010
1,2-Dibromoethane (EDB)	ND		12000		ug/m3			12/02/16 06:09	2010
1,2-Dichlorobenzene	ND	T2	4800		ug/m3			12/02/16 06:09	2010
1,3-Dichlorobenzene	ND	T2	4800		ug/m3			12/02/16 06:09	2010
1,4-Dichlorobenzene	ND		4800		ug/m3			12/02/16 06:09	2010
Dichlorodifluoromethane	ND	T2	4000		ug/m3			12/02/16 06:09	2010
1,1-Dichloroethane	ND		2400		ug/m3			12/02/16 06:09	2010
1,2-Dichloroethane	ND		6500		ug/m3			12/02/16 06:09	2010
1,1-Dichloroethene	ND		6400		ug/m3			12/02/16 06:09	2010
cis-1,2-Dichloroethene	ND	T2	3200		ug/m3			12/02/16 06:09	2010
trans-1,2-Dichloroethene	ND	T2	3200		ug/m3			12/02/16 06:09	2010
1,2-Dichloropropane	ND		3700		ug/m3			12/02/16 06:09	2010
cis-1,3-Dichloropropene	ND		3600		ug/m3			12/02/16 06:09	2010
trans-1,3-Dichloropropene	ND	T2	3600		ug/m3			12/02/16 06:09	2010
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	5600		ug/m3			12/02/16 06:09	2010

Client Sample ID: SB2-60-11182016

Lab Sample ID: 320-23751-5

Date Collected: 11/18/16 12:18
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	ND		3500		ug/m3			12/02/16 06:09	2010
4-Ethyltoluene	ND	T2	4000		ug/m3			12/02/16 06:09	2010
Hexachlorobutadiene	ND		43000		ug/m3			12/02/16 06:09	2010
2-Hexanone	ND	T2	3300		ug/m3			12/02/16 06:09	2010
Methylene Chloride	ND		2800		ug/m3			12/02/16 06:09	2010
4-Methyl-2-pentanone (MIBK)	ND		3300		ug/m3			12/02/16 06:09	2010
Styrene	ND		3400		ug/m3			12/02/16 06:09	2010
1,1,2,2-Tetrachloroethane	ND		5500		ug/m3			12/02/16 06:09	2010
Tetrachloroethene	**290000**		5500		ug/m3			12/02/16 06:09	2010
Toluene	ND		3000		ug/m3			12/02/16 06:09	2010
1,2,4-Trichlorobenzene	ND		30000		ug/m3			12/02/16 06:09	2010
1,1,1-Trichloroethane	ND		3300		ug/m3			12/02/16 06:09	2010
1,1,2-Trichloroethane	ND		4400		ug/m3			12/02/16 06:09	2010
Trichloroethene	ND		4300		ug/m3			12/02/16 06:09	2010
Trichlorofluoromethane	ND	T2	4500		ug/m3			12/02/16 06:09	2010
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	6200		ug/m3			12/02/16 06:09	2010
1,2,4-Trimethylbenzene	ND	T2	7900		ug/m3			12/02/16 06:09	2010
1,3,5-Trimethylbenzene	ND	T2	4000		ug/m3			12/02/16 06:09	2010
Vinyl acetate	ND		5700		ug/m3			12/02/16 06:09	2010
Vinyl chloride	ND		2100		ug/m3			12/02/16 06:09	2010
m,p-Xylene	ND		7000		ug/m3			12/02/16 06:09	2010
o-Xylene	ND		3500		ug/m3			12/02/16 06:09	2010

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*87*		*70 - 130*		*12/02/16 06:09*	*2010*
1,2-Dichloroethane-d4 (Surr)	*85*		*70 - 130*		*12/02/16 06:09*	*2010*
Toluene-d8 (Surr)	*100*		*70 - 130*		*12/02/16 06:09*	*2010*

Client Sample ID: SB2-70-11182016

Lab Sample ID: 320-23751-6

Date Collected: 11/18/16 13:25
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	1600		ppb v/v			12/02/16 07:01	317
Benzene	ND		130		ppb v/v			12/02/16 07:01	317
Benzyl chloride	ND		250		ppb v/v			12/02/16 07:01	317
Bromodichloromethane	ND	T2	95		ppb v/v			12/02/16 07:01	317
Bromoform	ND		130		ppb v/v			12/02/16 07:01	317
Bromomethane	ND		250		ppb v/v			12/02/16 07:01	317
2-Butanone (MEK)	ND		250		ppb v/v			12/02/16 07:01	317
Carbon disulfide	ND		250		ppb v/v			12/02/16 07:01	317
Carbon tetrachloride	ND		250		ppb v/v			12/02/16 07:01	317
Chlorobenzene	ND		95		ppb v/v			12/02/16 07:01	317
Dibromochloromethane	ND		130		ppb v/v			12/02/16 07:01	317
Chloroethane	ND		250		ppb v/v			12/02/16 07:01	317
Chloroform	ND		95		ppb v/v			12/02/16 07:01	317
Chloromethane	ND		250		ppb v/v			12/02/16 07:01	317

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-70-11182016
Date Collected: 11/18/16 13:25
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Lab Sample ID: 320-23751-6
Matrix: Air

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		250		ppb v/v			12/02/16 07:01	317
1,2-Dichlorobenzene	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,3-Dichlorobenzene	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,4-Dichlorobenzene	ND		130		ppb v/v			12/02/16 07:01	317
Dichlorodifluoromethane	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,1-Dichloroethane	ND		95		ppb v/v			12/02/16 07:01	317
1,2-Dichloroethane	ND		250		ppb v/v			12/02/16 07:01	317
1,1-Dichloroethene	ND		250		ppb v/v			12/02/16 07:01	317
cis-1,2-Dichloroethene	ND	T2	130		ppb v/v			12/02/16 07:01	317
trans-1,2-Dichloroethene	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,2-Dichloropropane	ND		130		ppb v/v			12/02/16 07:01	317
cis-1,3-Dichloropropene	ND		130		ppb v/v			12/02/16 07:01	317
trans-1,3-Dichloropropene	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	130		ppb v/v			12/02/16 07:01	317
Ethylbenzene	ND		130		ppb v/v			12/02/16 07:01	317
4-Ethyltoluene	ND	T2	130		ppb v/v			12/02/16 07:01	317
Hexachlorobutadiene	ND		630		ppb v/v			12/02/16 07:01	317
2-Hexanone	ND	T2	130		ppb v/v			12/02/16 07:01	317
Methylene Chloride	ND		130		ppb v/v			12/02/16 07:01	317
4-Methyl-2-pentanone (MIBK)	ND		130		ppb v/v			12/02/16 07:01	317
Styrene	ND		130		ppb v/v			12/02/16 07:01	317
1,1,2,2-Tetrachloroethane	ND		130		ppb v/v			12/02/16 07:01	317
Tetrachloroethene	**5000**		130		ppb v/v			12/02/16 07:01	317
Toluene	ND		130		ppb v/v			12/02/16 07:01	317
1,2,4-Trichlorobenzene	ND		630		ppb v/v			12/02/16 07:01	317
1,1,1-Trichloroethane	ND		95		ppb v/v			12/02/16 07:01	317
1,1,2-Trichloroethane	ND		130		ppb v/v			12/02/16 07:01	317
Trichloroethene	ND		130		ppb v/v			12/02/16 07:01	317
Trichlorofluoromethane	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	130		ppb v/v			12/02/16 07:01	317
1,2,4-Trimethylbenzene	ND	T2	250		ppb v/v			12/02/16 07:01	317
1,3,5-Trimethylbenzene	ND	T2	130		ppb v/v			12/02/16 07:01	317
Vinyl acetate	ND		250		ppb v/v			12/02/16 07:01	317
Vinyl chloride	ND		130		ppb v/v			12/02/16 07:01	317
m,p-Xylene	ND		250		ppb v/v			12/02/16 07:01	317
o-Xylene	ND		130		ppb v/v			12/02/16 07:01	317

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	3800		ug/m3			12/02/16 07:01	317
Benzene	ND		410		ug/m3			12/02/16 07:01	317
Benzyl chloride	ND		1300		ug/m3			12/02/16 07:01	317
Bromodichloromethane	ND	T2	640		ug/m3			12/02/16 07:01	317
Bromoform	ND		1300		ug/m3			12/02/16 07:01	317
Bromomethane	ND		980		ug/m3			12/02/16 07:01	317
2-Butanone (MEK)	ND		750		ug/m3			12/02/16 07:01	317
Carbon disulfide	ND		790		ug/m3			12/02/16 07:01	317
Carbon tetrachloride	ND		1600		ug/m3			12/02/16 07:01	317
Chlorobenzene	ND		440		ug/m3			12/02/16 07:01	317
Dibromochloromethane	ND		1100		ug/m3			12/02/16 07:01	317

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-70-11182016 — **Lab Sample ID: 320-23751-6**
Date Collected: 11/18/16 13:25 — **Matrix: Air**
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloroethane	ND		670		ug/m3			12/02/16 07:01	317
Chloroform	ND		460		ug/m3			12/02/16 07:01	317
Chloromethane	ND		520		ug/m3			12/02/16 07:01	317
1,2-Dibromoethane (EDB)	ND		1900		ug/m3			12/02/16 07:01	317
1,2-Dichlorobenzene	ND	T2	760		ug/m3			12/02/16 07:01	317
1,3-Dichlorobenzene	ND	T2	760		ug/m3			12/02/16 07:01	317
1,4-Dichlorobenzene	ND		760		ug/m3			12/02/16 07:01	317
Dichlorodifluoromethane	ND	T2	630		ug/m3			12/02/16 07:01	317
1,1-Dichloroethane	ND		380		ug/m3			12/02/16 07:01	317
1,2-Dichloroethane	ND		1000		ug/m3			12/02/16 07:01	317
1,1-Dichloroethene	ND		1000		ug/m3			12/02/16 07:01	317
cis-1,2-Dichloroethene	ND	T2	500		ug/m3			12/02/16 07:01	317
trans-1,2-Dichloroethene	ND	T2	500		ug/m3			12/02/16 07:01	317
1,2-Dichloropropane	ND		590		ug/m3			12/02/16 07:01	317
cis-1,3-Dichloropropene	ND		580		ug/m3			12/02/16 07:01	317
trans-1,3-Dichloropropene	ND	T2	580		ug/m3			12/02/16 07:01	317
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	890		ug/m3			12/02/16 07:01	317
Ethylbenzene	ND		550		ug/m3			12/02/16 07:01	317
4-Ethyltoluene	ND	T2	620		ug/m3			12/02/16 07:01	317
Hexachlorobutadiene	ND		6800		ug/m3			12/02/16 07:01	317
2-Hexanone	ND	T2	520		ug/m3			12/02/16 07:01	317
Methylene Chloride	ND		440		ug/m3			12/02/16 07:01	317
4-Methyl-2-pentanone (MIBK)	ND		520		ug/m3			12/02/16 07:01	317
Styrene	ND		540		ug/m3			12/02/16 07:01	317
1,1,2,2-Tetrachloroethane	ND		870		ug/m3			12/02/16 07:01	317
Tetrachloroethene	**34000**		860		ug/m3			12/02/16 07:01	317
Toluene	ND		480		ug/m3			12/02/16 07:01	317
1,2,4-Trichlorobenzene	ND		4700		ug/m3			12/02/16 07:01	317
1,1,1-Trichloroethane	ND		520		ug/m3			12/02/16 07:01	317
1,1,2-Trichloroethane	ND		690		ug/m3			12/02/16 07:01	317
Trichloroethene	ND		680		ug/m3			12/02/16 07:01	317
Trichlorofluoromethane	ND	T2	710		ug/m3			12/02/16 07:01	317
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	970		ug/m3			12/02/16 07:01	317
1,2,4-Trimethylbenzene	ND	T2	1200		ug/m3			12/02/16 07:01	317
1,3,5-Trimethylbenzene	ND	T2	620		ug/m3			12/02/16 07:01	317
Vinyl acetate	ND		890		ug/m3			12/02/16 07:01	317
Vinyl chloride	ND		320		ug/m3			12/02/16 07:01	317
m,p-Xylene	ND		1100		ug/m3			12/02/16 07:01	317
o-Xylene	ND		550		ug/m3			12/02/16 07:01	317

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*12/02/16 07:01*	*317*
1,2-Dichloroethane-d4 (Surr)	*89*		*70 - 130*		*12/02/16 07:01*	*317*
Toluene-d8 (Surr)	*102*		*70 - 130*		*12/02/16 07:01*	*317*

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-70-11182016 DUP
Lab Sample ID: 320-23751-7
Date Collected: 11/18/16 13:25
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	1600		ppb v/v			12/02/16 07:54	322
Benzene	ND		130		ppb v/v			12/02/16 07:54	322
Benzyl chloride	ND		260		ppb v/v			12/02/16 07:54	322
Bromodichloromethane	ND	T2	97		ppb v/v			12/02/16 07:54	322
Bromoform	ND		130		ppb v/v			12/02/16 07:54	322
Bromomethane	ND		260		ppb v/v			12/02/16 07:54	322
2-Butanone (MEK)	ND		260		ppb v/v			12/02/16 07:54	322
Carbon disulfide	ND		260		ppb v/v			12/02/16 07:54	322
Carbon tetrachloride	ND		260		ppb v/v			12/02/16 07:54	322
Chlorobenzene	ND		97		ppb v/v			12/02/16 07:54	322
Dibromochloromethane	ND		130		ppb v/v			12/02/16 07:54	322
Chloroethane	ND		260		ppb v/v			12/02/16 07:54	322
Chloroform	ND		97		ppb v/v			12/02/16 07:54	322
Chloromethane	ND		260		ppb v/v			12/02/16 07:54	322
1,2-Dibromoethane (EDB)	ND		260		ppb v/v			12/02/16 07:54	322
1,2-Dichlorobenzene	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,3-Dichlorobenzene	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,4-Dichlorobenzene	ND		130		ppb v/v			12/02/16 07:54	322
Dichlorodifluoromethane	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,1-Dichloroethane	ND		97		ppb v/v			12/02/16 07:54	322
1,2-Dichloroethane	ND		260		ppb v/v			12/02/16 07:54	322
1,1-Dichloroethene	ND		260		ppb v/v			12/02/16 07:54	322
cis-1,2-Dichloroethene	ND	T2	130		ppb v/v			12/02/16 07:54	322
trans-1,2-Dichloroethene	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,2-Dichloropropane	ND		130		ppb v/v			12/02/16 07:54	322
cis-1,3-Dichloropropene	ND		130		ppb v/v			12/02/16 07:54	322
trans-1,3-Dichloropropene	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	130		ppb v/v			12/02/16 07:54	322
Ethylbenzene	ND		130		ppb v/v			12/02/16 07:54	322
4-Ethyltoluene	ND	T2	130		ppb v/v			12/02/16 07:54	322
Hexachlorobutadiene	ND		640		ppb v/v			12/02/16 07:54	322
2-Hexanone	ND	T2	130		ppb v/v			12/02/16 07:54	322
Methylene Chloride	ND		130		ppb v/v			12/02/16 07:54	322
4-Methyl-2-pentanone (MIBK)	ND		130		ppb v/v			12/02/16 07:54	322
Styrene	ND		130		ppb v/v			12/02/16 07:54	322
1,1,2,2-Tetrachloroethane	ND		130		ppb v/v			12/02/16 07:54	322
Tetrachloroethene	**7100**		130		ppb v/v			12/02/16 07:54	322
Toluene	ND		130		ppb v/v			12/02/16 07:54	322
1,2,4-Trichlorobenzene	ND		640		ppb v/v			12/02/16 07:54	322
1,1,1-Trichloroethane	ND		97		ppb v/v			12/02/16 07:54	322
1,1,2-Trichloroethane	ND		130		ppb v/v			12/02/16 07:54	322
Trichloroethene	ND		130		ppb v/v			12/02/16 07:54	322
Trichlorofluoromethane	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	130		ppb v/v			12/02/16 07:54	322
1,2,4-Trimethylbenzene	ND	T2	260		ppb v/v			12/02/16 07:54	322
1,3,5-Trimethylbenzene	ND	T2	130		ppb v/v			12/02/16 07:54	322
Vinyl acetate	ND		260		ppb v/v			12/02/16 07:54	322
Vinyl chloride	ND		130		ppb v/v			12/02/16 07:54	322

Client Sample ID: SB2-70-11182016 DUP
Lab Sample ID: 320-23751-7
Date Collected: 11/18/16 13:25
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
m,p-Xylene	ND		260		ppb v/v			12/02/16 07:54	322
o-Xylene	ND		130		ppb v/v			12/02/16 07:54	322

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND	T2	3800		ug/m3			12/02/16 07:54	322
Benzene	ND		410		ug/m3			12/02/16 07:54	322
Benzyl chloride	ND		1300		ug/m3			12/02/16 07:54	322
Bromodichloromethane	ND	T2	650		ug/m3			12/02/16 07:54	322
Bromoform	ND		1300		ug/m3			12/02/16 07:54	322
Bromomethane	ND		1000		ug/m3			12/02/16 07:54	322
2-Butanone (MEK)	ND		760		ug/m3			12/02/16 07:54	322
Carbon disulfide	ND		800		ug/m3			12/02/16 07:54	322
Carbon tetrachloride	ND		1600		ug/m3			12/02/16 07:54	322
Chlorobenzene	ND		440		ug/m3			12/02/16 07:54	322
Dibromochloromethane	ND		1100		ug/m3			12/02/16 07:54	322
Chloroethane	ND		680		ug/m3			12/02/16 07:54	322
Chloroform	ND		470		ug/m3			12/02/16 07:54	322
Chloromethane	ND		530		ug/m3			12/02/16 07:54	322
1,2-Dibromoethane (EDB)	ND		2000		ug/m3			12/02/16 07:54	322
1,2-Dichlorobenzene	ND	T2	770		ug/m3			12/02/16 07:54	322
1,3-Dichlorobenzene	ND	T2	770		ug/m3			12/02/16 07:54	322
1,4-Dichlorobenzene	ND		770		ug/m3			12/02/16 07:54	322
Dichlorodifluoromethane	ND	T2	640		ug/m3			12/02/16 07:54	322
1,1-Dichloroethane	ND		390		ug/m3			12/02/16 07:54	322
1,2-Dichloroethane	ND		1000		ug/m3			12/02/16 07:54	322
1,1-Dichloroethene	ND		1000		ug/m3			12/02/16 07:54	322
cis-1,2-Dichloroethene	ND	T2	510		ug/m3			12/02/16 07:54	322
trans-1,2-Dichloroethene	ND	T2	510		ug/m3			12/02/16 07:54	322
1,2-Dichloropropane	ND		600		ug/m3			12/02/16 07:54	322
cis-1,3-Dichloropropene	ND		580		ug/m3			12/02/16 07:54	322
trans-1,3-Dichloropropene	ND	T2	580		ug/m3			12/02/16 07:54	322
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	T2	900		ug/m3			12/02/16 07:54	322
Ethylbenzene	ND		560		ug/m3			12/02/16 07:54	322
4-Ethyltoluene	ND	T2	630		ug/m3			12/02/16 07:54	322
Hexachlorobutadiene	ND		6900		ug/m3			12/02/16 07:54	322
2-Hexanone	ND	T2	530		ug/m3			12/02/16 07:54	322
Methylene Chloride	ND		450		ug/m3			12/02/16 07:54	322
4-Methyl-2-pentanone (MIBK)	ND		530		ug/m3			12/02/16 07:54	322
Styrene	ND		550		ug/m3			12/02/16 07:54	322
1,1,2,2-Tetrachloroethane	ND		880		ug/m3			12/02/16 07:54	322
Tetrachloroethene	**48000**		870		ug/m3			12/02/16 07:54	322
Toluene	ND		490		ug/m3			12/02/16 07:54	322
1,2,4-Trichlorobenzene	ND		4800		ug/m3			12/02/16 07:54	322
1,1,1-Trichloroethane	ND		530		ug/m3			12/02/16 07:54	322
1,1,2-Trichloroethane	ND		700		ug/m3			12/02/16 07:54	322
Trichloroethene	ND		690		ug/m3			12/02/16 07:54	322
Trichlorofluoromethane	ND	T2	720		ug/m3			12/02/16 07:54	322
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	T2	990		ug/m3			12/02/16 07:54	322
1,2,4-Trimethylbenzene	ND	T2	1300		ug/m3			12/02/16 07:54	322

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-70-11182016 DUP
Lab Sample ID: 320-23751-7
Date Collected: 11/18/16 13:25
Matrix: Air
Date Received: 11/22/16 09:50
Sample Container: Summa Canister 1L

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,3,5-Trimethylbenzene	ND	T2	630		ug/m3			12/02/16 07:54	322
Vinyl acetate	ND		910		ug/m3			12/02/16 07:54	322
Vinyl chloride	ND		330		ug/m3			12/02/16 07:54	322
m,p-Xylene	ND		1100		ug/m3			12/02/16 07:54	322
o-Xylene	ND		560		ug/m3			12/02/16 07:54	322

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*92*		*70 - 130*		*12/02/16 07:54*	*322*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*12/02/16 07:54*	*322*
Toluene-d8 (Surr)	*101*		*70 - 130*		*12/02/16 07:54*	*322*

Surrogate Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		BFB	12DCE	TOL
Lab Sample ID	Client Sample ID	(70-130)	(70-130)	(70-130)
320-23751-1	SB1-45-11172016	102	92	95
320-23751-2	SB1-60-11172016	99	87	100
320-23751-3	SB1-75-11172016	91	89	100
320-23751-4	SB2-40-11182016	101	92	97
320-23751-5	SB2-60-11182016	87	85	100
320-23751-6	SB2-70-11182016	91	89	102
320-23751-7	SB2-70-11182016 DUP	92	88	101
LCS 320-140204/3	Lab Control Sample	105	90	99
LCSD 320-140204/4	Lab Control Sample Dup	106	88	99
MB 320-140204/6	Method Blank	95	88	100

Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)

Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 320-140204/6
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		5.0		ppb v/v			12/01/16 17:40	1
Benzene	ND		0.40		ppb v/v			12/01/16 17:40	1
Benzyl chloride	ND		0.80		ppb v/v			12/01/16 17:40	1
Bromodichloromethane	ND		0.30		ppb v/v			12/01/16 17:40	1
Bromoform	ND		0.40		ppb v/v			12/01/16 17:40	1
Bromomethane	ND		0.80		ppb v/v			12/01/16 17:40	1
2-Butanone (MEK)	ND		0.80		ppb v/v			12/01/16 17:40	1
Carbon disulfide	ND		0.80		ppb v/v			12/01/16 17:40	1
Carbon tetrachloride	ND		0.80		ppb v/v			12/01/16 17:40	1
Chlorobenzene	ND		0.30		ppb v/v			12/01/16 17:40	1
Dibromochloromethane	ND		0.40		ppb v/v			12/01/16 17:40	1
Chloroethane	ND		0.80		ppb v/v			12/01/16 17:40	1
Chloroform	ND		0.30		ppb v/v			12/01/16 17:40	1
Chloromethane	ND		0.80		ppb v/v			12/01/16 17:40	1
1,2-Dibromoethane (EDB)	ND		0.80		ppb v/v			12/01/16 17:40	1
1,2-Dichlorobenzene	ND		0.40		ppb v/v			12/01/16 17:40	1
1,3-Dichlorobenzene	ND		0.40		ppb v/v			12/01/16 17:40	1
1,4-Dichlorobenzene	ND		0.40		ppb v/v			12/01/16 17:40	1
Dichlorodifluoromethane	ND		0.40		ppb v/v			12/01/16 17:40	1
1,1-Dichloroethane	ND		0.30		ppb v/v			12/01/16 17:40	1
1,2-Dichloroethane	ND		0.80		ppb v/v			12/01/16 17:40	1
1,1-Dichloroethene	ND		0.80		ppb v/v			12/01/16 17:40	1
cis-1,2-Dichloroethene	ND		0.40		ppb v/v			12/01/16 17:40	1
trans-1,2-Dichloroethene	ND		0.40		ppb v/v			12/01/16 17:40	1
1,2-Dichloropropane	ND		0.40		ppb v/v			12/01/16 17:40	1
cis-1,3-Dichloropropene	ND		0.40		ppb v/v			12/01/16 17:40	1
trans-1,3-Dichloropropene	ND		0.40		ppb v/v			12/01/16 17:40	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40		ppb v/v			12/01/16 17:40	1
Ethylbenzene	ND		0.40		ppb v/v			12/01/16 17:40	1
4-Ethyltoluene	ND		0.40		ppb v/v			12/01/16 17:40	1
Hexachlorobutadiene	ND		2.0		ppb v/v			12/01/16 17:40	1
2-Hexanone	ND		0.40		ppb v/v			12/01/16 17:40	1
Methylene Chloride	ND		0.40		ppb v/v			12/01/16 17:40	1
4-Methyl-2-pentanone (MIBK)	ND		0.40		ppb v/v			12/01/16 17:40	1
Styrene	ND		0.40		ppb v/v			12/01/16 17:40	1
1,1,2,2-Tetrachloroethane	ND		0.40		ppb v/v			12/01/16 17:40	1
Tetrachloroethene	ND		0.40		ppb v/v			12/01/16 17:40	1
Toluene	ND		0.40		ppb v/v			12/01/16 17:40	1
1,2,4-Trichlorobenzene	ND		2.0		ppb v/v			12/01/16 17:40	1
1,1,1-Trichloroethane	ND		0.30		ppb v/v			12/01/16 17:40	1
1,1,2-Trichloroethane	ND		0.40		ppb v/v			12/01/16 17:40	1
Trichloroethene	ND		0.40		ppb v/v			12/01/16 17:40	1
Trichlorofluoromethane	ND		0.40		ppb v/v			12/01/16 17:40	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40		ppb v/v			12/01/16 17:40	1
1,2,4-Trimethylbenzene	ND		0.80		ppb v/v			12/01/16 17:40	1
1,3,5-Trimethylbenzene	ND		0.40		ppb v/v			12/01/16 17:40	1
Vinyl acetate	ND		0.80		ppb v/v			12/01/16 17:40	1
Vinyl chloride	ND		0.40		ppb v/v			12/01/16 17:40	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-140204/6
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
m,p-Xylene	ND		0.80		ppb v/v			12/01/16 17:40	1
o-Xylene	ND		0.40		ppb v/v			12/01/16 17:40	1

