



LOWRY AFB  
COLORADO

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ADMINISTRATIVE RECORD  
COVER SHEET

AR File Number 1726

FINAL  
FIVE YEAR REVIEW REPORT  
SECOND FIVE YEAR REVIEW

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FORMER LOWRY AIR FORCE BASE, COLORADO

October 2013

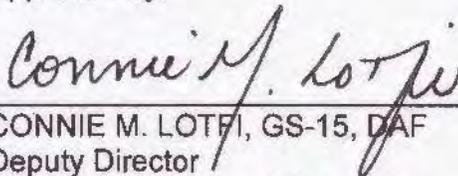
Prepared for:

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31 OCT 2013

# STATE OF COLORADO

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Colorado Department  
of Public Health  
and Environment

October 4, 2013

Mr. Stanley Pehl  
Department of the Air Force  
AFCEC/CIBW  
2261 Hughes Avenue, Suite 155  
JBSA Lackland, TX 78236-9853

Subject: October 2013 document entitled "Final Five Year Review Report, Second Five Year Review," Former Lowry Air Force Base, Denver, Colorado, transmitted on October 2, 2013 and received October 3, 2013.

Dear Mr. Pehl:

The Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division (the Division) received and has reviewed the subject document. The Division has no substantive comments on the subject document and concurs with the subject document in its current form.

Please contact me at 303/692-3453 if you have any questions.

Sincerely,

Lee J. Pivonka  
Federal Facility Remediation & Restoration Unit  
Remediation Program  
Hazardous Materials and Waste Management Division

cc: Mr. Tom Berger, LRA  
Mr. David Erickson, City and County of Denver  
Mr. Donald Roche, City of Aurora  
Ms. Pat Smith, EPA-Region 8  
Mr. Paul Weaverling, LAC

File: Former Lowry Air Force Base, DMA-1.1-\_\_

h:\lowry air force base\second (2013) five year review\october 2013 final five year review report, second five year review transmitted to cdphe october 2, 2013 and received by cdphe october 3, 2013.doc

## Five-Year Review Summary Form

### SITE IDENTIFICATION

**Site Name:** Lowry Air Force Base

**EPA ID:** [Click here to enter text.](#)

**Region:** 8

**State:** CO

**City/County:** Denver and Aurora

### SITE STATUS

**NPL Status:** Non-NPL

**Multiple OUs?**

Yes

**Has the site achieved construction completion?**

Yes

### REVIEW STATUS

**Lead agency:** Other Federal Agency

**If "Other Federal Agency" was selected above, enter Agency name:** Air Force Civil Engineer Center (AFCEC)

**Author name (Federal or State Project Manager):** Paul Weaverling

**Author affiliation:** Lowry Assumption, LLC

**Review period:** April 7, 2013 – October 7, 2013

**Date of site inspection:** May 14, 2013

**Type of review:** Discretionary

**Review number:** 2

**Triggering action date:** October 7, 2008

**Due date (five years after triggering action date):** 2013

**Five-Year Review Summary Form (continued)**

The table below is for the purpose of the summary form and associated data entry and does not replace the two tables required in Section VIII and IX by the FYR guidance. Instead, data entry in this section should match information in Section VII and IX of the FYR report.

**Issues/Recommendations**

<b>OU(s) without Issues/Recommendations Identified in the Five-Year Review:</b>
OU2

**Issues and Recommendations Identified in the Five-Year Review:**

OU5	<b>Issue Category: Remedy Performance</b>			
	<p><b>Issue:</b> Concentrations of trichloroethene (TCE) and Carbon Tetrachloride (CT) in groundwater in the Main TCE Plume (on-base and off-base), Fire Training Zone TCE Plume, and Headquarters TCE Plume have reached asymptotic conditions and remain above the CBGWS of 5 micrograms per liter (Regulation 41, CCR 1002-41). Locally within the TCE plumes, there is variability observed on a well by well basis from sampling event to sampling event and some wells display an increasing trend in detected concentrations. The significance of the variability and increasing trends is being considered in the ongoing assessment of the remedy effectiveness. Continued active treatment for TCE will not further reduce the residual mass found in the OU5 plumes.</p> <p><b>Recommendation:</b> Evaluate the suitability of and petition the Colorado Water Quality Control Commission for a site-specific standard for TCE and CT in accordance with the RAOs established in the Phase 2 CAP for OU5 (LAC, 2006). Absent applicable site-specific standard for TCE, a CDPHE-approved long-term monitoring plan is already in place; revise Phase 2 CAP as necessary.</p>			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	LAC	State	12/31/14
OU5	<b>Issue Category: Institutional Controls</b>			
	<p><b>Issue:</b> The boundaries for the State Environmental Covenant in the Fire Training Zone TCE Plumes area do not appear to coincide with the 2001 plume boundaries.</p> <p><b>Recommendation:</b> Determine basis for discrepancy of covenant boundary whether in legal description or cartographic representation. If necessary, redefine legal description for the plume boundaries and update State Environmental Covenant HMC0V00022 Attachment A.</p>			

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	LAC	State	12/31/14
OU5	<b>Issue Category: Institutional Controls</b>			
	<b>Issue:</b> There are no institutional controls in place north of the former base boundary.			
	<b>Recommendation:</b> Pursue Informational Institutional Controls			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	LAC	State	6/1/15
OU5	<b>Issue Category: Institutional Controls</b>			
	<b>Issue:</b> A search of the State Engineer's well database indicates two wells were permitted and installed in the 1950s within the boundary of the 2001 off-base Main TCE Plume. Wells designated for agricultural use; status of the wells is unknown.			
	<b>Recommendation:</b> Contact homeowners to assess the existence, condition, and uses of wells, if any. Take appropriate measures to eliminate potential exposure (e.g., well abandonment).			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	LAC	State	3/31/14

To add additional issues/recommendations here, copy and paste the above table as many times as necessary to document all issues/recommendations identified in the FYR report.

### Protectiveness Statement(s)

Include each individual OU protectiveness determination and statement. If you need to add more protectiveness determinations and statements for additional OUs, copy and paste the table below as many times as necessary to complete for each OU evaluated in the FYR report.

<i>Operable Unit:</i> OU2	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> <a href="#">Click here to enter date.</a>
<i>Protectiveness Statement:</i> The remedy at OU2 is protective. Exposure pathways that could result in unacceptable risk are controlled through the landfill cap, runoff control systems, implementation of the O&M plan, and the existing State Environmental Covenant (HMCOV00023) that runs with the land.		

<i>Operable Unit:</i>	<i>Protectiveness Determination:</i>	<i>Addendum Due Date</i>
-----------------------	--------------------------------------	--------------------------

OU5	Short-term Protective	<i>(if applicable):</i> Click here to enter date.
<p><i>Protectiveness Statement:</i> The remedy at OU5 is protective of human health and the environment in the short-term. Potential exposure pathways have been eliminated through the on-base State Environmental Covenant HMCOV00022, institutional controls, engineering controls, and aggressive remediation of the groundwater plumes. In order to be protective in the long term, a site specific standard will be pursued, the Phase 2 CAP will be revised as necessary, and other options will be considered such as off-base informational institutional controls, if needed. Groundwater monitoring following active treatment in OU5 continues to evaluate contaminant concentrations and the effectiveness of the remedy.</p>		

<b>Sitewide Protectiveness Statement (if applicable)</b>			
<i>For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.</i>			
<i>Protectiveness Determination:</i> Short-term Protective	<i>Addendum</i>	<i>Due Date</i>	<i>(if applicable):</i> 2018
<p><i>Protectiveness Statement:</i> Because remedial actions at OU5 are protective in the short-term, the site-wide protectiveness statement is protective in the short-term. In order to be protective in the long term, a site specific standard will be pursued, the Phase 2 CAP will be revised as necessary, and other options will be considered such as off-base informational institutional controls, if needed.</p>			

## **Executive Summary**

This Final Second Five Year Review addresses environmental remedial actions implemented at the Former Lowry Air Force Base (Lowry AFB), located in the City of Aurora (Arapahoe County) and the City and County of Denver, Colorado. Lowry AFB is not on the National Priorities List, but a Five Year Review is performed for Lowry AFB under the Consent Agreement with the Colorado Department of Public Health and Environment (CDPHE). The review is being performed by the Department of the Air Force as a matter of Air Force policy. Per Executive Order 12580, the Air Force is acting as the lead government agency for preparation of the five year reviews for Lowry AFB.

The Air Force began an environmental investigation program at Lowry AFB in 1983 under the Installation Restoration Program (IRP) records search, and the program was completed with investigations of sites identified during the Resource Conservation and Recovery Act (RCRA) Facility Assessment. Response actions have been (or are being) performed at 26 sites. These sites are comprised of five OUs, ten storage tanks, seven buildings, and four properties. At the time of this review, response actions at 24 of those sites had been completed allowing unrestricted land use. The remaining two remedial actions are being reviewed because the remedy resulted in hazardous materials, pollutants or contaminants remaining on site at concentrations that do not allow for unrestricted use or the actions are ongoing and will take more than five years to complete. The reviewed remedies include Operable Unit 5 Base-wide Groundwater (OU5) and Operable Unit 2 Landfill Zone (OU2).

### **Protectiveness Statement**

A Five Year Review was performed for remedies implemented at the Former Lowry Air Force Base, and the remedial actions at OU2 and OU5 are currently protective.

The remedy at OU5 is protective of human health and the environment in the short-term. Potential exposure pathways have been eliminated through the on-base State Environmental Covenant HMCOV00022, institutional controls, engineering controls, and aggressive remediation of the groundwater plumes. In order to be protective in the long term, a site specific standard will be pursued, the Phase 2 Corrective Action Plan will be revised as necessary, and other options will be considered such as off-base informational institutional controls, if needed. Groundwater monitoring following active treatment in OU5 continues to evaluate contaminant concentrations and the effectiveness of the remedy.

Construction of the remedy at OU2 was completed in 2005. The remedy is protective of human health and the environment based on the monitoring data. Exposure pathways that could result in unacceptable risk are controlled through the landfill cap, runoff control systems, implementation of the O&M plan, and the existing State Environmental Covenant (HMCOV00023) that runs with the land. Post-closure monitoring is ongoing in accordance with a CDPHE-approved plan. No issues were identified with the OU2 remedy which are not covered under the Operation Maintenance and Monitoring Plan.

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## Acronym List

ACTS	Air Corps Technical School
AF	US Air Force
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFRPA	Air Force Real Property Agency
AHS	Auto Hobby Shop
AOC	area of concern
ARARs	applicable or relevant and appropriate requirements
AS	air sparge
AST	aboveground storage tank
BAHCS	Boundary Area Hydraulic Containment System
bgs	below ground surface
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGA	Colorado Golf Association
CBGWS	Colorado Basic Groundwater Standard
CCCS	Colorado Community College System
CIP	Community Involvement Plan
CLP	Contract Laboratory Program
CT	carbon tetrachloride
ESCA	Cooperative Agreement for Environmental Services
FFS	Focused Feasibility Study
FOSET	Finding of Suitability for Early Transfer
FOSL	Finding of Suitability to Lease
FOST	Finding of Suitability to Transfer
FTZ	Fire Training Zone
GAC	granular activated carbon
GMP	groundwater monitoring program
GRO	gasoline-range organic
HQ	Headquarters
HVAC	heating, ventilation and air conditioning system
IRA	Interim Remedial Action
IRP	Installation Restoration Program
kg	Kilogram
KMnO <sub>4</sub>	potassium permanganate
LAC	Lowry Assumption, LLC
LAFB	Lowry Air Force Base

LCT	Lowry Cleanup Team
LERA	Lowry Economic Redevelopment Authority
LPL	low permeability layer
mg/L	milligrams per liter
MNA	monitored natural attenuation
NCP	National Contingency Plan
NFA	No Further Action Determination
NPL	National Priorities List
OFR	Outdoor Firing Range
O&M	Operations & Maintenance
ORC	oxygen releasing compound
ORP	oxidation reduction potential
OU	Operable Unit
OU2	Operable Unit 2
OU5	Operable Unit 5
OWS	oil/water separator
PID	photoionization detector
PRB	permeable reactive barrier
RAB	Restoration Advisory Board
RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RPI	Remediation Products, Inc.
SARA	Superfund Amendments and Reauthorization Act
SARS	Source Area Reduction System
SRI	Supplemental Remedial Investigation
SSDS	sub-slab depressurization system
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TPH	total petroleum hydrocarbons
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UU/UE	Unlimited use/unrestricted exposure
VOC	volatile organic compound
VFPE	very flexible polyethylene

## 1.0 Introduction

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) submits this Second Five Year Review associated with the Former Lowry Air Force Base (Lowry AFB), located in the City of Aurora (Arapahoe County) and the City and County of Denver, Colorado. Lowry AFB was closed as an active base under the Base Realignment and Closure Act (BRAC) in 1991. As of 2012, the U.S. Air Force no longer owns any of the property associated with Lowry AFB as the last parcel of land, the Buckley Annex (also known as Parcel CA-1), was transferred to the Lowry Economic Redevelopment Authority (LERA). However, due to Lowry AFB's status as a non-National Priorities List (NPL) former federal facility and BRAC site, AFCEC is conducting this five year review to be consistent with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121, which states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 9604 or 9606 of this title, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

In addition, under the National Contingency Plan (NCP), 40 CFR Section 300.430(f)(4)(ii), states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

On August 13, 2002, the Air Force Real Property Agency (AFRPA) and LERA entered into a Cooperative Agreement for Environmental Services (hereinafter referred to as ESCA or Cooperative Agreement) to obtain environmental services from the LERA to satisfy the responsibilities of the U.S. Air Force (AF) under the State of Colorado (State) and federal laws and regulations for responding to environmental contamination at Operable Unit 2 and Operable Unit 5 at the Former Lowry AFB, Denver, Colorado. On December 1, 2005, AFRPA and the LERA entered into the First Amendment to the Cooperative Agreement to perform additional environmental services under State and federal laws and regulations for responding to environmental contamination at Lowry AFB; including the performance of the CERCLA five year reviews. The LERA and LAC entered into a Remediation Agreement and amendments thereto in 2005, for LAC to assume responsibility and performance of the environmental services, including the responsibility for performing the required five-year reviews.

This Five Year Review is divided into eight sections, as follows:

- Section 1 – Introduction;
- Section 2 – Site Chronology and Background;
- Section 3 – Five Year Review Process;
- Section 4 – Operable Unit 5 (Base-wide Groundwater) Review;
- Section 5 – Operable Unit 2 (Landfill Zone) Review;
- Section 6 – Overall Protectiveness Statement;
- Section 7 – Next Review;
- Section 8 – References/Documents Reviewed.

As identified above, this Second Five Year Review is being conducted to be consistent with CERCLA Section (§) 121 and the NCP. The Comprehensive Five Year Review Guidance (United States Environmental Protection Agency [USEPA], 2001) was the primary guidance document used in preparing this review. This guidance provides an overview of the review process and describes roles and responsibilities of the lead and support agencies, components of the Five Year Review, and procedures for assessing the protectiveness of remedies. This review was based on the suggested Five Year Review Report Template, and includes the suggested topics where appropriate, but was tailored specifically to the process and remedial issues of Lowry AFB as recommended by the guidance.

The status of all 26 response actions implemented thus far at Lowry AFB were evaluated to identify those which would be reviewed in this Second Five Year Review. The 26 response actions reviewed were comprised of five OUs, ten storage tanks, seven buildings, and four properties (Table 1). The key reference documents for each were reviewed and cleanup action levels as well as future land use assumptions were evaluated. The cleanup action levels were compared to current standards to ensure that standards had not changed since the closure approvals were made. Two of the 26 response actions were reviewed: Operable Unit 2 (OU2) - the Landfill Zone and Operable Unit 5 (OU5) - Base-wide Groundwater (Figure 1). OU2 was reviewed because waste materials have been left in place and long-term post-closure monitoring is ongoing as required by the implemented remedy. OU5 was included because upon completion, it is expected that the contaminant concentrations will allow for unrestricted use; however, the approved remedial actions for this site have taken or will take more than five (5) years to complete. Table 2 summarizes the response actions carried forward for review.

During the regulatory review prior to finalizing this document, Colorado Department of Public Health and Environment (CDPHE) indicated concerns regarding two former response actions previously completed (i.e., OU3 and OU4) and two ongoing response actions (i.e., Primrose Property and Wetlands Park hydrocarbon in soil) at locations under the CDPHE-approved Soils Management Program for the former Lowry AFB. The issues raised by CDPHE for these four response actions are summarized in Table 3. Regulatory evaluation for these four response actions is ongoing and these actions are not discussed further in this Second Five Year Review. Pending the results

of CDPHE's evaluation, these response action issues may need to be addressed in the next five year review period as appropriate.

## 2.0 Site Chronology and Background

Lowry AFB opened in 1937, initially as the Air Corps Technical School (ACTS), and was closed in 1994 after being placed on the 1991 BRAC closure list. ACTS opened in 1937 on property formerly housing the Agnes Memorial Sanatorium, a tuberculosis treatment center, and was officially named Lowry Field in 1938. The base had numerous missions over its almost 60 year history, and a brief summary is provided below, excerpted from the RCRA Facility Assessment (RFA) (CH2M Hill, 2005).

Training in aerial photography and armaments began at Lowry AFB in 1938. Operations expanded rapidly to include Bombardier instruction and flight activities by 1940 and even cook's and baker's courses by 1941. During World War II, Lowry AFB was tasked with training 55,000 men annually, utilizing a 7-day/three shift training schedule. Following the war, enrollment declined by up to 60 percent, and Lowry AFB was processing up to 300 discharges a day. During the Korean Conflict, Lowry AFB's photography and armament programs expanded again to include courses in advanced aviation technologies. The US Air Force Academy was established at Lowry AFB in 1955 during construction of their permanent facilities in Colorado Springs. Following the Korean Conflict, flight activities at Lowry AFB ended (1966), Titan I silos were installed in the Lowry Bombing range located in Aurora, Colorado well east of the base, and training courses in intelligence and in preparation for fighting in Southeast Asia were added. From 1966 to 1975, Lowry AFB's mission included retraining of airmen convicted of military crimes and training in supply, aerospace sciences. During its last phase, Lowry AFB became home to the Air Force Accounting and Finance Center, and provided training in the space operations career field, Peacekeeper reentry vehicle, and intelligence.

Lowry AFB was officially closed in September 1994; the closure involved extensive coordination among numerous parties to allow for reuse of the property while at the same time addressing environmental concerns. LERA was established in 1994 to redevelop Lowry AFB according to a community reuse plan, excluding the Buckley Annex property. The LERA serves as the master planner and developer of the former base and the AF performs environmental investigation and cleanup. In 2002, the AF privatized the cleanup of groundwater and closure of the landfill, and in 2005, the remainder of the environmental program was privatized (with a few exceptions), both to LAC. LAC's obligations include the remediation of AF legacy conditions in OU2 and OU5, the requirement for LAC to implement a Soils Management Plan with the purpose of minimizing the impact of any AF legacy environmental conditions in soil identified during development; to administer institutional controls placed on Finding of Suitability for Early Transfer (FOSET) parcels; and to perform associated deed activities. A full description of the environmental program at Lowry AFB can be found in the RFA (CH2M Hill, 2005; Administrative Record (AR)\_1011, 1015, and 1028, at the Air Force Administrative Record website: <https://afarpaar.lackland.af.mil/ar/docsearch.aspx>) and the scope of the privatized cleanup can be found in the amended privatization agreements within the FOSET (LAC 2005; AR\_1156).

### 3.0 Lowry AFB Five Year Review Process

This Review is being performed by LAC on behalf of the AFCEC. The review was conducted in the second quarter 2013 and reviewed and revised in the third quarter 2013. LAC is under contract to the AFCEC through the Remediation Agreement referenced above.

A number of remedial actions have been performed at Lowry AFB, and for this Second Five Year Review, an evaluation of all those actions has been performed. All available documents in the information repository at the offices of the LERA and within the Administrative Record were drawn upon for this review. For the remedies subject to review, the five year review will be performed and will include community involvement, document review, data review, site inspections, input from community members, and a technical assessment. For each remedy, as issues are identified, recommendations for follow-up action will be made, and a protectiveness statement will be developed. This Five Year Review evaluates whether remedies at Lowry AFB are protective of human health and the environment through documenting methods, findings, and conclusions of the review, and identifies issues and recommendations to address them, if any arose during the process.

#### 3.1 Review of Lowry AFB Remedial Actions

The Air Force began the environmental program at Lowry AFB in 1983 with the Phase 1 Records Search. Work continued as Lowry AFB was closed in 1994 and redevelopment of the former base into a mixed use community began. Numerous base-wide assessments/investigations and remedial actions have been performed at Lowry AFB. A review of these activities was performed in the RFA (CH2M Hill, 2005; AR\_1011, 1015, and 1028), which evaluated each of the over 1,100 facilities and various IRP sites. Sections 3.3 and 3.4 of the RFA Report provide a thorough presentation of previous environmental investigations and response actions at Lowry AFB.

In 2002, the AF privatized the environmental services associated with Lowry AFB, including the closure of the former landfill and cleanup of base-wide groundwater, and in 2005, the AF privatized the environmental services associated with most of the remaining soil issues (LAC, 2002, AR\_991, and 2005, AR\_1156).

Additional investigation was completed at several sites identified in the RFA (CH2M Hill, 2005) (referred to as RFA Unknowns). All RFA Unknown sites were investigated and have received NFA's from the CDPHE.

As of the writing of this Second Five Year Review, 24 of the 26 sites with response actions at Lowry AFB have been closed, while two are currently in the response action or remediation phase (Table 1). As discussed in Section 1, two sites are being carried forward for further discussion in this Second Five Year Review (Table 2).

### 3.2 Community Involvement

Notice of the Second Five Year Review was initially made to the stakeholders and other interested parties through discussions at the Lowry Cleanup Team (LCT) meeting on January 23, 2013. The LCT is made up of representatives of CDPHE, AFCEC, USEPA, City and County of Denver, City of Aurora, the LERA, and LAC. Notice was published to the general community in April 2013 through a public notice in the Denver Post circulation. A copy of the notice was also posted on the Lowry Community Master Association's local communication vehicle managed on the World Wide Web ([www.lowry.org](http://www.lowry.org)) (Appendix A - Notices).