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		12		ug/m3			12/01/16 17:40	1
Benzene	ND		1.3		ug/m3			12/01/16 17:40	1
Benzyl chloride	ND		4.1		ug/m3			12/01/16 17:40	1
Bromodichloromethane	ND		2.0		ug/m3			12/01/16 17:40	1
Bromoform	ND		4.1		ug/m3			12/01/16 17:40	1
Bromomethane	ND		3.1		ug/m3			12/01/16 17:40	1
2-Butanone (MEK)	ND		2.4		ug/m3			12/01/16 17:40	1
Carbon disulfide	ND		2.5		ug/m3			12/01/16 17:40	1
Carbon tetrachloride	ND		5.0		ug/m3			12/01/16 17:40	1
Chlorobenzene	ND		1.4		ug/m3			12/01/16 17:40	1
Dibromochloromethane	ND		3.4		ug/m3			12/01/16 17:40	1
Chloroethane	ND		2.1		ug/m3			12/01/16 17:40	1
Chloroform	ND		1.5		ug/m3			12/01/16 17:40	1
Chloromethane	ND		1.7		ug/m3			12/01/16 17:40	1
1,2-Dibromoethane (EDB)	ND		6.1		ug/m3			12/01/16 17:40	1
1,2-Dichlorobenzene	ND		2.4		ug/m3			12/01/16 17:40	1
1,3-Dichlorobenzene	ND		2.4		ug/m3			12/01/16 17:40	1
1,4-Dichlorobenzene	ND		2.4		ug/m3			12/01/16 17:40	1
Dichlorodifluoromethane	ND		2.0		ug/m3			12/01/16 17:40	1
1,1-Dichloroethane	ND		1.2		ug/m3			12/01/16 17:40	1
1,2-Dichloroethane	ND		3.2		ug/m3			12/01/16 17:40	1
1,1-Dichloroethene	ND		3.2		ug/m3			12/01/16 17:40	1
cis-1,2-Dichloroethene	ND		1.6		ug/m3			12/01/16 17:40	1
trans-1,2-Dichloroethene	ND		1.6		ug/m3			12/01/16 17:40	1
1,2-Dichloropropane	ND		1.8		ug/m3			12/01/16 17:40	1
cis-1,3-Dichloropropene	ND		1.8		ug/m3			12/01/16 17:40	1
trans-1,3-Dichloropropene	ND		1.8		ug/m3			12/01/16 17:40	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		2.8		ug/m3			12/01/16 17:40	1
Ethylbenzene	ND		1.7		ug/m3			12/01/16 17:40	1
4-Ethyltoluene	ND		2.0		ug/m3			12/01/16 17:40	1
Hexachlorobutadiene	ND		21		ug/m3			12/01/16 17:40	1
2-Hexanone	ND		1.6		ug/m3			12/01/16 17:40	1
Methylene Chloride	ND		1.4		ug/m3			12/01/16 17:40	1
4-Methyl-2-pentanone (MIBK)	ND		1.6		ug/m3			12/01/16 17:40	1
Styrene	ND		1.7		ug/m3			12/01/16 17:40	1
1,1,2,2-Tetrachloroethane	ND		2.7		ug/m3			12/01/16 17:40	1
Tetrachloroethene	ND		2.7		ug/m3			12/01/16 17:40	1
Toluene	ND		1.5		ug/m3			12/01/16 17:40	1
1,2,4-Trichlorobenzene	ND		15		ug/m3			12/01/16 17:40	1
1,1,1-Trichloroethane	ND		1.6		ug/m3			12/01/16 17:40	1
1,1,2-Trichloroethane	ND		2.2		ug/m3			12/01/16 17:40	1
Trichloroethene	ND		2.1		ug/m3			12/01/16 17:40	1
Trichlorofluoromethane	ND		2.2		ug/m3			12/01/16 17:40	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		3.1		ug/m3			12/01/16 17:40	1

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 320-140204/6
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trimethylbenzene	ND		3.9		ug/m3			12/01/16 17:40	1
1,3,5-Trimethylbenzene	ND		2.0		ug/m3			12/01/16 17:40	1
Vinyl acetate	ND		2.8		ug/m3			12/01/16 17:40	1
Vinyl chloride	ND		1.0		ug/m3			12/01/16 17:40	1
m,p-Xylene	ND		3.5		ug/m3			12/01/16 17:40	1
o-Xylene	ND		1.7		ug/m3			12/01/16 17:40	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*95*		*70 - 130*		*12/01/16 17:40*	*1*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*		*12/01/16 17:40*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*12/01/16 17:40*	*1*

Lab Sample ID: LCS 320-140204/3
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	20.0	16.1		ppb v/v		81	71 - 131
Benzene	20.0	19.7		ppb v/v		98	68 - 128
Benzyl chloride	20.0	15.8		ppb v/v		79	58 - 120
Bromodichloromethane	20.0	19.2		ppb v/v		96	65 - 130
Bromoform	20.0	20.4		ppb v/v		102	64 - 144
Bromomethane	20.0	21.5		ppb v/v		108	70 - 131
2-Butanone (MEK)	20.0	19.1		ppb v/v		96	71 - 131
Carbon disulfide	20.0	18.8		ppb v/v		94	63 - 123
Carbon tetrachloride	20.0	18.6		ppb v/v		93	67 - 127
Chlorobenzene	20.0	20.0		ppb v/v		100	70 - 132
Dibromochloromethane	20.0	19.8		ppb v/v		99	68 - 128
Chloroethane	20.0	20.2		ppb v/v		101	70 - 131
Chloroform	20.0	19.2		ppb v/v		96	69 - 129
Chloromethane	20.0	17.3		ppb v/v		86	67 - 127
1,2-Dibromoethane (EDB)	20.0	20.5		ppb v/v		103	68 - 131
1,2-Dichlorobenzene	20.0	21.0		ppb v/v		105	73 - 143
1,3-Dichlorobenzene	20.0	21.0		ppb v/v		105	77 - 136
1,4-Dichlorobenzene	20.0	21.2		ppb v/v		106	73 - 143
Dichlorodifluoromethane	20.0	18.4		ppb v/v		92	69 - 129
1,1-Dichloroethane	20.0	18.2		ppb v/v		91	65 - 125
1,2-Dichloroethane	20.0	17.9		ppb v/v		89	71 - 131
1,1-Dichloroethene	20.0	16.7		ppb v/v		83	53 - 128
cis-1,2-Dichloroethene	20.0	20.1		ppb v/v		101	68 - 128
trans-1,2-Dichloroethene	20.0	18.0		ppb v/v		90	70 - 130
1,2-Dichloropropane	20.0	19.4		ppb v/v		97	74 - 128
cis-1,3-Dichloropropene	20.0	21.3		ppb v/v		106	78 - 132
trans-1,3-Dichloropropene	20.0	17.6		ppb v/v		88	56 - 136
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.0	21.5		ppb v/v		108	64 - 124
Ethylbenzene	20.0	20.1		ppb v/v		100	76 - 136
4-Ethyltoluene	20.0	20.5		ppb v/v		102	62 - 136

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-140204/3
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Hexachlorobutadiene	20.0	17.0		ppb v/v		85	42 - 150
2-Hexanone	20.0	19.6		ppb v/v		98	70 - 128
Methylene Chloride	20.0	15.7		ppb v/v		79	65 - 125
4-Methyl-2-pentanone (MIBK)	20.0	17.6		ppb v/v		88	73 - 133
Styrene	20.0	20.8		ppb v/v		104	76 - 144
1,1,2,2-Tetrachloroethane	20.0	20.7		ppb v/v		104	75 - 135
Tetrachloroethene	20.0	20.0		ppb v/v		100	56 - 138
Toluene	20.0	20.0		ppb v/v		100	71 - 132
1,2,4-Trichlorobenzene	20.0	18.0		ppb v/v		90	59 - 150
1,1,1-Trichloroethane	20.0	18.9		ppb v/v		94	65 - 124
1,1,2-Trichloroethane	20.0	21.1		ppb v/v		105	71 - 131
Trichloroethene	20.0	20.7		ppb v/v		103	64 - 127
Trichlorofluoromethane	20.0	19.3		ppb v/v		96	68 - 128
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	18.1		ppb v/v		91	50 - 132
1,2,4-Trimethylbenzene	20.0	20.1		ppb v/v		101	61 - 145
1,3,5-Trimethylbenzene	20.0	20.0		ppb v/v		100	65 - 136
Vinyl acetate	20.0	17.3		ppb v/v		87	77 - 134
Vinyl chloride	20.0	18.9		ppb v/v		95	69 - 129
m,p-Xylene	40.0	39.6		ppb v/v		99	75 - 138
o-Xylene	20.0	20.0		ppb v/v		100	77 - 132

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetone	48	38.3		ug/m3		81	71 - 131
Benzene	64	62.8		ug/m3		98	68 - 128
Benzyl chloride	100	81.9		ug/m3		79	58 - 120
Bromodichloromethane	130	129		ug/m3		96	65 - 130
Bromoform	210	211		ug/m3		102	64 - 144
Bromomethane	78	83.5		ug/m3		108	70 - 131
2-Butanone (MEK)	59	56.4		ug/m3		96	71 - 131
Carbon disulfide	62	58.7		ug/m3		94	63 - 123
Carbon tetrachloride	130	117		ug/m3		93	67 - 127
Chlorobenzene	92	92.0		ug/m3		100	70 - 132
Dibromochloromethane	170	169		ug/m3		99	68 - 128
Chloroethane	53	53.3		ug/m3		101	70 - 131
Chloroform	98	93.5		ug/m3		96	69 - 129
Chloromethane	41	35.7		ug/m3		86	67 - 127
1,2-Dibromoethane (EDB)	150	158		ug/m3		103	68 - 131
1,2-Dichlorobenzene	120	126		ug/m3		105	73 - 143
1,3-Dichlorobenzene	120	127		ug/m3		105	77 - 136
1,4-Dichlorobenzene	120	128		ug/m3		106	73 - 143
Dichlorodifluoromethane	99	91.0		ug/m3		92	69 - 129
1,1-Dichloroethane	81	73.8		ug/m3		91	65 - 125
1,2-Dichloroethane	81	72.3		ug/m3		89	71 - 131
1,1-Dichloroethene	79	66.1		ug/m3		83	53 - 128
cis-1,2-Dichloroethene	79	79.8		ug/m3		101	68 - 128
trans-1,2-Dichloroethene	79	71.3		ug/m3		90	70 - 130
1,2-Dichloropropane	92	89.6		ug/m3		97	74 - 128

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 320-140204/3
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,3-Dichloropropene	91	96.7		ug/m3		106	78 - 132
trans-1,3-Dichloropropene	91	79.9		ug/m3		88	56 - 136
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	150		ug/m3		108	64 - 124
Ethylbenzene	87	87.2		ug/m3		100	76 - 136
4-Ethyltoluene	98	101		ug/m3		102	62 - 136
Hexachlorobutadiene	210	181		ug/m3		85	42 - 150
2-Hexanone	82	80.3		ug/m3		98	70 - 128
Methylene Chloride	69	54.6		ug/m3		79	65 - 125
4-Methyl-2-pentanone (MIBK)	82	72.2		ug/m3		88	73 - 133
Styrene	85	88.5		ug/m3		104	76 - 144
1,1,2,2-Tetrachloroethane	140	142		ug/m3		104	75 - 135
Tetrachloroethene	140	136		ug/m3		100	56 - 138
Toluene	75	75.3		ug/m3		100	71 - 132
1,2,4-Trichlorobenzene	150	134		ug/m3		90	59 - 150
1,1,1-Trichloroethane	110	103		ug/m3		94	65 - 124
1,1,2-Trichloroethane	110	115		ug/m3		105	71 - 131
Trichloroethene	110	111		ug/m3		103	64 - 127
Trichlorofluoromethane	110	108		ug/m3		96	68 - 128
1,1,2-Trichloro-1,2,2-trifluoroethane	150	139		ug/m3		91	50 - 132
1,2,4-Trimethylbenzene	98	98.8		ug/m3		101	61 - 145
1,3,5-Trimethylbenzene	98	98.5		ug/m3		100	65 - 136
Vinyl acetate	70	61.1		ug/m3		87	77 - 134
Vinyl chloride	51	48.4		ug/m3		95	69 - 129
m,p-Xylene	170	172		ug/m3		99	75 - 138
o-Xylene	87	86.8		ug/m3		100	77 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*105*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*90*		*70 - 130*
Toluene-d8 (Surr)	*99*		*70 - 130*

Lab Sample ID: LCSD 320-140204/4
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	20.0	15.7		ppb v/v		78	71 - 131	3	25
Benzene	20.0	19.7		ppb v/v		98	68 - 128	0	25
Benzyl chloride	20.0	15.8		ppb v/v		79	58 - 120	0	25
Bromodichloromethane	20.0	19.1		ppb v/v		95	65 - 130	1	25
Bromoform	20.0	20.5		ppb v/v		102	64 - 144	0	25
Bromomethane	20.0	21.3		ppb v/v		106	70 - 131	1	25
2-Butanone (MEK)	20.0	18.9		ppb v/v		94	71 - 131	1	25
Carbon disulfide	20.0	18.7		ppb v/v		93	63 - 123	1	25
Carbon tetrachloride	20.0	18.4		ppb v/v		92	67 - 127	1	25
Chlorobenzene	20.0	20.0		ppb v/v		100	70 - 132	0	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-140204/4
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Dibromochloromethane	20.0	19.9		ppb v/v		100	68 - 128	1	25
Chloroethane	20.0	20.0		ppb v/v		100	70 - 131	1	25
Chloroform	20.0	18.9		ppb v/v		94	69 - 129	1	25
Chloromethane	20.0	17.5		ppb v/v		88	67 - 127	1	25
1,2-Dibromoethane (EDB)	20.0	20.6		ppb v/v		103	68 - 131	0	25
1,2-Dichlorobenzene	20.0	21.1		ppb v/v		106	73 - 143	0	25
1,3-Dichlorobenzene	20.0	21.1		ppb v/v		106	77 - 136	0	25
1,4-Dichlorobenzene	20.0	21.2		ppb v/v		106	73 - 143	0	25
Dichlorodifluoromethane	20.0	18.1		ppb v/v		91	69 - 129	1	25
1,1-Dichloroethane	20.0	18.0		ppb v/v		90	65 - 125	1	25
1,2-Dichloroethane	20.0	17.9		ppb v/v		89	71 - 131	0	25
1,1-Dichloroethene	20.0	16.4		ppb v/v		82	53 - 128	1	25
cis-1,2-Dichloroethene	20.0	19.9		ppb v/v		99	68 - 128	1	25
trans-1,2-Dichloroethene	20.0	17.7		ppb v/v		89	70 - 130	1	25
1,2-Dichloropropane	20.0	19.3		ppb v/v		96	74 - 128	1	25
cis-1,3-Dichloropropene	20.0	21.3		ppb v/v		107	78 - 132	0	25
trans-1,3-Dichloropropene	20.0	17.5		ppb v/v		88	56 - 136	0	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	20.0	21.1		ppb v/v		106	64 - 124	2	25
Ethylbenzene	20.0	20.1		ppb v/v		101	76 - 136	0	25
4-Ethyltoluene	20.0	20.4		ppb v/v		102	62 - 136	0	25
Hexachlorobutadiene	20.0	16.5		ppb v/v		82	42 - 150	3	25
2-Hexanone	20.0	19.6		ppb v/v		98	70 - 128	0	25
Methylene Chloride	20.0	15.4		ppb v/v		77	65 - 125	2	25
4-Methyl-2-pentanone (MIBK)	20.0	17.7		ppb v/v		88	73 - 133	0	25
Styrene	20.0	21.1		ppb v/v		105	76 - 144	2	25
1,1,2,2-Tetrachloroethane	20.0	20.9		ppb v/v		105	75 - 135	1	25
Tetrachloroethene	20.0	20.1		ppb v/v		101	56 - 138	1	25
Toluene	20.0	20.0		ppb v/v		100	71 - 132	0	25
1,2,4-Trichlorobenzene	20.0	17.7		ppb v/v		88	59 - 150	2	25
1,1,1-Trichloroethane	20.0	18.6		ppb v/v		93	65 - 124	2	25
1,1,2-Trichloroethane	20.0	21.1		ppb v/v		106	71 - 131	0	25
Trichloroethene	20.0	20.7		ppb v/v		103	64 - 127	0	25
Trichlorofluoromethane	20.0	19.0		ppb v/v		95	68 - 128	1	25
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0	17.9		ppb v/v		90	50 - 132	1	25
1,2,4-Trimethylbenzene	20.0	20.2		ppb v/v		101	61 - 145	0	25
1,3,5-Trimethylbenzene	20.0	20.2		ppb v/v		101	65 - 136	1	25
Vinyl acetate	20.0	17.1		ppb v/v		85	77 - 134	2	25
Vinyl chloride	20.0	19.2		ppb v/v		96	69 - 129	2	25
m,p-Xylene	40.0	39.7		ppb v/v		99	75 - 138	0	25
o-Xylene	20.0	20.1		ppb v/v		101	77 - 132	1	25

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetone	48	37.2		ug/m3		78	71 - 131	3	25
Benzene	64	62.9		ug/m3		98	68 - 128	0	25
Benzyl chloride	100	81.9		ug/m3		79	58 - 120	0	25
Bromodichloromethane	130	128		ug/m3		95	65 - 130	1	25
Bromoform	210	212		ug/m3		102	64 - 144	0	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-140204/4
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Bromomethane	78	82.6		ug/m3		106	70 - 131	1	25
2-Butanone (MEK)	59	55.6		ug/m3		94	71 - 131	1	25
Carbon disulfide	62	58.1		ug/m3		93	63 - 123	1	25
Carbon tetrachloride	130	116		ug/m3		92	67 - 127	1	25
Chlorobenzene	92	92.3		ug/m3		100	70 - 132	0	25
Dibromochloromethane	170	170		ug/m3		100	68 - 128	1	25
Chloroethane	53	52.8		ug/m3		100	70 - 131	1	25
Chloroform	98	92.3		ug/m3		94	69 - 129	1	25
Chloromethane	41	36.2		ug/m3		88	67 - 127	1	25
1,2-Dibromoethane (EDB)	150	159		ug/m3		103	68 - 131	0	25
1,2-Dichlorobenzene	120	127		ug/m3		106	73 - 143	0	25
1,3-Dichlorobenzene	120	127		ug/m3		106	77 - 136	0	25
1,4-Dichlorobenzene	120	128		ug/m3		106	73 - 143	0	25
Dichlorodifluoromethane	99	89.7		ug/m3		91	69 - 129	1	25
1,1-Dichloroethane	81	72.9		ug/m3		90	65 - 125	1	25
1,2-Dichloroethane	81	72.3		ug/m3		89	71 - 131	0	25
1,1-Dichloroethene	79	65.1		ug/m3		82	53 - 128	1	25
cis-1,2-Dichloroethene	79	78.8		ug/m3		99	68 - 128	1	25
trans-1,2-Dichloroethene	79	70.4		ug/m3		89	70 - 130	1	25
1,2-Dichloropropane	92	89.0		ug/m3		96	74 - 128	1	25
cis-1,3-Dichloropropene	91	96.7		ug/m3		107	78 - 132	0	25
trans-1,3-Dichloropropene	91	79.6		ug/m3		88	56 - 136	0	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	140	148		ug/m3		106	64 - 124	2	25
Ethylbenzene	87	87.3		ug/m3		101	76 - 136	0	25
4-Ethyltoluene	98	100		ug/m3		102	62 - 136	0	25
Hexachlorobutadiene	210	176		ug/m3		82	42 - 150	3	25
2-Hexanone	82	80.3		ug/m3		98	70 - 128	0	25
Methylene Chloride	69	53.5		ug/m3		77	65 - 125	2	25
4-Methyl-2-pentanone (MIBK)	82	72.4		ug/m3		88	73 - 133	0	25
Styrene	85	89.8		ug/m3		105	76 - 144	2	25
1,1,2,2-Tetrachloroethane	140	144		ug/m3		105	75 - 135	1	25
Tetrachloroethene	140	137		ug/m3		101	56 - 138	1	25
Toluene	75	75.4		ug/m3		100	71 - 132	0	25
1,2,4-Trichlorobenzene	150	131		ug/m3		88	59 - 150	2	25
1,1,1-Trichloroethane	110	101		ug/m3		93	65 - 124	2	25
1,1,2-Trichloroethane	110	115		ug/m3		106	71 - 131	0	25
Trichloroethene	110	111		ug/m3		103	64 - 127	0	25
Trichlorofluoromethane	110	107		ug/m3		95	68 - 128	1	25
1,1,2-Trichloro-1,2,2-trifluoroethane	150	137		ug/m3		90	50 - 132	1	25
1,2,4-Trimethylbenzene	98	99.3		ug/m3		101	61 - 145	0	25
1,3,5-Trimethylbenzene	98	99.3		ug/m3		101	65 - 136	1	25
Vinyl acetate	70	60.1		ug/m3		85	77 - 134	2	25
Vinyl chloride	51	49.1		ug/m3		96	69 - 129	2	25
m,p-Xylene	170	172		ug/m3		99	75 - 138	0	25
o-Xylene	87	87.3		ug/m3		101	77 - 132	1	25

Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCSD 320-140204/4
Matrix: Air
Analysis Batch: 140204

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
4-Bromofluorobenzene (Surr)	*106*		*70 - 130*
1,2-Dichloroethane-d4 (Surr)	*88*		*70 - 130*
Toluene-d8 (Surr)	*99*		*70 - 130*

Air - GC/MS VOA

Analysis Batch: 140204

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-23751-1	SB1-45-11172016	Total/NA	Air	TO-15	
320-23751-2	SB1-60-11172016	Total/NA	Air	TO-15	
320-23751-3	SB1-75-11172016	Total/NA	Air	TO-15	
320-23751-4	SB2-40-11182016	Total/NA	Air	TO-15	
320-23751-5	SB2-60-11182016	Total/NA	Air	TO-15	
320-23751-6	SB2-70-11182016	Total/NA	Air	TO-15	
320-23751-7	SB2-70-11182016 DUP	Total/NA	Air	TO-15	
MB 320-140204/6	Method Blank	Total/NA	Air	TO-15	
LCS 320-140204/3	Lab Control Sample	Total/NA	Air	TO-15	
LCSD 320-140204/4	Lab Control Sample Dup	Total/NA	Air	TO-15	

Lab Chronicle

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB1-45-11172016
Lab Sample ID: 320-23751-1
Date Collected: 11/17/16 12:18
Matrix: Air
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		3.53	170 mL	250 mL	140204	12/02/16 02:30	RS1	TAL SAC

Client Sample ID: SB1-60-11172016
Lab Sample ID: 320-23751-2
Date Collected: 11/17/16 14:06
Matrix: Air
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	595 mL	250 mL	140204	12/02/16 03:30	RS1	TAL SAC

Client Sample ID: SB1-75-11172016
Lab Sample ID: 320-23751-3
Date Collected: 11/17/16 15:18
Matrix: Air
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		70	7.67 mL	250 mL	140204	12/02/16 04:23	RS1	TAL SAC

Client Sample ID: SB2-40-11182016
Lab Sample ID: 320-23751-4
Date Collected: 11/18/16 10:04
Matrix: Air
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		11.3	42 mL	250 mL	140204	12/02/16 05:15	RS1	TAL SAC

Client Sample ID: SB2-60-11182016
Lab Sample ID: 320-23751-5
Date Collected: 11/18/16 12:18
Matrix: Air
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		2010	0.27 mL	250 mL	140204	12/02/16 06:09	RS1	TAL SAC

Client Sample ID: SB2-70-11182016
Lab Sample ID: 320-23751-6
Date Collected: 11/18/16 13:25
Matrix: Air
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		317	1.78 mL	250 mL	140204	12/02/16 07:01	RS1	TAL SAC

Lab Chronicle

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Client Sample ID: SB2-70-11182016 DUP — **Lab Sample ID: 320-23751-7**
Date Collected: 11/18/16 13:25 — **Matrix: Air**
Date Received: 11/22/16 09:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		322	1.72 mL	250 mL	140204	12/02/16 07:54	RS1	TAL SAC

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Certification Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Laboratory: TestAmerica Sacramento

Unless otherwise noted, all analytes for this laboratory were covered under each certification below.

Authority	Program	EPA Region	Certification ID	Expiration Date
Arizona	State Program	9	AZ0708	08-11-17

The following analytes are included in this report, but certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
TO-15		Air	1,1,2-Trichloro-1,2,2-trifluoroethane
TO-15		Air	1,2,4-Trimethylbenzene
TO-15		Air	1,2-Dichloro-1,1,2,2-tetrafluoroethane
TO-15		Air	1,2-Dichlorobenzene
TO-15		Air	1,3,5-Trimethylbenzene
TO-15		Air	1,3-Dichlorobenzene
TO-15		Air	2-Hexanone
TO-15		Air	4-Ethyltoluene
TO-15		Air	Acetone
TO-15		Air	Bromodichloromethane
TO-15		Air	cis-1,2-Dichloroethene
TO-15		Air	Dibromochloromethane
TO-15		Air	Dichlorodifluoromethane
TO-15		Air	trans-1,2-Dichloroethene
TO-15		Air	trans-1,3-Dichloropropene
TO-15		Air	Trichlorofluoromethane

Method Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

Laboratory References:

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper & Commerce SP0146B

TestAmerica Job ID: 320-23751-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-23751-1	SB1-45-11172016	Air	11/17/16 12:18	11/22/16 09:50
320-23751-2	SB1-60-11172016	Air	11/17/16 14:06	11/22/16 09:50
320-23751-3	SB1-75-11172016	Air	11/17/16 15:18	11/22/16 09:50
320-23751-4	SB2-40-11182016	Air	11/18/16 10:04	11/22/16 09:50
320-23751-5	SB2-60-11182016	Air	11/18/16 12:18	11/22/16 09:50
320-23751-6	SB2-70-11182016	Air	11/18/16 13:25	11/22/16 09:50
320-23751-7	SB2-70-11182016 DUP	Air	11/18/16 13:25	11/22/16 09:50

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
phone 916.374.4378 fax 916.372.1059

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact Information	**Project Manager:** Marla Miller	**Samples Collected By:** George A Hickam Jr / ROBERT FIFIELD
Company Name: GEOSYNTEC	Phone: 602-790-6052	
Address: 11811 N TATUM Blvd #185	Email: mmiller@geosyntec.com	
City/State/Zip Phoenix AZ 85028		
Phone:	**Site Contact:**	
FAX:	**TA Contact:**	
Project Name: Cooper E Commerce	**Anaylsis Turnaround Time**	
Site/Location:	Standard (Specific): X	
P O # SP01463	Rush (Specifiy):	

COC No: 1 of 1 COCs

For Lab Use Only:
Walk-in Client:
Lab Sampling:

Job / SDG No.:
(See below for Add'l Items)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, 'Hg (Start)'	Canister Vacuum in Field, 'Hg (Stop)'	Flow Controller ID	Canister ID	TO-15 (Med / Std / Low / SIM)	MA-APH	EPA 3C	EPA 25C / 25.3	ASTM D-1946 / 1945 / 3588	EPA 15/16	TO-3	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)	Sample Specific Notes:
SB1-45-111720l6	11-17-16	1213	1218	30	8.5	2564	340[illegible]	/														
SB1-60 1117201	11-17-16	1401	1406	30	8.0	7445	340[illegible]	/														
SB1-75 1117201	11-17-16	1513	1518	30	5.0	7555	340[illegible]	/														Possible moist
SB2-40-1118 2016	11/18/16	0958	1004	30	4.0	7121	340[illegible]	/														
SB2-60-1118 2016	11/18/16	1213	1218	30	7.0	7127	340[illegible]	/														
SB2-70-1118 2016	11/18/16	1320	1325	30	7.0	7239	340[illegible]	/														MOISTER PRESENT
SB2-70-1118 2016-DUP	11/18/16	1320	1325	30	6.5	7481	340[illegible]	/														MOISTER PRESENT

Temperature (Fahrenheit)			
Start	Interior	Ambient	
Stop			

Temperature (Fahrenheit)			
Start	Interior	Ambient	
Stop			

320-23751 Chain of Custody

Special Instructions/QC Requirements & Comments:

* Sample ID on TAL is SB2-45-111820l6 @ 11/22/16

Samples Shipped by:	**Date / Time:**	**Samples Received by:**	20.0°C/AMB
Samples Relinquished by:	**Date / Time:** 11/18/16 1647	**Received by:**	
Relinquished by:	**Date / Time:** 11/21/16 17:00	**Received by:** 11/22/16 950	no ice
Lab Use Only: **Shipper Name:**	**Opened by:**	**Condition:**	

Form No. CA-C-WI-003, Rev. 1, dated 05/10/2013

12/5/2016

Login Sample Receipt Checklist

Client: Geosyntec Consultants, Inc.

Job Number: 320-23751-1

Login Number: 23751
List Number: 1
Creator: Nelson, Kym D

List Source: TestAmerica Sacramento

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	911061
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sacramento
Canister QC Certification
Batch Certification

Certification Type: TO-15 SCAN + ADD ONS

Date Cleaned/Batch ID: DO-14-16

Date of QC: 10/17/2016

Data File Number: C:\MSDCHEM\1\DATA\161017\ MS7101722.d

320-22713 Chain of Custody

CANISTER ID NUMBERS

* 8514	34000963	
8509	34000313	
34000730	34000667	
34000951	34000986	
34000956	34001107	
34000762	34000993	
34000770	34001541	
34000235	34001075	

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: _____ Date: 10/18/16

2nd level Reviewed By: _____ Date: 10/18/16

Q:\FORMS\QA-814 BATCH CAN QC 20130729.DOC
QA-814

ERS 7/29/2013

TestAmeri

THE LEADER IN ENVIRONMENTAL TESTING

320-23657 Chain of Custody

Sacramento
Canister QC Certification
Batch Certification

Certification Type: TO15 SCAN

Date Cleaned/Batch ID: 11/17/16, 320-23657

Date of QC: 11/18/16

Data File Number: C:\MSDCHEM\1\DATA\161118\ ms7111813.d

CANISTER ID NUMBERS

7511 *	34001858	
34001810	34001884	
34001826	7509	
34001894	34001958	
34001818	34001913	
34001780	7540	
34001869	34001711	
7536	34001684	

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

1st level Reviewed By: _____ Date: 11/21/16

2nd level Reviewed By: _____ Date: 12/2/16

Q:\FORMS\QA-814 BATCH CAN QC 20130729.DOC
QA-814

ERS 7/29/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

320-23671 Chain of Custody

Sacramento
Canister QC Certification
Batch Certification

Certification Type	TO15 Scan
Date Cleaned/Batch ID	11/17/16, 320-23671
Date of QC	11/18/16
Data File Number	MS9 111821

CANISTER ID NUMBERS

34001768*	34001852	
7535	34001959	
34001851	34001753	
34001916	34001822	
34001803	34001888	
34001915	34001813	
34001741	34001923	
34001825	34001902	

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

dw for AP — 1st level Reviewed By: — 11/21/16 — Date:

2nd level Reviewed By: — 11/21/16 — Date:

Q:\FORMS\QA-814 BATCH CAN QC 20130729.DOC
QA-814

ERS 7/29/2013

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-22713-1

SDG No.:

Client Sample ID: 8514 Lab Sample ID: 320-22713-1

Matrix: Air Lab File ID: MS7101722.D

Analysis Method: TO-15 Date Collected: 10/14/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 10/18/2016 05:49

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 132885 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
67-64-1	Acetone	0.42	J	5.0	0.18
107-02-8	Acrolein	ND		2.0	0.22
107-13-1	Acrylonitrile	ND		2.0	0.19
107-05-1	Allyl chloride	ND		0.80	0.11
71-43-2	Benzene	ND		0.40	0.079
100-44-7	Benzyl chloride	ND		0.80	0.16
75-27-4	Bromodichloromethane	ND		0.30	0.066
75-25-2	Bromoform	ND		0.40	0.070
74-83-9	Bromomethane	ND		0.80	0.34
106-99-0	1,3-Butadiene	ND		0.80	0.15
106-97-8	n-Butane	ND		0.40	0.15
78-93-3	2-Butanone (MEK)	ND		0.80	0.20
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0	0.11
104-51-8	n-Butylbenzene	ND		0.40	0.18
135-98-8	sec-Butylbenzene	ND		0.40	0.070
98-06-6	tert-Butylbenzene	ND		0.80	0.068
75-15-0	Carbon disulfide	ND		0.80	0.078
56-23-5	Carbon tetrachloride	ND		0.80	0.064
108-90-7	Chlorobenzene	ND		0.30	0.064
75-45-6	Chlorodifluoromethane	ND		0.80	0.11
75-00-3	Chloroethane	ND		0.80	0.31
67-66-3	Chloroform	ND		0.30	0.095
74-87-3	Chloromethane	ND		0.80	0.20
95-49-8	2-Chlorotoluene	ND		0.40	0.080
110-82-7	Cyclohexane	ND		0.40	0.084
124-48-1	Dibromochloromethane	ND		0.40	0.079
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80	0.075
74-95-3	Dibromomethane	ND		0.40	0.057
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40	0.16
95-50-1	1,2-Dichlorobenzene	ND		0.40	0.13
541-73-1	1,3-Dichlorobenzene	ND		0.40	0.11
106-46-7	1,4-Dichlorobenzene	ND		0.40	0.15
75-71-8	Dichlorodifluoromethane	ND		0.40	0.15
75-34-3	1,1-Dichloroethane	ND		0.30	0.072
107-06-2	1,2-Dichloroethane	ND		0.80	0.088

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-22713-1

SDG No.:

Client Sample ID: 8514 Lab Sample ID: 320-22713-1

Matrix: Air Lab File ID: MS7101722.D

Analysis Method: TO-15 Date Collected: 10/14/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 10/18/2016 05:49

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 132885 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
75-35-4	1,1-Dichloroethene	ND		0.80	0.13
156-59-2	cis-1,2-Dichloroethene	ND		0.40	0.089
156-60-5	trans-1,2-Dichloroethene	ND		0.40	0.10
78-87-5	1,2-Dichloropropane	ND		0.40	0.24
10061-01-5	cis-1,3-Dichloropropene	ND		0.40	0.10
10061-02-6	trans-1,3-Dichloropropene	ND		0.40	0.088
123-91-1	1,4-Dioxane	ND		0.80	0.10
141-78-6	Ethyl acetate	ND		0.30	0.18
100-41-4	Ethylbenzene	ND		0.40	0.063
622-96-8	4-Ethyltoluene	ND		0.40	0.19
142-82-5	n-Heptane	ND		0.80	0.063
87-68-3	Hexachlorobutadiene	ND		2.0	0.43
110-54-3	n-Hexane	ND		0.80	0.075
591-78-6	2-Hexanone	ND		0.40	0.087
98-82-8	Isopropylbenzene	ND		0.80	0.10
99-87-6	4-Isopropyltoluene	ND		0.80	0.12
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80	0.050
80-62-6	Methyl methacrylate	ND		0.80	0.16
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14
75-09-2	Methylene Chloride	ND		0.40	0.072
98-83-9	alpha-Methylstyrene	ND		0.40	0.065
91-20-3	Naphthalene	ND		0.80	0.56
111-65-9	n-Octane	ND		0.40	0.055
109-66-0	n-Pentane	ND		0.80	0.26
115-07-1	Propylene	ND		0.40	0.099
103-65-1	N-Propylbenzene	ND		0.40	0.059
100-42-5	Styrene	ND		0.40	0.059
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40	0.069
127-18-4	Tetrachloroethene	ND		0.40	0.051
109-99-9	Tetrahydrofuran	ND		0.80	0.079
108-88-3	Toluene	ND		0.40	0.051
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16
120-82-1	1,2,4-Trichlorobenzene	ND		2.0	0.43
71-55-6	1,1,1-Trichloroethane	ND		0.30	0.065
79-00-5	1,1,2-Trichloroethane	ND		0.40	0.067

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-22713-1

SDG No.:

Client Sample ID: 8514 Lab Sample ID: 320-22713-1

Matrix: Air Lab File ID: MS7101722.D

Analysis Method: TO-15 Date Collected: 10/14/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 10/18/2016 05:49

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 132885 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
79-01-6	Trichloroethene	ND		0.40	0.11
75-69-4	Trichlorofluoromethane	ND		0.40	0.20
96-18-4	1,2,3-Trichloropropane	ND		0.40	0.17
95-63-6	1,2,4-Trimethylbenzene	ND		0.80	0.16
108-67-8	1,3,5-Trimethylbenzene	ND		0.40	0.13
540-84-1	2,2,4-Trimethylpentane	ND		0.40	0.071
108-05-4	Vinyl acetate	ND		0.80	0.15
593-60-2	Vinyl bromide	ND		0.80	0.26
75-01-4	Vinyl chloride	ND		0.40	0.12
179601-23-1	m,p-Xylene	ND		0.80	0.10
95-47-6	o-Xylene	ND		0.40	0.054
75-37-6	1,1-Difluoroethane	ND		0.40	0.051
111-84-2	n-Nonane	ND		0.80	0.058

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	82		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	103		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\ChromNA\Sacramento\ChromData\ATMS7\20161017-35731.b\MS7101722.D
Lims ID: 320-22713-A-1
Client ID: 8514
Sample Type: Client
Inject. Date: 18-Oct-2016 05:49:30 ALS Bottle#: 4 Worklist Smp#: 20
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-22713-A-1
Misc. Info.: 500 mL CAN CERT
Operator ID: LHS Instrument ID: ATMS7

Method: \\ChromNA\Sacramento\ChromData\ATMS7\20161017-35731.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 18-Oct-2016 08:16:39 Calib Date: 14-Oct-2016 23:23:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\ChromNA\Sacramento\ChromData\ATMS7\20161014-35680.b\MS7101410.D

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK048

First Level Reviewer: leeh Date: 18-Oct-2016 08:14:37

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	OnCol Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.269	12.300	-0.031	89	42992	4.00	
* 2 1,4-Difluorobenzene	114	14.429	14.459	-0.030	94	182361	4.00	
* 3 Chlorobenzene-d5 (IS)	117	21.109	21.139	-0.030	86	160548	4.00	
$ 4 1,2-Dichloroethane-d4 (Sur	65	13.474	13.510	-0.036	98	59322	4.12	
$ 5 Toluene-d8 (Surr)	100	17.836	17.860	-0.024	98	108313	3.95	
$ 6 4-Bromofluorobenzene (Surr	95	23.652	23.676	-0.024	91	59578	3.26	
11 Propene	41	3.850	3.844	0.006	36	477	0.0725	
32 Acetone	43	7.378	7.335	0.043	97	7658	0.4248	
75 Toluene	91	18.006	18.030	-0.024	68	1251	0.0254	

Reagents:

VAMSIS20_00002 Amount Added: 50.00 Units: mL Run Reagent

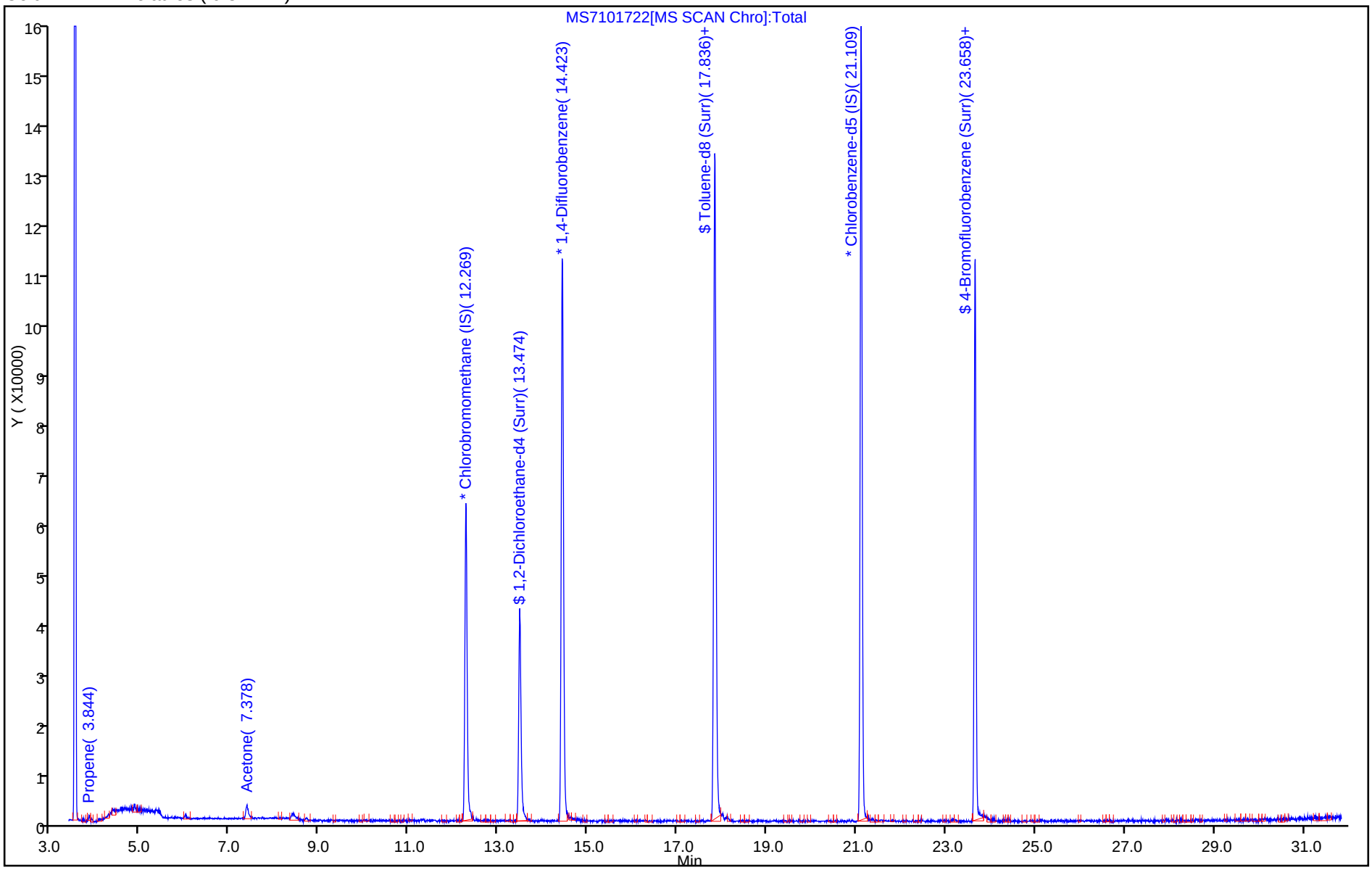
Report Date: 18-Oct-2016 08:17:01 Chrom Revision: 2.2 17-Oct-2016 09:27:18

TestAmerica Sacramento

Data File: \\ChromNA\Sacramento\ChromData\ATMS7\20161017-35731.b\MS7101722.D

Injection Date:	18-Oct-2016 05:49:30	Instrument ID:	ATMS7	Operator ID:	LHS
Lims ID:	320-22713-A-1	Lab Sample ID:	320-22713-1	Worklist Smp#:	20
Client ID:	8514				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	4
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)



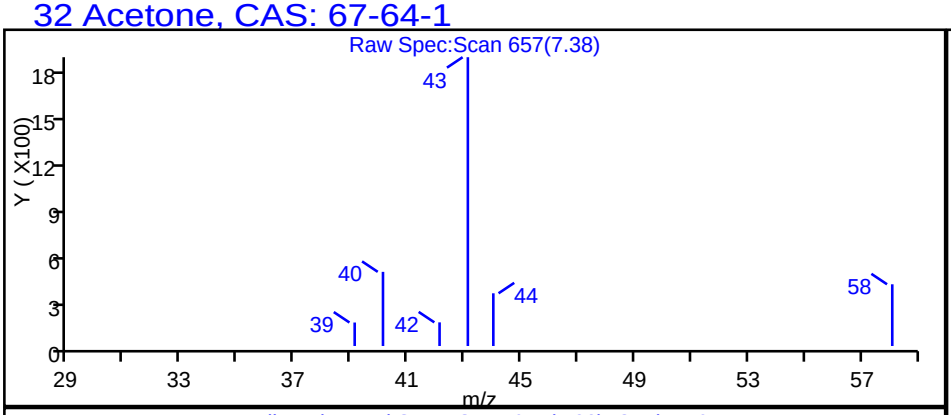
Report Date: 18-Oct-2016 08:17:02 Chrom Revision: 2.2 17-Oct-2016 09:27:18

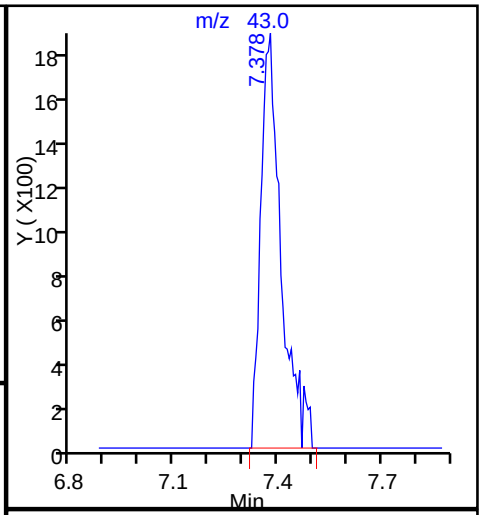
TestAmerica Sacramento

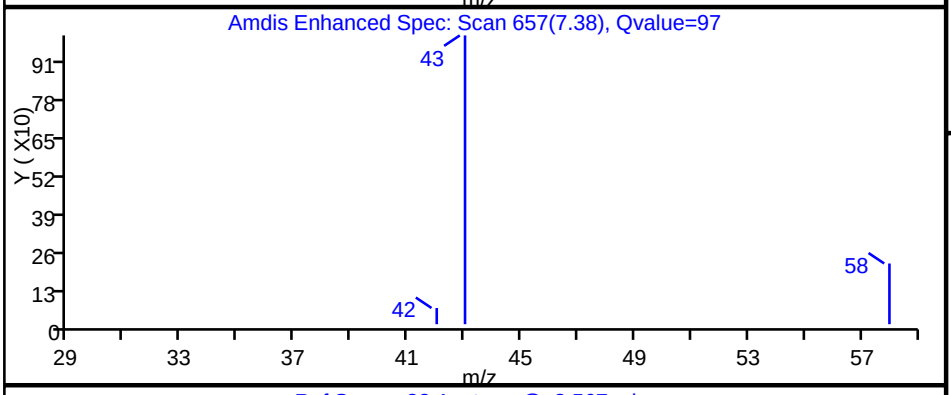
Data File: \\ChromNA\Sacramento\ChromData\ATMS7\20161017-35731.b\MS7101722.D

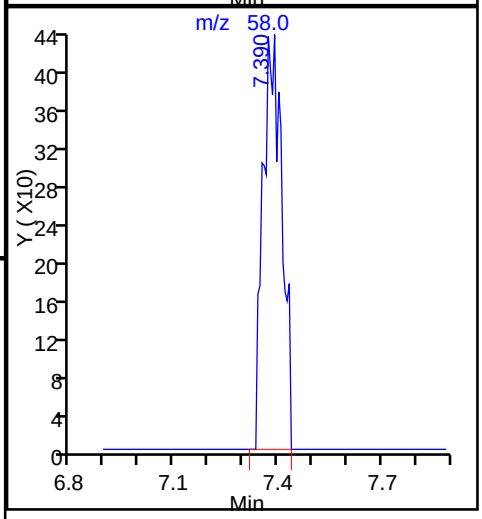
Injection Date:	18-Oct-2016 05:49:30	Instrument ID:	ATMS7		
Lims ID:	320-22713-A-1	Lab Sample ID:	320-22713-1		
Client ID:	8514				
Operator ID:	LHS	ALS Bottle#:	4	Worklist Smp#:	20
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

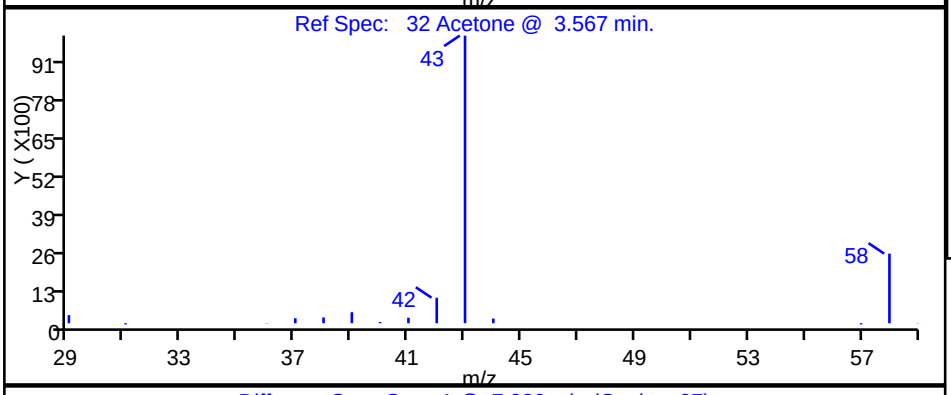
32 Acetone, CAS: 67-64-1

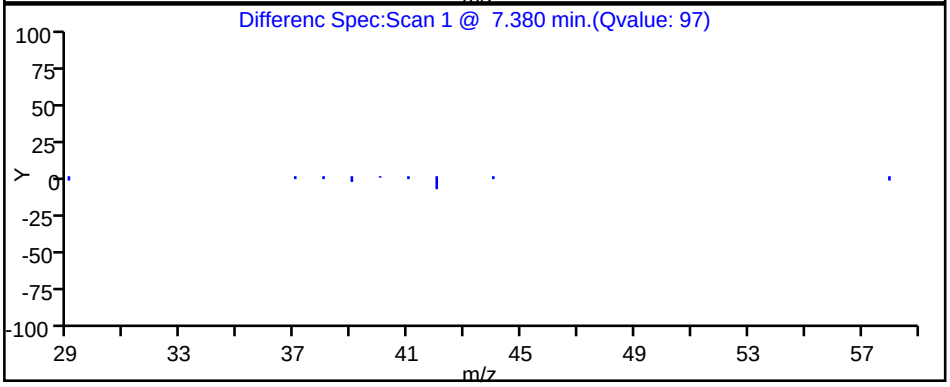












FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-23657-1

SDG No.:

Client Sample ID: 7511 Lab Sample ID: 320-23657-1

Matrix: Air Lab File ID: MS7111813.D

Analysis Method: TO-15 Date Collected: 11/17/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 11/18/2016 20:48