Public notice of the availability of the Second Five Year Review, when available, will also be made. A copy of the final document will be placed in the information repository at LAC's office, and will be added to the Administrative Record located on the Web at <https://afarpaar.lackland.af.mil/ar/docsearch.aspx>. A copy of the final document will also be available at the CDPHE Records Center.

In accordance with the Consent Agreement among the CDPHE, LAC, and LERA there is active communication among the parties of the Lowry AFB privatization (LERA, US Air Force, CDPHE, and LAC), and with the community through forums set forth in the CDPHE-approved Community Involvement Plan (CIP) for the Former Lowry Air Force Base (LAC, 2009). The parties currently meet quarterly as the LCT and work together to complete remediation in accordance with applicable regulations and the Consent Agreement, while allowing development to continue within the framework of these requirements. The quarterly meetings of the LCT and more frequent meetings between parties as needed allow for issues to be discussed and resolved as they occur.

The original *Draft Final Lowry Community Relations Plan* was released in 1997 by the Air Force Real Property Agency (Air Force) to facilitate two-way communication with the community on and surrounding Lowry AFB. The Community Relations Plan was updated in April 2005 due to the privatization of environmental services by the Air Force with LERA and LAC. The 2009 update prepared by LAC was based upon and meets the Office of Solid Waste and Environmental Regulation directives associated with Community Involvement Plans. The 2009 CIP replaces the Community Relations Plan released by the Air Force in April 2005 and has been updated to reflect the perspective of the current Lowry community. The plan addresses community involvement for the environmental program and identifies where to find information about the progress on the clean-ups, and who to contact with concerns. The CIP excludes the Buckley Annex. LAC anticipates updating the CIP in late 2013.

In cooperation with CDPHE, LAC conducted one-on-one interviews with 29 community members in April and May 2009 representing a broad cross-section of stakeholders. Data collected during the interviews showed several trends in public interest with respect to the environmental cleanup program. The interviews also provided insight into how communication for Lowry AFB could be structured to ensure all interested parties

are informed and involved. In general, the participants in the community interview process believed that the environmental cleanup at Lowry AFB was near completion. Most of those interviewed were interested in periodic updates about the cleanup process. Of those interested in updates, all indicated that they would prefer the information to be brief and appropriate for the layperson with references to websites or documents where more detailed information could be found. All participants were asked about the RAB and generally supported its adjournment, documented in the RAB Adjournment Memo (LAC, 2009) because of the status of the environmental program.

Three principal interests in the environmental program emerged as themes during the community interview process for the revised CIP. These included: the landfill (OU2), groundwater contamination, and the future discovery of contaminants in soil and groundwater.

Based on the information gathered through interviews for the revised CIP, LAC developed three goals to provide interested parties with regular information about the cleanup program and to provide opportunities for continued community input. Specific goals and the associated public involvement activities detailed in this plan include:

- Identify residents and community members interested in the environmental program at Lowry; increase awareness of current resources for information; and distribute information to all interested parties.
- Provide regularly updated information on site activities.
- Provide continued opportunities for dialogue and community input appropriate to the level of activity in the cleanup program at Lowry AFB.

A copy of the 2009 Community Involvement Plan is included in Appendix B.

Under the Consent Agreement (Paragraph 52),

*“The parties are committed to seeking active public involvement during all phases of the site characterization, corrective actions, long-term monitoring, and site close-out at LAFB. Towards that end, the parties agree to support the Restoration Advisory Board (“RAB”) and other similar community groups (e.g. Lowry Community Masters Association/Lowry Neighbors, East Montclair Neighborhood Association, and the Lowry Foundation), to enable them to provide advice to the LERA, LAC and the Department with respect to key remediation decisions.”*

The Restoration Advisory Board (RAB) was formally adjourned in 2009 in accordance with 32 CFR §202.10, Restoration Advisory Board (RAB) Adjournment and Dissolution. The basis for the adjournment and details of the adjournment process are described in detail in the RAB Adjournment Memorandum dated December 11, 2009. A copy of the memorandum is included in Appendix B. The memorandum is accessible on the Community Involvement page on the project website ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com)).

The LAC project website, [www.lowryafbcleanup.com](http://www.lowryafbcleanup.com), was set up in 2008 as a public source for updated information regarding the remediation progress at Lowry AFB.

### 3.3 Interviews

Under Section 3.5.2 of the Guidance document, "...interviews should be conducted, if necessary, to provide addition information about a site's status. The scope of the interviews should be tailored to the remedy evaluation on a site-specific basis." During the previous Five Year Review, AFCEC conducted thorough interviews as part of the RFA to gain as much information as possible regarding facilities work practices used by the AF and potentially related environmental impacts. Since the last Five Year Review was completed, LAC continues active communications among the parties of the privatization and the community through regular meetings of the LCT and communication vehicles within the LERA.

During the RFA, the AF contacted 222 individuals associated with Lowry (See Appendix C, RFA). The data collected in the AF interviews were critical in documenting the environmental history of the base, confirming previous research, and gathering some new information used in the evaluation. In response to these interviews, CDPHE requested that AFCEC follow up on several of these interviews for additional information, which the AF completed.

Using the AF interview information as a basis, interviews during this second Five Year Review focused on the major property owners of the Lowry community as well as state and local regulatory agencies familiar with the remediation progress at Lowry AFB. Questionnaires were sent via electronic mail to the following parties:

- Lowry Community Master Association, Ms. Mary Carr
- Colorado Golf Association, Mr. Ed Mate
- Colorado Community College System, Mr. Mark Superka
- Lowry Economic Redevelopment Association, Mr. Monty Force
- U.S. Air Force, AFCEC, Mr. Stanley Pehl
- U.S. Environmental Protection Agency, Region 8, Ms. Pat Smith
- Colorado Department of Public Health and Environment, Mr. Lee Pivonka
- City and County of Denver Department of Environmental Health, Mr. David Erickson
- City of Aurora Planning Department, Environmental Management Section, Mr. Don Roche
- IRG Redevelopment I, LLC, Mr. Brent Anderson
- Lowry Assumption, LLC, Mr. Paul Weaverling

Respondents provided a completed questionnaire form and follow-ups were conducted by telephone to address any significant issues raised by the respondents. Mr. Lee Pivonka (CDPHE) provided an amended response on June 6, 2013. Copies of the submitted responses from the parties listed above are compiled in Appendix C. As of the date of this Second Five Year Review,

there has been no response received from either the Colorado Community College System (CCCS) or the City of Aurora. A representative of the CCCS was contacted via telephone by LAC as a follow-up to the original interview request. A follow up email request to complete the interview questionnaire was also sent to the City of Aurora.

### Summary of Interviews

In general, there was very little concern conveyed through the interview process regarding the current status and operation of the remaining remedies in place at OU5 and OU2 by the regulatory agencies, major land owners, or the Lowry community. The Lowry Community Masters Association (LCMA) Executive Director and the current Board of Directors did voice some concern that they were not as well informed as they desire to be regarding the remaining remedies in place at Lowry AFB. To address these concerns, LAC will again provide the LCMA with the current Community Involvement Plan and provide annual project updates to the LCMA board in the future.

CDPHE's response (and amendment) requested that a questionnaire be sent to Ms. Christine O'Connor representing *Lowry United Neighborhood Zoning*. A questionnaire was sent to Ms. O'Connor. A copy of her completed questionnaire is included in Appendix C.

CDPHE also noted the concern that solid waste was left in place at the Fly Ash Disposal Area (OU3) and solid waste was apparently left in place beneath the 6th Avenue portion of the Coal Storage Yard (West) (OU4). Per CDPHE's response, "It is the Division's understanding that because solid waste was left in place at OU3, an Environmental Covenant may be appropriate for this operable unit to ensure long-term protectiveness." Regarding the portion of OU4 beneath 6th Avenue, CDPHE noted "...it is the Division's understanding that an Environmental Covenant was proposed in the OU4 decision document to ensure long-term protectiveness, but an Environmental Covenant was not attained." Several respondents also voiced concern over the proposed redevelopment of OU2 known as Lowry Vista. Although Lowry Vista is in its early conceptual phase and at some point in the future may be redeveloped for a different use, the effectiveness of the remedy at OU2 did not change during the Second Five Year Review period. Should any changes to the remedy occur at OU2 in the future, discussions of those changes and concerns from the community regarding the redevelopment will be addressed during a subsequent Five Year Review.

### 3.4 Site Inspection

As recommended in the Guidance, recent site inspections have been performed for each of the two review sites. The documentation for those inspections is provided in Appendix D. In addition, through the implementation of the Soils Management Program (amended in 2008 and 2013), LAC performs inspections at all soil disturbing activities to

identify unknown environmental conditions and does daily rounds of the former base property. Issues related to the impact of remediation or the environmental investigations would be observed during this activity.

## 4.0 Operable Unit 5 – Base-wide Groundwater

### 4.1 Site Chronology

Table 4 provides a chronology of environmental investigations and remedial activities at OU5.

### 4.2 Background

There are three trichloroethene (TCE) plumes and one carbon tetrachloride (CT) plume within OU 5. These include the following:

- Main TCE Plume
- Headquarters TCE Plume
- Fire Training Zone Plumes
- Carbon Tetrachloride Bedrock Source Area

These plume areas are illustrated on Figure 1 and are introduced in the following section.

#### Main TCE Plume

The Main TCE Plume originated from a source in the old firing range facilities near the eastern base boundary and a second source(s) near former Building 1432 and the Auto Hobby Shop (AHS – Building 1431). At its maximum extent, the plume extended roughly three miles northward from the Outdoor Firing Range source area to a point beneath the western part of the former Stapleton International Airport (Figure 1).

The origin of the Outdoor Firing Range (OFR) portion of the Main TCE Plume is likely from the release of chlorinated solvent at the firing range facilities. The released solvents entered weathered and fractured bedrock beneath a relatively thin interval of unsaturated alluvium. The second source for the Main TCE Plume is likely associated with past activities at the AHS and several former underground storage tanks (USTs) located at former Building 1432 that were removed. In the Outfall Source Area at the AHS, solvents apparently passed through the drain system and into the subsurface adjacent to Westerly Creek (Versar, 2001 OU5 RI). At Building 1432, historical site drawings reviewed by the AF indicated that spent solvent wastes were stored in at least one of the USTs. Small and large holes were observed in each of the tanks when removed (Earth Tech, 2003).

As an interim action at the Outfall Source Area, the AF installed the Source Area Reduction System (SARS). The SARS enclosed a remnant source area where elevated concentrations of chlorinated solvents were present in the soil column overlying bedrock and in both alluvial and bedrock water-bearing zones.

Within the former base boundary, property over the plumes is being developed for commercial and residential reuse and open space. One property and the existing building over the plume was redeveloped for use by Bonfils Blood Center (FOSET, 1999; Deeded, 2000). With the second FOSET (LAC, Dec. 2005), the remainder of the plume property was transferred from the AF to the LERA for development. Residential development has occurred in the former OFR area, the Lowry Lane Area located adjacent to 8<sup>th</sup> Avenue and Uinta, and in the Northwest Neighborhood located adjacent to 11<sup>th</sup> Avenue and Uinta. The central portion of the Main TCE Plume is primarily underneath the new Great Lawn Park and the Wetlands Park upstream of Kelly Road Dam. Land use over the northern off-base section of the plume is primarily residential.

#### Headquarters TCE Plume

The Headquarters (HQ) TCE Plume, located beneath the current Town Center near 2<sup>nd</sup> Avenue and Quebec Street, has migrated to the northwest from its source area (Figure 1). The source of the HQ TCE Plume appears to have been leakage from an oil/water separator at a former Air Force building to a storm sewer that runs along the southeastern side of 1<sup>st</sup> Place. During the removal of the oil-water separator in 2001, TCE was detected in a sample of the separator contents but was not detected in the surrounding or underlying soil. It was believed that leakage from junction vaults in the sewer system may have occurred resulting in the release of TCE to the environment.

In the source area of the HQ TCE Plume, the highest dissolved-phase TCE concentrations occurred in groundwater within bedrock. The source area was over an erosional bedrock high where the water table has historically fluctuated above and below the bedrock-alluvium contact. North and west of the suspected source, the plume entered the Cherry Creek paleochannel, a major alluvial paleochannel incised in the top of the bedrock surface.

Land use in the vicinity of the HQ TCE Plume is commercial. The Lowry Town Center was leased under a Finding of Suitability to Lease (FOSL) and then transferred to the owner following the FOSET approval in December 2005.

#### Fire Training Zone TCE Plumes

Several small, unconnected areas with TCE impacts in shallow bedrock are present in the former Fire Training Zone (FTZ) which is located adjacent to 1<sup>st</sup> Avenue on property owned by the Colorado Golf Association (CGA) (Figure 1). There are several potential sources for the TCE encountered in bedrock at the FTZ. These include leachate from former pits used for fire training activities, a former septic leach field, and/or potential solvent releases related to activities in nearby buildings. Based on historical groundwater monitoring data, the plumes remain isolated in bedrock from potential migration pathways.

The designated land use for the area encompassing the former FTZ is recreational/open space. The CGA has rebuilt the Common Ground Golf Course that covers a portion of the FTZ and plans for the remaining area include the future development of an outdoor golf instruction facility for its youth program.

### Carbon Tetrachloride Plume

Carbon tetrachloride (CT) was detected in the bedrock water-bearing zone in the center of the Main TCE Plume in the area of monitoring well ETMW03 (in the vicinity of 8<sup>th</sup> Avenue and Uinta). The apparent CT source area is located adjacent to Uinta Way and East 8<sup>th</sup> Avenue within the Wetlands Park open-space south of the Kelly Road Dam. In 2004 and 2005, LAC conducted an investigation to assess the extent of CT and to quantitatively assess the source mass. The investigation indicated that the original source was likely the result of localized disposal in the 1940's, and the continued detections are due to the presence of the compound in discontinuous bedrock fractures. In 2006, additional delineation of the area was performed to complete the characterization of the extent of the CT in groundwater and soil (LAC, February 2007). The location of the CT source area is shown on Figure 1.

The designated land use for the area encompassing the Carbon Tetrachloride source area is open space/parks. The area lies within the confines of the Wetlands Park which in turn is situated within the Kelly Road Dam flood pool.

#### 4.2.1 Interim Remedial Actions

Interim Remedial Actions (IRAs) to mitigate chlorinated solvent releases in OU5 have included the following:

- installation of a Permeable Reactive Barrier (PRB) containing zero-valent iron as a pilot test to address a portion of the Main TCE Plume near the Outfall Source Area,
- installation, operation, and monitoring of the Boundary Area Hydraulic Containment System (BAHCS) to cut-off the Main TCE Plume at the northern base boundary,
- installation, operation, and monitoring of the SARS at the Outfall Source Area,
- installation of active sub-slab depressurization systems (SSDS) at the off-site Heritage Estates apartment complex, and one home overlying the Main TCE Plume north of the base to minimize potential exposures to VOCs via the vapor intrusion to indoor air pathway, and
- removal of USTs at former Building 1432 source area.

#### Permeable Reactive Barrier Demonstration Treatment System

A zero-valent iron PRB was installed in 1995 as a technology demonstration across a portion of the Main TCE Plume just north of the SARS. The intent of the technology demonstration was to passively treat chlorinated solvent compounds *in situ*. The system consisted of an iron filing wall installed perpendicular to the groundwater plume and using sheet piling walls to assist in funneling groundwater containing dissolved-phase chlorinated solvents through the treatment zone of zero-valent iron. The iron facilitates the reductive dechlorination of dissolved-phase chlorinated solvents which are reduced to non-detectable concentrations within the treatment zone of the wall. The PRB did not fully intersect the plume as it was constructed as a small scale demonstration and provided treatment to only a small portion of the Main TCE Plume.

Details of the construction are described in the Final Reactive Wall Test Design (Versar/Dames & Moore, 1995) and the initial results of the operation are described in the Final Evaluation of Long-Term Performance of the Reactive Wall Demonstration Project (Versar/Dames & Moore, 1997). The PRB was not effective and remains in place within Wetlands Park.

#### Boundary Area Hydraulic Containment System

The BAHCS was installed to intersect the Main TCE Plume along the northern base boundary (Figure 1). It was installed in 1996 as part of a treatability study by the Air Force and was operated as an IRA to reduce the migration of dissolved-phase chlorinated solvents beyond the base boundary. The system consisted of seven groundwater capture wells, an air stripper for primary treatment of groundwater, GAC to treat vapor phase constituents from the air stripper, and re-injection of treated groundwater into the alluvial water bearing zone. The system was decommissioned in April 2005 after system efficiencies had decreased to the point of no longer providing effective capture and treatment of the Main TCE Plume at the base boundary.

#### Source Area Reduction System

In 1998, the AF installed the SARS downstream from the Outfall Source Area and the Building 1432 USTs to reduce a primary source of contaminants contributing to the Main TCE Plume. Soil and groundwater in the source area were isolated by bentonite slurry walls keyed into bedrock. Westerly Creek, a perennial stream that intersects the source area, was isolated by an impermeable liner. Inside the slurry wall boundaries, an extraction system was installed consisting of wells to extract soil vapor and groundwater. Soil vapor recovered from the containment zone was initially treated by GAC before discharge to the atmosphere. A small stream of condensate water was pumped to the BAHCS for treatment through the air stripper before being re-injected into the alluvial aquifer. Details of the system construction and operation are in the Final Source Area Reduction System Field Pilot Study Implementation Plan (Versar, 1999) and the Final Source Area Reduction System Performance Monitoring and Operations and Maintenance Plan (Versar, 2000). This system initially removed over 98 pounds of solvent; however, removal of mass decreased significantly over time. The extraction well and treatment system was decommissioned in April 2005; the slurry wall remains intact.

#### Sub-slab Depressurization Systems

In 1999, the AF installed active SSDS in 12 apartment buildings at the Heritage Estates apartment complex and in 2003, one single family residence which overlies the plume north of the base boundary. The actions were the result of the Groundwater to Indoor Air pathway Investigation (Versar 2001; AR\_1029). The system at Heritage Estates (now known as Lowry Heights – Figure 1) consists of 54 centrifugal fans that create negative pressure beneath the building foundation slabs, preventing groundwater-derived VOCs from migrating into the overlying structures (Versar, 1999). Sampling indicated that the system was effective in creating a negative pressure zone beneath the buildings. Following the Phase III Groundwater to Indoor air Pathway Investigation (Versar, 2003) a system was also installed in one home (UAO03 – Figure 1) because

the TCE concentration in an indoor air sample from the residence slightly exceeded target levels derived from a Reasonable Maximum Exposure estimate. These systems are periodically inspected for functionality and repaired as necessary; all systems were operating at the time this second five-year review was prepared.

#### Building 1432 Tank Removal

Seven waste USTs and one diesel UST were removed from an area adjacent to the north side of Building 1432 in August 2002. As-built drawings indicated that the waste USTs were intended to contain spent solvent, detergent, wash water, and acid wastes. Based on visual inspection during the UST Removal, all of the tanks were determined to have leaked at some time in their service life. Following removal of the tanks and the associated soil, a NFA determination was issued by CDPHE for soil at the site. The nature and extent of groundwater contamination resulting from the leaking tanks is being addressed under the OU5 remediation.

### 4.3 Basis for Taking Action

Chlorinated solvents, primarily TCE, are present in the groundwater plumes at Lowry AFB with detected concentrations above the Colorado Basic Groundwater Standard (CBGWS). The TCE plumes pass beneath existing residential structures between 11<sup>th</sup> Avenue and Montview Avenue and under newly redeveloped areas at both Lowry AFB and Stapleton. A CT source area and areally limited impacts in bedrock with detected concentrations above the CBGWS were discovered in an on-base location beneath the current Wetlands Park area. There are no direct ingestion or dermal exposure pathways for TCE or CT from groundwater because the aquifer is not used for drinking water. The exposure pathway via vapor intrusion was considered potentially complete for TCE.

### 4.4 Remedial Action

#### 4.4.1 Remedy Selection

Applicable or Relevant and Appropriate Requirements (ARARs) for remediation of the plume were evaluated in the Phase 1 CAP for OU5 (LAC, March 2005), which presented remedial objectives and evaluated a range of potential alternatives for the remediation. The remedial action objectives (RAOs) set forth in the Phase 2 CAP for OU5 (LAC, 2006) are as follows:

- Groundwater cleanup will be performed to achieve concentrations that are acceptable to the State of Colorado, and will be achieved through enhanced mass removal and a polishing period where it will be shown that the initial enhanced mass removal has reduced the risk to human health and the environment. Groundwater sampling will be performed and will demonstrate compliance with the CDPHE requirements in a reasonable timeframe.

- The State of Colorado has "Basic Standards for Groundwater", under Regulation No. 41, which are set by the Water Quality Control Commission of the CDPHE (<http://www.cdphe.state.co.us/op/reggs/waterregs/100241basicstandardsforgroundwater.pdf>). Currently the groundwater standard for trichloroethylene is 5 micrograms per liter ( $\mu\text{g/L}$ ). This standard will be the final cleanup goal for TCE in the groundwater on or downgradient of the Lowry AFB site. If at some future date, it is determined that this standard is not achievable, the Water Quality Control Commission will be petitioned for a site-specific standard. The ultimate cleanup goal will be established based on technical feasibility, the long term risk from the groundwater to indoor air exposure pathway and protective of groundwater. Where technically feasible at the Lowry site, TCE concentrations in groundwater will be remediated to levels that are protective of the groundwater to indoor air pathway in accordance with the CDPHE Policy on Interim Risk Evaluation and Management Approach for TCE, August 20, 2004. In the event that it is technically infeasible to achieve these levels through groundwater cleanup, other methods will be employed to address the risk to the groundwater to the indoor air pathway.
- Where source areas are encountered in groundwater, technologies to remove source materials will be employed. If these technologies are not effective, then technologies to contain source areas will be evaluated, implemented, and maintained as necessary to protect human health and the environment.
- Potential indoor air risks due to the presence of COC concentrations in groundwater will be addressed through active and aggressive removal of contaminant mass in the groundwater source. This approach presumes that the best approach to controlling the indoor air pathway is to remove the majority of the source materials in the groundwater within a reasonable timeframe.
- Preference should be given to technologies that can rapidly and cost-effectively reduce chlorinated solvent concentrations in groundwater relative to other technologies.
- Technologies employed to reduce the COC concentrations in groundwater should consider the impact of the technology on public and private properties. Impacts to be considered include but are not limited to: noise, road closures, remedial infrastructure installed on private property, deleterious effects on utilities, and remedial activities on or within private properties.
- Technologies employed to reduce the COC concentrations in groundwater should consider the impact of the technology on surface water and sediment.