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 138459 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
67-64-1	Acetone	ND		5.0	0.18
107-02-8	Acrolein	ND		2.0	0.22
107-13-1	Acrylonitrile	ND		2.0	0.19
107-05-1	Allyl chloride	ND		0.80	0.11
71-43-2	Benzene	ND		0.40	0.079
100-44-7	Benzyl chloride	ND		0.80	0.16
75-27-4	Bromodichloromethane	ND		0.30	0.066
75-25-2	Bromoform	ND		0.40	0.070
74-83-9	Bromomethane	ND		0.80	0.34
106-99-0	1,3-Butadiene	ND		0.80	0.15
106-97-8	n-Butane	ND		0.40	0.15
78-93-3	2-Butanone (MEK)	ND		0.80	0.20
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0	0.11
104-51-8	n-Butylbenzene	ND		0.40	0.18
135-98-8	sec-Butylbenzene	ND		0.40	0.070
98-06-6	tert-Butylbenzene	ND		0.80	0.068
75-15-0	Carbon disulfide	ND		0.80	0.078
56-23-5	Carbon tetrachloride	ND		0.80	0.064
108-90-7	Chlorobenzene	ND		0.30	0.064
75-45-6	Chlorodifluoromethane	ND		0.80	0.27
75-00-3	Chloroethane	ND		0.80	0.31
67-66-3	Chloroform	ND		0.30	0.095
74-87-3	Chloromethane	ND		0.80	0.20
95-49-8	2-Chlorotoluene	ND		0.40	0.080
110-82-7	Cyclohexane	ND		0.40	0.084
124-48-1	Dibromochloromethane	ND		0.40	0.079
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80	0.075
74-95-3	Dibromomethane	ND		0.40	0.057
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40	0.16
95-50-1	1,2-Dichlorobenzene	ND		0.40	0.13
541-73-1	1,3-Dichlorobenzene	ND		0.40	0.11
106-46-7	1,4-Dichlorobenzene	ND		0.40	0.15
75-71-8	Dichlorodifluoromethane	ND		0.40	0.15
75-34-3	1,1-Dichloroethane	ND		0.30	0.072
107-06-2	1,2-Dichloroethane	ND		0.80	0.088

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-23657-1

SDG No.:

Client Sample ID: 7511 Lab Sample ID: 320-23657-1

Matrix: Air Lab File ID: MS7111813.D

Analysis Method: TO-15 Date Collected: 11/17/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 11/18/2016 20:48

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 138459 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
75-35-4	1,1-Dichloroethene	ND		0.80	0.13
156-59-2	cis-1,2-Dichloroethene	ND		0.40	0.089
156-60-5	trans-1,2-Dichloroethene	ND		0.40	0.10
78-87-5	1,2-Dichloropropane	ND		0.40	0.24
10061-01-5	cis-1,3-Dichloropropene	ND		0.40	0.10
10061-02-6	trans-1,3-Dichloropropene	ND		0.40	0.088
123-91-1	1,4-Dioxane	ND		0.80	0.10
141-78-6	Ethyl acetate	ND		0.30	0.18
100-41-4	Ethylbenzene	ND		0.40	0.063
622-96-8	4-Ethyltoluene	ND		0.40	0.19
142-82-5	n-Heptane	ND		0.80	0.063
87-68-3	Hexachlorobutadiene	ND		2.0	0.43
110-54-3	n-Hexane	ND		0.80	0.075
591-78-6	2-Hexanone	ND		0.40	0.087
98-82-8	Isopropylbenzene	ND		0.80	0.10
99-87-6	4-Isopropyltoluene	ND		0.80	0.12
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80	0.12
80-62-6	Methyl methacrylate	ND		0.80	0.16
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14
75-09-2	Methylene Chloride	ND		0.40	0.072
98-83-9	alpha-Methylstyrene	ND		0.40	0.065
91-20-3	Naphthalene	ND		0.80	0.56
111-65-9	n-Octane	ND		0.40	0.055
109-66-0	n-Pentane	ND		0.80	0.26
115-07-1	Propylene	0.12	J	0.40	0.099
103-65-1	N-Propylbenzene	ND		0.40	0.059
100-42-5	Styrene	ND		0.40	0.059
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40	0.069
127-18-4	Tetrachloroethene	ND		0.40	0.051
109-99-9	Tetrahydrofuran	ND		0.80	0.21
108-88-3	Toluene	ND		0.40	0.051
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16
120-82-1	1,2,4-Trichlorobenzene	ND		2.0	0.43
71-55-6	1,1,1-Trichloroethane	ND		0.30	0.065
79-00-5	1,1,2-Trichloroethane	ND		0.40	0.067

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-23657-1

SDG No.:

Client Sample ID: 7511 Lab Sample ID: 320-23657-1

Matrix: Air Lab File ID: MS7111813.D

Analysis Method: TO-15 Date Collected: 11/17/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 11/18/2016 20:48

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 138459 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
79-01-6	Trichloroethene	ND		0.40	0.11
75-69-4	Trichlorofluoromethane	ND		0.40	0.20
96-18-4	1,2,3-Trichloropropane	ND		0.40	0.17
95-63-6	1,2,4-Trimethylbenzene	ND		0.80	0.16
108-67-8	1,3,5-Trimethylbenzene	ND		0.40	0.13
540-84-1	2,2,4-Trimethylpentane	ND		0.40	0.071
108-05-4	Vinyl acetate	ND		0.80	0.15
593-60-2	Vinyl bromide	ND		0.80	0.26
75-01-4	Vinyl chloride	ND		0.40	0.12
179601-23-1	m,p-Xylene	ND		0.80	0.10
95-47-6	o-Xylene	ND		0.40	0.054

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	89		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	109		70-130
2037-26-5	Toluene-d8 (Surr)	103		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\ChromNA\Sacramento\ChromData\ATMS7\20161118-37022.b\MS7111813.D
Lims ID: 320-23657-A-1
Client ID: 7511
Sample Type: Client
Inject. Date: 18-Nov-2016 20:48:30 ALS Bottle#: 8 Worklist Smp#: 14
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-23657-A-1
Misc. Info.: 500 mL CAN CERT
Operator ID: LHS Instrument ID: ATMS7

Method: \\ChromNA\Sacramento\ChromData\ATMS7\20161118-37022.b\TO15_ATMS7N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 21-Nov-2016 10:46:15 Calib Date: 11-Nov-2016 18:11:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\ChromNA\Sacramento\ChromData\ATMS7\20161111-36770.b\MS7111111.D

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK013

First Level Reviewer: phanthasena Date: 21-Nov-2016 10:46:15

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	OnCol Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.294	12.336	-0.042	90	37418	4.00	
* 2 1,4-Difluorobenzene	114	14.453	14.490	-0.037	94	154055	4.00	
* 3 Chlorobenzene-d5 (IS)	117	21.139	21.163	-0.024	87	149437	4.00	
$ 4 1,2-Dichloroethane-d4 (Sur	65	13.498	13.535	-0.037	98	56278	4.36	
$ 5 Toluene-d8 (Surr)	100	17.860	17.897	-0.037	97	93994	4.10	
$ 6 4-Bromofluorobenzene (Surr	95	23.676	23.706	-0.030	91	66103	3.56	
11 Propene	41	3.850	3.868	-0.018	82	633	0.1184	
17 Butane	43	4.598	4.628	-0.030	1	619	0.0691	
65 Trichloroethene	130	15.220	15.256	-0.036	1	335	0.0241	

Reagents:

VAMSIS20_00002 Amount Added: 50.00 Units: mL Run Reagent

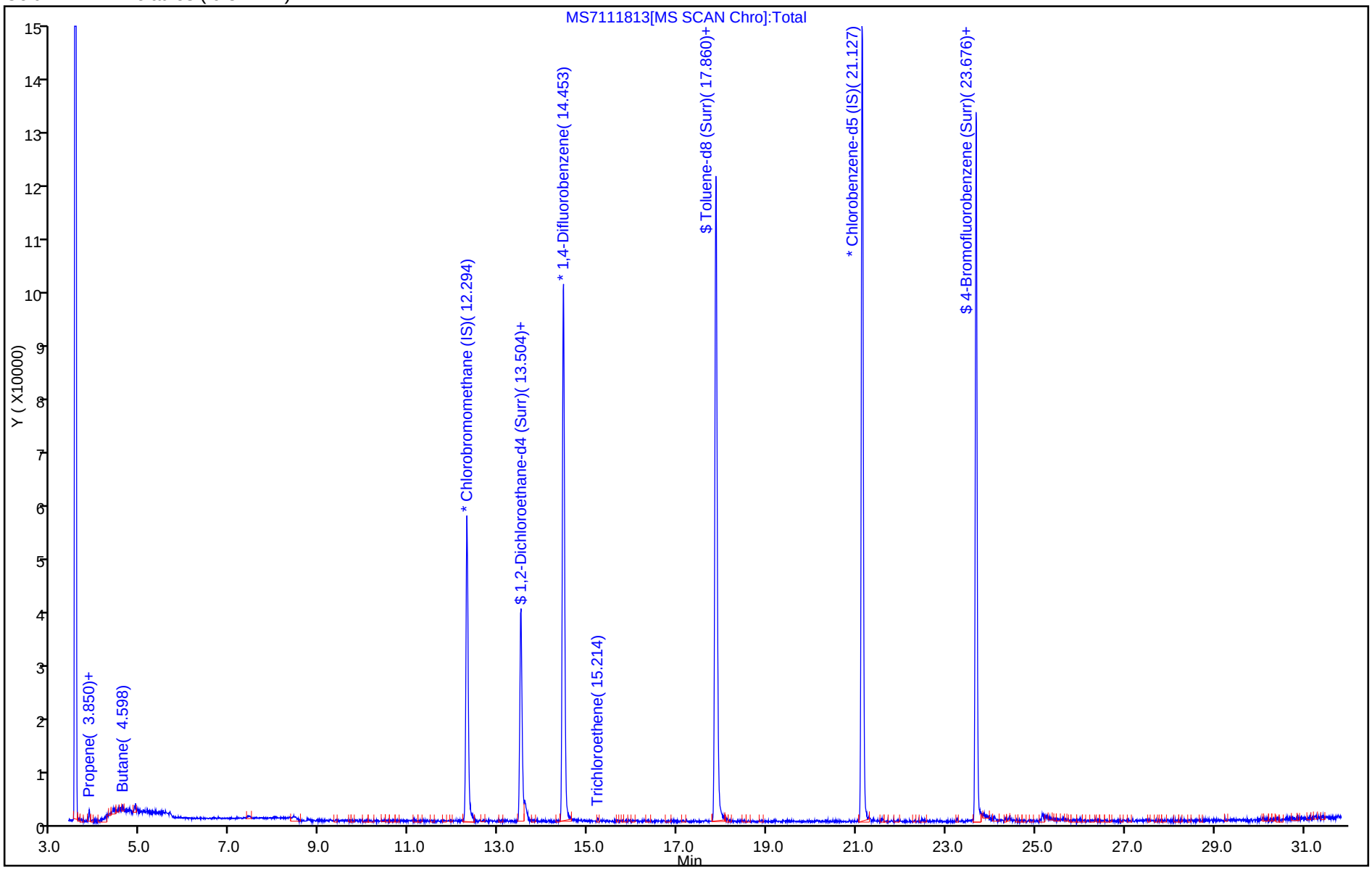
Report Date: 21-Nov-2016 10:46:16 Chrom Revision: 2.2 14-Nov-2016 08:15:18

TestAmerica Sacramento

Data File: \\ChromNA\Sacramento\ChromData\ATMS7\20161118-37022.b\MS7111813.D

Injection Date:	18-Nov-2016 20:48:30	Instrument ID:	ATMS7	Operator ID:	LHS
Lims ID:	320-23657-A-1	Lab Sample ID:	320-23657-1	Worklist Smp#:	14
Client ID:	7511				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	8
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm)



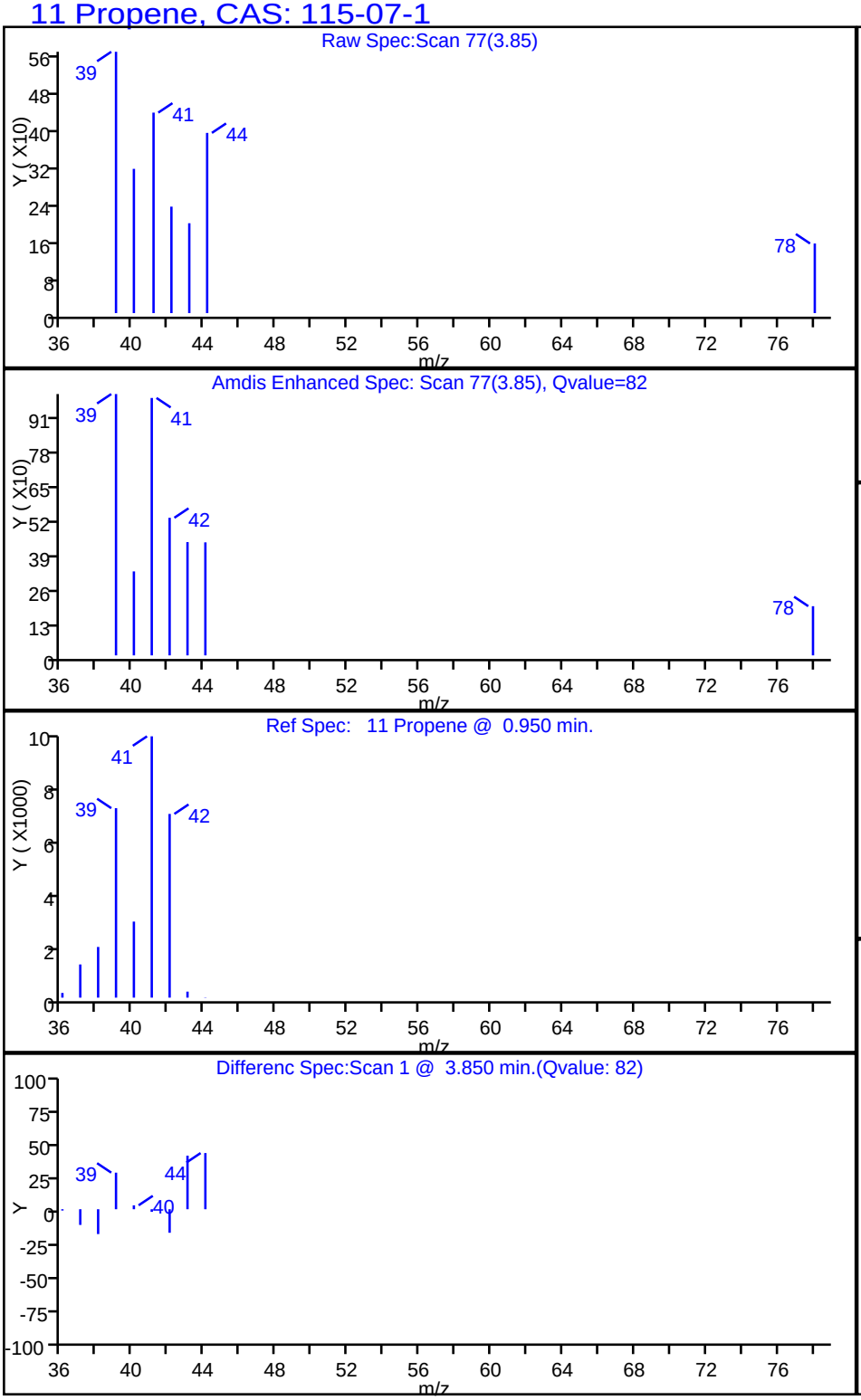
Report Date: 21-Nov-2016 10:46:16 Chrom Revision: 2.2 14-Nov-2016 08:15:18

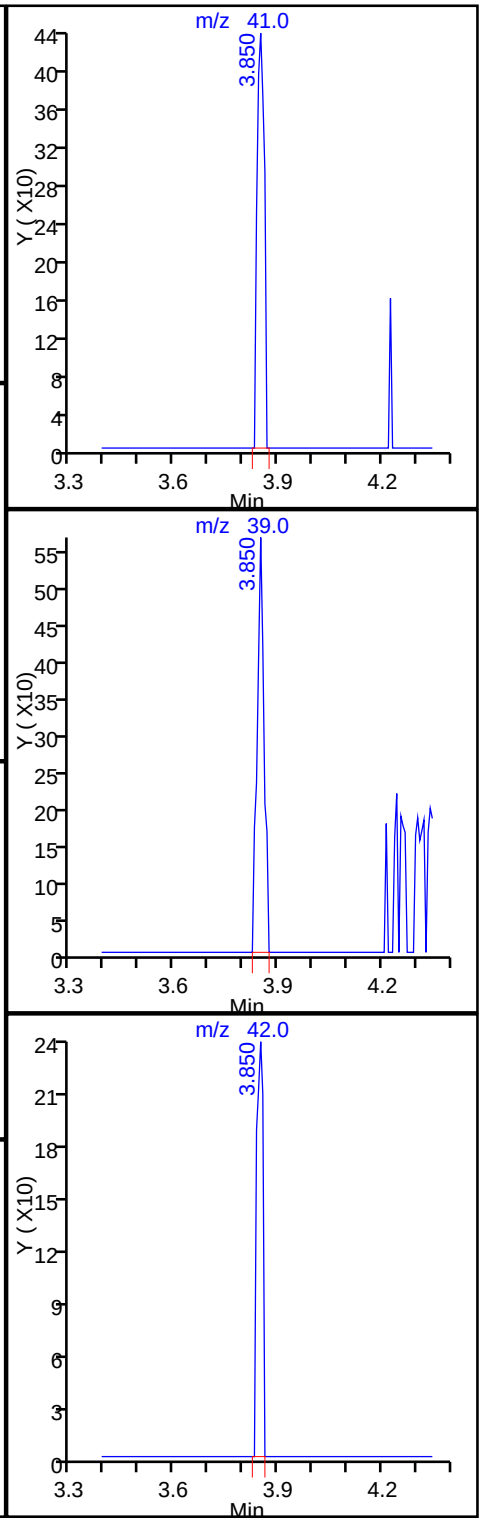
TestAmerica Sacramento

Data File: \\ChromNA\Sacramento\ChromData\ATMS7\20161118-37022.b\MS7111813.D

Injection Date:	18-Nov-2016 20:48:30	Instrument ID:	ATMS7		
Lims ID:	320-23657-A-1	Lab Sample ID:	320-23657-1		
Client ID:	7511				
Operator ID:	LHS	ALS Bottle#:	8	Worklist Smp#:	14
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS7N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

11 Propene, CAS: 115-07-1





FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-23671-1

SDG No.:

Client Sample ID: 34001768 Lab Sample ID: 320-23671-1

Matrix: Air Lab File ID: MS9111821.D

Analysis Method: TO-15 Date Collected: 11/17/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 11/19/2016 06:03

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 138417 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
67-64-1	Acetone	ND		5.0	0.18
107-02-8	Acrolein	ND		2.0	0.22
107-13-1	Acrylonitrile	ND		2.0	0.19
107-05-1	Allyl chloride	ND		0.80	0.11
71-43-2	Benzene	ND		0.40	0.079
100-44-7	Benzyl chloride	ND		0.80	0.16
75-27-4	Bromodichloromethane	ND		0.30	0.066
75-25-2	Bromoform	ND		0.40	0.070
74-83-9	Bromomethane	ND		0.80	0.34
106-99-0	1,3-Butadiene	ND		0.80	0.15
106-97-8	n-Butane	ND		0.40	0.15
78-93-3	2-Butanone (MEK)	ND		0.80	0.20
75-65-0	tert-Butyl alcohol (TBA)	ND		2.0	0.11
104-51-8	n-Butylbenzene	ND		0.40	0.18
135-98-8	sec-Butylbenzene	ND		0.40	0.070
98-06-6	tert-Butylbenzene	ND		0.80	0.068
75-15-0	Carbon disulfide	ND		0.80	0.078
56-23-5	Carbon tetrachloride	ND		0.80	0.064
108-90-7	Chlorobenzene	ND		0.30	0.064
75-45-6	Chlorodifluoromethane	ND		0.80	0.27
75-00-3	Chloroethane	ND		0.80	0.31
67-66-3	Chloroform	ND		0.30	0.095
74-87-3	Chloromethane	ND		0.80	0.20
95-49-8	2-Chlorotoluene	ND		0.40	0.080
110-82-7	Cyclohexane	ND		0.40	0.084
124-48-1	Dibromochloromethane	ND		0.40	0.079
106-93-4	1,2-Dibromoethane (EDB)	ND		0.80	0.075
74-95-3	Dibromomethane	ND		0.40	0.057
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.40	0.16
95-50-1	1,2-Dichlorobenzene	ND		0.40	0.13
541-73-1	1,3-Dichlorobenzene	ND		0.40	0.11
106-46-7	1,4-Dichlorobenzene	ND		0.40	0.15
75-71-8	Dichlorodifluoromethane	ND		0.40	0.15
75-34-3	1,1-Dichloroethane	ND		0.30	0.072
107-06-2	1,2-Dichloroethane	ND		0.80	0.088

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-23671-1

SDG No.:

Client Sample ID: 34001768 Lab Sample ID: 320-23671-1

Matrix: Air Lab File ID: MS9111821.D

Analysis Method: TO-15 Date Collected: 11/17/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 11/19/2016 06:03

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 138417 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
75-35-4	1,1-Dichloroethene	ND		0.80	0.13
156-59-2	cis-1,2-Dichloroethene	ND		0.40	0.089
156-60-5	trans-1,2-Dichloroethene	ND		0.40	0.10
78-87-5	1,2-Dichloropropane	ND		0.40	0.24
10061-01-5	cis-1,3-Dichloropropene	ND		0.40	0.10
10061-02-6	trans-1,3-Dichloropropene	ND		0.40	0.088
123-91-1	1,4-Dioxane	ND		0.80	0.10
141-78-6	Ethyl acetate	ND		0.30	0.18
100-41-4	Ethylbenzene	ND		0.40	0.063
622-96-8	4-Ethyltoluene	ND		0.40	0.19
142-82-5	n-Heptane	ND		0.80	0.063
87-68-3	Hexachlorobutadiene	ND		2.0	0.43
110-54-3	n-Hexane	ND		0.80	0.075
591-78-6	2-Hexanone	ND		0.40	0.087
98-82-8	Isopropylbenzene	ND		0.80	0.10
99-87-6	4-Isopropyltoluene	ND		0.80	0.12
1634-04-4	Methyl-t-Butyl Ether (MTBE)	ND		0.80	0.12
80-62-6	Methyl methacrylate	ND		0.80	0.16
108-10-1	4-Methyl-2-pentanone (MIBK)	ND		0.40	0.14
75-09-2	Methylene Chloride	0.10	J	0.40	0.072
98-83-9	alpha-Methylstyrene	ND		0.40	0.065
91-20-3	Naphthalene	ND		0.80	0.56
111-65-9	n-Octane	ND		0.40	0.055
109-66-0	n-Pentane	ND		0.80	0.26
115-07-1	Propylene	ND		0.40	0.099
103-65-1	N-Propylbenzene	ND		0.40	0.059
100-42-5	Styrene	ND		0.40	0.059
79-34-5	1,1,2,2-Tetrachloroethane	ND		0.40	0.069
127-18-4	Tetrachloroethene	ND		0.40	0.051
109-99-9	Tetrahydrofuran	ND		0.80	0.21
108-88-3	Toluene	ND		0.40	0.051
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.40	0.16
120-82-1	1,2,4-Trichlorobenzene	ND		2.0	0.43
71-55-6	1,1,1-Trichloroethane	ND		0.30	0.065
79-00-5	1,1,2-Trichloroethane	ND		0.40	0.067

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Sacramento Job No.: 320-23671-1

SDG No.:

Client Sample ID: 34001768 Lab Sample ID: 320-23671-1

Matrix: Air Lab File ID: MS9111821.D

Analysis Method: TO-15 Date Collected: 11/17/2016 00:00

Sample wt/vol: 500(mL) Date Analyzed: 11/19/2016 06:03

Soil Aliquot Vol: Dilution Factor: 1

Soil Extract Vol.: GC Column: RTX-Volatiles ID: 0.32(mm)

% Moisture: Level: (low/med) Low

Analysis Batch No.: 138417 Units: ppb v/v

CAS NO.	COMPOUND NAME	RESULT	Q	RL	MDL
79-01-6	Trichloroethene	ND		0.40	0.11
75-69-4	Trichlorofluoromethane	ND		0.40	0.20
96-18-4	1,2,3-Trichloropropane	ND		0.40	0.17
95-63-6	1,2,4-Trimethylbenzene	ND		0.80	0.16
108-67-8	1,3,5-Trimethylbenzene	ND		0.40	0.13
540-84-1	2,2,4-Trimethylpentane	ND		0.40	0.071
108-05-4	Vinyl acetate	ND		0.80	0.15
593-60-2	Vinyl bromide	ND		0.80	0.26
75-01-4	Vinyl chloride	ND		0.40	0.12
179601-23-1	m,p-Xylene	ND		0.80	0.10
95-47-6	o-Xylene	ND		0.40	0.054

CAS NO.	SURROGATE	%REC	Q	LIMITS
460-00-4	4-Bromofluorobenzene (Surr)	96		70-130
17060-07-0	1,2-Dichloroethane-d4 (Surr)	87		70-130
2037-26-5	Toluene-d8 (Surr)	99		70-130

TestAmerica Sacramento
Target Compound Quantitation Report

Data File: \\ChromNA\Sacramento\ChromData\ATMS9\20161118-37016.b\MS9111821.D
Lims ID: 320-23671-A-1
Client ID: 34001768
Sample Type: Client
Inject. Date: 19-Nov-2016 06:03:30 ALS Bottle#: 4 Worklist Smp#: 21
Purge Vol: 5.000 mL Dil. Factor: 1.0000
Sample Info: 320-23671-A-1
Misc. Info.: 500
Operator ID: SV Instrument ID: ATMS9

Method: \\ChromNA\Sacramento\ChromData\ATMS9\20161118-37016.b\TO15_ATMS9N.m
Limit Group: MSA - TO15 - ICAL
Last Update: 21-Nov-2016 12:32:13 Calib Date: 14-Oct-2016 22:01:30
Integrator: RTE ID Type: Deconvolution ID
Quant Method: Internal Standard Quant By: Initial Calibration
Last ICal File: \\ChromNA\Sacramento\ChromData\ATMS9\20161014-35678.b\MS9101412.D

Column 1 : RTX Volatiles (0.32 mm) Det: MS SCAN
Process Host: XAWRK013

First Level Reviewer: phanthasena Date: 21-Nov-2016 12:32:12

Compound	Sig	RT (min.)	Adj RT (min.)	Dlt RT (min.)	Q	Response	OnCol Amt ppb v/v	Flags
* 1 Chlorobromomethane (IS)	130	12.412	12.424	-0.012	96	60774	4.00	
* 2 1,4-Difluorobenzene	114	14.511	14.523	-0.012	94	253155	4.00	
* 3 Chlorobenzene-d5 (IS)	117	20.436	20.436	0.000	86	225263	4.00	
$ 4 1,2-Dichloroethane-d4 (Sur	65	13.586	13.598	-0.012	98	71611	3.47	
$ 5 Toluene-d8 (Surr)	100	17.680	17.686	-0.006	99	150039	3.97	
$ 6 4-Bromofluorobenzene (Surr	174	22.358	22.358	0.000	96	124875	3.82	
14 Propene	41	4.193	4.193	0.000	43	942	0.0592	
22 Butane	43	4.965	4.953	0.012	25	1207	0.0463	
31 Acetone	43	7.758	7.691	0.067	94	4299	0.1455	
47 Methylene Chloride	49	8.950	8.950	0.000	95	2456	0.1049	
85 Toluene	91	17.832	17.838	-0.006	88	2420	0.0363	

Reagents:

VAMSIS20_00002 Amount Added: 50.00 Units: mL Run Reagent

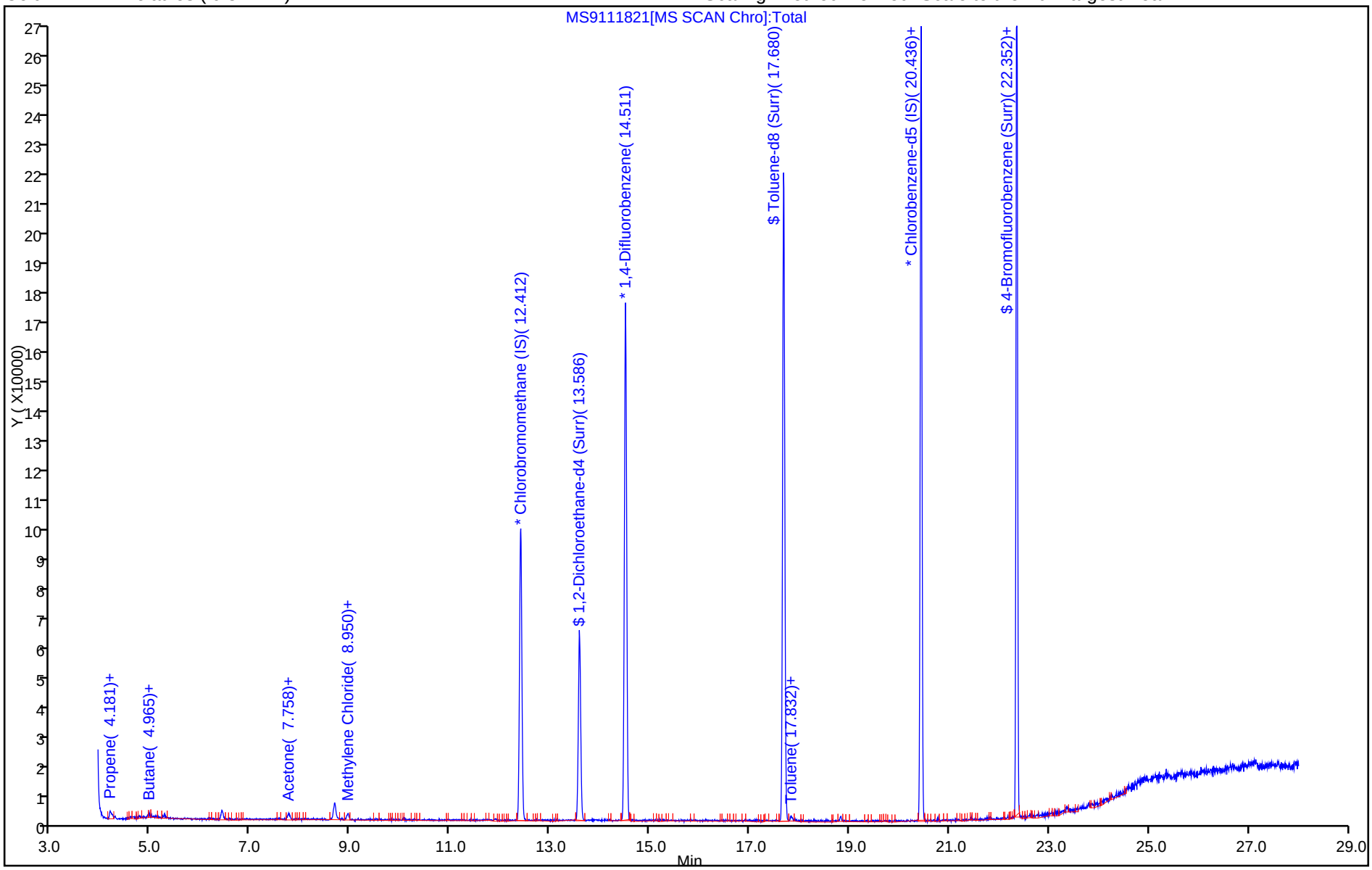
Report Date: 21-Nov-2016 12:32:14 Chrom Revision: 2.2 14-Nov-2016 08:15:18

TestAmerica Sacramento

Data File: \\ChromNA\Sacramento\ChromData\ATMS9\20161118-37016.b\MS9111821.D

Injection Date:	19-Nov-2016 06:03:30	Instrument ID:	ATMS9	Operator ID:	SV
Lims ID:	320-23671-A-1	Lab Sample ID:	320-23671-1	Worklist Smp#:	21
Client ID:	34001768				
Purge Vol:	5.000 mL	Dil. Factor:	1.0000	ALS Bottle#:	4
Method:	TO15_ATMS9N	Limit Group:	MSA - TO15 - ICAL		

Column: RTX Volatiles (0.32 mm) Y Scaling: Method Defined: Scale to the Nth Largest Peak: 2



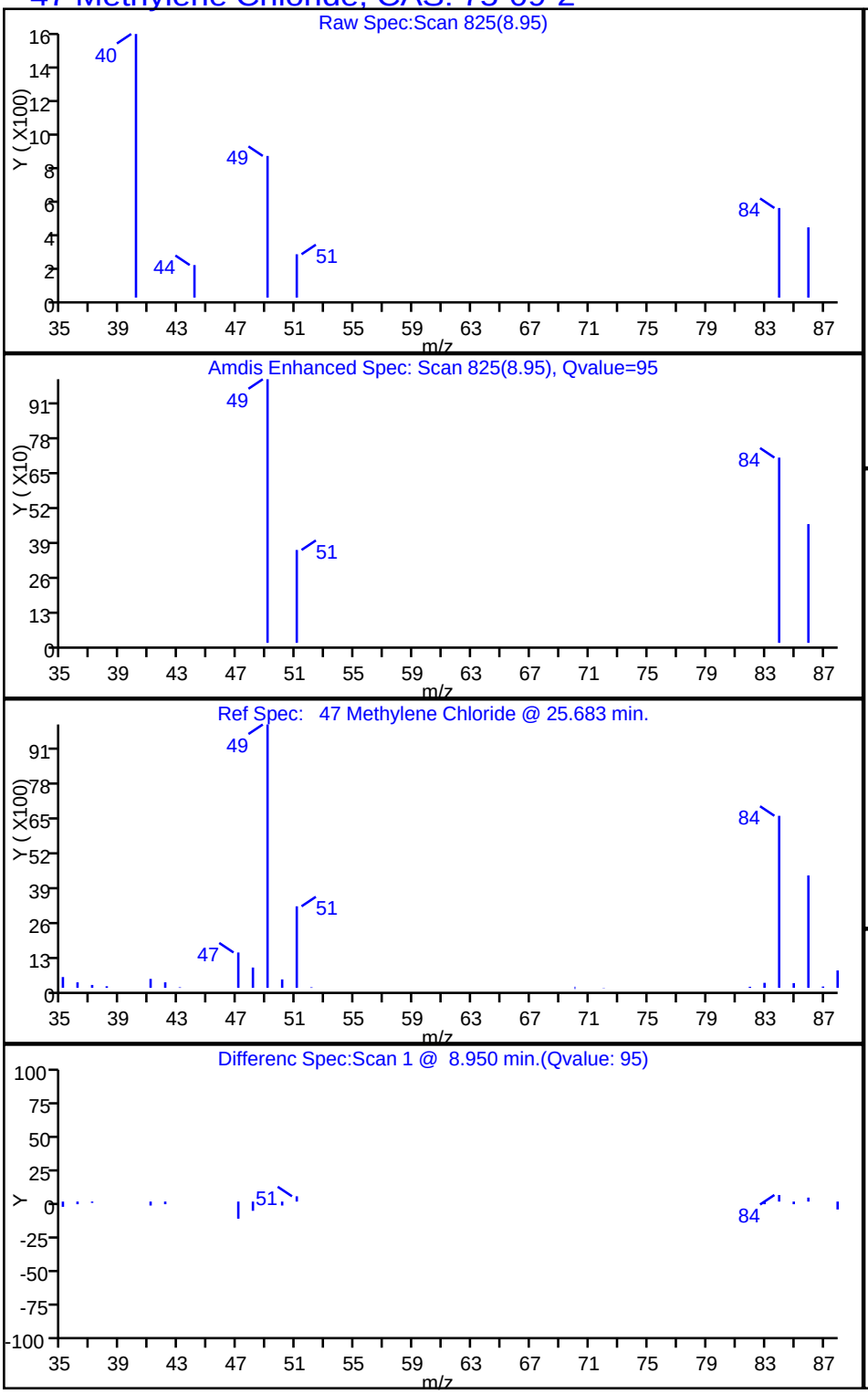
Report Date: 21-Nov-2016 12:32:14 Chrom Revision: 2.2 14-Nov-2016 08:15:18

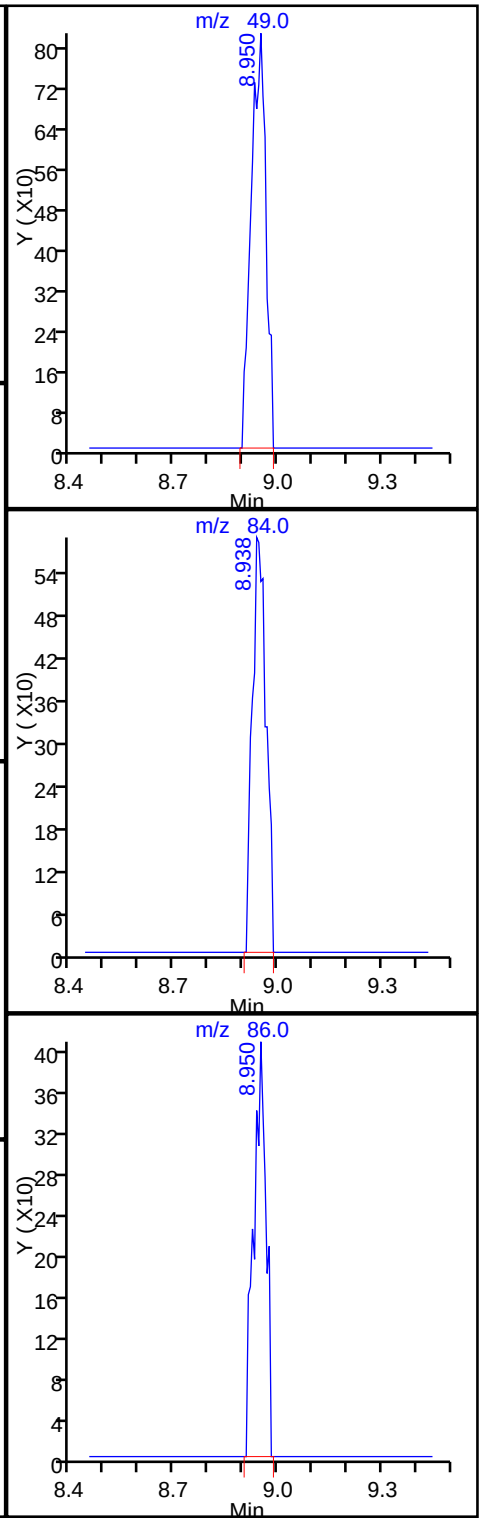
TestAmerica Sacramento

Data File: \\ChromNA\Sacramento\ChromData\ATMS9\20161118-37016.b\MS9111821.D

Injection Date:	19-Nov-2016 06:03:30	Instrument ID:	ATMS9		
Lims ID:	320-23671-A-1	Lab Sample ID:	320-23671-1		
Client ID:	34001768				
Operator ID:	SV	ALS Bottle#:	4	Worklist Smp#:	21
Purge Vol:	5.000 mL	Dil. Factor:	1.0000		
Method:	TO15_ATMS9N	Limit Group:	MSA - TO15 - ICAL		
Column:	RTX Volatiles (0.32 mm)	Detector	MS SCAN		

47 Methylene Chloride, CAS: 75-09-2





TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-73249-1
Client Project/Site: Cooper and Commerce SP0146B

For:
Geosyntec Consultants, Inc.
11811 N Tatum Blvd
Ste P186
Phoenix, Arizona 85028

Attn: Marla Miller

Authorized for release by:
11/28/2016 11:12:28 AM

Camille Murray, Project Manager I
(949)261-1022
camille.murray@testamericainc.com

Table of Contents

Definitions/Glossary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
N1	See case narrative.
D2	Sample required dilution due to high concentration of analyte.
M1	Matrix spike recovery was high, the associated blank spike recovery was acceptable.
E4	Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL) but above MDL.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 550-73249-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-73249-1

Comments
No additional comments.

Receipt
The samples were received on 11/18/2016 4:44 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.5º C.

Receipt Exceptions

The following sample was received at the laboratory without a sample collection time or date documented on the chain of custody: TB-11172016 (550-73249-6). The laboratory was instructed to use a sample collection time of 00:01 and the sample date as listed in the sample ID.

GC/MS VOA
Method(s) 8260B: The client provided less than the prescribed amount for the extraction of the following samples :SB2-40-11182016 (550-73249-1) and SB1-75-11182016 (550-73249-5). The methanol kit weights extracted did not fall within +/-25% of the prescribed 10 grams necessary for the analysis of soils by 8260B using methanol kits. The results will be reported and flagged with an N1 qualifier, see analytical batch 550-104030.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

VOA Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-73249-1	SB2-40-11182016	Solid	11/18/16 10:30	11/18/16 16:44
550-73249-2	SB2-69-11182016	Solid	11/18/16 13:30	11/18/16 16:44
550-73249-3	SB2-69-11182016-DUP	Solid	11/18/16 13:30	11/18/16 16:44
550-73249-4	SB1-45-11182016	Solid	11/17/16 11:17	11/18/16 16:44
550-73249-5	SB1-75-11182016	Solid	11/17/16 14:47	11/18/16 16:44
550-73249-6	TB-11172016	Solid	11/17/16 00:01	11/18/16 16:44

Detection Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: SB2-40-11182016 — Lab Sample ID: 550-73249-1

No Detections.

Client Sample ID: SB2-69-11182016 — Lab Sample ID: 550-73249-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene - DL	46000	D2	1100		ug/Kg	10		8260B	Total/NA

Client Sample ID: SB2-69-11182016-DUP — Lab Sample ID: 550-73249-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene	12000		130		ug/Kg	1		8260B	Total/NA

Client Sample ID: SB1-45-11182016 — Lab Sample ID: 550-73249-4

No Detections.

Client Sample ID: SB1-75-11182016 — Lab Sample ID: 550-73249-5

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Tetrachloroethene - DL	77000	D2	1500		ug/Kg	10		8260B	Total/NA

Client Sample ID: TB-11172016 — Lab Sample ID: 550-73249-6

No Detections.

This Detection Summary does not include radiochemical test results.

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: SB2-40-11182016
Date Collected: 11/18/16 10:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-1
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,1,1-Trichloroethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,1,2,2-Tetrachloroethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,1,2-Trichloroethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,1-Dichloroethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,1-Dichloroethene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,1-Dichloropropene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2,3-Trichlorobenzene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2,3-Trichloropropane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2,4-Trichlorobenzene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2,4-Trimethylbenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2-Dibromo-3-Chloropropane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2-Dibromoethane (EDB)	ND	N1	34		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2-Dichlorobenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2-Dichloroethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,2-Dichloropropane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,3,5-Trimethylbenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,3-Dichlorobenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,3-Dichloropropane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
1,4-Dichlorobenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
2,2-Dichloropropane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
2-Butanone (MEK)	ND	N1	680		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
2-Chlorotoluene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
2-Hexanone	ND	N1	680		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
4-Chlorotoluene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
4-Methyl-2-pentanone (MIBK)	ND	N1	680		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Acetone	ND	N1	1400		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Benzene	ND	N1	68		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Bromobenzene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Bromochloromethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Bromodichloromethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Bromoform	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Bromomethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Carbon disulfide	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Carbon tetrachloride	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Chlorobenzene	ND	N1	68		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Chloroethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Chloroform	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Chloromethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
cis-1,2-Dichloroethene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
cis-1,3-Dichloropropene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Chlorodibromomethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Dibromomethane	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Dichlorodifluoromethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Ethylbenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Hexachlorobutadiene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Iodomethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Isopropylbenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
m,p-Xylenes	ND	N1	200		ug/Kg		11/18/16 10:30	11/24/16 00:28	1

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: SB2-40-11182016

Date Collected: 11/18/16 10:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-1
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Methylene Chloride	ND	N1	680		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Methyl tert-butyl ether	ND	N1	68		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Naphthalene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
n-Butylbenzene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
n-Propylbenzene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
o-Xylene	ND	N1	200		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
p-Isopropyltoluene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
sec-Butylbenzene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Styrene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
tert-Butylbenzene	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Tetrachloroethene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Toluene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
trans-1,2-Dichloroethene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
trans-1,3-Dichloropropene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Trichloroethene	ND	N1	140		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Trichlorofluoromethane	ND	N1	340		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Vinyl acetate	ND	N1	1700		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Vinyl chloride	ND	N1	68		ug/Kg		11/18/16 10:30	11/24/16 00:28	1
Xylenes, Total	ND	N1	410		ug/Kg		11/18/16 10:30	11/24/16 00:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*118*		*34.7 - 143*	*11/18/16 10:30*	*11/24/16 00:28*	*1*
Toluene-d8 (Surr)	*102*		*39.1 - 145*	*11/18/16 10:30*	*11/24/16 00:28*	*1*
4-Bromofluorobenzene (Surr)	*92*		*38.2 - 149*	*11/18/16 10:30*	*11/24/16 00:28*	*1*

Client Sample ID: SB2-69-11182016

Date Collected: 11/18/16 13:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-2
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,1,1-Trichloroethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,1,2,2-Tetrachloroethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,1,2-Trichloroethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,1-Dichloroethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,1-Dichloroethene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,1-Dichloropropene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2,3-Trichlorobenzene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2,3-Trichloropropane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2,4-Trichlorobenzene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2,4-Trimethylbenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2-Dibromo-3-Chloropropane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2-Dibromoethane (EDB)	ND		28		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2-Dichlorobenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2-Dichloroethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,2-Dichloropropane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,3,5-Trimethylbenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,3-Dichlorobenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
1,3-Dichloropropane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1

Client Sample ID: SB2-69-11182016
Date Collected: 11/18/16 13:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-2
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
2,2-Dichloropropane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
2-Butanone (MEK)	ND		570		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
2-Chlorotoluene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
2-Hexanone	ND		570		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
4-Chlorotoluene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
4-Methyl-2-pentanone (MIBK)	ND		570		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Acetone	ND		1100		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Benzene	ND		57		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Bromobenzene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Bromochloromethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Bromodichloromethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Bromoform	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Bromomethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Carbon disulfide	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Carbon tetrachloride	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Chlorobenzene	ND		57		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Chloroethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Chloroform	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Chloromethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
cis-1,2-Dichloroethene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
cis-1,3-Dichloropropene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Chlorodibromomethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Dibromomethane	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Dichlorodifluoromethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Ethylbenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Hexachlorobutadiene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Iodomethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Isopropylbenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
m,p-Xylenes	ND		170		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Methylene Chloride	ND		570		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Methyl tert-butyl ether	ND		57		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Naphthalene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
n-Butylbenzene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
n-Propylbenzene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
o-Xylene	ND		170		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
p-Isopropyltoluene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
sec-Butylbenzene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Styrene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
tert-Butylbenzene	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Toluene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
trans-1,2-Dichloroethene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
trans-1,3-Dichloropropene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Trichloroethene	ND		110		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Trichlorofluoromethane	ND		280		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Vinyl acetate	ND		1400		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Vinyl chloride	ND		57		ug/Kg		11/18/16 13:30	11/24/16 01:00	1
Xylenes, Total	ND		340		ug/Kg		11/18/16 13:30	11/24/16 01:00	1

Client Sample ID: SB2-69-11182016

Date Collected: 11/18/16 13:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-2

Matrix: Solid

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*106*		*34.7 - 143*	*11/18/16 13:30*	*11/24/16 01:00*	*1*
Toluene-d8 (Surr)	*97*		*39.1 - 145*	*11/18/16 13:30*	*11/24/16 01:00*	*1*
4-Bromofluorobenzene (Surr)	*91*		*38.2 - 149*	*11/18/16 13:30*	*11/24/16 01:00*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	46000	D2	1100	ug/Kg		11/18/16 13:30	11/25/16 03:39	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*118*		*34.7 - 143*	*11/18/16 13:30*	*11/25/16 03:39*	*10*
Toluene-d8 (Surr)	*113*		*39.1 - 145*	*11/18/16 13:30*	*11/25/16 03:39*	*10*
4-Bromofluorobenzene (Surr)	*94*		*38.2 - 149*	*11/18/16 13:30*	*11/25/16 03:39*	*10*

Client Sample ID: SB2-69-11182016-DUP

Date Collected: 11/18/16 13:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-3

Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,1,1-Trichloroethane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,1,2,2-Tetrachloroethane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,1,2-Trichloroethane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,1-Dichloroethane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,1-Dichloroethene	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,1-Dichloropropene	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2,3-Trichlorobenzene	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2,3-Trichloropropane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2,4-Trichlorobenzene	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2,4-Trimethylbenzene	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2-Dibromo-3-Chloropropane	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2-Dibromoethane (EDB)	ND		33	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2-Dichlorobenzene	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2-Dichloroethane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,2-Dichloropropane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,3,5-Trimethylbenzene	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,3-Dichlorobenzene	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,3-Dichloropropane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
1,4-Dichlorobenzene	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
2,2-Dichloropropane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
2-Butanone (MEK)	ND		650	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
2-Chlorotoluene	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
2-Hexanone	ND		650	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
4-Chlorotoluene	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
4-Methyl-2-pentanone (MIBK)	ND		650	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Acetone	ND		1300	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Benzene	ND		65	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Bromobenzene	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Bromochloromethane	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Bromodichloromethane	ND		130	ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Bromoform	ND		330	ug/Kg		11/18/16 13:30	11/24/16 01:31	1

Client Sample ID: SB2-69-11182016-DUP

Lab Sample ID: 550-73249-3

Date Collected: 11/18/16 13:30

Matrix: Solid

Date Received: 11/18/16 16:44

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Bromomethane	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Carbon disulfide	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Carbon tetrachloride	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Chlorobenzene	ND		65		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Chloroethane	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Chloroform	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Chloromethane	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
cis-1,2-Dichloroethene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
cis-1,3-Dichloropropene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Chlorodibromomethane	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Dibromomethane	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Dichlorodifluoromethane	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Ethylbenzene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Hexachlorobutadiene	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Iodomethane	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Isopropylbenzene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
m,p-Xylenes	ND		200		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Methylene Chloride	ND		650		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Methyl tert-butyl ether	ND		65		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Naphthalene	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
n-Butylbenzene	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
n-Propylbenzene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
o-Xylene	ND		200		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
p-Isopropyltoluene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
sec-Butylbenzene	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Styrene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
tert-Butylbenzene	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Tetrachloroethene	**12000**		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Toluene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
trans-1,2-Dichloroethene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
trans-1,3-Dichloropropene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Trichloroethene	ND		130		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Trichlorofluoromethane	ND		330		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Vinyl acetate	ND		1600		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Vinyl chloride	ND		65		ug/Kg		11/18/16 13:30	11/24/16 01:31	1
Xylenes, Total	ND		390		ug/Kg		11/18/16 13:30	11/24/16 01:31	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*102*		*34.7 - 143*	*11/18/16 13:30*	*11/24/16 01:31*	*1*
Toluene-d8 (Surr)	*99*		*39.1 - 145*	*11/18/16 13:30*	*11/24/16 01:31*	*1*
4-Bromofluorobenzene (Surr)	*100*		*38.2 - 149*	*11/18/16 13:30*	*11/24/16 01:31*	*1*

Client Sample ID: SB1-45-11182016

Lab Sample ID: 550-73249-4

Date Collected: 11/17/16 11:17

Matrix: Solid

Date Received: 11/18/16 16:44

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,1,1-Trichloroethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1