- Investigation and remediation derived wastes shall be handled in an appropriate manner.
- Off-gasses generated during remedial activities will be dealt with in accordance with the Colorado Air Regulations.
- NFA for any plume area will require sufficient quarterly groundwater monitoring to demonstrate that the contaminant concentrations are below the levels acceptable to the State and that these levels will not rebound above the acceptable levels.
- Following receipt of NFA, site restoration activities will be performed, including removal of any treatment buildings, decommissioning of any wells and piping, and abandonment-in-place of any subsurface features.

The established RAOs were used to evaluate and to select remedial technologies for the OU5 TCE groundwater plumes. Remedial alternatives were evaluated for five geographic areas resulting in the following recommendations:

- Northern off-site plume, north of 17<sup>th</sup> Avenue – phased potassium permanganate (KMnO<sub>4</sub>) treatment program, including installation of an injection barrier along 17<sup>th</sup> Avenue and injection in high concentration areas to address adsorbed mass.
- Northern off-site plume between 11<sup>th</sup> and 17<sup>th</sup> Avenues - KMnO<sub>4</sub> injections in core of plume and possibly injection barriers along 11<sup>th</sup>, 14<sup>th</sup>, and 16<sup>th</sup> Avenues.
- Main TCE Plume - KMnO<sub>4</sub> injections directed at areas with highest concentrations including former Building 1432, at least one Air Sparge/Soil Vapor Extraction (AS/SVE) cutoff.
- Headquarters Plume – AS/SVE downgradient of source (2003 treatability studies targeted source area with KMnO<sub>4</sub>) monitoring and reevaluation.
- Fire Training Zone - KMnO<sub>4</sub> injection in three low concentration plumes.

The CT source area was not fully characterized until after the finalization of the Phase 2 CAP for OU5 (LAC, 2006). The detected concentrations were in excess of the applicable CBGWS for CT (5 µg/l; Regulation 41, CCR 1002-41, release occurred prior to September 14, 2004). Following the RAOs established in the Phase 2 CAP for OU5, several work plans were prepared as addenda to the Phase 2 CAP to identify a potential remedy for the CT source area (LAC, 2007; LAC, 2008). In situ chemical oxidation (activated sodium persulfate) was the preliminary selected remedy and was applied as an interim action. Based on only moderate results, a second remedial technology was selected and implemented - the application of an in situ reductive dechlorination technology (BOS-100<sup>®</sup> trap and treat carbon-based media).

All recommended remedial alternatives included performance monitoring.

#### 4.4.2 Remedy Implementation

The Phase 2 CAP (LAC, December 2006) describes the implementation of the preferred remedy: extensive use of chemical oxidation using  $\text{KMnO}_4$  and limited use of AS/SVE. The CAP specified:

- locations and depth intervals for chemical injections;
- calculations for volume and concentration of injectant;
- the design of the Uinta Street AS barrier;
- injection into and evaluation of the SARS;
- description of the performance monitoring program;
- documentation of how state standards and RAOs are supported by the remedy;
- operation and maintenance processes; and
- quality control and program review guidelines.

A change to the remedy proposed in the Phase 1 CAP in the HQ Plume area was documented in the Phase 2 CAP. Following evaluation of the treatability study data, the implementation plan calls for pressure driven  $\text{KMnO}_4$  injection rather than installing an AS/SVE system in that area.

#### Uinta Street AS/SVE Barrier

During installation of the proposed AS/SVE injection barrier along Uinta Street, the system was converted to a  $\text{KMnO}_4$  injection barrier (LAC, March 29, 2005) (Figure 1). The subsurface lithologies encountered at the planned barrier location were significantly more fine-grained than the treatability test plot located several hundred yards upgradient. Field testing of the preliminary AS/SVE array installed indicated that the fine-grained soil encountered at the barrier system location prevented acceptable recovery in the SVE wells. The initial  $\text{KMnO}_4$  treatment at the Uinta Street barrier was injected under pressure and subsequent monthly treatments were by gravity feed. The  $\text{KMnO}_4$  injections have been terminated and the injection well points have been abandoned.

#### $\text{KMnO}_4$ Injections

Direct injections of  $\text{KMnO}_4$  into the OU5 water-bearing aquifers for the treatment of TCE began in Fall 2004 and extended through Fall 2010. The intent of the injections was to reduce source area contaminant mass and potential exposures within the boundaries of the plumes. The source areas including the OFR, the Building 1432/Outfall, and the HQ Area were targeted through increased density and volume of injection. In total, five rounds of chemical oxidant groundwater treatment were completed in on-base locations and three rounds were completed in the Northern Offsite Main TCE Plume. The reference source documents summarizing the OU5  $\text{KMnO}_4$  injections are included in Table 4. Table 5 summarizes the  $\text{KMnO}_4$  injection history for the treatment of TCE in groundwater within OU5. Plate 1 illustrates the composite locations of all  $\text{KMnO}_4$  injections completed within OU5.

The methods for determining injection spacing and volumes are described in the Phase 2 CAP and subsequent addenda. In general, the  $\text{KMnO}_4$  solution was injected under pressure through Geoprobe rods advanced to the target depths using a direct push rig. The volume of injectant required for each remediation area was based on estimates of dissolved-phase and sorbed TCE mass in bedrock and alluvial water-bearing zones. Performance monitoring was conducted through the Long Term and Performance Monitoring Semiannual Groundwater Sampling and Analysis Groundwater Monitoring Program (GMP) for OU5. The results of the semiannual monitoring events are included in a series of reports submitted to the CDPHE since June 2003 as part of the requirements of the Long Term and Performance Monitoring Semiannual Groundwater Sampling and Analysis GMP for OU5.

#### 4.4.2.1 Corrective Action Plan Addenda

Additional characterization/remediation has been performed at several sites as CAP Addenda including:

- Phase 2 CAP Addendum for the Conversion of the Planned Uinta Street AS/SVE to an Injection Barrier (LAC, March 29, 2005) –  $\text{KMnO}_4$  was gravity fed into this barrier system that consisted of 16 piezometers arrayed perpendicular to the plume axis. Eight injection events were completed between April 2005 and March 2007; the injection points were abandoned in 2010.
- Phase 2 CAP Addendum – Work Plan for Monitoring Well Installation and Groundwater Sampling – Yosemite Street Gate (LAC, October 2006) – following installation of the well and sampling, an NFA was issued by the CDPHE for this site in May 2007.
- Phase 2 CAP Addendum for Remediation of CT in Bedrock Waterbearing Zones in the Vicinity of Well ETMW03 (LAC, February 2007) – injection of sodium persulfate was performed in the CT source area and bedrock plume in Summer 2006. After conducting bench-scale and pilot-scale tests to assess the effects of activated sodium persulfate on CT, 34,750 gallons of 4.74 percent Klozur® Persulfate and 1.44 percent sodium hydroxide solution were injected into bedrock water-bearing zones at 55 locations. Post-injection monitoring showed only minor reductions of CT concentrations in the source area.
- Phase 2 CAP Addendum – Remediation of Carbon Tetrachloride in Bedrock Waterbearing Zones in the Vicinity of Well ETMW03 (LAC, April 2008; February 2009, February 10, 2011) – injection of BOS-100® trap and treat carbon-based media was performed in the CT source area and bedrock plume in Summer 2008 followed by a localized treatment in 2010. After conducting bench-scale treatability studies and field injection testing for delivery and radius of influence, the 2008 injections consisted of 15,000 pounds of BOS-100® injected in 81 points in the bedrock source area and 83 points in the overlying saturated alluvium. In 2010, a follow-up injection event consisting of 600 pounds of BOS-100® delivered at 17 bedrock points was

completed in the vicinity of well MWCT08 to address localized residual concentrations of CT still above the CBGWS.

- Phase 2 CAP Addendum - BOS-100<sup>®</sup> Injections to Address Remnant Concentrations of TCE (LAC, April 2008; February 2009, February 10, 2011) - injection of BOS-100<sup>®</sup> trap and treat carbon-based media was performed within the SARS boundary walls in 2009 and 2010. The 2009 injections consisted of BOS-100<sup>®</sup> injected in 63 points in the saturated alluvium. In 2010, a follow-up injection of BOS-100<sup>®</sup> was delivered at 50 points.

#### 4.4.3 System Operations/Operations and Maintenance

Remediation was performed by injection of treatment compounds directly into the subsurface; therefore, there was no system Operations and Maintenance (O&M) required. Monitoring the effectiveness of the injections is being accomplished through performance groundwater monitoring.

#### 4.4.4 Institutional Controls

The properties overlying the on-base plumes were transferred under separate deeds with separate FOSETs in accordance with CERCLA §120. The first FOSET reviewed the property currently occupied by the Bonfils Blood Center in August 1999. The second FOSET in December 2005 reviewed the remainder of the AF property over the on-base groundwater plumes that was conveyed to the LERA. There are currently no institutional controls restricting off-base groundwater usage.

##### 4.4.4.1 Bonfils Parcel

The following use restrictions are in place at the Bonfils Parcel, and were specified in Exhibit 8 of the Bonfils FOSET as “assurances to be included in the deed or other agreement by CERCLA 120(h)(3)”:

- Notice to and approval by the US Air Force for any work performed below the floor of the structure that will involve excavating in and/or disturbing concrete flooring, soil and/or groundwater or will impede remedial activities;
- Preservation of access to the Bonfils property for remedial investigations, field activities, and remedial actions; and
- A provision for additional indoor air sampling by Bonfils, review and evaluation by CDPHE, and necessary response actions by the AF.

In addition, environmental response obligation assurances specified in Exhibit 8 of the Bonfils FOSET regarding OU5 include the covenants summarized below:

- Bonfils shall not allow residential use without written consent of CDPHE;

- Bonfils shall not extract, utilize, consume or permit to be extracted, any water from the upper aquifer;
- Bonfils shall not make any excavations which result in contact with groundwater or permit such excavations;
- Bonfils shall not make or permit any alterations to the existing condition of the property which may alter the plume configuration or compromise OU5 remedial activities, such as modification of existing landscaping, irrigation systems, or drainage patterns, or flushing of fire hydrants on the property.

Under its obligations in the Remediation Agreement with LERA, LAC has been in contact with the facilities staff at Bonfils regarding implementation of their deed restrictions including access for remediation and oversight of excavation activities. No residential use, extraction of water from the upper aquifer, or alterations of the property altering the plume configuration has occurred at the property.

#### 4.4.4.2 2005 Transfer – Remainder of property over the OU5 Plume

The 2005 FOSET (LAC, December 2005) covered the base-wide groundwater plumes, which were conveyed to the LERA via two separate deeds in 2006. The deeds provide the following environmental covenants and environmental restrictive covenants:

(i). The Grantee covenants and agree not excavate into, extract or utilize, in any manner whatsoever any water from the alluvial aquifer and weathered Denver aquifer below the surfaces of the ground within the boundary of the OU5 for any purpose whatsoever unless the Grantee shall first have obtained the prior written approval of the Air Force.

(ii). Grantee covenants and agree that if groundwater is encountered during any excavation of soil at the property, the Grantee must dispose of the groundwater in accordance with applicable federal, state, and local law and regulation, at its own cost and expense.

(iii). The Grantee is notified and acknowledges that there are a series of monitoring wells on the Property. The Grantee covenants and agrees not tamper with or damage in any manner any of these wells. The Grantee shall repair any damage to such wells or replacement of such wells at the Grantee's sole expense within ten (10) days that are required by the CDPHE.

In addition to the Restrictive Covenant within the deeds, the LERA placed a State Environmental Covenant in accordance with C.R.S. §§ 25-15-321-327 on the properties affected by the base-wide groundwater plumes. The State Environmental Covenant HMC0V00022 covers Operable Unit 5 for the on-base portion of Lowry AFB. A copy of the covenant is included in Appendix F and can also be viewed on the CDPHE website at the following address:

<http://www.colorado.gov/cs/Satellite/CDPHE-HM/CBON/1251616815890>

Per the covenant, the restrictions associated with OU5 are as follows:

- ◆ The OWNER shall not excavate into, extract or utilize, in any manner whatsoever any water from the alluvial aquifer and weathered Denver aquifer below the surfaces of the ground within the boundary of OU5 for any purpose whatsoever unless the OWNER shall first have obtained the prior written approval of the Department. The OWNER shall not tamper with or damage in any manner any of the monitoring wells.
- ◆ If groundwater is encountered during any excavation of soil at the OU5, the OWNER shall notify the Department within two (2) business days of the incident, and must dispose of the groundwater in accordance with applicable federal, state, and local law and regulation, at its own cost and expense.
- ◆ There is a series of monitoring wells on OU5. The OWNER shall notify the Department within forty-eight (48) hours of any damage to these wells of which it has knowledge. Unless otherwise agreed to by the Department, the OWNER, shall repair any damage to such wells or replace such wells at the OWNER's sole expense within ten (10) days.
- ◆ Unless a written determination is obtained from the Department that such systems are not required, the OWNER shall, at its sole expense, install and arrange for maintenance of the following ventilation systems in structures constructed on OU5 after the date of this Covenant, unless deemed and verified unnecessary in writing by the Department.
  1. Newly-constructed residential structures must contain a sub-slab depressurization system (SSDS).
  2. Newly-constructed commercial structures must contain a heating, ventilating, and air conditioning system (HVAC) which, while operating, is designed to provide an internal positive pressure in the building, and such HVAC must be operated in accordance with normal and customary operating procedures for similar buildings in Denver, Colorado and Denver City Ordinance or a SSDS.

The term "structures" as utilized herein shall not include garages or other outbuildings used primarily for storage, built slab on grade, where no soil excavation five (5) feet or more below the ground surface is necessary for the construction or operation thereof.

Under its obligations in the Remediation Agreement with LERA, and the oversight agreements between LAC and the property owners (LRA and the various builders), the builders are obligated to notify LAC of all soil disturbing activities. LAC provides daily notice to CDPHE of the location and scope of all activities, completes daily oversight logs which are on file in LAC's field office, and maintains a database documenting all oversight activities (e.g., location, activity, hours, inspector, observations, etc.).

Property owners notify the State in accordance with their respective deed restrictions if they anticipate drilling into groundwater. As stated by Ms. Sheila Gaston, CDPHE, in an email dated April 29, 2008:

*“...the State does not have a system to track drilling/excavation into groundwater. The LAC oversight, at least for the 10 year period, is meant to handle that in the short term.”*

LAC directs property owners to notify the State when there is the potential, based on assessment of the location and scope of the activity, that interaction with the groundwater in an OU5 parcel may occur. Drilling to the groundwater surface elevation has occurred on a number of occasions including during geotechnical investigations, but extraction of groundwater does not normally occur. When groundwater extraction is necessary, additional procedures and approvals are required by the CDPHE.

Implementation of these deed restrictions is performed by the owner (usually the builders at the time of the new construction) at Lowry AFB in accordance with the State Environmental Covenant. For the new construction in the Northwest neighborhood (FOSET Parcel 1), CDPHE was involved in the approval of design and installation requirements for the subslab systems in 2007 by specifying to the builders that the systems must be “active” as opposed to “passive” and that they are designed and installed in accordance with the CDPHE requirements for active radon systems. In addition, CDPHE requested that there be a light installed on the outside of the home indicating that the system was not working. As of December 2012, residential construction over the OU5 plumes is complete except for two lots located in the Lowry East neighborhood (FOSET Parcel 4b). LAC has observed through inspections in these developments that the systems were installed and include a light on the exterior of the home that turns on if the system is not functioning. Under the contract between LRA and each builder, homeowners are notified of the covenants and requirement for the subslab system by the respective builders in a fact sheet created by the LRA with input from CDPHE, and through the title searches as long as the covenant is in place.

In the Town Center (FOSET Parcel 3), the Restrictive Covenants summarized below were approved by CDPHE and implemented on the lease on April 5, 2001. These covenants were transferred to the property owner Miller Weingarten in October 2006:

“The LRA, Albertson's, and MW by acceptance of this Restrictive Use Covenant, covenant and agree for themselves, their successors and assigns that activities in subparagraphs I(a), I(b), I(c), I(d), I(e), I(f) and I(g) shall not be permitted on the Property unless: (i) the restrictions set forth in this paragraph have terminated pursuant to Paragraph 2 of the Restrictive Use Covenant to which this exhibit is attached; or (ii) the Property owner or lessee or its tenants or subtenants has obtained all necessary state and federal permits and prior written approval from the Department of the Air Force after concurrence of the Colorado Department of Public Health and Environment ("CDPHE") and the Environmental Protection Agency ("EPA") to permit a prohibited use or activity. The costs associated with obtaining the approval necessary to authorize a prohibited use or activity, including the cost of any studies, analysis or remediation required to obtain such approval, shall be the sole responsibility of the Property owner or lessee or its tenants or subtenants, without any cost whatsoever to the United States.

- a. Residential habitation of the Property;
- b. Commercial buildings located or constructed over known groundwater contamination must contain a heating, ventilating and air conditioning system ("HVAC") which while operating is designed to provide an internal positive pressure in the building and such HVAC must be operated in accordance with normal and customary operating procedures for similar buildings in Denver, Colorado;
- c. Child care;
- d. Excavation or construction activities at or below a depth of 25 feet below existing ground surface (or to groundwater, whichever is encountered first);
- e. Utilization, extraction or consumption of any water from the aquifer below ground surface of the Property;
- f. Irrigation of more than thirty percent (30%) of the total acreage of the Property; or
- g. Activities that would interfere with or disrupt required remedial investigations response actions or oversight activities that are permitted pursuant to this Restrictive Use Covenant."

Under its obligations in the Consent Agreement, LAC interacts with all contractors working in this parcel and understands that no use changes have been made since the implementation of these restrictions when the area was developed, and that residential or child care uses have not been incorporated into the property. LAC has performed oversight of excavations in the parcel and had access for activities related to investigation and remediation of the parcel.

#### 4.5 Data Review

A large amount of groundwater data have been collected in and around the Main TCE Plume, the HQ TCE Plume, and the FTZ TCE Plumes since the various investigation, remediation, and performance monitoring programs began at Lowry AFB. Since the remediation of OU5 was privatized in 2002, LAC has collected groundwater data semiannually from June 2003 through July 2013 for long-term monitoring and remediation performance monitoring of the three TCE groundwater plumes (LAC GMP Reports– June 2003 through July 2013). The monitoring program has focused on the axis of the plumes where concentrations have been highest. This was done to provide a more conservative approach to assessing remedial progress and effectiveness.

Concentrations in the plumes have been significantly reduced since the groundwater remedy was implemented and it appears that mass transfer from the source areas to the downgradient dissolved-phase plumes has been limited. These concentration reductions are likely the result of a combination of all remedial efforts to date as well as natural attenuation processes. Figures 2 through 5 illustrate the overall decreases in the average TCE concentrations within the Main TCE Plume, both on-base and off-base, the HQ TCE Plume, and the FTZ plumes.

The decline curves presented in Figures 2 through 5 represent the changes in average TCE concentrations for specific areas of the TCE plumes. The averages cited are a calculated arithmetic mean of detected concentrations from a group of wells within a given area of each plume. For a given area, only those wells with detected concentrations are included in the data set to calculate the average concentration. This reduction in the data set population has the effect of skewing the average concentration higher, thus remaining conservative in the evaluation of remedial effectiveness.

### Main TCE Plume

The plume extent and boundaries were defined by the AF in the OU5 RI (Versar, May 2001) and subsequent plume delineation studies (Versar, May 2003). At that time, the Main TCE Plume extended from the OFR through the Building 1432/Outfall Source area and terminated just south of 29<sup>th</sup> Avenue and Quebec Street (Figure 6A). TCE concentrations in the alluvium along the axis of the plume were as high as 37,000 µg/l (CP-82) on-base and 360 µg/l (CPT Sample SGOB01) in the off-base portion of the Main TCE Plume when the OU5 RI was issued in 2001.

Since active remediation efforts were initiated in 2004, the extent of the Main TCE Plume has contracted with concurrent decreases in dissolved-phase TCE concentrations in the alluvium (LAC, April 2008, LAC, October 2010, LAC, September 2011, LAC, January 2013). Figure 7 illustrates the concentration decreases within and the contraction throughout the Main TCE Plume in a time sequence beginning with October 2001 (pre-remediation extent), then in January 2008 at the time of the first five year review, and in July 2013 concurrent with this second five year review.

The reductions of dissolved-phase concentrations in the alluvium are interpreted to reflect elimination of mass transfer from the source areas as well as from residual TCE in shallow weathered bedrock throughout the plume. Figure 6B illustrates recent TCE concentrations in weathered bedrock both in the identified source areas and beneath the trace of the Main TCE Plume in alluvium. This has resulted in the Main TCE Plume separating into distinct segments with overall lower TCE concentrations in alluvium relative to those observed in 2003 and earlier. The highest detected TCE concentration along the axis of the alluvial portion of the plume outside of the source areas in July 2013 is 77 µg/l (TWOFR-01) on-base and 38 µg/l (MWHE05) in the off-base portion of the Main TCE Plume. Each of the segments is separated by areas where dissolved-phase concentrations of TCE in groundwater are less than 5 µg/l.

### *On-Base Plume Area*

In the on-base portion of the Main TCE Plume (i.e., south of 11<sup>th</sup> Avenue), the overall TCE concentrations in alluvial groundwater have been reduced by 78% when comparing the maximum concentrations from February 2001 to July 2013. Since 2001, the overall extent of the on-base portion of the Main TCE Plume has been reduced to approximately 68% of the original plume area (Figure 6A). The following table illustrates the comparative reductions in average TCE concentrations for this time

period. (Note: As noted above, the averages cited are a calculated arithmetic mean of detected concentrations.)