Client Sample ID: SB1-45-11182016
Date Collected: 11/17/16 11:17
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-4
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,2,2-Tetrachloroethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,1,2-Trichloroethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,1-Dichloroethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,1-Dichloroethene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,1-Dichloropropene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2,3-Trichlorobenzene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2,3-Trichloropropane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2,4-Trichlorobenzene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2,4-Trimethylbenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2-Dibromo-3-Chloropropane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2-Dibromoethane (EDB)	ND		24		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2-Dichlorobenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2-Dichloroethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,2-Dichloropropane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,3,5-Trimethylbenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,3-Dichlorobenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,3-Dichloropropane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
1,4-Dichlorobenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
2,2-Dichloropropane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
2-Butanone (MEK)	ND		480		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
2-Chlorotoluene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
2-Hexanone	ND		480		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
4-Chlorotoluene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
4-Methyl-2-pentanone (MIBK)	ND		480		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Acetone	ND		950		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Benzene	ND		48		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Bromobenzene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Bromochloromethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Bromodichloromethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Bromoform	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Bromomethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Carbon disulfide	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Carbon tetrachloride	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Chlorobenzene	ND		48		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Chloroethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Chloroform	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Chloromethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
cis-1,2-Dichloroethene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
cis-1,3-Dichloropropene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Chlorodibromomethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Dibromomethane	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Dichlorodifluoromethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Ethylbenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Hexachlorobutadiene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Iodomethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Isopropylbenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
m,p-Xylenes	ND		140		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Methylene Chloride	ND		480		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Methyl tert-butyl ether	ND		48		ug/Kg		11/17/16 11:17	11/24/16 02:03	1

Client Sample ID: SB1-45-11182016

Lab Sample ID: 550-73249-4

Date Collected: 11/17/16 11:17

Matrix: Solid

Date Received: 11/18/16 16:44

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
n-Butylbenzene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
n-Propylbenzene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
o-Xylene	ND		140		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
p-Isopropyltoluene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
sec-Butylbenzene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Styrene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
tert-Butylbenzene	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Tetrachloroethene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Toluene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
trans-1,2-Dichloroethene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
trans-1,3-Dichloropropene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Trichloroethene	ND		95		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Trichlorofluoromethane	ND		240		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Vinyl acetate	ND		1200		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Vinyl chloride	ND		48		ug/Kg		11/17/16 11:17	11/24/16 02:03	1
Xylenes, Total	ND		290		ug/Kg		11/17/16 11:17	11/24/16 02:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*98*		*34.7 - 143*	*11/17/16 11:17*	*11/24/16 02:03*	*1*
Toluene-d8 (Surr)	*88*		*39.1 - 145*	*11/17/16 11:17*	*11/24/16 02:03*	*1*
4-Bromofluorobenzene (Surr)	*88*		*38.2 - 149*	*11/17/16 11:17*	*11/24/16 02:03*	*1*

Client Sample ID: SB1-75-11182016

Lab Sample ID: 550-73249-5

Date Collected: 11/17/16 14:47

Matrix: Solid

Date Received: 11/18/16 16:44

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,1,1-Trichloroethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,1,2,2-Tetrachloroethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,1,2-Trichloroethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,1-Dichloroethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,1-Dichloroethene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,1-Dichloropropene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2,3-Trichlorobenzene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2,3-Trichloropropane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2,4-Trichlorobenzene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2,4-Trimethylbenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2-Dibromo-3-Chloropropane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2-Dibromoethane (EDB)	ND	N1	38		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2-Dichlorobenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2-Dichloroethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,2-Dichloropropane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,3,5-Trimethylbenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,3-Dichlorobenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,3-Dichloropropane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
1,4-Dichlorobenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
2,2-Dichloropropane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: SB1-75-11182016
Date Collected: 11/17/16 14:47
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-5
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
2-Butanone (MEK)	ND	N1	770		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
2-Chlorotoluene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
2-Hexanone	ND	N1	770		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
4-Chlorotoluene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
4-Methyl-2-pentanone (MIBK)	ND	N1	770		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Acetone	ND	N1	1500		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Benzene	ND	N1	77		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Bromobenzene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Bromochloromethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Bromodichloromethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Bromoform	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Bromomethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Carbon disulfide	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Carbon tetrachloride	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Chlorobenzene	ND	N1	77		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Chloroethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Chloroform	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Chloromethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
cis-1,2-Dichloroethene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
cis-1,3-Dichloropropene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Chlorodibromomethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Dibromomethane	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Dichlorodifluoromethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Ethylbenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Hexachlorobutadiene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Iodomethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Isopropylbenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
m,p-Xylenes	ND	N1	230		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Methylene Chloride	ND	N1	770		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Methyl tert-butyl ether	ND	N1	77		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Naphthalene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
n-Butylbenzene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
n-Propylbenzene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
o-Xylene	ND	N1	230		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
p-Isopropyltoluene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
sec-Butylbenzene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Styrene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
tert-Butylbenzene	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Toluene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
trans-1,2-Dichloroethene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
trans-1,3-Dichloropropene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Trichloroethene	ND	N1	150		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Trichlorofluoromethane	ND	N1	380		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Vinyl acetate	ND	N1	1900		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Vinyl chloride	ND	N1	77		ug/Kg		11/17/16 14:47	11/24/16 02:34	1
Xylenes, Total	ND	N1	460		ug/Kg		11/17/16 14:47	11/24/16 02:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*96*		*34.7 - 143*	*11/17/16 14:47*	*11/24/16 02:34*	*1*
Toluene-d8 (Surr)	*89*		*39.1 - 145*	*11/17/16 14:47*	*11/24/16 02:34*	*1*

Client Sample ID: SB1-75-11182016

Lab Sample ID: 550-73249-5

Date Collected: 11/17/16 14:47

Matrix: Solid

Date Received: 11/18/16 16:44

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	*90*		*38.2 - 149*	*11/17/16 14:47*	*11/24/16 02:34*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	77000	D2	1500		ug/Kg		11/17/16 14:47	11/25/16 04:11	10

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Dibromofluoromethane (Surr)	*97*		*34.7 - 143*	*11/17/16 14:47*	*11/25/16 04:11*	*10*
Toluene-d8 (Surr)	*99*		*39.1 - 145*	*11/17/16 14:47*	*11/25/16 04:11*	*10*
4-Bromofluorobenzene (Surr)	*95*		*38.2 - 149*	*11/17/16 14:47*	*11/25/16 04:11*	*10*

Client Sample ID: TB-11172016

Lab Sample ID: 550-73249-6

Date Collected: 11/17/16 00:01

Matrix: Solid

Date Received: 11/18/16 16:44

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,1,1-Trichloroethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,1,2,2-Tetrachloroethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,1,2-Trichloroethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,1-Dichloroethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,1-Dichloroethene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,1-Dichloropropene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2,3-Trichlorobenzene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2,3-Trichloropropane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2,4-Trichlorobenzene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2,4-Trimethylbenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2-Dibromo-3-Chloropropane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2-Dibromoethane (EDB)	ND		25		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2-Dichlorobenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2-Dichloroethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,2-Dichloropropane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,3,5-Trimethylbenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,3-Dichlorobenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,3-Dichloropropane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
1,4-Dichlorobenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
2,2-Dichloropropane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
2-Butanone (MEK)	ND		500		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
2-Chlorotoluene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
2-Hexanone	ND		500		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
4-Chlorotoluene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
4-Methyl-2-pentanone (MIBK)	ND		500		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Acetone	ND		1000		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Benzene	ND		50		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Bromobenzene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Bromochloromethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Bromodichloromethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Bromoform	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Bromomethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: TB-11172016
Date Collected: 11/17/16 00:01
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-6
Matrix: Solid

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Carbon disulfide	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Carbon tetrachloride	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Chlorobenzene	ND		50		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Chloroethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Chloroform	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Chloromethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
cis-1,2-Dichloroethene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
cis-1,3-Dichloropropene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Chlorodibromomethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Dibromomethane	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Dichlorodifluoromethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Ethylbenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Hexachlorobutadiene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Iodomethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Isopropylbenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
m,p-Xylenes	ND		150		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Methylene Chloride	ND		500		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Methyl tert-butyl ether	ND		50		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Naphthalene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
n-Butylbenzene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
n-Propylbenzene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
o-Xylene	ND		150		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
p-Isopropyltoluene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
sec-Butylbenzene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Styrene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
tert-Butylbenzene	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Tetrachloroethene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Toluene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
trans-1,2-Dichloroethene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
trans-1,3-Dichloropropene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Trichloroethene	ND		100		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Trichlorofluoromethane	ND		250		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Vinyl acetate	ND		1300		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Vinyl chloride	ND		50		ug/Kg		11/17/16 00:00	11/24/16 03:05	1
Xylenes, Total	ND		300		ug/Kg		11/17/16 00:00	11/24/16 03:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*114*		*34.7 - 143*	*11/17/16 00:00*	*11/24/16 03:05*	*1*
Toluene-d8 (Surr)	*104*		*39.1 - 145*	*11/17/16 00:00*	*11/24/16 03:05*	*1*
4-Bromofluorobenzene (Surr)	*101*		*38.2 - 149*	*11/17/16 00:00*	*11/24/16 03:05*	*1*

Surrogate Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		DBFM	TOL	BFB
Lab Sample ID	Client Sample ID	(34.7-143)	(39.1-145)	(38.2-149)
550-73249-1	SB2-40-11182016	118	102	92
550-73249-2	SB2-69-11182016	106	97	91
550-73249-2 - DL	SB2-69-11182016	118	113	94
550-73249-3	SB2-69-11182016-DUP	102	99	100
550-73249-4	SB1-45-11182016	98	88	88
550-73249-5	SB1-75-11182016	96	89	90
550-73249-5 - DL	SB1-75-11182016	97	99	95
550-73249-6	TB-11172016	114	104	101
550-73277-C-1-D MS	Matrix Spike	127	124	119
550-73277-C-1-E MSD	Matrix Spike Duplicate	119	117	108
LCS 550-103749/2-A	Lab Control Sample	103	97	94
LCSD 550-103749/3-A	Lab Control Sample Dup	100	95	91
MB 550-103749/1-A	Method Blank	111	96	93

Surrogate Legend

DBFM = Dibromofluoromethane (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 550-103749/1-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 103749

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,1,1-Trichloroethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,1,2,2-Tetrachloroethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,1,2-Trichloroethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,1-Dichloroethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,1-Dichloroethene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,1-Dichloropropene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2,3-Trichlorobenzene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2,3-Trichloropropane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2,4-Trichlorobenzene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2,4-Trimethylbenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2-Dibromo-3-Chloropropane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2-Dibromoethane (EDB)	ND		25		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2-Dichlorobenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2-Dichloroethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,2-Dichloropropane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,3,5-Trimethylbenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,3-Dichlorobenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,3-Dichloropropane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
1,4-Dichlorobenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
2,2-Dichloropropane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
2-Butanone (MEK)	ND		500		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
2-Chlorotoluene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
2-Hexanone	ND		500		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
4-Chlorotoluene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
4-Methyl-2-pentanone (MIBK)	ND		500		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Acetone	ND		990		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Benzene	ND		50		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Bromobenzene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Bromochloromethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Bromodichloromethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Bromoform	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Bromomethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Carbon disulfide	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Carbon tetrachloride	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Chlorobenzene	ND		50		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Chloroethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Chloroform	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Chloromethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
cis-1,2-Dichloroethene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
cis-1,3-Dichloropropene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Chlorodibromomethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Dibromomethane	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Dichlorodifluoromethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Ethylbenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Hexachlorobutadiene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Iodomethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Isopropylbenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 550-103749/1-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 103749

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
m,p-Xylenes	ND		150		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Methylene Chloride	ND		500		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Methyl tert-butyl ether	ND		50		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Naphthalene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
n-Butylbenzene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
n-Propylbenzene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
o-Xylene	ND		150		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
p-Isopropyltoluene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
sec-Butylbenzene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Styrene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
tert-Butylbenzene	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Tetrachloroethene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Toluene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
trans-1,2-Dichloroethene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
trans-1,3-Dichloropropene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Trichloroethene	ND		99		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Trichlorofluoromethane	ND		250		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Vinyl acetate	ND		1200		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Vinyl chloride	ND		50		ug/Kg		11/21/16 16:35	11/23/16 19:46	1
Xylenes, Total	ND		300		ug/Kg		11/21/16 16:35	11/23/16 19:46	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dibromofluoromethane (Surr)	*111*		*34.7 - 143*	*11/21/16 16:35*	*11/23/16 19:46*	*1*
Toluene-d8 (Surr)	*96*		*39.1 - 145*	*11/21/16 16:35*	*11/23/16 19:46*	*1*
4-Bromofluorobenzene (Surr)	*93*		*38.2 - 149*	*11/21/16 16:35*	*11/23/16 19:46*	*1*

Lab Sample ID: LCS 550-103749/2-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1,2-Tetrachloroethane	1250	1200		ug/Kg		96	70 - 130
1,1,1-Trichloroethane	1250	1200		ug/Kg		96	67 - 119
1,1,2,2-Tetrachloroethane	1250	1150		ug/Kg		92	62 - 125
1,1,2-Trichloroethane	1250	1130		ug/Kg		91	65 - 125
1,1-Dichloroethane	1250	1230		ug/Kg		99	60 - 112
1,1-Dichloroethene	1250	1080		ug/Kg		86	54 - 118
1,1-Dichloropropene	1250	1100		ug/Kg		88	58 - 120
1,2,3-Trichlorobenzene	1250	1150		ug/Kg		93	70 - 137
1,2,3-Trichloropropane	1250	1170		ug/Kg		94	62 - 129
1,2,4-Trichlorobenzene	1250	1130		ug/Kg		91	70 - 130
1,2,4-Trimethylbenzene	1250	1250		ug/Kg		100	70 - 130
1,2-Dibromo-3-Chloropropane	1250	977		ug/Kg		78	43 - 136
1,2-Dibromoethane (EDB)	1250	1110		ug/Kg		89	68 - 126
1,2-Dichlorobenzene	1250	1230		ug/Kg		99	70 - 130
1,2-Dichloroethane	1250	1240		ug/Kg		99	67 - 128
1,2-Dichloropropane	1250	1180		ug/Kg		95	64 - 117
1,3,5-Trimethylbenzene	1250	1250		ug/Kg		100	70 - 130

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 550-103749/2-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,3-Dichlorobenzene	1250	1160		ug/Kg		93	70 - 130
1,3-Dichloropropane	1250	1110		ug/Kg		89	68 - 120
1,4-Dichlorobenzene	1250	1170		ug/Kg		94	70 - 130
2,2-Dichloropropane	1250	1050		ug/Kg		84	65 - 118
2-Butanone (MEK)	1250	1060		ug/Kg		85	42 - 132
2-Chlorotoluene	1250	1190		ug/Kg		95	70 - 130
2-Hexanone	1250	854		ug/Kg		68	50 - 140
4-Chlorotoluene	1250	1050		ug/Kg		84	70 - 130
4-Methyl-2-pentanone (MIBK)	1250	1090		ug/Kg		87	52 - 129
Acetone	1250	909	E4	ug/Kg		73	37 - 148
Benzene	1250	1170		ug/Kg		94	67 - 118
Bromobenzene	1250	1200		ug/Kg		96	70 - 130
Bromochloromethane	1250	1260		ug/Kg		101	66 - 124
Bromodichloromethane	1250	1080		ug/Kg		87	69 - 118
Bromoform	1250	1060		ug/Kg		85	59 - 115
Bromomethane	1250	1090		ug/Kg		87	63 - 111
Carbon disulfide	1250	1220		ug/Kg		98	56 - 119
Carbon tetrachloride	1250	1090		ug/Kg		87	65 - 130
Chlorobenzene	1250	1150		ug/Kg		92	70 - 130
Chloroethane	1250	1260		ug/Kg		101	51 - 113
Chloroform	1250	1300		ug/Kg		104	66 - 116
Chloromethane	1250	998		ug/Kg		80	54 - 101
cis-1,2-Dichloroethene	1250	1240		ug/Kg		99	61 - 115
cis-1,3-Dichloropropene	1250	1110		ug/Kg		89	64 - 124
Chlorodibromomethane	1250	1110		ug/Kg		89	61 - 119
Dibromomethane	1250	1120		ug/Kg		90	67 - 124
Dichlorodifluoromethane	1250	485		ug/Kg		39	29 - 90
Ethylbenzene	1250	1190		ug/Kg		95	68 - 124
Hexachlorobutadiene	1250	1190		ug/Kg		95	71 - 140
Iodomethane	1250	1320		ug/Kg		106	70 - 130
Isopropylbenzene	1250	1250		ug/Kg		100	70 - 130
m,p-Xylenes	1250	1150		ug/Kg		92	64 - 122
Methylene Chloride	1250	1180		ug/Kg		95	61 - 117
Methyl tert-butyl ether	1250	1300		ug/Kg		104	57 - 126
Naphthalene	1250	1120		ug/Kg		90	57 - 147
n-Butylbenzene	1250	1160		ug/Kg		93	64 - 131
n-Propylbenzene	1250	1210		ug/Kg		97	68 - 132
o-Xylene	1250	1190		ug/Kg		96	70 - 130
p-Isopropyltoluene	1250	1190		ug/Kg		96	67 - 122
sec-Butylbenzene	1250	1270		ug/Kg		102	66 - 127
Styrene	1250	1220		ug/Kg		98	67 - 121
tert-Butylbenzene	1250	1200		ug/Kg		97	70 - 130
Tetrachloroethene	1250	1050		ug/Kg		85	65 - 124
Toluene	1250	1140		ug/Kg		91	68 - 122
trans-1,2-Dichloroethene	1250	1270		ug/Kg		102	59 - 115
trans-1,3-Dichloropropene	1250	1110		ug/Kg		89	64 - 123
Trichloroethene	1250	1100		ug/Kg		88	68 - 117
Trichlorofluoromethane	1250	1040		ug/Kg		84	63 - 139

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 550-103749/2-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Vinyl acetate	1250	1320		ug/Kg		106	51 - 134
Vinyl chloride	1250	325		ug/Kg		26	10 - 99
Xylenes, Total	2500	2340		ug/Kg		94	70 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*103*		*34.7 - 143*
Toluene-d8 (Surr)	*97*		*39.1 - 145*
4-Bromofluorobenzene (Surr)	*94*		*38.2 - 149*

Lab Sample ID: LCSD 550-103749/3-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1,1,2-Tetrachloroethane	1260	1200		ug/Kg		95	70 - 130	0	20
1,1,1-Trichloroethane	1260	1180		ug/Kg		94	67 - 119	2	20
1,1,2,2-Tetrachloroethane	1260	1160		ug/Kg		92	62 - 125	1	29
1,1,2-Trichloroethane	1260	1180		ug/Kg		94	65 - 125	4	26
1,1-Dichloroethane	1260	1190		ug/Kg		95	60 - 112	4	20
1,1-Dichloroethene	1260	1060		ug/Kg		85	54 - 118	1	20
1,1-Dichloropropene	1260	1110		ug/Kg		88	58 - 120	1	20
1,2,3-Trichlorobenzene	1260	1160		ug/Kg		93	70 - 137	1	24
1,2,3-Trichloropropane	1260	1140		ug/Kg		91	62 - 129	2	32
1,2,4-Trichlorobenzene	1260	1090		ug/Kg		87	70 - 130	4	22
1,2,4-Trimethylbenzene	1260	1220		ug/Kg		97	70 - 130	3	20
1,2-Dibromo-3-Chloropropane	1260	1010		ug/Kg		80	43 - 136	3	36
1,2-Dibromoethane (EDB)	1260	1170		ug/Kg		93	68 - 126	5	26
1,2-Dichlorobenzene	1260	1200		ug/Kg		96	70 - 130	3	20
1,2-Dichloroethane	1260	1230		ug/Kg		98	67 - 128	1	26
1,2-Dichloropropane	1260	1180		ug/Kg		94	64 - 117	0	21
1,3,5-Trimethylbenzene	1260	1200		ug/Kg		96	70 - 130	4	20
1,3-Dichlorobenzene	1260	1130		ug/Kg		90	70 - 130	2	20
1,3-Dichloropropane	1260	1170		ug/Kg		93	68 - 120	5	22
1,4-Dichlorobenzene	1260	1170		ug/Kg		93	70 - 130	0	20
2,2-Dichloropropane	1260	1040		ug/Kg		83	65 - 118	0	20
2-Butanone (MEK)	1260	1160		ug/Kg		92	42 - 132	8	40
2-Chlorotoluene	1260	1150		ug/Kg		92	70 - 130	3	20
2-Hexanone	1260	928		ug/Kg		74	50 - 140	8	36
4-Chlorotoluene	1260	1040		ug/Kg		83	70 - 130	1	20
4-Methyl-2-pentanone (MIBK)	1260	1120		ug/Kg		89	52 - 129	3	36
Acetone	1260	1060		ug/Kg		84	37 - 148	15	40
Benzene	1260	1190		ug/Kg		95	67 - 118	1	20
Bromobenzene	1260	1210		ug/Kg		96	70 - 130	1	20
Bromochloromethane	1260	1250		ug/Kg		100	66 - 124	1	26
Bromodichloromethane	1260	1100		ug/Kg		88	69 - 118	2	20
Bromoform	1260	1100		ug/Kg		88	59 - 115	4	27
Bromomethane	1260	1090		ug/Kg		87	63 - 111	0	21
Carbon disulfide	1260	1210		ug/Kg		96	56 - 119	1	20

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCSD 550-103749/3-A
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 103749

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Carbon tetrachloride			1260	1110		ug/Kg		89	65 - 130	2	20
Chlorobenzene			1260	1190		ug/Kg		95	70 - 130	4	20
Chloroethane			1260	1230		ug/Kg		98	51 - 113	3	22
Chloroform			1260	1270		ug/Kg		101	66 - 116	2	21
Chloromethane			1260	953		ug/Kg		76	54 - 101	5	32
cis-1,2-Dichloroethene			1260	1230		ug/Kg		98	61 - 115	0	23
cis-1,3-Dichloropropene			1260	1140		ug/Kg		91	64 - 124	2	22
Chlorodibromomethane			1260	1140		ug/Kg		91	61 - 119	3	24
Dibromomethane			1260	1140		ug/Kg		91	67 - 124	2	25
Dichlorodifluoromethane			1260	438		ug/Kg		35	29 - 90	10	40
Ethylbenzene			1260	1180		ug/Kg		94	68 - 124	1	20
Hexachlorobutadiene			1260	1100		ug/Kg		88	71 - 140	8	20
Iodomethane			1260	1330		ug/Kg		106	70 - 130	1	21
Isopropylbenzene			1260	1240		ug/Kg		98	70 - 130	1	20
m,p-Xylenes			1260	1160		ug/Kg		93	64 - 122	2	20
Methylene Chloride			1260	1210		ug/Kg		96	61 - 117	2	23
Methyl tert-butyl ether			1260	1330		ug/Kg		106	57 - 126	2	32
Naphthalene			1260	1140		ug/Kg		90	57 - 147	1	30
n-Butylbenzene			1260	1150		ug/Kg		91	64 - 131	1	20
n-Propylbenzene			1260	1180		ug/Kg		94	68 - 132	2	20
o-Xylene			1260	1190		ug/Kg		94	70 - 130	1	20
p-Isopropyltoluene			1260	1170		ug/Kg		93	67 - 122	2	20
sec-Butylbenzene			1260	1260		ug/Kg		100	66 - 127	1	20
Styrene			1260	1250		ug/Kg		99	67 - 121	2	20
tert-Butylbenzene			1260	1200		ug/Kg		95	70 - 130	1	20
Tetrachloroethene			1260	1070		ug/Kg		86	65 - 124	2	20
Toluene			1260	1180		ug/Kg		94	68 - 122	4	20
trans-1,2-Dichloroethene			1260	1230		ug/Kg		98	59 - 115	3	20
trans-1,3-Dichloropropene			1260	1140		ug/Kg		91	64 - 123	2	24
Trichloroethene			1260	1100		ug/Kg		88	68 - 117	0	20
Trichlorofluoromethane			1260	1040		ug/Kg		83	63 - 139	1	21
Vinyl acetate			1260	1370		ug/Kg		109	51 - 134	3	37
Vinyl chloride			1260	293		ug/Kg		23	10 - 99	10	30
Xylenes, Total			2510	2350		ug/Kg		94	70 - 120	0	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*100*		*34.7 - 143*
Toluene-d8 (Surr)	*95*		*39.1 - 145*
4-Bromofluorobenzene (Surr)	*91*		*38.2 - 149*

Lab Sample ID: 550-73277-C-1-D MS
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1,2-Tetrachloroethane	ND	M1	1250	1600	M1	ug/Kg		129	52 - 122
1,1,1-Trichloroethane	ND	M1	1250	1500	M1	ug/Kg		121	50 - 119
1,1,2,2-Tetrachloroethane	ND		1250	1490		ug/Kg		120	41 - 132

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 550-73277-C-1-D MS
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,2-Trichloroethane	ND		1250	1510		ug/Kg		121	47 - 128
1,1-Dichloroethane	ND	M1	1250	1520	M1	ug/Kg		122	46 - 111
1,1-Dichloroethene	ND		1250	1400		ug/Kg		113	36 - 114
1,1-Dichloropropene	ND		1250	1430		ug/Kg		115	45 - 117
1,2,3-Trichlorobenzene	ND		1250	1550		ug/Kg		124	41 - 150
1,2,3-Trichloropropane	ND		1250	1420		ug/Kg		114	51 - 129
1,2,4-Trichlorobenzene	ND		1250	1500		ug/Kg		121	43 - 150
1,2,4-Trimethylbenzene	ND		1250	1610		ug/Kg		129	42 - 137
1,2-Dibromo-3-Chloropropane	ND		1250	1390		ug/Kg		112	27 - 140
1,2-Dibromoethane (EDB)	ND		1250	1550		ug/Kg		124	49 - 130
1,2-Dichlorobenzene	ND		1250	1530		ug/Kg		123	54 - 130
1,2-Dichloroethane	ND	M1	1250	1560	M1	ug/Kg		125	53 - 124
1,2-Dichloropropane	ND	M1	1250	1500	M1	ug/Kg		120	48 - 118
1,3,5-Trimethylbenzene	ND		1250	1550		ug/Kg		125	50 - 131
1,3-Dichlorobenzene	ND		1250	1490		ug/Kg		120	56 - 127
1,3-Dichloropropane	ND		1250	1540		ug/Kg		124	50 - 124
1,4-Dichlorobenzene	ND		1250	1520		ug/Kg		122	52 - 128
2,2-Dichloropropane	ND		1250	1340		ug/Kg		108	47 - 117
2-Butanone (MEK)	ND	M1	1250	1830	M1	ug/Kg		147	32 - 130
2-Chlorotoluene	ND		1250	1480		ug/Kg		119	54 - 123
2-Hexanone	ND		1250	1570		ug/Kg		126	32 - 144
4-Chlorotoluene	ND		1250	1310		ug/Kg		105	56 - 123
4-Methyl-2-pentanone (MIBK)	ND		1250	1450		ug/Kg		117	37 - 134
Acetone	ND		1250	1700		ug/Kg		136	32 - 148
Benzene	ND	M1	1250	1530	M1	ug/Kg		123	51 - 118
Bromobenzene	ND		1250	1490		ug/Kg		120	58 - 127
Bromochloromethane	ND	M1	1250	1570	M1	ug/Kg		126	50 - 123
Bromodichloromethane	ND		1250	1440		ug/Kg		116	51 - 122
Bromoform	ND		1250	1430		ug/Kg		115	45 - 115
Bromomethane	ND		1250	1320		ug/Kg		106	28 - 115
Carbon disulfide	ND	M1	1250	1500	M1	ug/Kg		121	32 - 116
Carbon tetrachloride	ND		1250	1440		ug/Kg		115	48 - 128
Chlorobenzene	ND	M1	1250	1550	M1	ug/Kg		124	57 - 122
Chloroethane	ND	M1	1250	1510	M1	ug/Kg		121	32 - 107
Chloroform	ND	M1	1250	1640	M1	ug/Kg		132	52 - 116
Chloromethane	ND		1250	1130		ug/Kg		91	28 - 100
cis-1,2-Dichloroethene	ND	M1	1250	1540	M1	ug/Kg		124	47 - 113
cis-1,3-Dichloropropene	ND		1250	1500		ug/Kg		120	41 - 130
Chlorodibromomethane	ND		1250	1510		ug/Kg		121	44 - 122
Dibromomethane	ND		1250	1470		ug/Kg		118	49 - 128
Dichlorodifluoromethane	ND		1250	515		ug/Kg		41	10 - 73
Ethylbenzene	ND		1250	1580		ug/Kg		127	50 - 130
Hexachlorobutadiene	ND		1250	1510		ug/Kg		121	33 - 150
Iodomethane	ND		1250	1640		ug/Kg		132	39 - 147
Isopropylbenzene	ND		1250	1580		ug/Kg		127	59 - 143
m,p-Xylenes	ND		1250	1550		ug/Kg		124	43 - 128
Methylene Chloride	ND	M1	1250	1500	M1	ug/Kg		121	45 - 115
Methyl tert-butyl ether	ND	M1	1250	1660	M1	ug/Kg		133	41 - 125

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 550-73277-C-1-D MS
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Naphthalene	ND		1250	1480		ug/Kg		119	34 - 150
n-Butylbenzene	ND		1250	1530		ug/Kg		123	44 - 140
n-Propylbenzene	ND		1250	1540		ug/Kg		124	52 - 135
o-Xylene	ND		1250	1590		ug/Kg		127	48 - 127
p-Isopropyltoluene	ND		1250	1520		ug/Kg		122	51 - 126
sec-Butylbenzene	ND		1250	1630		ug/Kg		131	49 - 131
Styrene	ND	M1	1250	1670	M1	ug/Kg		134	49 - 123
tert-Butylbenzene	ND		1250	1560		ug/Kg		125	54 - 130
Tetrachloroethene	ND		1250	1410		ug/Kg		113	49 - 124
Toluene	ND		1250	1520		ug/Kg		122	52 - 126
trans-1,2-Dichloroethene	ND	M1	1250	1570	M1	ug/Kg		126	44 - 113
trans-1,3-Dichloropropene	ND		1250	1480		ug/Kg		119	43 - 130
Trichloroethene	ND		1250	1430		ug/Kg		115	53 - 120
Trichlorofluoromethane	ND		1250	1300		ug/Kg		104	33 - 134
Vinyl acetate	ND	M1	1250	1590	M1	ug/Kg		128	10 - 126
Vinyl chloride	ND		1250	371		ug/Kg		30	10 - 82
Xylenes, Total	ND	M1	2490	3140	M1	ug/Kg		126	57 - 122

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Dibromofluoromethane (Surr)	*127*		*34.7 - 143*
Toluene-d8 (Surr)	*124*		*39.1 - 145*
4-Bromofluorobenzene (Surr)	*119*		*38.2 - 149*

Lab Sample ID: 550-73277-C-1-E MSD
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1,1,2-Tetrachloroethane	ND	M1	1250	1400		ug/Kg		113	52 - 122	13	36
1,1,1-Trichloroethane	ND	M1	1250	1360		ug/Kg		109	50 - 119	10	29
1,1,2,2-Tetrachloroethane	ND		1250	1300		ug/Kg		104	41 - 132	14	37
1,1,2-Trichloroethane	ND		1250	1380		ug/Kg		111	47 - 128	9	34
1,1-Dichloroethane	ND	M1	1250	1390	M1	ug/Kg		112	46 - 111	8	26
1,1-Dichloroethene	ND		1250	1220		ug/Kg		98	36 - 114	14	32
1,1-Dichloropropene	ND		1250	1260		ug/Kg		101	45 - 117	13	29
1,2,3-Trichlorobenzene	ND		1250	1340		ug/Kg		107	41 - 150	15	38
1,2,3-Trichloropropane	ND		1250	1330		ug/Kg		107	51 - 129	7	40
1,2,4-Trichlorobenzene	ND		1250	1330		ug/Kg		107	43 - 150	12	36
1,2,4-Trimethylbenzene	ND		1250	1430		ug/Kg		115	42 - 137	11	40
1,2-Dibromo-3-Chloropropane	ND		1250	1120		ug/Kg		90	27 - 140	22	40
1,2-Dibromoethane (EDB)	ND		1250	1330		ug/Kg		107	49 - 130	15	39
1,2-Dichlorobenzene	ND		1250	1390		ug/Kg		112	54 - 130	9	38
1,2-Dichloroethane	ND	M1	1250	1430		ug/Kg		115	53 - 124	9	32
1,2-Dichloropropane	ND	M1	1250	1360		ug/Kg		110	48 - 118	9	30
1,3,5-Trimethylbenzene	ND		1250	1410		ug/Kg		113	50 - 131	10	36
1,3-Dichlorobenzene	ND		1250	1320		ug/Kg		106	56 - 127	12	33
1,3-Dichloropropane	ND		1250	1290		ug/Kg		103	50 - 124	18	35
1,4-Dichlorobenzene	ND		1250	1340		ug/Kg		107	52 - 128	13	33

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 550-73277-C-1-E MSD
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 103749

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2,2-Dichloropropane	ND		1250	1180		ug/Kg		95	47 - 117	12	27
2-Butanone (MEK)	ND	M1	1250	1410		ug/Kg		113	32 - 130	26	40
2-Chlorotoluene	ND		1250	1310		ug/Kg		105	54 - 123	12	33
2-Hexanone	ND		1250	1130		ug/Kg		91	32 - 144	32	40
4-Chlorotoluene	ND		1250	1180		ug/Kg		95	56 - 123	11	32
4-Methyl-2-pentanone (MIBK)	ND		1250	1320		ug/Kg		106	37 - 134	10	40
Acetone	ND		1250	1240		ug/Kg		99	32 - 148	31	40
Benzene	ND	M1	1250	1370		ug/Kg		110	51 - 118	11	27
Bromobenzene	ND		1250	1370		ug/Kg		110	58 - 127	8	36
Bromochloromethane	ND	M1	1250	1430		ug/Kg		115	50 - 123	9	32
Bromodichloromethane	ND		1250	1320		ug/Kg		106	51 - 122	9	33
Bromoform	ND		1250	1260		ug/Kg		101	45 - 115	13	39
Bromomethane	ND		1250	1170		ug/Kg		94	28 - 115	12	40
Carbon disulfide	ND	M1	1250	1330		ug/Kg		107	32 - 116	12	38
Carbon tetrachloride	ND		1250	1290		ug/Kg		103	48 - 128	11	31
Chlorobenzene	ND	M1	1250	1340		ug/Kg		108	57 - 122	14	34
Chloroethane	ND	M1	1250	1380	M1	ug/Kg		111	32 - 107	9	40
Chloroform	ND	M1	1250	1490	M1	ug/Kg		119	52 - 116	10	29
Chloromethane	ND		1250	1070		ug/Kg		86	28 - 100	6	40
cis-1,2-Dichloroethene	ND	M1	1250	1380		ug/Kg		111	47 - 113	11	29
cis-1,3-Dichloropropene	ND		1250	1300		ug/Kg		104	41 - 130	14	34
Chlorodibromomethane	ND		1250	1300		ug/Kg		105	44 - 122	15	40
Dibromomethane	ND		1250	1320		ug/Kg		106	49 - 128	11	34
Dichlorodifluoromethane	ND		1250	432		ug/Kg		35	10 - 73	18	40
Ethylbenzene	ND		1250	1370		ug/Kg		110	50 - 130	14	32
Hexachlorobutadiene	ND		1250	1350		ug/Kg		108	33 - 150	11	37
Iodomethane	ND		1250	1480		ug/Kg		119	39 - 147	11	40
Isopropylbenzene	ND		1250	1420		ug/Kg		114	59 - 143	11	33
m,p-Xylenes	ND		1250	1360		ug/Kg		109	43 - 128	13	37
Methylene Chloride	ND	M1	1250	1330		ug/Kg		107	45 - 115	13	26
Methyl tert-butyl ether	ND	M1	1250	1540		ug/Kg		123	41 - 125	8	35
Naphthalene	ND		1250	1310		ug/Kg		106	34 - 150	12	34
n-Butylbenzene	ND		1250	1340		ug/Kg		108	44 - 140	13	34
n-Propylbenzene	ND		1250	1370		ug/Kg		110	52 - 135	12	33
o-Xylene	ND		1250	1390		ug/Kg		111	48 - 127	13	39
p-Isopropyltoluene	ND		1250	1370		ug/Kg		110	51 - 126	10	34
sec-Butylbenzene	ND		1250	1440		ug/Kg		116	49 - 131	12	34
Styrene	ND	M1	1250	1440		ug/Kg		116	49 - 123	15	33
tert-Butylbenzene	ND		1250	1360		ug/Kg		110	54 - 130	13	35
Tetrachloroethene	ND		1250	1220		ug/Kg		98	49 - 124	14	32
Toluene	ND		1250	1370		ug/Kg		110	52 - 126	10	30
trans-1,2-Dichloroethene	ND	M1	1250	1400		ug/Kg		113	44 - 113	12	26
trans-1,3-Dichloropropene	ND		1250	1320		ug/Kg		106	43 - 130	12	34
Trichloroethene	ND		1250	1330		ug/Kg		107	53 - 120	7	29
Trichlorofluoromethane	ND		1250	1160		ug/Kg		93	33 - 134	11	40
Vinyl acetate	ND	M1	1250	1470		ug/Kg		118	10 - 126	8	40
Vinyl chloride	ND		1250	330		ug/Kg		27	10 - 82	12	40
Xylenes, Total	ND	M1	2490	2750		ug/Kg		110	57 - 122	13	22

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 550-73277-C-1-E MSD
Matrix: Solid
Analysis Batch: 104030

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 103749

Surrogate	MSD %Recovery	MSD Qualifier	Limits
Dibromofluoromethane (Surr)	*119*		*34.7 - 143*
Toluene-d8 (Surr)	*117*		*39.1 - 145*
4-Bromofluorobenzene (Surr)	*108*		*38.2 - 149*

GC/MS VOA

Prep Batch: 103749

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-73249-1	SB2-40-11182016	Total/NA	Solid	5035A	
550-73249-2 - DL	SB2-69-11182016	Total/NA	Solid	5035A	
550-73249-2	SB2-69-11182016	Total/NA	Solid	5035A	
550-73249-3	SB2-69-11182016-DUP	Total/NA	Solid	5035A	
550-73249-4	SB1-45-11182016	Total/NA	Solid	5035A	
550-73249-5 - DL	SB1-75-11182016	Total/NA	Solid	5035A	
550-73249-5	SB1-75-11182016	Total/NA	Solid	5035A	
550-73249-6	TB-11172016	Total/NA	Solid	5035A	
MB 550-103749/1-A	Method Blank	Total/NA	Solid	5035A	
LCS 550-103749/2-A	Lab Control Sample	Total/NA	Solid	5035A	
LCSD 550-103749/3-A	Lab Control Sample Dup	Total/NA	Solid	5035A	
550-73277-C-1-D MS	Matrix Spike	Total/NA	Solid	5035A	
550-73277-C-1-E MSD	Matrix Spike Duplicate	Total/NA	Solid	5035A	

Analysis Batch: 104030

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-73249-1	SB2-40-11182016	Total/NA	Solid	8260B	103749
550-73249-2	SB2-69-11182016	Total/NA	Solid	8260B	103749
550-73249-3	SB2-69-11182016-DUP	Total/NA	Solid	8260B	103749
550-73249-4	SB1-45-11182016	Total/NA	Solid	8260B	103749
550-73249-5	SB1-75-11182016	Total/NA	Solid	8260B	103749
550-73249-6	TB-11172016	Total/NA	Solid	8260B	103749
MB 550-103749/1-A	Method Blank	Total/NA	Solid	8260B	103749
LCS 550-103749/2-A	Lab Control Sample	Total/NA	Solid	8260B	103749
LCSD 550-103749/3-A	Lab Control Sample Dup	Total/NA	Solid	8260B	103749
550-73277-C-1-D MS	Matrix Spike	Total/NA	Solid	8260B	103749
550-73277-C-1-E MSD	Matrix Spike Duplicate	Total/NA	Solid	8260B	103749

Analysis Batch: 104039

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-73249-2 - DL	SB2-69-11182016	Total/NA	Solid	8260B	103749
550-73249-5 - DL	SB1-75-11182016	Total/NA	Solid	8260B	103749

Lab Chronicle

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: SB2-40-11182016
Date Collected: 11/18/16 10:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035A			7.4 g	10 mL	103749	11/18/16 10:30	NBL	TAL PHX
Total/NA	Analysis	8260B		1	200 uL	10 mL	104030	11/24/16 00:28	UT	TAL PHX

Client Sample ID: SB2-69-11182016
Date Collected: 11/18/16 13:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035A			8.78 g	10 mL	103749	11/18/16 13:30	NBL	TAL PHX
Total/NA	Analysis	8260B		1	200 uL	10 mL	104030	11/24/16 01:00	UT	TAL PHX
Total/NA	Prep	5035A	DL		8.78 g	10 mL	103749	11/18/16 13:30	NBL	TAL PHX
Total/NA	Analysis	8260B	DL	10	200 uL	10 mL	104039	11/25/16 03:39	R1K	TAL PHX

Client Sample ID: SB2-69-11182016-DUP
Date Collected: 11/18/16 13:30
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035A			7.67 g	10 mL	103749	11/18/16 13:30	NBL	TAL PHX
Total/NA	Analysis	8260B		1	200 uL	10 mL	104030	11/24/16 01:31	UT	TAL PHX

Client Sample ID: SB1-45-11182016
Date Collected: 11/17/16 11:17
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-4
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035A			10.51 g	10 mL	103749	11/17/16 11:17	NBL	TAL PHX
Total/NA	Analysis	8260B		1	200 uL	10 mL	104030	11/24/16 02:03	UT	TAL PHX

Client Sample ID: SB1-75-11182016
Date Collected: 11/17/16 14:47
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-5
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035A			6.51 g	10 mL	103749	11/17/16 14:47	NBL	TAL PHX
Total/NA	Analysis	8260B		1	200 uL	10 mL	104030	11/24/16 02:34	UT	TAL PHX
Total/NA	Prep	5035A	DL		6.51 g	10 mL	103749	11/17/16 14:47	NBL	TAL PHX
Total/NA	Analysis	8260B	DL	10	200 uL	10 mL	104039	11/25/16 04:11	R1K	TAL PHX

Lab Chronicle

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Client Sample ID: TB-11172016
Date Collected: 11/17/16 00:01
Date Received: 11/18/16 16:44

Lab Sample ID: 550-73249-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035A			10 g	10 mL	103749	11/17/16 00:00	NBL	TAL PHX
Total/NA	Analysis	8260B		1	200 uL	10 mL	104030	11/24/16 03:05	UT	TAL PHX

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

Certification Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA-LAP, LLC	ELLAP		154268	07-01-17
AIHA-LAP, LLC	IHLAP		154268	07-01-17
Arizona	State Program	9	AZ0728	06-09-17
California	State Program	9	2941	11-30-17
Nevada	State Program	9	AZ01030	07-31-17
Oregon	NELAP	10	AZ100001	03-09-17
USDA	Federal		P330-16-00302	08-27-19

Laboratory: TestAmerica Irvine

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	CA01531	06-30-17
Arizona	State Program	9	AZ0671	10-14-17
California	LA Cty Sanitation Districts	9	10256	01-31-17 *
California	State Program	9	CA ELAP 2706	06-30-18
Guam	State Program	9	Cert. No. 16-001r	01-23-17
Hawaii	State Program	9	N/A	01-29-17
Kansas	NELAP Secondary AB	7	E-10420	07-31-17
Nevada	State Program	9	CA015312016-2	07-31-17
New Mexico	State Program	6	N/A	01-29-17
Northern Mariana Islands	State Program	9	MP0002	01-29-17
Oregon	NELAP	10	4028	01-29-17
USDA	Federal		P330-15-00184	07-08-18
Washington	State Program	10	C900	09-03-17

* Certification renewal pending - certification considered valid.

Method Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Cooper and Commerce SP0146B

TestAmerica Job ID: 550-73249-1

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL PHX

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

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TAL-0013-550 (0116)

CHAIN OF CUSTODY FORM

[ ] Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340

73249

11/28/2016

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Client Name/Address:	Project/PO Number:	Analysis Required
GROSYNTEC 1180 N. TATUM P-186 PHOENIX ARIZONA 85028	SP0146B	
Project Manager: MARCA MCCANN	Phone Number:	
Sampler: ROBERT RIVERS	Email Address:	

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	8260B	Special Instructions
SB2-40-11182016	S	VOA	2	11/18/16	1030	MEOH	✓	-01
SB2-69-11182016	S	VOA	2	11/18/16	1330	MEOH	✓	-02
SB2-69-11182016 DUP	S	VOA	2	11/18/16	1330	MEOH	✓	-03
SB1-45-11172016	S	VOA	2	11/17/16	1117	MEOH	✓	-04
SB1-75-11172016	S	VOA	2	11/17/16	1447	MEOH	✓	-05
TB-11172016		VOA	1				✓	-06

550-73249 Chain of Custody

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)	
	11/18/16 1644			same day ____	72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____	5 days ____
				48 hours ____	normal ____
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)	
			11/18/16 16:44	intact ✓	on ice ✓

3.5°C

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

Login Sample Receipt Checklist

Client: Geosyntec Consultants, Inc.

Job Number: 550-73249-1

Login Number: 73249
List Number: 1
Creator: Gravlin, Andrea

List Source: TestAmerica Phoenix

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	False	TB does not have sample time provided.
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	Check done at department level as required.

APPENDIX C
Cross-Sectional Site Figures

Legend

- Monitor Well
- Well With Dedicated Pump (Not Currently Pumping)
- Extraction Well
- Well With Dedicated Pump (Currently Pumping)
- Cross Section View
- WQARF Site Boundary
- Former Unichem Facility

N

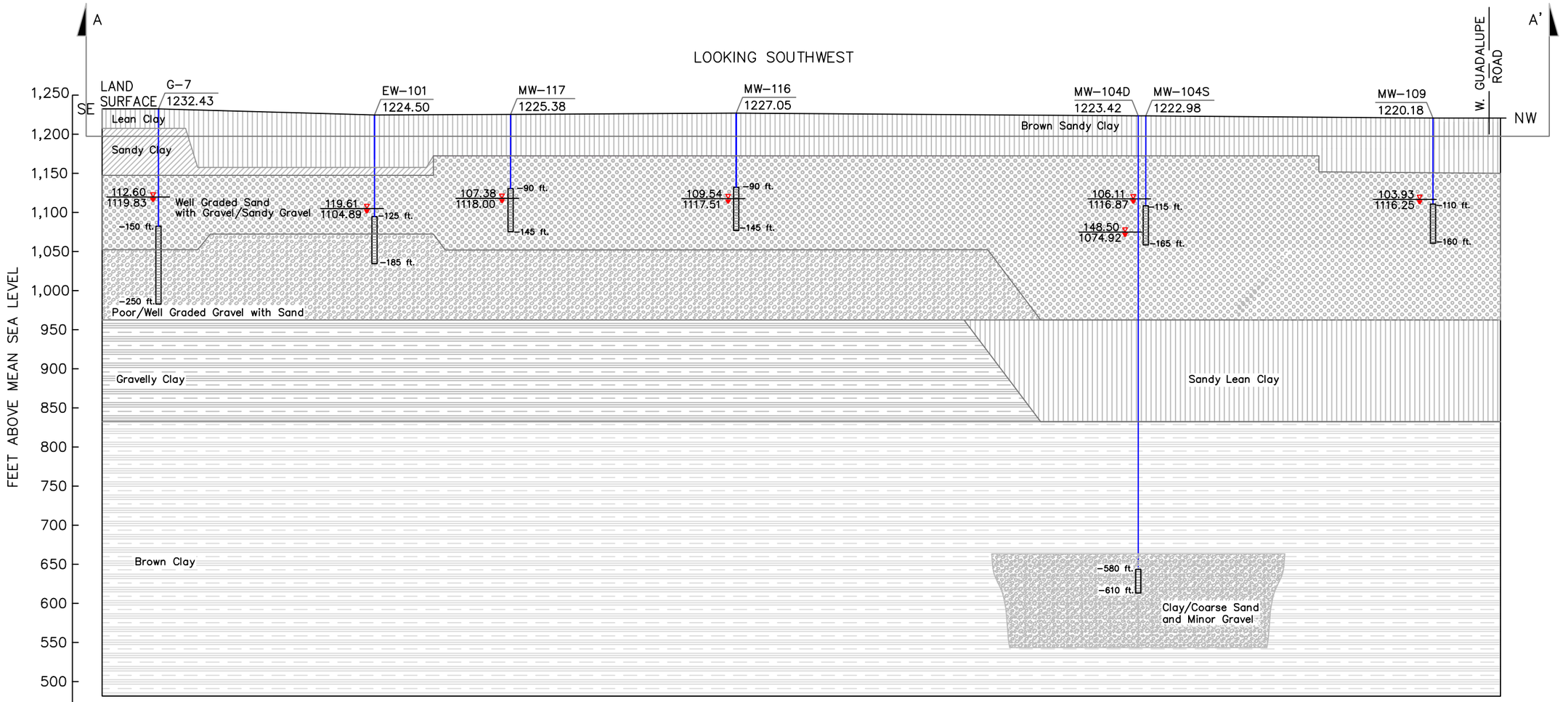
0 600 1,200

SCALE IN FEET

HYDRO GEO CHEM, INC.

MONITORING WELL LOCATION PLAN
COOPER AND COMMERCE WQARF SITE
GILBERT, ARIZONA

Approved	Date	Author	Revised	File Name	Figure
MJB	3/13/14	JAA	5/1/14	2010002082A	2



LEGEND

-180 ft. / -200 ft.	MONITOR WELL SCREEN INTERVAL
MW-117 / 1225.38	MONITOR WELL IDENTIFICATION NUMBER MEASURING POINT ELEVATION
-200 ft.	SCREEN DEPTH
107.38 / 1118.00	DEPTH TO GROUNDWATER GROUNDWATER ELEVATION
DRY	WELL DRY
NA	NOT APPLICABLE

NOTE WATER LEVELS WERE COLLECTED FOR ALL WELLS APRIL, 2014, WITH THE EXCEPTION OF EW-101 WHICH WAS COLLECTED IN MAY, 2014. CROSS SECTION LOCATION SHOWN ON FIGURE 2.