<b>On-base Alluvium</b>	<b>Minimum Concentration (µg/l)</b>	<b>Maximum Concentration (µg/l)</b>	<b>Average Concentration (µg/l)</b>
February 2001	29	1100	234
January 2008	<5	630	87
July 2013	<2	240	37

The decreases in concentrations realized over the time period summarized in the table above reflect the cumulative effects of the on-base KMnO<sub>4</sub> injections in alluvium and bedrock and ongoing physical processes of dispersion, diffusion, and volatilization. Figure 2 illustrates the overall decline in the average TCE concentration in the alluvium within the on-base plume area.

The remediation program focused on the elimination of contaminant mass in the source areas at the OFR and the Building 1432/Outfall area in order to reduce or cut-off the downgradient transport of contaminants within the dissolved-phase plume. The results of this approach have yielded overall TCE concentration reductions in the OFR source area and Building 1432/Outfall source area. Data from bedrock wells and alluvial wells downgradient of the source areas demonstrate reductions of TCE concentrations indicating that the source mass has been confined by the KMnO<sub>4</sub> injections and is no longer contributing to downgradient groundwater impacts. These data imply that there is no transfer from the shallow bedrock to the saturated alluvium; hence the concentration decreases observed in the alluvium are directly linked to a decrease in potential risk exposure. As shown in Figures 6 and 7, the highest residual concentrations in the alluvium are adjacent to the contaminant source areas for the Main TCE Plume, specifically the OFR Source Area and the Building 1432/Outfall Source Area.

#### *Off-Base Plume Area*

In the off-base portion of the Main TCE Plume (i.e., north of 11<sup>th</sup> Avenue), the overall TCE concentrations in alluvial groundwater have been reduced by 82% when comparing the maximum concentrations from December 1999 to July 2013. Since 2001, the overall extent of the Northern Offsite Plume has been reduced to approximately 73% of the original plume area (Figure 6A). The following table illustrates the comparative reductions in average TCE concentrations for this time period.

Off-base Alluvium	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	Average Concentration (µg/l)
December 1999	9.5	220	86
January 2008	2.3	72	21
July 2013	<2	38	14

The decrease in off-base concentrations realized since 2004 reflect the cumulative effect of the off-base KMnO<sub>4</sub> injections and ongoing physical processes of dispersion, diffusion, and volatilization. It has been four years since active treatment occurred in off-base portions of the plume and average alluvial concentrations and individual well concentrations of TCE continue to attenuate. Figure 3 illustrates the overall decline in average TCE concentration in the alluvium in the off-base plume area.

The remediation program in the off-base plume area was focused on aggressively treating groundwater in order to reduce TCE concentrations to levels that would effectively eliminate vapor intrusion via the groundwater-to-indoor air pathway. As illustrated in Figure 3 and Figure 7, the data indicate that significant concentration reductions were achieved through the remedy implementation with little or no apparent rebound. LAC evaluated the groundwater-to-indoor air pathway in 2007 and 2010 (LAC, 2008, 2010) and found a direct correlation between decreasing groundwater concentrations and decreasing indoor air concentrations. The indoor air data show strong correlations between the alluvial groundwater and indoor air TCE concentrations, (as well as soil gas and sub-slab concentrations) indicating that as groundwater concentrations decrease, there are comparable decreases in indoor air concentrations. Thus the remedy is shown to have been effective in mitigating risks through the indoor air pathway (Figures 8 and 9). At the time of the 2010 evaluation, the indoor air concentrations had sufficiently decreased to levels that were considered protective of human health. The 2010 indoor air data showed that 75% of sample locations were below 0.43 micrograms per cubic meter (µg/m<sup>3</sup>), 25% between 0.43 and 2.1 µg/m<sup>3</sup> (Figure 10). All locations are below the 2.1 µg/m<sup>3</sup> action level. CDPHE issued a concurrence letter to LAC on August 6, 2012.

#### Headquarters TCE Plume

KMnO<sub>4</sub> injections completed in the HQ TCE Plume include a KMnO<sub>4</sub> treatability study (LAC, October 2006) and two different rounds of KMnO<sub>4</sub> injections that occurred in 2004 and 2009 (LAC, August 2006, December 2006, and January 2010) (Figure 11). Injections occurred in more than 100 points; over 27,000 pounds (by weight) of KMnO<sub>4</sub> were injected into the saturated alluvium and bedrock intervals.

The overall TCE concentrations in alluvial groundwater in the HQ Area have been reduced by 79% when comparing the maximum concentrations from August 2001 to July 2013. Overall, the extent of the HQ TCE Plume has been greatly reduced since 2001 with approximately 81% of the alluvial TCE plume area having been reduced to below the CBGWS (Figure 11). The following table illustrates the comparative reductions in average TCE concentrations from August 2001 through July 2013.

Headquarters TCE Plume- Alluvium	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	Average Concentration (µg/l)
August 2001	9.9	83	35
January 2008	5	89	33
July 2013	6.2	17	13

Figure 4 illustrates the overall decline in average TCE concentrations in the Headquarters Area. Figure 4 does indicate an apparent increase in the more recent average concentration between January 2012 and January 2013. As discussed earlier in Section 4.5, this increase largely reflects a change in the monitoring well set as several wells that achieved the CBGWS for at least 18 months were dropped from the monitoring program and subsequently abandoned; the current average reflects three alluvial monitoring wells located in the approximate axis of the plume. The effect is to exaggerate localized fluctuations in the average concentrations. Some of the increase could also be attributed to localized desorption of TCE from the fine-grained alluvial matrix (i.e., interbedded silts and clays) in which the existing monitoring wells are completed. The July 2013 data indicate a return to a decrease in the average TCE concentration in the alluvium.

#### Fire Training Zone TCE Plumes

The FTZ TCE Plumes are located underneath the Common Ground Golf Course. Groundwater in the FTZ is present in the bedrock; the target TCE mass in this area is present within bedrock fractures with little or no overlying saturated alluvium. Treatment of TCE in bedrock was accomplished through two rounds of  $\text{KMnO}_4$  injections that occurred over a two year period (LAC, August 2004; December 2006); over 13,150 pounds (by weight) of  $\text{KMnO}_4$  were injected into the bedrock groundwater through 51 injection points (Figure 12).

The overall TCE concentrations in bedrock groundwater in the FTZ have been reduced by 90% when comparing the maximum concentrations from August 2001 to July 2013. Since 2001, the overall extent of the FTZ plumes has been reduced with approximately 93% of the original plume area in bedrock having been reduced to concentrations below the CBGWS (Figure 12). The following table illustrates the comparative reductions in average TCE concentrations from August 2001 through July 2013.

Fire Training Zone TCE Plumes - Bedrock	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	Average Concentration (µg/l)
August 2001	7.4	140	59
January 2008	9.6	59	32
July 2013	7	14	11

Figure 5 illustrates the overall decline in average TCE concentration in the FTZ plumes. As noted above, the TCE mass in the FTZ area was contained within bedrock fractures

in three localized areas (Figure 12). The TCE concentrations in the area monitored by wells MWFT11 and FT-13 were reduced to levels less than the CBGWS or became non-detect; the monitoring wells in that area have been abandoned with CDPHE concurrence. Concentration decline curves constructed for each of the bedrock monitoring wells in the remaining two areas also exhibit TCE concentration trends that are decreasing with time (Figure 13).

#### Carbon Tetrachloride Plume

Targeted remediation of CT in bedrock in the vicinity of well ETMW03 was initiated in 2006 (LAC, March 2007). Using a direct push rig, a focused injection of pH activated sodium persulfate solution was conducted in the CT source area. A significant decrease in CT concentrations was initially observed for the bedrock wells inside the pre-injection CT plume boundary (Figure 14 - wells ETMW03, MWCT01, and MWCT04). Within the source area at well ETMW03, the CT concentration dropped 81 percent, from 7,800 µg/L to 1,500 µg/L. Just beyond the downgradient edge of the source area at well MWCT01, the CT concentration dropped from 270 µg/L (January 2004) to 9.5 µg/L. Approximately 430 feet downgradient of the source area, the CT concentration in well MWCT04 dropped from 94 µg/L (April 2005) to 33 µg/L. Follow-up groundwater monitoring indicated rebound of CT suggesting the remedial technology or the injection methodology was not adequate to reduce contaminant mass effectively.

In 2008, BOS-100<sup>®</sup> trap and treat carbon-based media was injected in the CT source area followed by a second, localized injection in 2010 (LAC, April 2008; February 2009, February 10, 2011) (Figure 14). The 2008 injections consisted of 15,000 pounds of BOS-100<sup>®</sup> injected in 81 points in the bedrock source area and 83 points in the overlying saturated alluvium. In 2010, the follow-up injection event consisted of 600 pounds of BOS-100<sup>®</sup> delivered into 17 bedrock points in the vicinity of well MWCT08 to address localized residual concentrations of CT still above the CBGWS (Figure 11).

ETMW03 was the most impacted point in bedrock and is used to illustrate the positive effect of LAC's remedial efforts. The CT concentration in ETMW03 prior to the 2008 BOS-100<sup>®</sup> treatment was as high as 5,856 µg/l; within six months after the injections CT was non-detect and remained so for four consecutive monitoring events over a nearly two year period (Figure 15). As illustrated in Figure 15, concentration decline curves for the other impacted bedrock wells in the CT area display similar results with concentrations either stable, decreasing, or below the CBGWS.

#### 4.6 Site Inspection

LAC performs oversight for all excavations on property throughout Lowry in accordance with the Soils Management Program (LAC, 2006, LAC, 2008, LAC 2013), and in doing so monitors compliance with the institutional controls. Logs are kept for each site where oversight occurs and the information recorded is shown on the blank log provided in Appendix D. A summary of the data are entered into a database used for tracking

purposes. In addition, an inspection of OU5 was performed in May 2013; the results of that inspection are presented in Appendix D.

#### 4.7 Discussion of Future Land Use and Exposure Assumptions

Both residential and commercial development has occurred over the plumes at Lowry AFB and Stapleton. The area between the two redevelopment properties has remained residential. The Baseline Risk Assessment (BRA) (Versar, OU5 RI, 2001), based on USEPA guidance and protocols, evaluated potential threats to human health and the environment for potential current and future exposures to groundwater, indoor air, sediments, and surface water.

In addition to the BRA, an Assessment of Risk was performed for the FOSET (LAC, December 2005) that included the review of existing site-specific documents and additional calculations of risk were performed to assure that a conservative risk assessment was presented (Appendix E). In the FOSET, parcel-specific calculation of risks for TCE using both USEPA's withdrawn values and USEPA's draft proposed toxicity criteria were used. In addition, in August 2004, CDPHE issued a policy that addresses screening and remediation levels for TCE that may be present in indoor air. Calculations based upon CDPHE's policy were incorporated into the FOSET Assessment of Risk. However, these changes do not currently affect the exposure assumptions.

The residential and recreational exposure scenarios evaluated in the BRA and the FOSET Assessment of Risk conservatively represent current uses of the property and are still valid.

#### 4.8 Technical Assessment

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

- Remedial Action Performance – Significant contaminant concentration reductions in the identified TCE source areas and the CT source area have been achieved via the selected remedies; these source area reductions are reflected in decreasing dissolved-phase contaminant concentrations in the OU5 groundwater plumes. Based on the results discussed above in Section 4.5 – Data Review, the remedial action has greatly reduced the concentrations of the contaminants of concern (i.e., TCE and CT) in groundwater. No additional treatment or other active corrective measures are contemplated for the OU5 groundwater plumes. The average TCE concentration decline curves for the on-base and off-base Main TCE Plume, the HQ TCE Plume, and the FTZ TCE Plumes (Figures 2 through 5) indicate the trends have reached, or are approaching, asymptotic conditions. The average concentrations and the trend plots shown in Figures 2 through 5 reflect the overall behavior of a group of wells in a given area through time. When taken individually, there is local variability observed within the plumes on a well by well basis from sampling event to sampling event. Some

wells do display an increasing trend in detected concentrations though in nearly every case those concentrations do not approach historical maximums for a given well. The significance of these fluctuations is being considered in the ongoing assessment of the remedy effectiveness.

The remedy for TCE was successful at addressing the mass that was dissolved in groundwater and in the permeable sandy areas of the plumes. The remedy also succeeded in removing mass within bedrock and the fine-grained alluvium (i.e., interbedded silts and clays). However, the remaining TCE mass is effectively trapped in low permeability sediment within the alluvial aquifer and in the claystone comprising the upper bedrock, and has become increasingly difficult to remove. While the average TCE concentration within the Off-Base plume area is less than 15 µg/l, this silty area holds about 44% of the remaining mass in the Main TCE Plume. Delivering a treatment reagent to this mass is not possible because of the relatively impermeable nature of the silt. The TCE sorbed to these silts is expected to diffuse slowly out of the matrix with enough mass eventually leaving the system that groundwater will meet the current CBGWS; however, this desorption process will take a long time – more than 10 years - before the standard is met.

The historical data show that as treatment efforts increased over time, the magnitude of TCE mass reductions decreased (Figure 16). The TCE plumes have reached a point where additional chemical oxidation will not yield appreciable additional reduction in TCE mass. Remediation experience with chemical oxidation indicates that geologic constraints to the distribution of chemical oxidation reagents, as well as the sorption of contaminants within the subsurface matrix, can limit the effectiveness of chemical oxidation over time (Siegrist et al., 2001). Thus, contaminant mass sorbed to fine-grained sediment and claystone is difficult, if not technically impracticable, to fully remediate.

The vapor intrusion pathway has been addressed through aggressive active remediation of groundwater to reduce concentrations to a point that eliminated the potential pathway and through the installation of vapor mitigation systems. In the January 2010 indoor air study, all locations are below the 2.1 µg/m<sup>3</sup> action level (See Figures 8-10).

While appreciable groundwater concentration reductions have been achieved and concentrations continue to decline, the final cleanup goal of the CBGWS has not been attained. The Phase 2 CAP for OU5 provides for requesting a site-specific standard given the technology has reached the limits of technical practicability and there are no known unacceptable routes of exposure.

- System Operation and Maintenance – The selected remedy for OU5 was in situ chemical injection; active remediation has ceased and there is no ongoing O&M.

- Costs of System Operation/O&M – The selected remedy for OU5 was in situ chemical injection; there is no ongoing O&M.
- Implementation of Institutional Controls and other measures –State Environmental Covenants (Appendix F) are in place for all on-base areas over the plumes and are addressing any potential exposures. The on-base covenants:
  - prohibit the extraction and use of groundwater,
  - require radon mitigation systems (i.e., sub-slab depressurization systems [SSDS]) for residential development over the on-base plumes and
  - require positive displacement HVAC systems in commercial development over the plumes.

Deed restrictions on the property owner also require that the owner notify the CDPHE if groundwater will be contacted or extracted during construction activities.

While LAC currently performs administrative checks to assess if any SSDS in a residence over a groundwater plume is not running, the homeowner is ultimately responsible for the operation, maintenance, and repair of the SSDS at their residence. In the event the system is not running the owner is notified by written communication sent out in the U.S. Mail.

In the off-base area of the Main TCE Plume there are no institutional controls in place. Potable water is supplied by the City of Denver and soil vapor concentrations are protective of human health.

- Monitoring Activities - Monitoring has occurred on a semiannual basis through 2013 as scheduled under the CDPHE-approved GMP for OU5. With CDPHE approval, a revised GMP for the Main TCE Plume was implemented in January 2013 to support ongoing regulatory closure discussions. A revised GMP for the FTZ and HQ Area TCE Plumes was also approved by CDPHE for implementation in 2013 (LAC, December 2012). Future monitoring for OU5 after the July 2013 sampling event will be conducted on an annual basis.
- Opportunities for Optimization – None.

Early Indicators of Potential Remedy Problems - The TCE concentration trends in all alluvial and bedrock plume areas are asymptotic above the CBGWS. Active remediation has reached the technically practical limits of effectiveness. As noted above, the average concentrations and the trend plots shown in Figures 2 through 5 reflect the overall behavior of a group of wells in a given area through time. When taken individually, there is variability observed within the plumes on a well by well basis from sampling event to sampling event. Some wells do display an increasing trend in detected concentrations though in nearly every case those concentrations do not approach historical maximums for a given well.

The significance of these fluctuations is being considered in the ongoing assessment of the remedy effectiveness.

At this point, the remedy set forth in the Phase 2 CAP for OU5 has not been changed. In accordance with the Phase 2 CAP, LAC is pursuing a site-specific standard for TCE and CT. In the absence of attaining a site-specific standard, the Phase 2 CAP may need to be modified. Groundwater monitoring to document the continued decrease in concentrations toward the CBGWS will be implemented per the CDPHE-approved groundwater monitoring program for 2013 and beyond.

Question B – Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Human health and ecological risks were evaluated in the BRA for OU 5 using groundwater, sediments, surface water, and indoor air data. Risks to both current and future residential (adults and children) and commercial/industrial populations were evaluated. The scenarios are considered conservative and reasonable in evaluating risk and are still valid for land uses within the plume areas today. In addition to the BRA, an Assessment of Risk was performed for the FOSET (LAC, December 2005) that included the review of existing site-specific documents and additional calculations of risk were performed to assure that a conservative risk assessment was presented (Appendix E). In the FOSET, parcel-specific calculation of risks for TCE using both USEPA's withdrawn values and USEPA's draft proposed toxicity criteria were used. (Note: EPA finalized the new TCE toxicity criteria in September 2011.) In addition, in August 2004, CDPHE issued a policy that addresses screening and remediation levels for TCE that may be present in indoor air. Calculations based upon CDPHE's policy were incorporated into the FOSET Assessment of Risk. Based on the EPA's 2011 finalization of the new TCE toxicity criteria, the CDPHE modified its policy addressing screening and remediation levels for TCE that may be present in indoor air (CDPHE, December 2011). The values adopted by CDPHE in 2012 to assess the risk associated with the indoor air pathway are less stringent than those set forth in the August 2004 policy. These changes do not currently affect the protectiveness of the remedy.

Screening for 1,4-dioxane was performed in the OU5 plumes in 2009. The CBGWS for 1,4-dioxane changed in January 2013 to 0.35 µg/l; however, the detected concentrations were all below 2.0 µg/l which is in the acceptable risk range,

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

No.

#### Technical Assessment Summary

Significant contaminant concentration reductions in the identified TCE source areas and the CT source area have been achieved via the selected remedies; these source area

reductions are reflected in decreasing dissolved-phase contaminant concentrations in the OU5 groundwater plumes. Average TCE concentration trends in the plume areas are asymptotic and the CT source area has been effectively eliminated. The average concentration trend reflects the overall behavior of a group of wells in a given area through time. When taken individually, there is variability observed within the plumes on a well by well basis from sampling event to sampling event. Some wells do display an increasing trend in detected concentrations though in nearly every case those concentrations do not approach historical maximums for a given well. The significance of these fluctuations is being considered in the ongoing assessment of the remedy effectiveness.

Active remediation has reached the technically practical limits of effectiveness. While appreciable reductions have been achieved, the final cleanup goal of the CBGWS has not been attained. The vapor intrusion pathway has been addressed through aggressive active remediation of groundwater to reduce concentrations to a point that eliminated the potential pathway and through the installation of vapor mitigation systems. There have been changes in the toxicity factors of the primary contaminant of concern but those changes did not affect the protectiveness of the remedy. Although potable water is supplied by the City of Denver, there are no institutional controls restricting groundwater use north of the former base boundary.

#### 4.8.1 Issues

Table 6 summarizes the issues identified for OU5 during this Second Five Year Review.

#### 4.8.2 Recommendations and Follow-Up actions

Table 7 summarizes the recommendations and follow-up actions for the issues identified for OU5 during this Second Five Year Review.

### 4.9 Protectiveness Statement

The remedy at OU5 is protective of human health and the environment in the short-term. Potential exposure pathways have been eliminated through the on-base State Environmental Covenant HMC0V00022, institutional controls, engineering controls, and aggressive remediation of the groundwater plumes. In order to be protective in the long term, a site specific standard will be pursued, the Phase 2 CAP will be revised as necessary, and other options will be considered such as off-base informational institutional controls, if needed. Groundwater monitoring following active treatment in OU5 continues to evaluate contaminant concentrations and the effectiveness of the remedy.

## 5.0 OU2 Landfill Zone

### 5.1 Site Chronology

Table 8 provides a chronology of environmental investigation and remedial activities at OU 2.

### 5.2 Background

The OU2 Landfill Zone encompasses approximately 69.8 acres and is located in the south-central portion of Lowry AFB in the city of Denver, Colorado (Figure 1). OU2 is bordered by Alameda Avenue to the south and the Westerly Creek Dam wetlands to the north, Westerly Creek to the east, and vacant property to the west. The landfill was historically used for disposal of base-related waste and associated construction waste and debris primarily from training activities conducted by the AF at Lowry AFB. Disposal occurred from approximately 1948 until 1989 according to the SRI (Parsons, 1995).

Investigations were conducted at OU2 during the 1990 RI (SAIC, 1990), the SRI (Parsons, 1995), and the Focused Feasibility Study (FFS) (Versar, 1998) to determine the nature and extent of contamination present in soil, soil gas, surface water, and groundwater. The remedy for OU2 was selected under the CERCLA process as a presumptive remedy as described in the Proposed Plan (1998) and details provided in the Phase 2 CAP for OU2 (LAC, November 2003). The final cover design included the following elements:

- construction of an 18-inch thick low permeability layer (LPL) with a maximum hydraulic conductivity of  $1 \times 10^{-5}$  centimeters per second over the entire area using soil from offsite borrow sources;
- placement of a 6-inch thick vegetative layer over the LPL using soil imported from offsite borrow sources;
- installation of landfill gas vents and monitoring probes; and
- construction of surface water structures to control run-on and run-off from the 100-year, 24-hour storm event (Figure 17).

Import and stockpiling of soil began in late 2003, and construction was completed in the fall of 2004. The Completion Report for the OU2 Landfill Closure (LAC, March 2005) was approved by CDPHE in September 2006 and included the issuance of an NFA for the closure construction activities at OU2. The NFA triggered the initiation of post-closure monitoring activities for OU2. Long-term post-closure monitoring began in November 2006, in accordance with the Post-Closure Monitoring Plan, OU2 (Appendix G, Phase 2 Corrective Action Plan, LAC, 2003). The monitoring schedule is presented in Table 6 of this document.