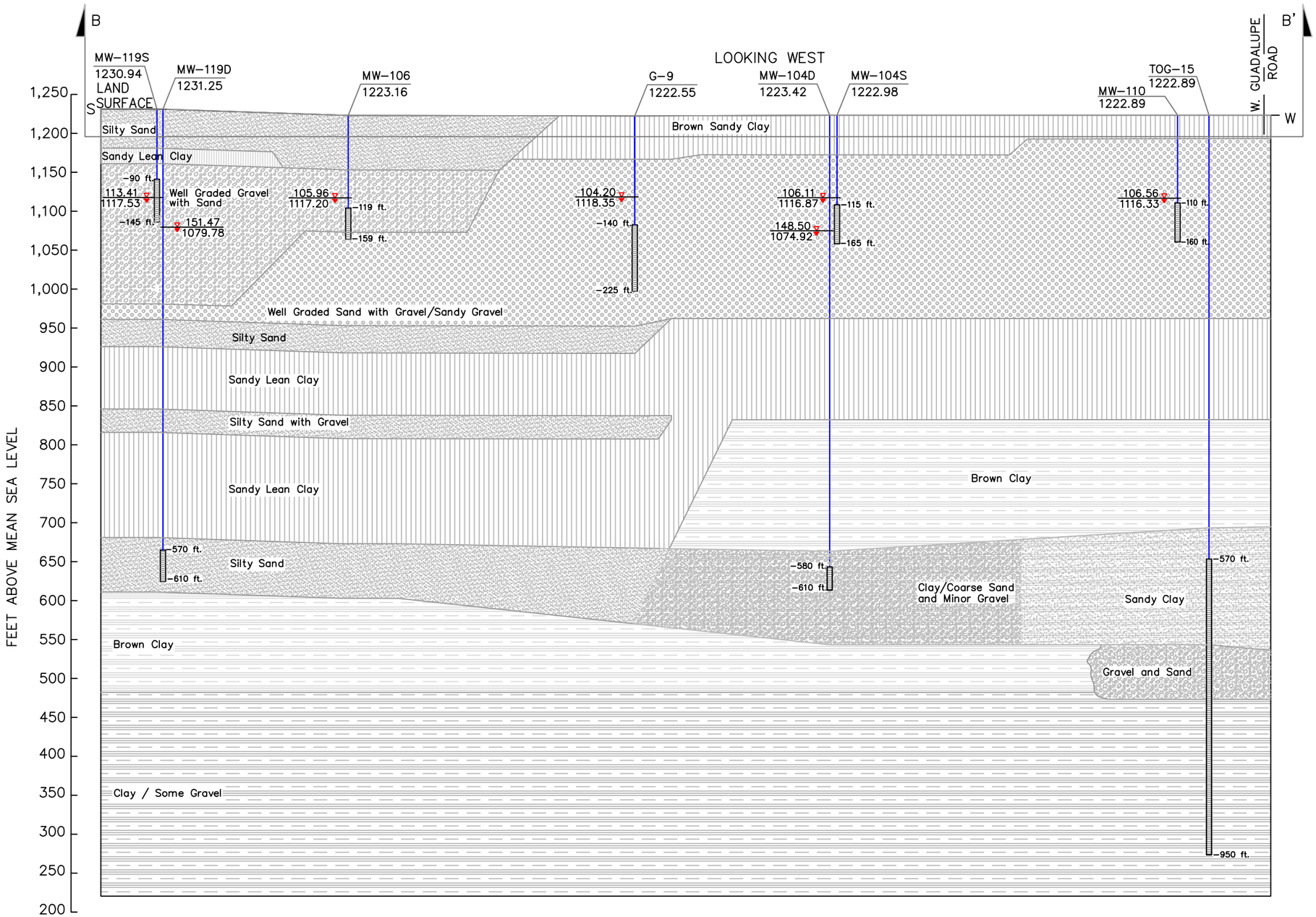
APPROXIMATE SCALE
Measured In Feet
Horizontal Scale
0 140 280

APPROXIMATE SCALE
Measured In Feet
Vertical Scale
0 70 140

HYDRO GEO CHEM, INC.

SOUTHEAST-NORTHWEST CROSS SECTION A-A'
MONITORING WELL NETWORK
COOPER AND COMMERCE WQARF SITE

Approved	Date	Author	Date	File Name	Figure
MJB	9/23/14	JAA	9/23/14	2010002088A	4



LEGEND

-180 ft. / -200 ft.	MONITOR WELL SCREEN INTERVAL
MW-117 / 1225.38	MONITOR WELL IDENTIFICATION NUMBER MEASURING POINT ELEVATION
-200 ft.	SCREEN DEPTH
107.38 / 1118.00	DEPTH TO GROUNDWATER GROUNDWATER ELEVATION
DRY	WELL DRY
NA	NOT APPLICABLE

NOTE WATER LEVELS WERE COLLECTED FOR ALL WELLS APRIL, 2014. CROSS SECTION LOCATION SHOWN ON FIGURE 2.

APPROXIMATE SCALE
Measured In Feet
Horizontal Scale
0 140 280

APPROXIMATE SCALE
Measured In Feet
Vertical Scale
0 70 140

HYDRO GEO CHEM, INC.

SOUTH-NORTH CROSS SECTION B-B'
MONITORING WELL NETWORK
COOPER AND COMMERCE WQARF SITE

Approved	Date	Author	Date	File Name	Figure
MJB	9/23/14	JAA	9/23/14	2010002088A	5

APPENDIX D
Detailed Cost Sheets for Remedial Alternatives

Table D-1
Estimated Costs for Reference Remedies
Cooper and Commerce WQARF Site
Gilbert, Arizona

	Quantity	Units	Cost Per Unit	Total Cost	Total Cost (-25%)	Total Cost (+50%)
Vadose Zone (Arsenic, Copper) - Additional Delineation, Risk Assessment, Institutional Controls						
Estimated Capital Costs						
Confirmation Soil Borings (Assume 3) & Risk Assessment	1	LS	$97,000	$97,000	$73,000	$146,000
Institutional Controls and Property Owner Coordination	1	LS	$26,000	$26,000	$20,000	$39,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
Capital Costs Subtotal				**$136,000**	**$102,000**	**$204,000**
Vadose Zone (Arsenic, Copper) Capital Costs				**$136,000**	**$102,000**	**$204,000**
Vadose Zone (VOCs) - Continued Operation of SVE System						
Estimated Capital Costs						
Miscellaneous Field Supplies	1	LS	$3,000	$3,000	$2,000	$5,000
Annual Air Permit Fee	5	LS	$2,000	$10,000	$8,000	$15,000
Confirmation Soil and Soil Vapor Sampling	1	LS	$117,000	$117,000	$88,000	$176,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
Capital Costs Subtotal				**$143,000**	**$107,000**	**$215,000**
Estimated Annual O&M Costs						
Routine Monitoring/Sampling/Reporting	1	LS	$33,000	$33,000	$25,000	$50,000
Repair and Maintenance	1	LS	$7,000	$7,000	$5,000	$11,000
Utilities (electric)	12	Monthly	$1,000	$12,000	$9,000	$18,000
VGAC Changeout (assumes 1 changeout/5 years)	1	LS	$2,000	$2,000	$2,000	$3,000
Miscellaneous Field Supplies	1	LS	$6,000	$6,000	$5,000	$9,000
Project Management/Administration	1	LS	$9,000	$9,000	$7,000	$14,000
Annual O&M Subtotal				**$69,000**	**$52,000**	**$104,000**
Total O&M Costs for 5 Years (including 3% annual inflation)				**$366,000**	**$275,000**	**$549,000**
Vadose Zone (VOCs) Capital and O&M Costs				**$509,000**	**$382,000**	**$764,000**
Estimated Vadose Zone Contingency Costs						
SVE Well Installation (Three Wells with Targeted Screens)	1	LS	$60,000	$60,000	$45,000	$90,000
Vadose Zone VOC Risk Assessment	1	LS	$25,000	$25,000	$19,000	$38,000
O&M Costs for 5 Additional Years (including 3% annual inflation)	1	LS	$436,000	$436,000	$327,000	$654,000
Vadose Zone Contingency Costs Subtotal				**$521,000**	**$391,000**	**$782,000**
Total Vadose Zone (VOCs) Capital, O&M Costs, and Contingency Costs				**$1,030,000**	**$773,000**	**$1,545,000**
Groundwater - MNA Monitoring Current Well Network Semiannually						
Estimated Capital Costs						
Installation and Development of 2 Downgradient Monitoring Wells	1	LS	$118,000	$118,000	$89,000	$177,000
Miscellaneous Equipment /Repairs	1	LS	$8,000	$8,000	$6,000	$12,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
Capital Costs Subtotal				**$139,000**	**$104,000**	**$209,000**
Estimated Annual Costs						
Semiannual Groundwater Monitoring/Reporting	1	LS	$46,000	$46,000	$35,000	$69,000
Miscellaneous Sampling & Field Supplies	1	LS	$6,000	$6,000	$5,000	$9,000
Project Management/Administration	1	LS	$8,000	$8,000	$6,000	$12,000
Annual MNA Groundwater Monitoring Subtotal				**$60,000**	**$45,000**	**$90,000**
Total Groundwater Monitoring Costs for 18 Years (including 3% annual inflation)				**$1,405,000**	**$1,054,000**	**$2,108,000**
Groundwater Capital and Monitoring Costs				**$1,544,000**	**$1,158,000**	**$2,316,000**
Estimated Groundwater Contingency Costs						
MNA Monitoring for 10 Additional Years (including 3% annual inflation)	1	LS	$1,171,000	$1,171,000	$878,000	$1,757,000
Wellhead Treatment						
Professional services (design, engineering, etc.)	-	15%	$213,000	$213,000	$160,000	$320,000
Treatment compound (foundation, fence, instrumentation and controls, site improvements, etc.)	1	LS	$405,000	$405,000	$304,000	$608,000
LGAC system (vessels, bag filter system, interconnective piping)	1	LS	$978,000	$978,000	$734,000	$1,467,000
Conveyance piping modifications	200	LF	$200	$40,000	$30,000	$60,000
System Commissioning and Startup	1	LS	$35,000	$35,000	$26,000	$53,000
Construction services (system installation oversight, etc.)	-	15%	$213,000	$213,000	$160,000	$320,000
O&M costs (assuming 18 years including 3% annual inflation)	1	LS	$4,476,000	$4,476,000	$3,357,000	$6,714,000
Groundwater Contingency Costs Subtotal				**$7,531,000**	**$5,648,000**	**$11,297,000**
Groundwater Capital, Monitoring Costs, and Contingency Costs				**$9,075,000**	**$6,806,000**	**$13,613,000**
Total Vadose Zone and Groundwater Reference Remedy Costs (Including Contingencies)				**$10,241,000**	**$7,681,000**	**$15,362,000**

Abbreviations:

WQARF = Water Quality Assurance Revolving Fund
% = percent
LS = lump sum
$ = United States dollars
VOCs = volatile organic compounds
SVE = soil vapor extraction
O&M = operations and maintenance
VGAC = vapor phase granular activated carbon
MNA = monitored natural attenuation
LGAC = liquid phase granular activated carbon
LF = linear feet
PLC = programmable logic controller

Notes:

Costs rounded off to nearest thousand
Labor and utility costs are based on current SVE operational costs
Total O&M and monitoring costs including 3% annual inflation
Wellhead Treatment Assumptions
Wellhead treatment installed at one existing Salt River Project or Town of Gilbert Production well with enough existing adjacent property for installation of treatment system.
Costs are based on 2017 dollar values.
Costs exclude land acquisition and/or access agreements.
Costs excludes permitting.
LGAC system included two, 20,000-pound lead/lag systems in parallel for maximum flowrate of up to 2,200 gallons per minute.
Wellhead owner will accept a flowrate limitation of 2,200 gallons per minute.
Existing production well pump will have enough capacity to overcome hydraulic head of treatment system.
No production well pump or additional booster pumps will be needed for wellhead treatment.
No break/equalization tanks will be needed.
Treatment system discharge will be to existing discharge location of production well.
Treatment system will be on 1-foot thick concrete slab on grade with secondary containment curbing.
Treatment system will be within 8-foot high metal mesh fence.
Gravel path to treatment compound from nearest roadway.
Costs include up to 8 air release valves.
A new electrical service/transformer will not be required.
Instrumentation and controls will be connected to existing PLC.
No modifications will be needed for existing wellhead instrumentation and controls.
O&M costs include routine bag filters, sampling, and 2 carbon vessel changeouts per year for a total of 80,000 pounds of LGAC per year.
O&M costs exclude monthly utility costs.

Table D-2
Estimated Costs for More Aggressive Remedies
Cooper and Commerce WQARF Site
Gilbert, Arizona

	Quantity	Units	Cost Per Unit	Total Cost	Total Cost (-25%)	Total Cost (+50%)
Vadose Zone (Arsenic, Copper) - Additional Delineation, Risk Assessment, Institutional Controls						
Estimated Capital Costs						
Confirmation Soil Borings (Assume 3) & Risk Assessment	1	LS	$97,000	$97,000	$73,000	$146,000
Institutional Controls and Property Owner Coordination	1	LS	$26,000	$26,000	$20,000	$39,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
Capital Costs Subtotal				**$136,000**	**$102,000**	**$204,000**
Vadose Zone (Arsenic, Copper) Capital Costs				**$136,000**	**$102,000**	**$204,000**
Vadose Zone (VOCs) - Expanded SVE System						
Estimated Capital Costs						
Miscellaneous Field Supplies	1	LS	$3,000	$3,000	$2,000	$5,000
Annual Air Permit Fee	10	LS	$2,000	$20,000	$15,000	$30,000
Confirmation Soil and Soil Vapor Sampling and SVE Well Installation	1	LS	$126,000	$126,000	$95,000	$189,000
Project Management/Administration	1	LS	$15,000	$15,000	$11,000	$23,000
Capital Costs Subtotal				**$164,000**	**$123,000**	**$246,000**
Estimated Annual O&M Costs						
Routine Monitoring/Sampling/Reporting	1	LS	$33,000	$33,000	$25,000	$50,000
Repair and Maintenance	1	LS	$7,000	$7,000	$5,000	$11,000
Utilities (electric)	12	Monthly	$1,000	$12,000	$9,000	$18,000
VGAC Changeout (assumes 1 changeout/5 years)	1	LS	$2,000	$2,000	$2,000	$3,000
Miscellaneous Field Supplies	1	LS	$6,000	$6,000	$5,000	$9,000
Project Management/Administration	1	LS	$9,000	$9,000	$7,000	$14,000
Annual O&M Subtotal				**$69,000**	**$52,000**	**$104,000**
Total O&M Costs for 10 Years (including 3% annual inflation)				**$791,000**	**$593,000**	**$1,187,000**
Vadose Zone (VOCs) Capital and O&M Costs				**$955,000**	**$716,000**	**$1,433,000**
Groundwater - GETS and Groundwater Monitoring						
Estimated Capital Costs						
Downgradient Groundwater Monitoring Wells						
Installation and Development of 2 Downgradient Monitoring Wells	1	LS	$118,000	$118,000	$89,000	$177,000
Miscellaneous Equipment /Repairs	1	LS	$8,000	$8,000	$6,000	$12,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
GETS						
Land Acquisition	1	LS	$300,000	$300,000	$225,000	$450,000
Treatment Compound (foundation, fence, power, etc.)	1	LS	$100,000	$100,000	$75,000	$150,000
Groundwater extraction wells (well, pump, power)	3	EA	$100,000	$300,000	$225,000	$450,000
LGAC system (vessels, bag filter, break tank, piping)	1	LS	$90,000	$90,000	$68,000	$135,000
Conveyance piping from extraction wells to compound	3000	LF	$200	$600,000	$450,000	$900,000
Conveyance to SRP lateral	1,000	LF	$200	$200,000	$150,000	$300,000
Professional Services (design, engineering, permitting, etc)	-	25%	$398,000	$398,000	$299,000	$597,000
Capital Costs Subtotal				**$2,127,000**	**$1,597,000**	**$3,191,000**
Estimated Annual Costs						
GETS O&M/Sampling/Reporting	1	LS	$98,000	$98,000	$74,000	$147,000
Electric Power	12	Monthly	$3,000	$36,000	$27,000	$54,000
LGAC Changeout (per vessel)	1	LS	$20,000	$20,000	$15,000	$30,000
Semiannual Groundwater Monitoring/Reporting	1	LS	$46,000	$46,000	$35,000	$69,000
Miscellaneous Sampling, Field Supplies, & GETS Supplies	1	LS	$14,000	$14,000	$11,000	$21,000
Project Management/Administration	1	LS	$22,000	$22,000	$17,000	$33,000
Annual O&M and Monitoring Subtotal				**$236,000**	**$177,000**	**$354,000**
Total O&M and Monitoring Costs for 16 Years (including 3% annual inflation)				**$4,757,000**	**$3,568,000**	**$7,136,000**
Groundwater Capital, O&M, and Monitoring Costs				**$6,884,000**	**$5,163,000**	**$10,326,000**
Estimated Groundwater Contingency Costs						
Installation of Two Additional Extraction Wells and Connection to GETS System	1	LS	$1,300,000	$1,300,000	$975,000	$1,950,000
Single EISB Injection Event at MW-104S and Monitoring	1	LS	$185,000	$185,000	$139,000	$278,000
Groundwater Monitoring only for 10 Additional Years (including 3% annual inflation)	1	LS	$847,000	$847,000	$635,000	$1,271,000
Wellhead Treatment						
Professional services (design, engineering, etc.)	-	15%	$213,000	$213,000	$160,000	$320,000
Treatment compound (foundation, fence, instrumentation and controls, site improvements, etc.)	1	LS	$405,000	$405,000	$304,000	$608,000
LGAC system (vessels, bag filter system, interconnective piping)	1	LS	$978,000	$978,000	$734,000	$1,467,000
Conveyance piping modifications	200	LF	$200	$40,000	$30,000	$60,000
System Commissioning and Startup	1	LS	$35,000	$35,000	$26,000	$53,000
Construction services (system installation oversight, etc.)	-	15%	$213,000	$213,000	$160,000	$320,000
O&M costs (assuming 18 years including 3% annual inflation)	1	LS	$4,476,000	$4,476,000	$3,357,000	$6,714,000
Groundwater Contingency Costs Subtotal				**$8,692,000**	**$6,519,000**	**$13,038,000**
Groundwater Capital, Monitoring Costs, and Contingency Costs				**$15,576,000**	**$11,682,000**	**$23,364,000**
Total Vadose Zone and Groundwater Reference Remedy Costs (Including Contingencies)				**$16,667,000**	**$12,500,000**	**$25,001,000**

Table D-2
Estimated Costs for More Aggressive Remedies
Cooper and Commerce WQARF Site
Gilbert, Arizona

Abbreviations:

WQARF = Water Quality Assurance Revolving Fund
% = percent
LS = lump sum
$ = United States dollars
VOCs = volatile organic compounds
SVE = soil vapor extraction
O&M = operations and maintenance
GETS = groundwater extraction and treatment system
EA = each
LGAC = liquid phase granular activated carbon
LF = linear feet
SRP = Salt River Project
EISB = enhanced in-situ bioremediation
PLC = programmable logic controller

Notes:

Costs rounded off to nearest thousand
Labor and utility costs are based on current SVE operational costs
Total O&M and monitoring costs include a 3% cost increase from year to year
Contingent Additional Extraction Well Assumptions
- Costs are based on 2017 dollar values.
- Expansion of the GETS treatment system (i.e., additional carbon vessels or treatment systems) would not be required.
- Additional extraction wells will be within 1,600 and 2,600 linear feet of GETS in new trenches.
- Costs exclude land acquisition and/or access agreements.

Contingent EISB Assumptions
- Costs are based on 2017 dollar values.
- Costs include work plan and baseline sampling activities for up to three existing monitoring wells.
- Groundwater conditions suitable to EISB without additional augmentation to use of other than KB-1® Plus and an extended release, water mixable oil as donor.
- Single injection event at groundwater monitoring well MW-104S consisting of 200,000 gallon injectate volume, using KB-1® Plus and an extended release, water mixable oil.
- Costs associated with site/property access agreements excluded.

Wellhead Treatment Assumptions
- Wellhead treatment installed at one existing Salt River Project or Town of Gilbert Production well with enough existing adjacent property for installation of treatment system.
- Costs are based on 2017 dollar values.
- Costs exclude land acquisition and/or access agreements.
- LGAC system included two, 20,000-pound lead/lag systems in parallel for maximum flowrate of up to 2,200 gallons per minute.
- Wellhead owner will accept a flowrate limitation of 2,200 gallons per minute.
- Existing production well pump will have enough capacity to overcome hydraulic head of treatment system.
- No production well pump or additional booster pumps will be needed for wellhead treatment.
- No break/equalization tanks will be needed.
- Treatment system discharge will be to existing discharge location of production well.
- Treatment system will be on 1-foot thick concrete slab on grade with secondary containment curbing.
- Treatment system will be within 8-foot high metal mesh fence.
- Gravel path to treatment compound from nearest roadway.
- Costs include up to 8 air release valves.
- A new electrical service/transformer will not be required.
- Instrumentation and controls will be connected to existing PLC.
- No modifications will be needed for existing wellhead instrumentation and controls.
- O&M costs include routine bag filters, sampling, and 2 carbon vessel changeouts per year for a total of 80,000 pounds of LGAC per year.
- O&M costs exclude monthly utility costs.

Table D-3
Estimated Costs for Less Aggressive Remedies
Cooper and Commerce WQARF Site
Gilbert, Arizona

	Quantity	Units	Cost Per Unit	Total Cost	Total Cost (-25%)	Total Cost (+50%)
Vadose Zone (Arsenic, Copper) - Additional Delineation, Risk Assessment, Institutional Controls						
Estimated Capital Costs						
Confirmation Soil Borings (Assume 3) & Risk Assessment	1	LS	$97,000	$97,000	$73,000	$146,000
Institutional Controls and Property Owner Coordination	1	LS	$26,000	$26,000	$20,000	$39,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
Capital Costs Subtotal				**$136,000**	**$102,000**	**$204,000**
Vadose Zone (Arsenic, Copper) Capital Costs				**$136,000**	**$102,000**	**$204,000**
Vadose Zone (VOCs) - Shutdown of Current SVE System						
Estimated Capital Costs						
Confirmation Soil and Soil Vapor Sampling	1	LS	$117,000	$117,000	$88,000	$176,000
Capital Costs Subtotal				**$117,000**	**$88,000**	**$176,000**
Estimated Annual O&M Costs						
Quarterly Rebound Monitoring/Reporting	4	Qtrly	$2,000	$8,000	$6,000	$12,000
Project Management/Administration	1	LS	$2,000	$2,000	$2,000	$3,000
Annual O&M Subtotal				**$10,000**	**$8,000**	**$15,000**
Total O&M Costs for 1 Year				**$10,000**	**$8,000**	**$15,000**
Vadose Zone Capital and O&M Costs				**$127,000**	**$95,000**	**$191,000**
Groundwater - MNA Monitoring Limited Well Network Annually						
Estimated Capital Costs						
Installation and Development of 2 Downgradient Monitoring Wells	1	LS	$118,000	$118,000	$89,000	$177,000
Miscellaneous Equipment	1	LS	$8,000	$8,000	$6,000	$12,000
Project Management/Administration	1	LS	$13,000	$13,000	$10,000	$20,000
Capital Costs Subtotal				**$139,000**	**$104,000**	**$209,000**
Estimated Annual Costs						
Annual Groundwater Monitoring/Reporting	1	LS	$21,000	$21,000	$16,000	$32,000
Miscellaneous Sampling & Field Supplies	1	LS	$3,000	$3,000	$2,000	$5,000
Project Management/Administration	1	LS	$4,000	$4,000	$3,000	$6,000
Annual Groundwater Monitoring Subtotal				**$28,000**	**$21,000**	**$42,000**
Total Groundwater Monitoring Costs for 18 Years				**$656,000**	**$492,000**	**$984,000**
Groundwater Capital and Monitoring Costs				**$795,000**	**$596,000**	**$1,193,000**
Estimated Groundwater Contingency Costs						
MNA Monitoring for 10 Additional Years (including 3% annual inflation)	1	LS	$677,000	$677,000	$508,000	$1,016,000
Wellhead Treatment						
Professional services (design, engineering, etc.)	-	15%	$213,000	$213,000	$160,000	$320,000
Treatment compound (foundation, fence, instrumentation and controls, site improvements, etc.)	1	LS	$405,000	$405,000	$304,000	$608,000
LGAC system (vessels, bag filter system, interconnective piping)	1	LS	$978,000	$978,000	$734,000	$1,467,000
Conveyance piping modifications	200	LF	$200	$40,000	$30,000	$60,000
System Commissioning and Startup	1	LS	$35,000	$35,000	$26,000	$53,000
Construction services (system installation oversight, etc.)	-	15%	$213,000	$213,000	$160,000	$320,000
O&M costs (assuming 18 years including 3% annual inflation)	1	LS	$4,476,000	$4,476,000	$3,357,000	$6,714,000
Groundwater Contingency Costs Subtotal				**$7,037,000**	**$5,278,000**	**$10,556,000**
Groundwater Capital, Monitoring Costs, and Contingency Costs				**$7,832,000**	**$5,874,000**	**$11,748,000**
Total Vadose Zone and Groundwater Reference Remedy Costs (Including Contingencies)				**$8,095,000**	**$6,071,000**	**$12,143,000**

Abbreviations:

WQARF = Water Quality Assurance Revolving Fund
% = percent
LS = lump sum
$ = United States dollars
VOCs = volatile organic compounds
SVE = soil vapor extraction
O&M = operations and maintenance
Qtrly = quarterly
MNA = monitored natural attenuation
LGAC = liquid phase granular activated carbon
LF = linear feet
PLC = programmable logic controller

Notes:

Costs rounded off to nearest thousand
Total O&M and monitoring costs include a 3% cost increase from year to year
Wellhead Treatment Assumptions
Wellhead treatment installed at one existing Salt River Project or Town of Gilbert Production well with enough existing adjacent property for installation of treatment system.
Costs are based on 2017 dollar values.
Costs exclude land acquisition and/or access agreements.
Costs excludes permitting.
LGAC system included two, 20,000-pound lead/lag systems in parallel for maximum flowrate of up to 2,200 gallons per minute.
Wellhead owner will accept a flowrate limitation of 2,200 gallons per minute.
Existing production well pump will have enough capacity to overcome hydraulic head of treatment system.
No production well pump or additional booster pumps will be needed for wellhead treatment.
No break/equalization tanks will be needed.
Treatment system discharge will be to existing discharge location of production well.
Treatment system will be on 1-foot thick concrete slab on grade with secondary containment curbing.
Treatment system will be within 8-foot high metal mesh fence.
Gravel path to treatment compound from nearest roadway.
Costs include up to 8 air release valves.
A new electrical service/transformer will not be required.
Instrumentation and controls will be connected to existing PLC.
No modifications will be needed for existing wellhead instrumentation and controls.
O&M costs include routine bag filters, sampling, and 2 carbon vessel changeouts per year for a total of 80,000 pounds of LGAC per year.
O&M costs exclude monthly utility costs.