The AF performed a year-long monitoring program to investigate whether radionuclides of potential concern could be derived from the landfill zone (Cabrera, 2005). Based on CDPHE comments to the study, LAC performed two additional quarters of monitoring and an evaluation of the radiological data (LAC, June 2008). The evaluation provided additional characterization of the geochemistry at OU2 and an understanding of the natural conditions which result in elevated uranium and gross alpha in the northeast portion of the site. CDPHE approved the evaluation report (CDPHE July 21, 2008) and agreed “that the information presented indicates the source of elevated uranium is naturally occurring with a source related to the geology of the site”. CDPHE also stated “that the current long-term post-closure monitoring plan for gross alpha and gross beta sampling is adequate for the present situation”.

### 5.3 Basis for Taking Action

OU2 was identified through the IRP as a municipal landfill. Risks from potential exposures to soil and waste materials in the landfill zone were addressed by the USEPA’s presumptive remedy approach in accordance with State of Colorado Regulations Pertaining to Solid Waste and Facilities (6CCR1007-2).

### 5.4 Remedial Action

#### 5.4.1 Remedy Selection

The following RAOs for the OU2 closure were developed in the Phase 2 CAP for the Operable Unit 2 Landfill Closure (LAC, 2003) based upon the preliminary remedial action goals given in the FFS (Versar, 1998) and the requirements of 6 CCR 1007-2.

- Prevent current and future exposure to, or contact with, the landfill mass either directly or indirectly.
- Reduce the potential for leachate generation or groundwater quality degradation by minimizing surface water infiltration through the landfill cover.
- Prevent the potential for instability or erosion of the landfill mass.
- Reduce the overall site safety hazard by placing miscellaneous surface debris beneath an engineered landfill cap.
- Reduce the potential for surface water quality degradation through contact with the landfill mass.
- Prevent potential contact with or use of groundwater/leachate within the landfill.
- Monitor groundwater to detect the migration of landfill contaminants beyond the OU2 boundary.
- Prevent the uncontrolled accumulation of gas within the landfill and the release of landfill gas above the CDPHE threshold limit at the OU2 boundary.
- Prevent exposure to, or contact with, landfill gas.

- Monitor landfill gas emissions/concentrations, as required by 6 CCR 1007-2, to detect concentrations above action levels described in the Post-Closure O&M Plan.
- Provide long-term effectiveness of the remedial action through operation and maintenance of the implemented action.

Alternatives evaluated during the FFS included:

- No action.
- Excavation and off-site disposal of landfill waste.
- Eleven capping alternatives including caps composed of soil, native soil admixture, synthetic membrane, composite (clay plus very flexible polyethylene (VFPE)), evapotranspiration soil layer, and clay. Capping alternatives included active or passive gas control, and all alternatives except for the landfill excavation included long-term monitoring and institutional controls.

#### 5.4.2 Remedy Implementation

Closure of the landfill zone was completed in accordance with the Phase 2 Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry (OU2 Phase 2 CAP) (LAC, November 2003). The closure included:

- Preparation of the site by clearing and grubbing the landfill surface, and abandoning wells within the landfill limits and protecting wells just outside of the landfill limits.
- Grading of the existing cover soils within the landfill limits identified in the FFS and shown on the Design Drawings so that a minimum one percent slope is achieved towards the wetlands area.
- Extension of the existing culvert that drains storm water from the south side of Alameda Avenue onto the landfill so that the water is discharged directly into the wetlands area north of the landfill.
- Construction of an 18-inch-thick LPL with a maximum hydraulic conductivity (permeability) of  $1 \times 10^{-5}$  cm/s over the entire area using soils imported from borrow sources.
- Placement of a 6-inch thick vegetative layer over the LPL using soils imported from a borrow source(s).
- Construction of surface water structures to control run-on and run-off from the 100-year, 24-hour storm event.
- Installation of landfill gas vents and monitoring probes in the culvert extension bedding material and around the southern and western perimeter of the landfill on 200-foot centers.

The construction was completed between May and October 2004, and is documented in the Completion Report for the OU2 Landfill Closure at Lowry (LAC, March 2005) approved by CDPHE on September 8, 2006.

### 5.4.3 Institutional Controls

OU2 and adjoining property around the perimeter of OU2 was transferred by deed from the AF to LERA via a FOST and FOSET in 2002. The FOSET includes the following environmental protection provisions to ensure protection of human health and the environment from OU2 and to preclude any interference with ongoing or completed remediation activities. The deed provides the following Restrictive Covenants:

*The Grantee shall not disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in the regulations of the Colorado Department of Public Health and Environment.*

*It is the intent of the Grantor and Grantee that these Restrictive Covenants bind the Grantee and shall run with the land and are perpetual, unless modified or terminated pursuant to this paragraph. It is also the intent of the Grantor and the Grantee that the Grantor will retain the right to enforce the Restrictive Covenants through the chain of title, in addition to any State law that permits the State to enforce the Restrictive Covenants. The Grantee or its successors and assigns may request that the Air Force approve a modification or termination of any of the Restrictive Covenants. The Air Force shall review any submitted information and may request additional information. Grantor recognizes that future Grantees may change the Environmental Covenants in accordance with the Environmental Covenant Statute including but not limited to providing for limited disturbance of the final cover of OU2. Grantor agrees to consider such changes set forth in the Environmental Covenant for its Restrictive Covenant. No modification or termination of a Restrictive Covenant shall be effective unless the Air Force has approved such modification or termination in writing, which approval shall not be unreasonably withheld or delayed.*

In addition, the LERA placed a State Environmental Covenant on this parcel in accordance with Colorado Revised Statutes (CRS) §§ 25-15-321-327. State Environmental Covenant HMCOV00023 covers Operable Unit 2. A copy of the covenant is included in Appendix F and can also be viewed on the CDPHE website at the following address: <http://www.colorado.gov/cs/Satellite/CDPHE-HM/CBON/1251616815890> .

In accordance with the covenant, the use restrictions associated with OU2 are as follows:

- ♦ *Unless the covenant is modified in accordance with the State's statute and regulations, OU2 will only be used as open space/non-irrigated park following closure.*
- ♦ *In general, the OWNER shall not use or conduct any activity on OU2 that will adversely affect:*
  - i. the integrity of the cover,*

- ii. the effectiveness of drainage or erosion controls,*
- iii. slope stability, or*
- iv. groundwater or gas monitoring or control systems.*
- ◆ *Specifically, no activity shall be conducted or permitted by the OWNER, nor shall the OWNER use OU2 in any manner that is inconsistent with the use designated in the preceding paragraph or that is not in compliance with the requirements of section 3.6.1(A) of 6 CCR 1007-2 or the Final Closure Plan for the Operable Unit 2 Landfill Closure at Lowry, issued for review August 29, 2003.*
- ◆ *The OWNER shall not extract or utilize in any manner whatsoever any water from the upper aquifer below the surface of the ground within OU2 for any purpose whatsoever, unless the OWNER shall first have obtained the prior written approval of the Department.*
- ◆ *For the duration of this covenant, the Air Force shall perform all of the requirements set forth in sections 3 and 4 of the Post-Closure Operation and Maintenance Plan, Appendix E of the Final Closure Plan for the Operable Unit 2 Landfill Closure at Lowry, issued for review August 29, 2003.*

In 2006, the OU2 property was conveyed to the current owner, IRG Redevelopment I, LLC. Under its obligations in the Remediation Agreement with LERA, and the oversight agreements between LAC and the property owner (IRG Redevelopment I, LLC), the owner is obligated to notify LAC regarding any soil disturbing activities at the site. LAC provides daily notice to CDPHE of the location and scope of all activities, completes daily oversight logs which are on file in LAC's field office, and maintains a database documenting all oversight activities (e.g. location, activity, hours, inspector, observations, etc.). The use and activity restrictions above have been implemented by the property owner under their deed.

The Post Closure Operation and Maintenance Plan is implemented by LAC under the Consent Agreement. Semiannual monitoring reports and annual O&M reports are submitted to CDPHE under this program as spelled out in Sections 3 and 4 of the plan. The landfill is fenced in fulfillment of the requirement to protect the integrity of the cap. The condition of the cap and fence are observed during the scheduled inspections, repairs are made as necessary, and results are reported to CDPHE in the annual O&M report.

## 5.5 Data Review

Following approval of the OU2 closure documents in September 2006, LAC initiated a Post-Closure Operations, Maintenance and Monitoring (O,M&M) program set forth in the Phase 2 CAP. As described in the Phase 2 CAP, the monitoring program includes groundwater, surface water, and soil gas sampling at varying frequencies. Sampling locations are shown on Figure 18. In addition, a detection monitoring program is in place to evaluate statistically significant changes in groundwater concentrations. The detection monitoring is performed semiannually.

Through seven years of post-closure monitoring, there have been no statistically significant increases in any of the 75 parameters which are analyzed during each semiannual event. Chloride is typically detected above the CDPHE secondary drinking water standard (250 milligrams per liter) in one upgradient monitoring well (BG-5). Concentrations of chloride in the remaining upgradient and downgradient monitoring wells are below the secondary drinking water standard and indicate no discharge from the landfill. Gross alpha is detected in groundwater above the CDPHE Domestic Water Supply – Human Health Standard (15 picocuries per liter); however, detected concentrations are commensurate in both up- and down-gradient monitoring locations. These detections do not reflect releases from OU2. There have been no releases from the landfill to either surface water or groundwater. Also, based on the results of the soil vapor monitoring, there is little or no methane generation occurring at OU2 (LTE, 2007-2013).

## 5.6 Site Inspection

LAC currently performs surface inspections on a quarterly basis as required by the post-closure monitoring plan and ensures compliance with the institutional controls in accordance with the Phase 2 Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry, Appendix G (LAC, 2003). Results of the quarterly inspections are provided in Appendix D and are documented in the annual Post-Closure Operation and Maintenance Reports (LTE, 2007-2012). In addition, an inspection for the Second Five Year Review was performed in May 2013, and the completed inspection form is included in Appendix D.

## 5.7 Discussion of Future Land Use and Exposure Assumptions

OU2 is considered a municipal landfill; therefore, the FFS (Versar, 1998) was conducted in accordance with the USEPA's presumptive remedy guidance which assumes that a landfill will be closed by capping and provides for additional containment remedies as appropriate. As stated in the Proposed Plan (1998, contained in Phase 2 CAP OU2, LAC, 2003), the remedial alternatives were evaluated for future reuse as open space, and current institutional controls consist of land use, irrigation and groundwater use restrictions. The Proposed Plan goes on to say "Any future change in land use would be possible only if it could be demonstrated that the change would not increase the potential threat to human health and the environment, and the proposed change is reviewed and approved by CDPHE." IRG Redevelopment I, LLC, the current landowner, is currently contemplating redevelopment of the site. Such redevelopment would require approvals from the AF and the CDPHE prior to any change in use consistent with the deed and the State Environmental Covenant.

## 5.8 Technical Assessment

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

- Remedial Action Performance – The remedy was implemented as designed, and the closure approved by CDPHE on September 8, 2006. A review of the decision documents, site inspection, and seven years of monitoring data demonstrate that the landfill cap, O&M, and monitoring program are functioning as intended to prevent exposures to the landfill solids and gas, to reduce the potential for leachate generation and gas accumulation, and to prevent potential instability or erosion of the landfill material.
- System Operation and Maintenance – There is no active operation of the remedy since it is a cap; however, inspections of the cap are performed in accordance with the schedule provided in Table 9, and maintenance is performed as necessary. An annual O&M report is issued to document any maintenance issues and resolution of those issues.
- Costs of System Operation/O&M – LAC has the responsibility for O&M through the privatization. In addition, a financial assurance vehicle is in place to cover the estimated costs with funds backed by a payment bond.
- Implementation of Institutional Controls and other measures - Institutional controls are in place as described above to ensure: (i) the integrity of the cover; (ii) the effectiveness of drainage or erosion controls; (iii) slope stability; or (iv) groundwater or gas monitoring or control systems. The institutional controls are monitored through inspections of the cover surface in accordance with the Post-Closure Plan.
- Monitoring Activities – Scheduled monitoring activities are ongoing in accordance with the O&M Plan in the OU2 Phase 2 CAP, Appendix G (LAC, 2003).
- Opportunities for Optimization – None.
- Early Indicators of Potential Remedy Problems – None. The O&M Plan provides for repairs to the cap, perimeter fencing, and the drainage on an as needed basis.

Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection are still valid.

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

Several interview respondents voiced concern over the proposed redevelopment of OU2, also known as Lowry Vista. Although Lowry Vista is in its early conceptual phase and at some point in the future may be redeveloped for a different use, the effectiveness of the remedy at OU2 did not change during the Second Five Year Review period. Should the OU2 remedy change in any way,

discussions of those changes and potential effects on the protectiveness will be addressed with the regulators and the community.

#### Technical Assessment Summary

Based on the data reviewed, the site inspections, and communications with stakeholders, the remedy is functioning as intended by the OU2 Phase 2 CAP. The landfill cap is effective in preventing exposures to human health and the environment, the vent system is successful in eliminating gas build-up, the O&M plan is effective in reducing trespass and maintaining the cap, and the monitoring system confirms releases to ground water are not taking place. There have been no changes in the land use at the site that would affect the protectiveness of the remedy. The remedy is currently protective; protectiveness will continue to be assessed as additional monitoring data are collected in the future.

#### 5.8.1 Issues

None.

#### 5.8.2 Recommendations and Follow-Up actions

None.

### 5.9 Protectiveness Statement

The remedy at OU2 is protective. Exposure pathways that could result in unacceptable risk are controlled through the landfill cap, runoff control systems, implementation of the O&M plan, and the existing State Environmental Covenant (HMCOV00023) that runs with the land.

## **6.0 Overall Protectiveness Statement**

This Second Five Year Review was performed for remedies implemented in OU2 and OU5 at the Former Lowry Air Force Base.

Because remedial actions at OU5 are protective in the short-term, the site-wide protectiveness statement is protective in the short-term. In order to be protective in the long term, a site specific standard will be pursued, the Phase 2 CAP will be revised as necessary, and other options will be considered such as off-base informational institutional controls, if needed.

## **7.0 Next Review**

The next Five Year Review for Lowry AFB is due by October 7, 2018, ten years from the date of the initial review.

## 8.0 References/Documents Reviewed

**Note:** Where possible, a reference to the Administrative Record has been added to the citation and is shown as "AR\_####"; documents can be found at the Administrative Record Website as of 10/08:

<https://afarpaar.lackland.af.mil/ar/docsearch.aspx>

Cabrera Services, December 2005, Comprehensive Summary Report, Long-Term Monitoring for Radiological Parameters, Operable Unit 2, Former Lowry Air Force Base, Colorado

CDLE (Colorado Department of Labor and Employment), Division of Oil and Public Safety, July 15, 2003, Re: Petroleum Underground Storage Tanks (USTs) at Building 1437, Lowry Air Force Base, City and County of Denver. (Event ID 2463)

CDPHE, 1993, Re: Underground Storage Tank (UST) Closures of Tanks G, H and X (AR\_410)

CDPHE, 1995, NFA ST-16 Tank QQ, Reported in RFA, CH2MHill, 2005, Table 3-6

CDPHE, February 7 1995, Re: Second-Level Site Assessment Report for Underground Storage Tank (UST) Closure at IRP Site ST10 (Tank T) Lowry Air Force Base, Denver, Denver County, Colorado (AR\_431)

CDPHE, June 5, 1995, RE: Underground Storage Tank (UST) closure of Tanks 353 A, B, C, and D, Lowry Air Force Base, 6<sup>th</sup> Avenue and Quebec Streets, Denver, Denver County, Colorado (ST07 and ST08) (AR 453)

CDPHE, January 13, 1998, RE: Draft Final Operable Unit 3 – Fly Ash Disposal Area No Further Response Action Planned Document, Lowry Air Force Base, Colorado, November, 1997 (AR\_537)

CDPHE April 10, 2000, Re: No Further Response Action Planned Decision Document for the Former Jet Fuel Storage Yard of IRP Site ST07 and the Status of Underground Tanks A and B of IRP Site ST08, Lowry AFB, Denver, CO (AR\_660)

CDPHE July 25, 2000, Re: Draft Final Environmental Baseline Survey Supplement (EBSS) and the Draft Final Finding of Suitability for Transfer (FOST) for Economic Development Conveyance ROD for the Priority 23 Portion of Parcel P (including Nose Cone Facility and Tank 51387)

CDPHE, 2001, NFA Tank U, Reported in RFA, CH2MHill, 2005, Table 3-6

CDPHE, 2001, NFA ST-13 Tank V, Reported in RFA, CH2MHill, 2005, Table 3-6

CDPHE, 2001, NFA ST-15 Tank W, Reported in RFA, CH2MHill, 2005, Table 3-6

CDPHE, 2002, NFA Tank 51387 Reported in RFA, CH2MHill, 2005, Table 4.3-A

CDPHE, September 25, 2003, Re: Draft Final Site Characterization and Closure Report for Building 1430 – Auto Hobby Shop, Lowry AFB, Denver, CO-OU5

CDPHE, March 14, 2006, Re: Report of Soil Investigation, RFA Area PAA\_2 (AR\_1179)

CDPHE, May 5, 2006, Re: Remediation and Closure Report, Fire Training Zone Soil -OU1-(AR\_1204)

CDPHE, September 8, 2006, Re: Request for No Further Action, OU2 Closure Activities, Lowry AFB, Denver, CO

CDPHE, October 2006; Re: Completion Report – Removal of Diesel Fuel Contaminated Soil, Power House Plaza (AR\_1183)

CDPHE, May 11, 2007, Re: Draft Request for No Further Action for the Yosemite Street Gate Plume Area, Former Lowry AFB, Denver CO-OU5

CDPHE, June 21, 2006, No Further Action, Outdoor Firing Range (AR\_1221)

CDPHE, November 9, 2007. CDPHE Approval of Offsite Permanganate Injections, Main TCE Plume, Operable Unit 5, Phase 2 Corrective Action Plan Addendum

CDPHE, July 21, 2008. Letter to Paul Carroll, AFRPA re: Evaluation of Radiological Parameters, Landfill Zone (Operable Unit 2), Follow-up to June 10, 2008 submittal and June 23, 2008 phone call, Former Lowry Air Force Base, Denver, CO

CH2M Hill, January 2005, Final RCRA Facility Assessment Report; Former Lowry AFB, Colorado (AR\_1011; AR\_1015)

Dames and Moore, 1986, Phase II, Stage 1, Second Draft Confirmation/Quantification Report, 1986 (AR\_9)

Earth Tech, August 2003, Final Building 1432 Underground Storage Tank Removal Summary Report (AR\_1032)

Earth Tech, September 2003, Final Building 1432 Underground Storage Tank Removal Report (AR\_1032)

Engineering-Science, 1983, Phase 1 Records Search Report (AR\_5)

Engineering-Science, February 1992, Underground Storage Tanks Site Assessment Report, (AR\_78, AR\_79)

Engineering-Science March 1992, Decision Document IRP Site ST-10, Site 8, Tank T, 1992 (AR\_83)

Engineering-Science, March 1992, Decision Document, IRP Site ST-16, Site 6 Tank QQ, (AR\_88);

Engineering-Science, March 1992, Decision Document, IRP Site ST-11, Site 9 Tank U, (AR\_84);

Engineering-Science, March 1992, Decision Document, IRP Site ST-15 Site 11 Tank W, (AR\_87);

Engineering-Science, March 1992, Decision Document, Site 10 Tank V IRP Site ST-13, (AR\_85)

Engineering-Science, March 1992, Decision Document, Site 12 Tank X (IRP Site ST-14), (AR\_86).

Gomez-MTARRI, January 2003, Final Site Closeout Report No Further Response Actions Planned Decision Document for the Coal Storage Yard (West) –OU4- (AR\_1031)

Gomez-MTARRI, January 2003, Final Site Closeout Report No Further Response Actions Planned Decision Document for the Coal Storage Zone (East)-OU3- (AR\_1004)

Gomez-MTARRI, June 2003, Revised Draft Final Site Closeout Report No Further Response Actions Planned Decision Document for the Skeet and Trap Ranges (AR\_1002)

Lowry Assumption, LLC (LAC), July 2002, Lowry AFB Privatization Documents (AR\_991)

LAC, January 2003, Draft Final Transition Plan for Groundwater Cleanup and Landfill Closure at Lowry (AR\_1029)-OU5

LAC, August 2003, Final Offsite Treatability Study Work Plan for Groundwater Cleanup and Landfill Closure at Lowry-OU5

LAC, November 2003, Phase 2 Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry

LAC, January 2004, Final Onsite Treatability Study Work Plan for Groundwater Cleanup and Landfill Closure at Lowry-OU5

LAC, 2004, Groundwater Monitoring Program (GMP) Work Plan for Groundwater Cleanup and Landfill Closure at Lowry-OU5

LAC, March 2004, Final Offsite Treatability Study Report-OU5

LAC, February 2005, Final Supplemental Groundwater Characterization Report for Groundwater Cleanup and Landfill Closure at Lowry-OU5

LAC, March 2005, Completion Report for the Operable Unit 2 (OU2) Landfill Closure at Lowry

LAC, March 2005, Final Phase 1 Corrective Action Plan for Groundwater Cleanup at Lowry-OU5

LAC, March 29, 2005, Letter CAP Addendum for the Conversion of the Planned Uinta Street AS/SVE to an Injection Barrier-OU5

LAC, December 2005, Finding of Suitability for Early Transfer (AR\_1156)

LAC, August 2006, Initial Sitewide Potassium Permanganate Injection Report and Proposed Next Phase of Sitewide Injection Plan-OU5

LAC, October 2006, Phase 2 CAP Addendum – Work Plan for Monitoring Well Installation and Groundwater Sampling – Yosemite Street Gate-OU5

LAC, October 10, 2006, Final Onsite Treatability Study Report-OU5

LAC, November 2006, Source Area Reduction System Shutdown and Decommissioning Report-OU5

LAC, December 2006, Phase 2 Corrective Action for Groundwater Cleanup at Lowry-OU5

LAC, December, 2006 Final Transition Plan II (includes the Soils Management Program)

LAC, January 31, 2007, OU5 TCE in Bedrock Investigation Letter Report Addendum

LAC, February 2007 Carbon Tetrachloride Remediation Progress Report for Lowry Air Force Base, Colorado-OU5

LAC, February 2007, Final RFA Groundwater Data Gaps Investigation Letter Report, Former Lowry Air Force Base, Colorado

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LAC, July 6, 2007, OU5 OFR Soil Gas Probe Installation and Sampling Work Plan

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LAC, October 19, 2007, Results for the July 2007 Semi-annual Groundwater Monitoring Closure/Performance Groundwater Monitoring Program, Main TCE Plume, OU5

LAC, October 26, 2007, OU5 Letter Work Plan-Offsite Permanganate Injection – Main TCE Plume

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LAC, January 17, 2008, OU5 Letter – January 2008 Closure Performance GMP Sampling Event – Main TCE Plume

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LAC, February 6, 2008, Letter Report – OU5 Main TCE Plume – Offsite Permanganate Injection – November/December 2007

LAC, February 12, 2008, OU5 Well Abandonment Request – Yosemite Street Gate

LAC, March 18, 2008, OU5 January 2008 Groundwater Monitoring Program Report – Main TCE Plume.

LAC, March 19, 2008, OU5 January 2008 Groundwater Monitoring Program Report – HQ/FTZ TCE Plumes

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LAC, April 15, 2008, OU5 Well Abandonment Letter Report - Mira Vista Golf Course and Fire Training Zone – Fall 2007

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LAC, April 21, 2008, OU5 NFA Request – Former AF Building 1002E - Dayton Street Septic Tank

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LAC, May 21, 2008, OU5 Phase 2 CAP Addendum for Treatability Study Remediation of Carbon Tetrachloride in Bedrock and Alluvial Water bearing Zones Using BOS100 in the Vicinity of Well ETMW03

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LAC, June 10, 2008, Evaluation of Radiological Parameters, Landfill Zone (Operable Unit 2), Follow-up to Meeting held on April 7, 2008

LAC, June 20, 2008, OU5 July 2008 Modification to Closure/Performance Groundwater Monitoring Program Work Plan-FTZ and HQ Area TCE Plumes

LAC, July, 2008, Evaluation of Radiological Parameters, Landfill Zone (Operable Unit 2), Follow-up to June 10, 2008 submittal and June 23, 2008 phone call

LAC, July 8, 2008, OU5 Supplemental Investigation Report – Groundwater-to-Indoor Air VOC Migration Pathway

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LAC, July 30, 2008, Amended Final Transition Plan II - Revised Soils Management Program

LAC, July 31, 2008, OU5 Summary Report-OU5 Main TCE Plume – Onsite Permanganate Injection-Spring 2008

LAC, August 8, 2008, OU5 Well Abandonment Letter Report, Mira Vista Golf Course and Fire Training Zone - Spring 2008

LAC, August 27, 2008, OU5 July 2008 Groundwater Monitoring Program Report-Main TCE Plume

LAC, August 27, 2008, OU5 July 2008 Groundwater Monitoring Program Report-HQ/FTZ TCE Plumes

LAC, October 21, 2008, OU2 Adjustment to Surface Water Monitoring Schedule, OU2 Landfill Post-Closure Monitoring

LAC, November 25, 2008, OU5 Letter Request to Relocate Well MWWCP02, Main TCE Plume

LAC, December 19, 2008 OU5 January 2009 Closure/Performance Groundwater Monitoring Program Work Plan – Main TCE Plume

LAC, December 19, 2008, OU5 January 2009 Modification to Closure/Performance Groundwater Monitoring Program Work Plan-FTZ and HQ Area TCE Plumes

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LAC, February 25, 2009, OU5 RFA Groundwater Data Gaps Follow-on-Sump Inspection Buildings 849, 905, 959, Request for NFA

LAC, March 12, 2009, January 2009 OU5 Groundwater Monitoring Program Report-Main TCE Plume

LAC, March 30, 2009, OU5 January 2009 Groundwater Monitoring Program Report – FTZ and HQ Area TCE Plumes

LAC, April 17, 2009, OU5 Letter Work Plan-On and Off-Base Permanganate Injections – Main TCE Plume and Headquarters TCE Plume-Spring 2009

LAC, May 18, 2009, OU5 Letter Work Plan Addendum – On- and Off-Base Permanganate Injections - Main TCE Plume and Headquarters TCE Plume-Spring 2009

LAC, May 18, 2009, OU5 RFA Groundwater Data Gaps Follow-on-Thallium Resample and Request for NFA

LAC, June 16, 2009, OU5 July 2009 Closure/Performance Groundwater Monitoring Program Work Plan – Main TCE Plume

LAC, June 16, 2009, OU5 July 2009 Modification to Closure/Performance Groundwater Monitoring Program Work Plan-FTZ and HQ Area TCE Plumes

LAC, August 4, 2009, OU5 Groundwater Sampling Results for 1, 4-dioxane and Request for No Further Action

LAC, August 10, 2009, OU5 July 2009 Groundwater Monitoring Program Report – FTZ Area TCE Plumes

LAC, August 31, 2009, OU2 Results of the OU2 Fire Damage Technical Assessment and Restoration, OU2 Landfill Cap

LAC, September 9, 2009, OU5 July 2009 Groundwater Monitoring Program Report – Main TCE Plume

LAC, October 12, 2009, OU5 Well Abandonment Work Plan – Fall 2009 – Main TCE Plume

LAC, October 20, 2009, OU5 Phase 2 CAP Addendum - Letter Work Plan Addendum-Off-Base Permanganate Injections Main TCE Plume – Fall 2009

LAC, November 10, 2009, OU5 2010 Groundwater-to-Indoor Air VOC Migration Pathway – Work Plan

LAC, December 14, 2009, OU5 January 2010 Closure/Performance Groundwater Monitoring Program Work Plan-Main TCE Plume

LAC, December 18, 2009, OU5 January 2010 Modification to Closure/Performance Groundwater Monitoring Program Work Plan – FTZ and HQ Area TCE Plumes

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LAC, March 26, 2010, OU5 January 2010 Groundwater Monitoring Program Report – Main TCE Plume

LAC, May 3, 2010, OU5 Letter Work Plan-On-Site Permanganate Injections – Mani TCE Plume – Spring and Fall

LAC, May 17, 2010, OU5 July 2010 Work Plan for Semiannual Closure/Performance Groundwater Monitoring Program – HQ Area TCE Plumes

LAC, May 19, 2010, OU5 Indoor Air Study Data Summary and Analysis Report

LAC, May 25, 2010, OU5 July 2010 Closure/Performance Groundwater Monitoring Program Work Plan – Main TCE Plume

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LAC, November 12, 2010, OU5 January 2011 Closure/Performance Groundwater Monitoring Program Work Plan – Main TCE Plume

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LAC, January 28, 2011, OU5 2010 Well Abandonment Completion Report – Main TCE Plume

LAC, February 10, 2011, OU5 Letter Completion Report Summary of 2010 On-Base Potassium Permanganate and OS-100 Injections, OU5

LAC, March 2, 2011, OU5 January 2011 Groundwater Monitoring Program Report – HQ Area TCE Plume

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LAC, May 27, 2011, Well Abandonment Letter Work Plan – 2011, Operable Unit 2 and Operable Unit 5

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LAC, January 10, 2012, OU5, July 2011 Groundwater Monitoring Program Report – Main TCE Plume

LAC, January 10, 2012, OU5 January 2012 Work Plan for Semiannual Closure/Performance Groundwater Monitoring Program – HQ Area TCE Plumes

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LAC, April 4, 2012, OU5 January 2012 Groundwater Monitoring Program Report – Main TCE Plume

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LAC, December 6, 2012, OU5 Groundwater Sampling Program Revised Scope of Work

LAC, February 11, 2013, 2011 Well Abandonment Completion Report-OU2 and OU5

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LT Environmental, April 18, 2007, 1<sup>st</sup> QTR 2007 Groundwater, Surface Water and Soil Vapor Monitoring Report, OU2

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LT Environmental, June 27, 2007, 2<sup>nd</sup> QTR 2007 Groundwater, Surface Water, and Soil Vapor Monitoring Report, OU2

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LT Environmental, June 16, 2008, OU2 Groundwater, Surface Water, and Soil Vapor Monitoring Report – Post-Closure Monitoring Q2 2008

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LT Environmental, November 19, 2008, OU2 Post Closure Operation and Maintenance Report – November 2007 through October 2008

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Versar, May 2001, Final Operable Unit 5 – Groundwater Remedial Investigation (AR\_697-AR\_702)

Versar, December 2002, Final Report of the January 2002 Phase III Environmental Baseline Survey Mercury Survey of Building 898 (AR\_97)

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Versar, March 2006, Report of Soil Investigation, RFA Area PAA-2 (AR\_1180)  
Versar, April 2006, Remediation and Closure Report for the Fire Training Zone Soil – OU1 - (AR\_1161)

Versar, December 2007, Report of the Investigation for the RCRA Facility Unknowns, Former Lowry Air Force Base

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# TABLES

**TABLE 1**  
**RESPONSE ACTION STATUS**  
**SECOND FIVE YEAR REVIEW - FORMER LOWRY AIR FORCE BASE**

Site Name	Date of Response Action	Action Description	Action Levels	Key Reference	Status / Carry Forward?
Operable Unit 2 - Landfill Closure	Completed 2006	Landfill Closure; capping, long-term monitoring	Presumptive remedy, capping and long-term monitoring); statistical detection monitoring	Phase 2 Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry (LAC, November 2003) . Completion Report for the Operable Unit 2 (OU2) Landfill Closure at Lowry (LAC, March 2005); NFA (CDPHE, 9/8/2006)	Remedy Complete - Yes
Operable Unit 5 - Groundwater Cleanup	Interim remedial actions began in 1996. Active injections on-base and off-base 2004-2010, Notice of Completion Report submitted 2011	Groundwater TCE, DCA, and CT contamination. Analysis for metals, inorganics, pesticides, PCBs, radionuclides, SVOCs, and VOCs. Aggressive treatment of TCE plumes via potassium permanganate injections to reduce source area concentrations and eliminate groundwater-to-indoor air pathway. CT source area treated via activated sodium persulfate and BOS-100® Carbon Trap & Treat.	Colorado Basic Standards for Ground Water, or if technically impracticable, petition for site-specific standard from Colorado Water Quality Control Commission.	Phase 2 Corrective Action Plan for Groundwater Cleanup at Lowry (LAC, December 2006; AR_1625); Notice of Completion Report (September 2011).	Remedy Complete - Yes
Operable Unit 1 - Fire Training Zone Soil	Completed 2006	Excavation of PCDD/ PCDF-contaminated soil (incineration) and PAH-contaminated soil; off-site disposal.	PCDD/PCDF- (1 ppb TEQ) contaminated soil. PAH-(0.09 ppm per benzo(a)pyrene).	Remediation and Closure Report for the Fire Training Zone Soil (Versar, April 2006; AR_1161). No Further Action (CDPHE 5/5/06; AR_1204).	UU/EE No
Operable Unit 3 - Fly Ash Disposal Area	Completed 1998	Fly ash-bearing soils were analyzed for PAH, metals, pesticides, VOCs, and PCBs.	Risk-based; unrestricted use	Final Operable Unit 3 - Fly Ash Disposal Area NFRAP Decision Document AR_575; NFA (CDPHE January 13, 1998; AR_537)	UU/EE No
Operable Unit 4 - Coal Storage Yard (West)	Completed 2003	Removal of 44,000 CY of PAH-contaminated soil. <i>As part of the Second Five Year Review, LAC reviewed the ROD - the final remedy set forth in the ROD did not include the restrictive covenant for long-term institutional controls as the remedy was considered protective - this is different than the Proposed Plan which called for a covenant (see Table 3). LAC also reviewed text of the NFRAP: Because the completed remedies do not result in PAH-contaminated soils remaining on site at concentrations posing a threat to human health and the environment for current and future land uses, and long-term institutional controls are not components of the remedies, a five year review is not required for the remedial actions.</i>	EPA Region IX, PRGs for PAHs, feasibility study site-specific remediation goals. Excavation of soils/offsite disposal; long-term protection of health and environment federal threshold of $1 \times 10^{-4}$ and CDPHE of $1 \times 10^{-6}$ .	Coal Storage Yard West Record of Decision (ROD) (Versar, 2000; AR_1065); Final Site Closeout Report NFRAP Decision Document for the Coal Storage Yard (West) (Gomez-MTARRI, January 2003; AR_1031)	UU/EE No
Operable Unit 4 - Coal Storage Zone (East)	Completed 2003	Removal of 7,863 CY of PAH-contaminated soil. Soil analyzed for metals and PAH. <i>As part of the Second Five Year Review, LAC reviewed the ROD which selected removal and off-site disposal of PAH contaminated soil. LAC also reviewed text of the NFRAP: Because the completed remedies do not result in PAH-contaminated soils remaining on site at concentrations posing a threat to human health and the environment for current and future land uses, and long-term institutional controls are not components of the remedies, a five year review is not required for the remedial actions.</i>	EPA Region IX, PRGs for PAHs, feasibility study site-specific remediation goals. Excavation of soils/offsite disposal; long-term protection of health and environment federal threshold of $1 \times 10^{-4}$ and CDPHE of $1 \times 10^{-6}$ .	Coal Storage Yard East Record of Decision (ROD) (Versar, 2001); Final Site Closeout Report NFRAP Decision Document for the Coal Storage Zone (East) (Gomez-MTARRI, January 2003; AR_1004)	UU/EE No
Building 606 Former Base Exchange Gas Station	Completed 2008	Approximately 3,576 CY of petroleum-contaminated soil removed, soil analyzed for TVPH and BTEX, ORC applied at the groundwater interface. BOS-200® trap and treat injected. Groundwater monitoring	Tier 1 risk-based screening levels (RBSLs) for BTEX(CDLE OIS, 1999). Soil cleanup standards 500 mg/kg total TPH, 0.26 mg/kg benzene, 170 mg/kg toluene, 200 mg/kg ethylbenzene, and 1,900 mg/kg xylenes	Progress Report - Additional Remediation Activities, Request for No Further Action Determination, Former Building 606 (LTE, January 2008, AR_1680). NFA (CDPHE, 2/1/08;AR_1681)	UU/EE No

**TABLE 1  
RESPONSE ACTION STATUS  
SECOND FIVE YEAR REVIEW - FORMER LOWRY AIR FORCE BASE**

Site Name	Date of Response Action	Action Description	Action Levels	Key Reference	Status / Carry Forward?
Building 777	Completed 2006	Removal of beryllium contaminated dust on the horizontal surfaces of the buildings main structural beams.	Corrective Action implemented to address beryllium-contaminated dust. EPA Region 3 cancer risk-based number of 0.00075 ug/m <sup>3</sup> and non-cancer risk of 0.01 ug/m <sup>3</sup>	RCRA Facility Assessment (CH2MHill, January 2005). Former Air Force Building 777 Closure Report, Beryllium Remediation (LAC, October 2006; AR_1157, 1205). NFA (CDPHE, 11/1/06; AR_1159; 1207)	UU/EE No
Building 402 Soil and Building 667 Grease Trap	Completed 2004	Removal of PCB-contaminated soil and concrete. Removal of grease trap contents and cleaning. Removal of approximately 8 CY of concrete rubble and 15 CY of soil beneath concrete slab. Analysis for PCBs, VOCs, SVOCs, pesticides, herbicides, and metals.	Toxic Substances Control Act for PCB concentrations 1 mg/kg. Final concentrations below risk based 0.22 mg/kg	PCB Removal at Building 402 and Grease Trap Closure at Building 667 (CH2M HILL, 2/24/05), NFA (CDPHE 11/29/05)	UU/EE No
Building 1432 (Soils)	Completed 2003	Removal of seven solvent USTs.	Tanks removed and contaminated soils removed to water table. Groundwater addressed under OU5	Final Building 1432 Underground Storage Tank Removal Summary Report (Earth Tech, August 2003; AR_1032).	UU/EE No
Building 1437 Former Military Service Station	Completed 2003	Removal of approximately 2,050 CY of petroleum-contaminated soil followed by groundwater monitoring.	RBSLs from the Petroleum Storage Tank Owner Operator Guidance Document (CDLE/OIS, 1999) as approved in the Corrective Action Plan.	NFA Building 1437 (CDLE OPS, July 15, 2003)	UU/EE No
SS-06 (Auto Hobby Shop) IRP Site	Completed 1999	Removal of 700 CY of soil, OWS, and buildings. Soil analyzed for PAH, VOCs, SVOCs, PCBs, TEH, and O&G.	RAC II action level for TPH	Final Site Characterization and Closure Report for Bldg. 1430 - Auto Hobby Shop (TIE, 10/1/2003; AR_1048) : NFA (CDPHE, 9/25/03)	UU/EE No
Building 667 - Oil and Grease trap	Completed 2004	Grease trap was closed, plugged with grout and capped with concrete, PCBs were not detected	NA	PCB Removal at Building 402 and Grease Trap Closure at Building 667 (CH2M HILL, 2/24/05), NFA (CDPHE 11/29/05)	UU/EE No
Power House Plaza Deisel Contaminated Soil	Completed 2006	Removal of ~400 CY of soil. Soil analyzed for PAH, VOCs, SVOCs, PCBs, DRO, and GRO	Lowry Soil Action Levels (LAC, 2006)	Completion Report – Removal of Diesel Fuel Contaminated Soil and No Further Action Request Power House Plaza Deisel Spill (LAC, September 2006; AR_1182). NFA (CDPHE 10/06; AR_1183).	UU/EE No
Outdoor Firing Range Soil	Completed 2006	Screening for unexploded ordnance, removal of lead-contaminated soil and lead fragments	RAOs - CDPHE 400 mg/kg for lead, removal lead fragments in the soil	Remediation Completion Report Former Outdoor Firing Range Remediation (MT2, May 2006; AR_1223). No Further Action (CDPHE 6/21/06; AR_1221)	UU/EE No
Skeet and Trap Ranges	Completed 2003	Approximately 24,900 CY soil remediated; contaminated with lead and PAH.	400 mg/kg lead; and reduce or eliminate the potential for future soil contamination from remnant lead shot	Final Site Closeout Report No Further Response Actions Planned Decision Document for the Skeet and Trap Ranges (2003; AR_1002)	UU/EE No
ST-07 (POL Yard and Old Jet Fuel Storage Yard)	Completed 1999	Bioventing for the contaminated soil; groundwater monitoring program to remediate petroleum hydrocarbon in the soil and groundwater (BTEX, TEH, and TVH).	RAC II action level for TPH	NFRAP approval, ST-07 (POL Yard and Old Jet Fuel Storage Yard) (April 10, 2000 AR_660)	UU/EE No
ST-08 (Tanks A, B, C)	Completed 1993	Petroleum hydrocarbon-contaminated soil removal and tank removal.	RAC III action levels	UST Site Assessment Report, (ES, Feb. 1992 AR_78) initial review of Tank C; CDPHE June 5 1995, AR_453; NFA Tanks A and B (CDPHE, 4/10/2000 (AR_660)	UU/EE No
ST-09 (Yosemite Street Gate)	Completed 2004	SVE/Bioventing system to remediate soils, long term groundwater monitoring.	MCL	NFA Request Yosemite Street Gate (LAC, 3/19/2007), NFA Yosemite Street Gate (CDPHE 5/11/07)	UU/EE No
ST-10 (Tank T)	Completed 1991	Petroleum hydrocarbon-contaminated soil removal and Tank T removal.	RAC III action levels	Decision Document ST-10, (ES, 1992 - AR_83); SLSA - (Parsons, 1994 AR_424); NFA (CDPHE, 2/7/95 AR_431);	UU/EE No

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RESPONSE ACTION STATUS  
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Site Name	Date of Response Action	Action Description	Action Levels	Key Reference	Status / Carry Forward?
ST-11 (Tank U)	Completed 1991	Petroleum hydrocarbon-contaminated soil removal and Tank U removal.	RAC III action levels	UST Site Assessment Report, (ES, Feb. 1992 AR_78); Decision Document, IRP Site ST-11, Site 9 Tank U (Engineering-Science, March 1992 (AR_84); NFA Tank U, 2001	UU/EE No
ST-13 (Tank V)	Completed 1991	Petroleum hydrocarbon-contaminated soil removal and Tank V removal.	RAC III action levels	UST Site Assessment Report, 1992 AR_78; Decision Document, Site 10 Tank V (IRP Site ST-13 ) Engineering-Science, March 1992 (AR_85); NFA, Tank V, CDPHE 2001	UU/EE No
ST-14 (Tank X)	Completed 1991	Petroleum hydrocarbon-contaminated soil removal and Tank X removal.	RAC III action levels	UST Site Assessment Report, (ES Feb 1992), AR_78; Decision Document, Site 12 Tank X IRP Site ST-14(Engineering-Science, March 1992 AR_86); NFA Tank X (CDPHE 1993, AR_410)	UU/EE No
ST-15 (Tank W)	Completed 1991	Petroleum hydrocarbon-contaminated soil removal and Tank W removal.	RAC III action levels	UST Site Assessment Report, (ES, Feb 1992 AR_78); Decision Document, IRP Site ST-15, Site 11 Tank W, (Engineering-Science, March 1992 AR_87); NFA Tank W, (CDPHE, 2001)	UU/EE No
ST-16 (Tank QQ)	Completed 1991	Petroleum hydrocarbon-contaminated soil removal and Tank QQ removal.	RAC III action levels	UST Site Assessment Report, (ES, 1992 AR_78); Decision Document, IRP Site ST-16, Site 6 Tank QQ, (Engineering-Science, March 1992 AR_88); NFA, (CDPHE, 1995)	UU/EE No
1392 Tank 51387	Completed 2002	Removal of UST	RAC II action levels plus CDLE 1995 guidance requiring delineation of vertical and horizontal extent of soil contamination to 20 mg/kg TPH and 5 mg/kg BTEX. CBGWS	Second Level Site Assessment, Tank 51387 (URS/Dames and Moore, 9/1/01; AR_1063). NFA, (CDPHE 2002). FOST approval 7/25/2000.	UU/EE No
<b>Notes:</b>					
SHADED cells indicate site is carried forward for review in the Second Five Year Review					
RAC II Action Levels - 250 mg/Kg total petroleum hydrocarbons (TPH) and 50 mg/Kg total BTEX. A target cleanup level of 1,000 mg/Kg for oil					
RAC III Action Levels - 500 mg/Kg total petroleum hydrocarbons (TPH) and 100 mg/Kg total BTEX.					
<b>Acronyms:</b>					
AR	US Air Force Administrative Record	mg/kg	milligrams per kilogram	PCE	Tetrachloroethene
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes	NA	Not applicable	ppm	part per million
CBGWS	Colorado Basic Groundwater Standard - Regulation 41	NFA	No further action	PRG	Preliminary remediation goal
CDLE	Colorado Division of Labor & Employment	NFRAP	No Further Response Action Planned	RAO	Remedial Action Objective
CDPHE	Colorado Department of Public Health and Environment		Decision Document	RBSL	Risk-based screening level
CT	Carbon Tetrachloride	OIS	Oil Inspection Section	RCRA	Resource Conservation and Recovery Act
CY	cubic yard	OPS	Office of Public Safety	ROD	Record of Decision
DCA	Dichloroethane	ORC	Oxygen release compound	SVOC	Semi-volatile organic compound
DRO	Diesel range organics	OU	Operable unit	TCE	Trichloroethene
EPA	Environmental Protection Agency	OWS	Oil water separator	TEH	Total Extractible Hydrocarbon
FOST	Finding of Suitability for Transfer	O&G	Oil and grease	TPH	Total Petroleum Hydrocarbons
GRO	Gasoline range organics	PAH	Polynuclear aromatic hydrocarbon	TVPH	Total volatile petroleum hydrocarbon
IRP	Installation Restoration Program	PCB	Polychlorinated biphenyl	UST	Underground Storage Tank
LAC	Lowry Assumption, LLC	PCCD	Polychlorinated dibenzo-p-dioxin	VOC	Volatile organic compound
MCL	Maximum Contaminant Level	PCCF	Polychlorinated dibenzofuran	ug/m <sup>3</sup>	micrograms per cubic meter

**Table 2 – Response Actions Carried Forward for Review  
Second Five Year Review  
Former Lowry Air Force Base**

<b>OU Common name ROD date</b>	<b>RAOs</b>	<b>Remedy</b>
<p align="center"><b>OU2</b></p> <p>Landfill Zone</p> <p>Decision Date 11/05/03 Phase 2 CAP</p>	<ul style="list-style-type: none"> <li>• Prevent current and future exposure to, or contact with, the landfill mass either directly or indirectly.</li> <li>• Reduce the potential for leachate generation or groundwater quality degradation by minimizing surface water infiltration through the landfill cover.</li> <li>• Prevent the potential for instability or erosion of the landfill mass.</li> <li>• Reduce the overall site safety hazard by placing miscellaneous surface debris beneath an engineered landfill cap.</li> <li>• Reduce the potential for surface water quality degradation through contact with the landfill mass.</li> <li>• Prevent potential contact with or use of groundwater/leachate within the landfill.</li> <li>• Monitor groundwater to detect the migration of landfill contaminants beyond the OU 2 boundary.</li> <li>• Prevent the uncontrolled accumulation of gas within the landfill and the release of landfill gas above the CDPHE threshold limit at the OU2 boundary.</li> <li>• Prevent exposure to or contact with landfill gas.</li> <li>• Monitor landfill gas emissions/concentrations, as required by 6 CCR 1007-2, to detect concentrations above action levels described in the Post-Closure O&amp;M Plan.</li> <li>• Provide long-term effectiveness of the remedial action through operation and maintenance of the implemented action.</li> </ul>	<ul style="list-style-type: none"> <li>• Design, construct, and maintain a new landfill cap</li> <li>• Install landfill gas vents and monitoring probes</li> <li>• Complete the groundwater monitoring network for post-closure monitoring</li> <li>• Post-closure monitoring and cap maintenance</li> <li>• Prepare and implement Environmental Covenant/Institutional Controls in the FOSET</li> </ul>

**Table 2 – Response Actions Carried Forward for Review  
Second Five Year Review  
Former Lowry Air Force Base**

OU Common name ROD date	RAOs	Remedy
<p align="center"><b>OU5</b></p> <p>Groundwater</p> <p>Decision Date 12/21/06 Phase 2 CAP</p>	<ul style="list-style-type: none"> <li>▪ Groundwater cleanup will be performed to achieve concentrations that are acceptable to the State of Colorado, and will be achieved through enhanced mass removal and a polishing period where it will be shown that the initial enhanced mass removal has reduced the risk to human health and the environment. Groundwater sampling will be performed and will demonstrate compliance with the CDPHE requirements in a reasonable timeframe.</li> <li>▪ The State of Colorado has "Basic Standards for Groundwater", under Regulation No. 41, which are set by the Water Quality Control Commission of the CDPHE (<a href="http://www.cdphe.state.co.us/op/regs/waterregs/100241basicstandardsforgroundwater.pdf">http://www.cdphe.state.co.us/op/regs/waterregs/100241basicstandardsforgroundwater.pdf</a>). Currently the groundwater standard for trichloroethylene is 5 µg/L. This standard will be the final cleanup goal for TCE in the groundwater on or downgradient of the Lowry AFB site. If at some future date, it is determined that this standard is not achievable, the Water Quality Control Commission will be petitioned for a site-specific standard. The ultimate cleanup goal will be established based on technical feasibility, the long term risk from the groundwater to indoor air exposure pathway and protective of groundwater. Where technically feasible at the Lowry site, TCE concentrations in groundwater will be remediated to levels that are protective of the groundwater to indoor air pathway in accordance with the CDPHE Policy on Interim Risk Evaluation and Management Approach for TCE, August 20, 2004. In the event that it is technically infeasible to achieve these levels through groundwater cleanup, other methods will be employed to address the risk to the groundwater to the indoor air pathway.</li> </ul>	<ul style="list-style-type: none"> <li>• In Situ chemical oxidation w/potassium permanganate to address TCE mass in alluvium and bedrock</li> <li>• In situ reductive dechlorination w/BOS100 to eliminate CT mass in bedrock source area</li> <li>• Groundwater monitoring to demonstrate effectiveness of remedy and to support closure</li> <li>• Prepare and implement Environmental Covenant/Institutional Controls in the FOSET for the on-base areas</li> </ul>

**Table 2 – Response Actions Carried Forward for Review  
Second Five Year Review  
Former Lowry Air Force Base**

OU Common name ROD date	RAOs	Remedy
OU5 Continued	<ul style="list-style-type: none"> <li>▪ Where source areas are encountered in groundwater, technologies to remove source materials will be employed. If these technologies are not effective, then technologies to contain source areas will be evaluated, implemented, and maintained as necessary to protect human health and the environment.</li> <li>▪ Potential indoor air risks due to the presence of COG concentrations in groundwater will be addressed through active and aggressive removal of contaminant mass in the groundwater source. This approach presumes that the best approach to controlling the indoor air pathway is to remove the majority of the source materials in the groundwater within a reasonable timeframe.</li> <li>▪ Preference should be given to technologies that can rapidly and cost-effectively reduce chlorinated solvent concentrations in groundwater relative to other technologies.</li> <li>▪ Technologies employed to reduce the COC concentrations in groundwater should consider the impact of the technology on public and private properties. Impacts to be considered include but are not limited to: noise, road closures, remedial infrastructure installed on private property, deleterious effects on utilities, and remedial activities on or within private properties.</li> <li>▪ Technologies employed to reduce the COC concentrations in groundwater should consider the impact of the technology on surface water and sediment.</li> <li>▪ Investigation and remediation derived wastes shall be handled in an appropriate manner.</li> <li>▪ Off-gasses generated during remedial activities will be dealt with in accordance with the Colorado Air Regulations.</li> </ul>	

**Table 2 – Response Actions Carried Forward for Review  
Second Five Year Review  
Former Lowry Air Force Base**

OU Common name ROD date	RAOs	Remedy
OU5 Continued	<ul style="list-style-type: none"> <li>▪ NFA for any plume area will require sufficient quarterly groundwater monitoring to demonstrate that the contaminant concentrations are below the levels acceptable to the State and that these levels will not rebound above the acceptable levels.</li> <li>▪ Following receipt of NFA, site restoration activities will be performed, including removal of any treatment buildings, decommissioning of any wells and piping, and abandonment-in-place of any subsurface features.</li> </ul>	

**Acronyms**

AFB Air Force Base  
 CAP Corrective Action Plan  
 CDPHE Colorado Department of Public Health and Environment  
 COC Contaminant of Concern  
 CT Carbon tetrachloride  
 EPA Environmental Protection Agency

FADA Fly Ash Disposal Area  
 FOSET Finding of Suitability for Early Transfer  
 OU Operable Unit  
 O&M Operations and Maintenance  
 RAOs Remedial Action Objectives  
 TCE Trichloroethene

**Table 3  
Regulatory Issues Raised During the Second Year Review  
Former Lowry Air Force Base**

Location	AF Name	Common Name	Decision Date	Why Not Evaluated	Issue
<b>OUs not being evaluated</b>					
OU3	OT-05	Fly Ash Disposal Area (FADA)	1998	No ROD NFRAP	* Final Remedy: risk-based unrestricted use. Long-term protectiveness questioned by CDPHE in 2013 - solid waste left in place, no Land Use Control in place
OU4	OT-03	Coal Storage Yard (West)	2000	ROD/NFRAP (UU/UE)	* Final Remedy: Excavation and waste disposal in base landfill (OU2). Long-term protectiveness called into question by CDPHE in 2013. Difference between Proposed Plan and Final ROD: Proposed Plan called for a LUC for waste left in place under a portion of 6th Avenue; however, the Final ROD did not require a LUC for waste left in place under 6 <sup>th</sup> Avenue
	OT-03	Coal Storage Yard (West)	2000	ROD/NFRAP (UU/UE)	* Approximately 4,000 cubic yards of waste (coal dust, PAH-impacted soil, debris, fly ash, and asbestos) excavated from the OT-3 portion of OU4 and intended for final disposition in the base landfill (OU2) was historically stockpiled circa 2000/2001 on the south end of property formerly owned by the AF (currently owned by the City and County of Denver), located immediately west of OU2. Based on June 2013 field observations by CDPHE, this waste was subsequently partially reburied and redistributed on and beneath land surface, north of the initial stockpile location on land formerly owned by the AF and currently owned by IRG Redevelopment I. Visible OU4-related waste remains along the eastern property boundary (to the west of OU2) at least 800 feet north of Alameda Parkway.
	OT-04	Coal Storage Zone (East)	2000	ROD/NFRAP (UU/UE)	None

**Table 3  
Regulatory Issues Raised During the Second Year Review  
Former Lowry Air Force Base**

Location	AF Name	Common Name	Decision Date	Why Not Evaluated	Issue
<b>Areas not being evaluated</b>					
Primrose Property Hydrocarbon in Soil Removal	NA	Primrose Property	None	No ROD	(1) Hydrocarbon impacted soil area remaining in place above actionable levels
Wetlands Park Hydrocarbon in Soil Removal	NA	Wetlands Park/Kelly Road Dam	None	No ROD	(1) Hydrocarbon impacted soil remaining in place above actionable levels

\*If necessary, issue will be evaluated and resolved during the Third Five Year Review Period

(1) Recent removal action conducted by LAC under the CDPHE-approved Soils Management Program - efforts to resolve remaining issues are ongoing

AF            U.S. Air Force  
 CDPHE      Colorado Department of Public Health and Environment  
 FADA       Fly Ash Disposal Area (OU3)  
 LUC        Land Use Control  
 NA          Not applicable  
 NFRAP     No Further Remedial Action Planned Decision Document  
 OU         Operable Unit  
 PAH        Polycyclic Aromatic Hydrocarbon  
 ROD        Record of Decision  
 UU/UE     Unrestricted Use / Unrestricted Exposure

**Table 4 - Operable Unit 5 Chronology  
Second Five Year Review  
Former Lowry Air Force Base**

<b>Event</b>	<b>Date</b>	<b>Source Document</b>
<b><u>Air Force</u></b>		
Phase I Records Search, initial AOC identification	1983	Engineering-Science, 1983
Remedial Investigation (RI) and Supplemental RIs	1990 1993-1995	SAIC, 1990 Versar, 2001
UST investigations and Second Level Site Assessments	1990-1995 1997-2000	Various
Permeable Reactive Wall Demonstration Treatment System	1995	Versar, May 2001
Boundary Area Hydraulic Containment System installation (BAHCS) –Main TCE Plume at the 11 <sup>th</sup> Avenue boundary.	Dec-96	Versar 1996
SARS installation– located in the outfall and Building 1432 source area.	May-96	Versar 1996
Heritage Estates Sub-slab Depressurization System installed	1998	Versar, 2001
Building 404 OWS Removal in Headquarters TCE Plume source area	2001	Versar, February 2001 (AR_1059)
OU5 Remedial Investigation	May-01	Versar, 2001
Groundwater to Indoor Air Contaminant Migration Pathway Investigation	2002	Versar, 2003
MNA Investigation	2002	Versar, 2003
Plume Boundary Refinement Activities	2001-2002	Versar, 2003
Building 1432 Tank removal	2003	Earth Tech, September 2003 (AR_1032)
<b><u>Privatization - LAC</u></b>		
Transition Plan for Groundwater Cleanup and Landfill Closure at Lowry Air Force Base	Jan-03	LAC, January 2003
Supplemental Groundwater Characterization Program	2004	LAC, February 2005
Phase 1 CAP	2003	LAC, March 2005
SARS Shutdown	2003	LAC, November 2006
Treatability Studies	2003 - 2006	LAC, March 2004; October 2006;
Phase 2 CAP	2004-2006	LAC, December 2006
Potassium permanganate injections	2004 – 2010	LAC, August 2006; February 2008; August 2008; January 2010; February 2011

**Table 4 - Operable Unit 5 Chronology  
Second Five Year Review  
Former Lowry Air Force Base**

<b>Event</b>	<b>Date</b>	<b>Source Document</b>
Phase 2 CAP Addendum – Carbon Tetrachloride Investigation	2004-2005	LAC, March 2007
Phase 2 CAP Addendum – Building 1432 Bedrock Investigation	2004-2005	LAC, August 2006
Phase 2 CAP Addendum – Uinta Street Injection Barrier	2005	LAC, March 2005
RCRA Facility Assessment	2004-2005	CH2MHill, December 2005
BAHCS Decommissioned	2005	Versar, 1996
RFA Groundwater Data Gaps Investigation	2006	LAC, February 2007
Phase 2 CAP Addenda – Carbon Tetrachloride Source Area Remediation	2006 - 2008	LAC, February 2007; April 2008; February 2009
Yosemite Street Gate NFA	May-07	CDPHE, May 11, 2007
Groundwater-to-Indoor Air Pathway Study	Mar-07 Jan-2010	LAC, October 2008; December 2010
Remedial Progress Assessment	Spring 2008 Spring 2010 Fall 2011	LAC, April 4, 2008; October 2010; September 2011
Havana PCE Plume NFA	Aug-08	CDPHE, August 19, 2008
Havana 1,2 DCA Plume NFA	Aug-08	CDPHE, August 19, 2008
Initial Five Year Review	2008	LAC, October 7, 2008
1,4-Dioxane NFA	2009	LAC, October 6, 2009
Notice of Completion	2012	LAC, September 26, 2011

AOC Area of Concern  
 BAHCS Boundary Area Hydraulic Containment System  
 CAP Corrective Action Plan  
 DCA Dichloroethane  
 LAC Lowry Assumption, LLC  
 MNA Monitored Natural Attenuation  
 NFA No Further Action  
 OU Operable Unit  
 OWS Oil-Water Separator  
 PCE Tetrachloroethene  
 RCRA Resource Conservation and Recovery Act  
 RI Remedial Investigation  
 SARS Source Area Reduction System  
 TCE Trichloroethene  
 UST Underground Storage Tank

**Table 5 – Summary of KMnO<sub>4</sub> Injections - Operable Unit 5 - Groundwater  
Second Five Year Review  
Former Lowry Air Force Base**

Injection Event	Percent KMnO <sub>4</sub> Solution Injected	Lbs of KMnO <sub>4</sub> Injected	Injection Interval	OU5 Plume Areas					Total Number of Injection Points
				Northern Off-site	Main TCE Plume - On-base	Headquarters TCE Plume	Fire Training Zone TCE Plumes	SARS	
<b>Initial 5 Year Review</b>									
2004	3%	76,769	Bedrock/Alluvium	89	272	6	13	24	404
2006	3%	44,000	Bedrock/Alluvium	-	325	21	38	-	384
2007	4%	99,216	Alluvium	299	-	-	-	-	299
<b>Second 5 Year Review</b>									
2008	4%	68,318	Alluvium	-	206	-	-	-	206
2009	4%	195,000	Bedrock/Alluvium	186	323	73	-	**63	582
2010	4%	109,208	Bedrock/Alluvium	-	306	-	-	**50	306
<b>Totals:</b>		<b>592,511</b>		<b>574</b>	<b>1432</b>	<b>100</b>	<b>51</b>	<b>24</b>	<b>2181</b>

\*\*Indicates BOS-100<sup>®</sup>, not included in total

**References:**

LAC, August 2006, December 2006, November 2007, July 2008, January 2010, February 2011

- KMnO<sub>4</sub> Potassium permanganate
- LAC Lowry Assumption, LLC
- Lbs pounds
- OU Operable unit
- SARS Source Area Reduction System
- TCE Trichloroethene

**Table 6**  
**Issues Identified for Operable Units Reviewed**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

Issue Number	OU	Issues	Affects Protectiveness (Y/N)	
			Current	Future
1	OU5	Concentrations of TCE and CT in groundwater in the Main TCE Plume (on-base and off-base), Fire Training Zone TCE Plume, and Headquarters TCE Plume have reached asymptotic conditions and remain above the CBGWS of 5 micrograms per liter (Regulation 41, CCR 1002-41). Locally within the TCE plumes, there is variability observed on a well by well basis from sampling event to sampling event and some wells display an increasing trend in detected concentrations. The significance of the variability and increasing trends is being considered in the ongoing assessment of the remedy effectiveness. Continued active treatment for TCE will not further reduce the residual mass found in the OU5 plumes.	N	Y
2	OU5	The boundaries for the State Environmental Covenant in the Fire Training Zone TCE Plumes area do not appear to coincide with the 2001 plume boundaries.	N	Y
3	OU5	There are no institutional controls in place north of the former base boundary	N	Y
4	OU5	A search of the State Engineer's well database indicates two wells were permitted and installed in the 1950s within the boundary of the 2001 off-base Main TCE Plume. Wells designated for agricultural use; status of the wells is unknown.	N	Y

CBGWS      Colorado Basic Groundwater Standard – Regulation 41, CCR 1002-41  
CCR        Colorado Code of Regulations  
CT         Carbon tetrachloride  
OU         Operable Unit  
TCE        Trichloroethene

**Table 7**  
**Recommendations and Follow-up Actions for Operable Units Reviewed**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

Issue Number (1)	OU	Recommendations	Responsible Party	Oversight Agency	Anticipated Milestone Date	Affects Protectiveness (Y/N)	
						Current	Future
1	OU5	Evaluate the suitability of and petition the Colorado Water Quality Control Commission for a site-specific standard for TCE and CT.	LAC	CDPHE	9/1/14	N	Y
1	OU5	Absent attaining site-specific standards for TCE and CT, a CDPHE-approved long-term monitoring plan is already in place; revise Phase 2 CAP as necessary	LAC	CDPHE	12/31/14	N	Y
2	OU5	Determine basis for discrepancy of covenant boundary whether in legal description or cartographic representation. If necessary, redefine legal description for the plume boundaries and update State Environmental Covenant HMCOV00022 Attachment A.	LAC	CDPHE	12/31/14	N	Y
3	OU5	Consider options available such as Informational Institutional Controls and apply as appropriate.	LAC	CDPHE	6/1/15	N	Y
4	OU5	Contact homeowners to assess the existence, condition, and uses of wells, if any. Take appropriate measures to eliminate potential exposure (e.g., well abandonment).	LAC	CDPHE	3/31/14	N	Y

(1) Issue numbers correspond to the issues listed on Table 6

CAP            Corrective Action Plan  
CDPHE        Colorado Department of Public Health and Environment  
CT             Carbon Tetrachloride  
LAC            Lowry Assumption, LLC  
N/A            Not applicable  
OU             Operable Unit  
RAO            Remedial Action Objective  
TCE            Trichloroethene

**Table 8 - Operable Unit 2 Chronology  
Second Five Year Review  
Former Lowry Air Force Base**

<b>Event</b>	<b>Date</b>	<b>Citation</b>
<b>Air Force</b>		
IRP Phase 1 records search	1983	Engineering Science, 1983 (AR_5)
IRP Phase II Confirmation/Quantification Stage 1 – included groundwater sampling at landfill	1987	Dames and Moore, 1986 (AR_9)
Remedial Investigation (RI)	1990	SAIC, 1990 (AR_57)
Supplemental RI for the landfill zone	1995	Parsons, 1995 (AR_289)
Focused Feasibility Study (FFS)	1998	Versar, 1998 (AR_400; AR_549)
Proposed Plan	1998	see LAC, 2003, Phase 2 CAP Operable Unit 2, Appendix A
Long-Term Monitoring for Radiological Parameters	2004-2005	Cabrera Services, Inc., 2005
Privatization - LAC	Aug-02	
Preliminary Closure Plan for OU2	2003	LAC, June 2003
Phase 2 Corrective Action Plan (CAP)	2003	LAC, November 2003
Cover Construction Complete	Mar-2005	
Landfill Completion Report	2005	LAC, March 2005
Closure Approved	2006	CDPHE, September 2006
Monitoring System Well Installation Complete	Nov-2006	
Post-Closure Monitoring – 30 Year	Initiated 2006 ongoing	LTE, 2007 – 2013; See References in Section 8 for complete listing
Additional Radiological Monitoring	2007	LTE, May 2007, July 2007, LAC 2008
Well Abandonment – non-essential wells	2011-2012	LAC, February 2013

CDPHE Colorado Department of Public Health and Environment

IRP Installation Restoration Program

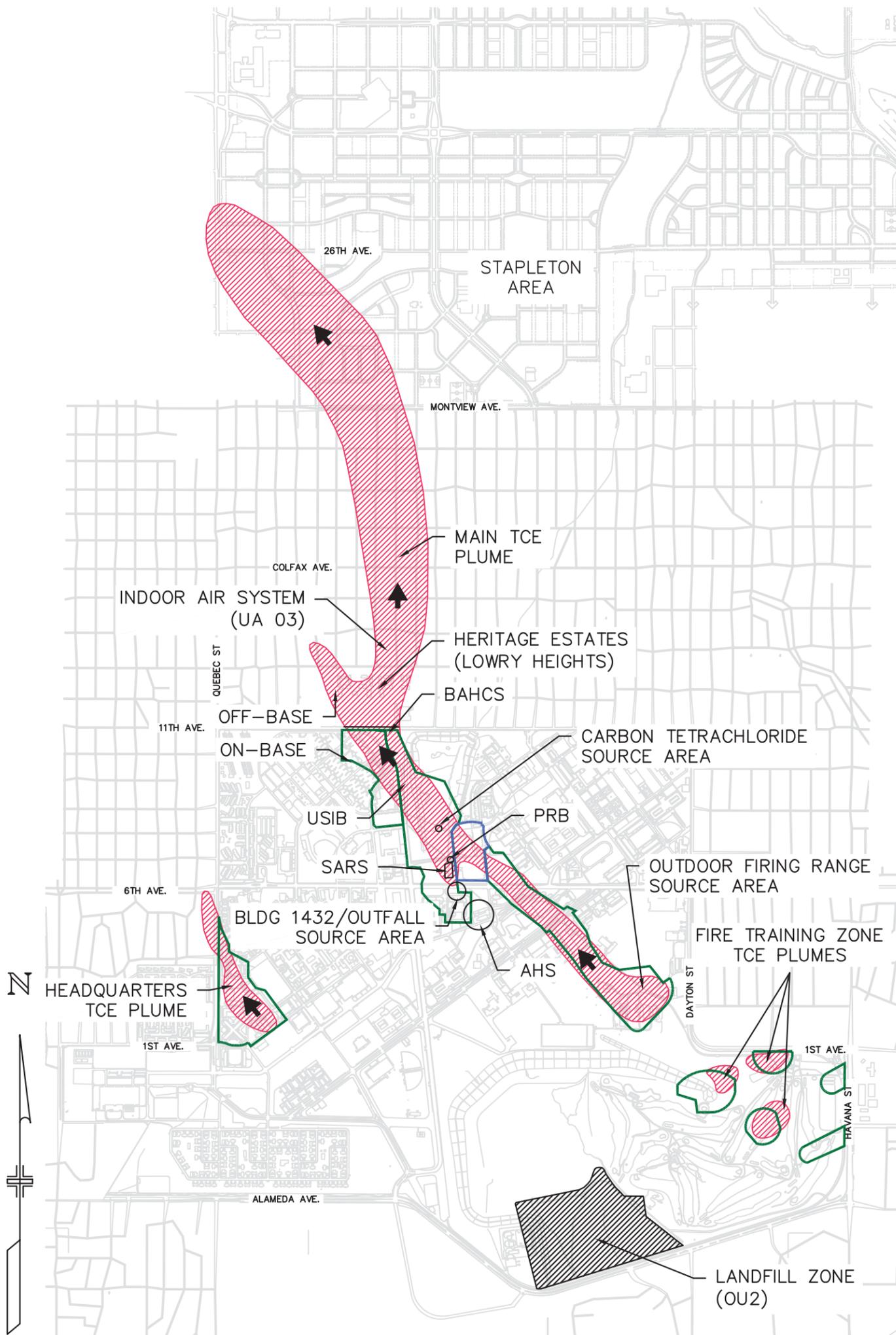
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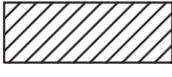
OU Operable Unit

**Table 9**  
**Operable Unit 2 Monitoring Schedule - November 2006 through October 2036**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

<b>Operation &amp; Maintenance</b>	
Cap Monitoring & Inspection	Monthly for Year 1; quarterly for Years 2- 10; semiannually for Years 11 - 30
Video Inspection of sewer	Once per year: Years 1 - 30
Annual Operation & Maintenance Reporting	Once per year: Years 1 - 30
<b>Post-Closure Monitoring</b>	
Standard Groundwater Monitoring- 9 wells	9 well groundwater monitoring network - sample quarterly for Years 1- 2; semiannually for Years 3 - 30
Surface Water Sampling-3 locations	3 sample locations in Westerly Creek - sample semiannually for Years 1 - 30
Soil Gas Monitoring 27 probes	27 gas probes - monitor monthly for Year 1; quarterly for Years 2- 10; semiannually for Years 11 - 20; annually for Years 21 - 30
Groundwater Detection Data Compilation	Quarterly for Years 1 - 2; semiannually for Years 3 - 30
Groundwater Monitoring Report without Statistical Summary	Every other quarter during Years 1 - 2 (Quarters 1, 3, 5, 7)
Groundwater Monitoring Report with Statistical Summary	Semi-annually Years 3 - 30
<b>As-needed Items</b>	
Surface Water Sample - Seep	Sample seep(s) as they appear and as volume allows - assume sample one seep every three years
Soil Gas Analytical – methane only	Collect and analyze samples per conditions stipulated in Phase 2 CAP for OU2
<b>Cover Maintenance/Repair</b>	
O&M Vegetation Control - Mow/fertilize	Mow vegetative cover at least once per year for 30 years or until cover well established

# FIGURES



-  2001 OU5 TCE PLUME BOUNDARIES  
(Boundary defined by 5 micrograms per liter for trichloroethene: Regulation 41, CCR 1002-41)
-  Alluvial Groundwater Flow Direction
-  OU2 Landfill (Boundary represents extent of State Environmental Covenant HMC0V00023)
-  OU5 Boundary of State Environmental Covenant HMC0V00022
-  Belle Bonfils Use Restriction Area

- AHS – Auto Hobby Shop
- BAHCS – Boundary Area Hydraulic Containment System
- PRB – Permeable Reactive Barrier Demonstration
- SARS – Source Area Reduction System
- USIB – Uinta Street Injection Barrier

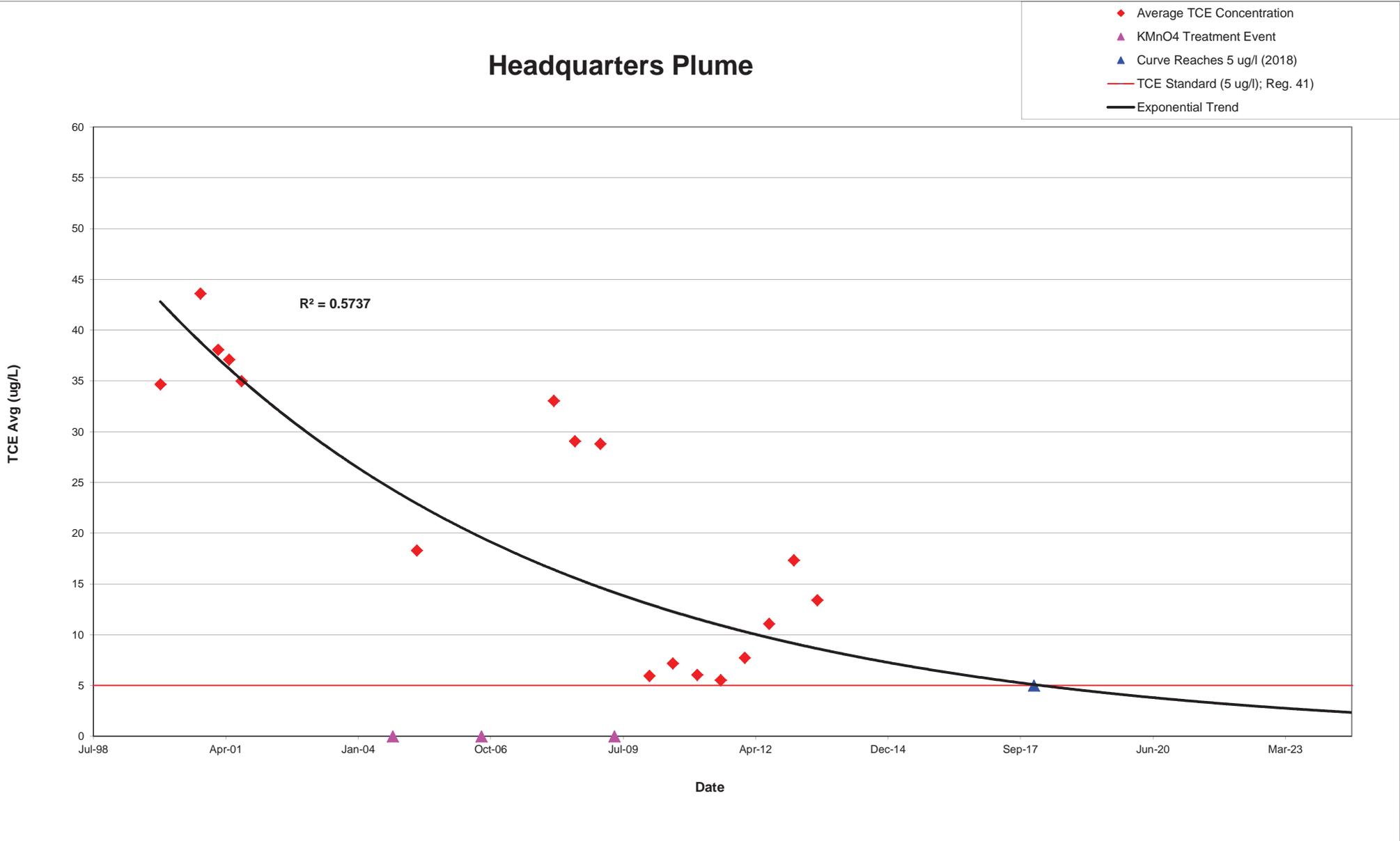
<b>LOWRY ASSUMPTION, LLC</b>			
<b>FIGURE 1</b>			
LOCATION MAP SECOND FIVE YEAR REVIEW			
DESIGNED BY:	SCALE:	DATE ISSUED: September 2013	
DRAWN BY: JKB	HORIZ: 1"=2000'	CHECKED BY: ADJ	VERT. n/g
SHEET NO. 1 OF 1 SHEETS			<b>EX1</b>





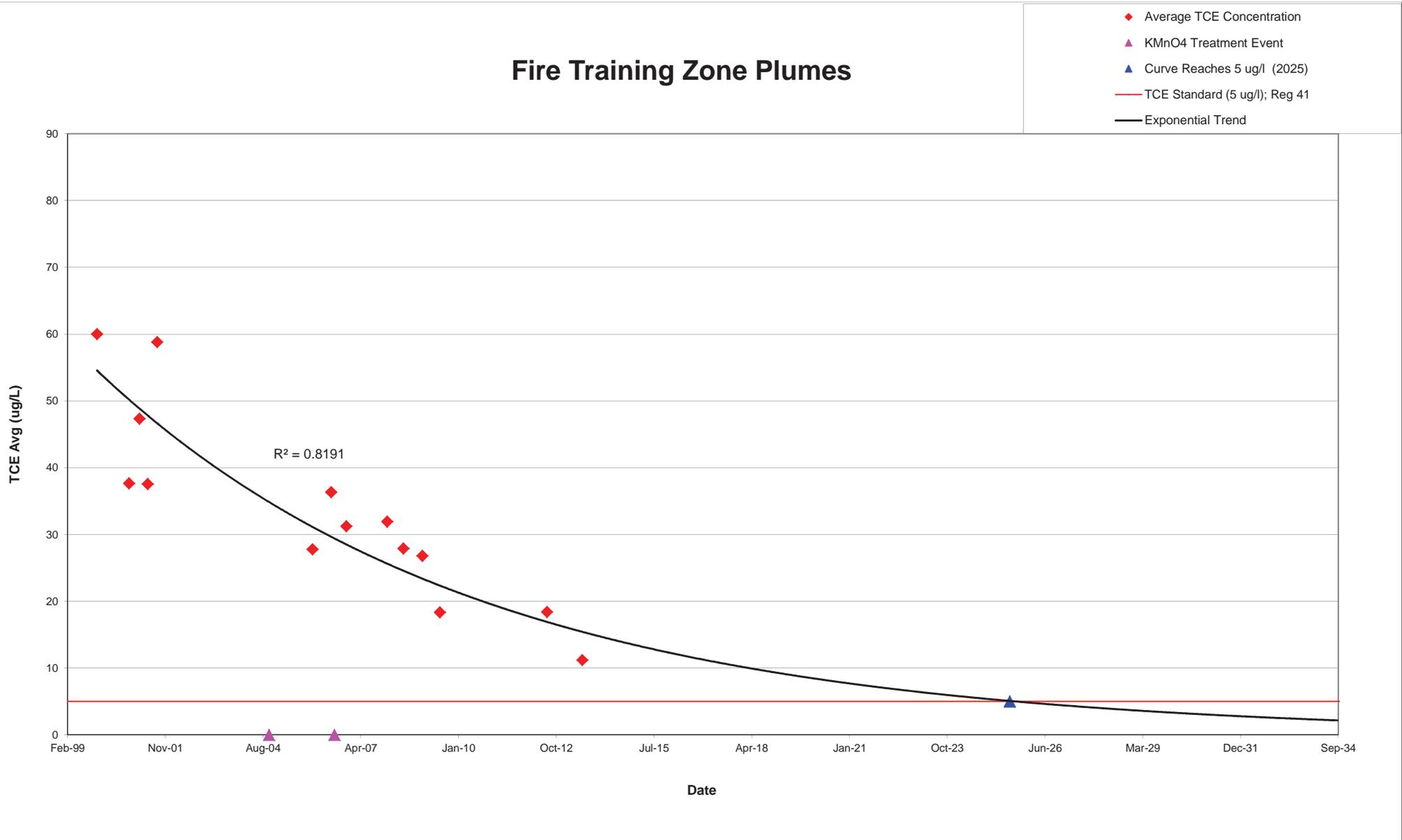
**FIGURE 4**  
**AVERAGE ALLUVIAL TCE CONCENTRATION DECLINE CURVE**

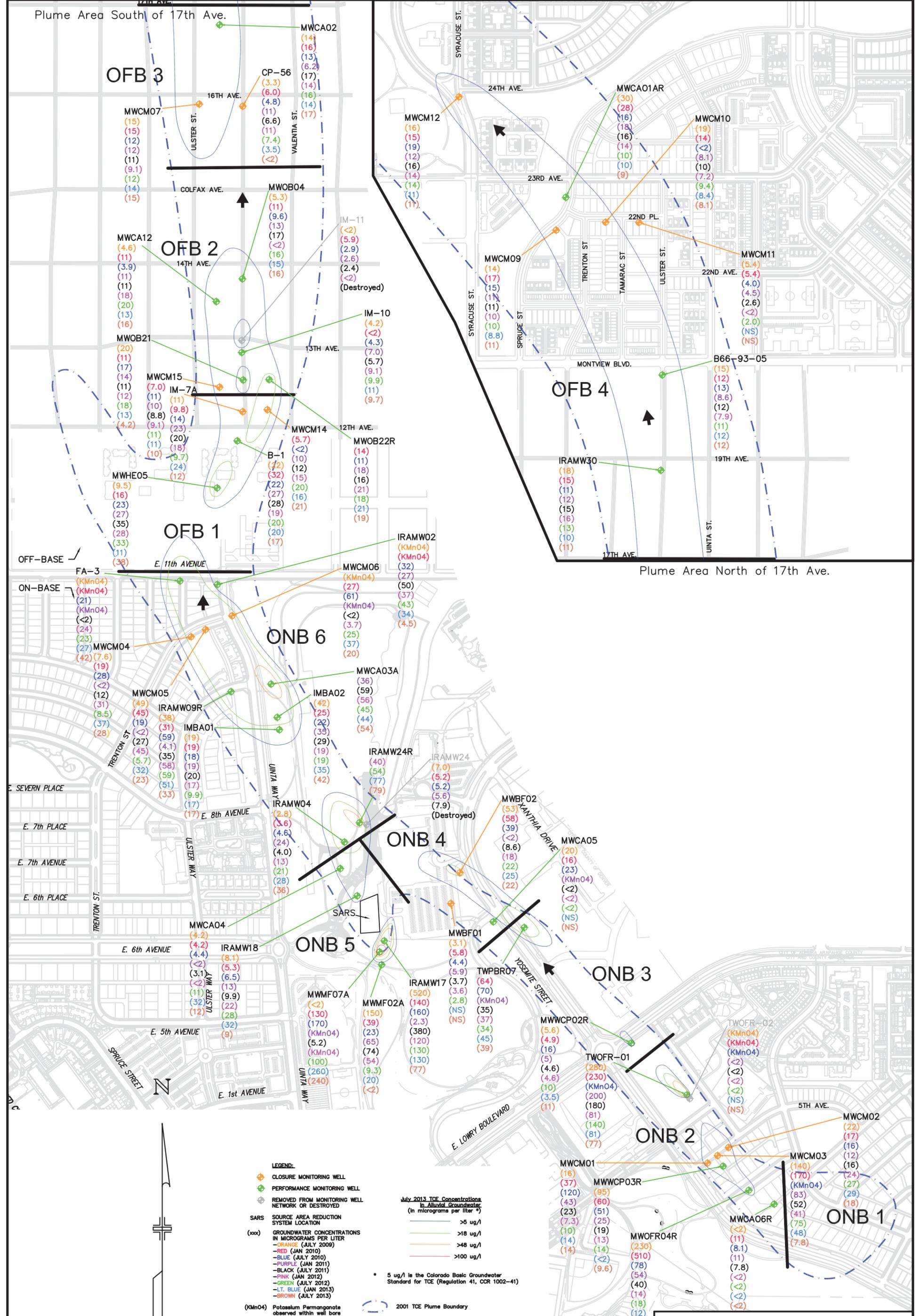
### Headquarters Plume



**FIGURE 5**  
**AVERAGE BEDROCK TCE CONCENTRATION DECLINE CURVE**

**Fire Training Zone Plumes**





**LOWRY ASSUMPTION, LLC**

**FIGURE 6A**

Main TCE Plume – Alluvium  
July 2013  
Second Five Year Review

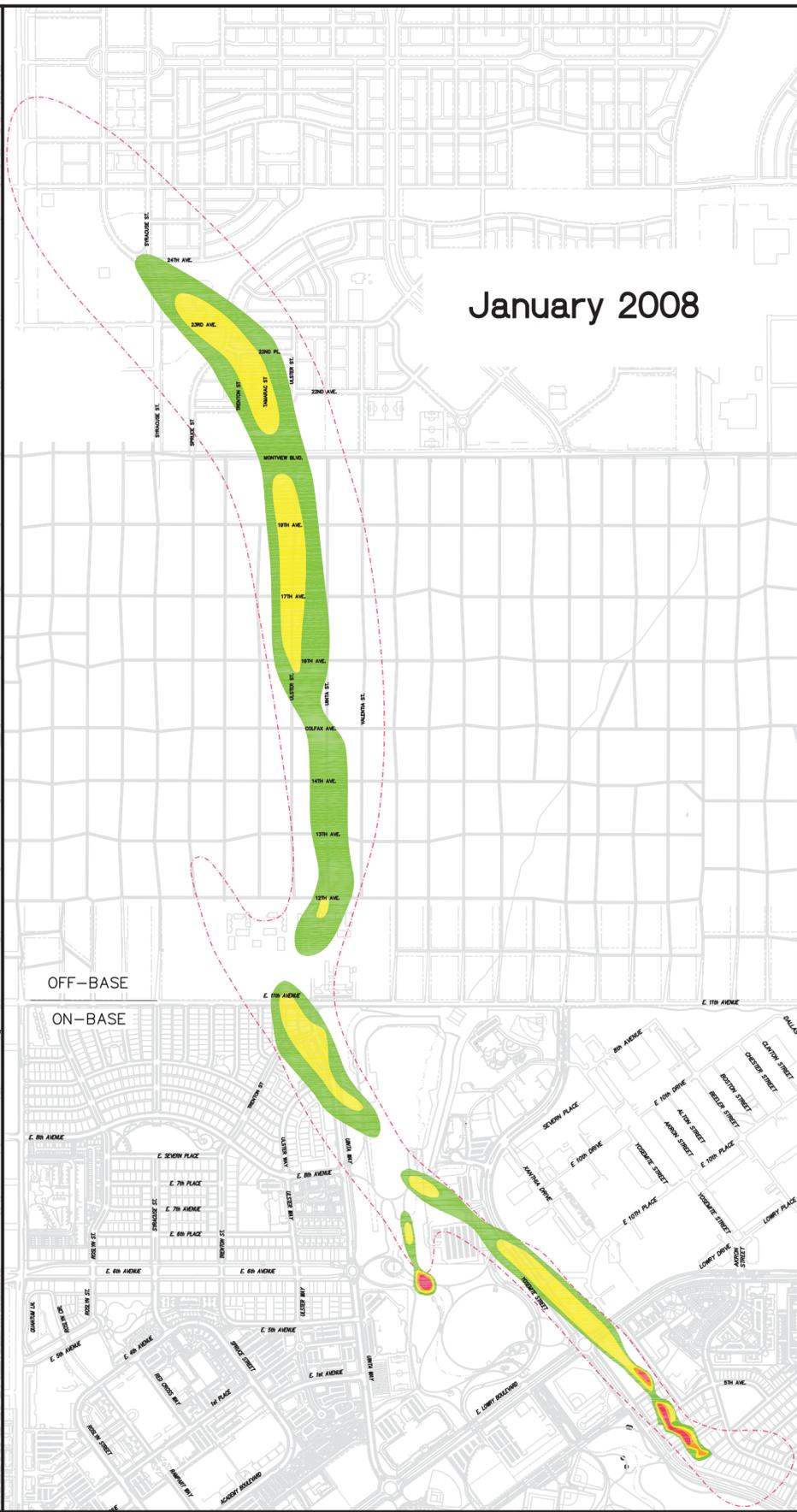
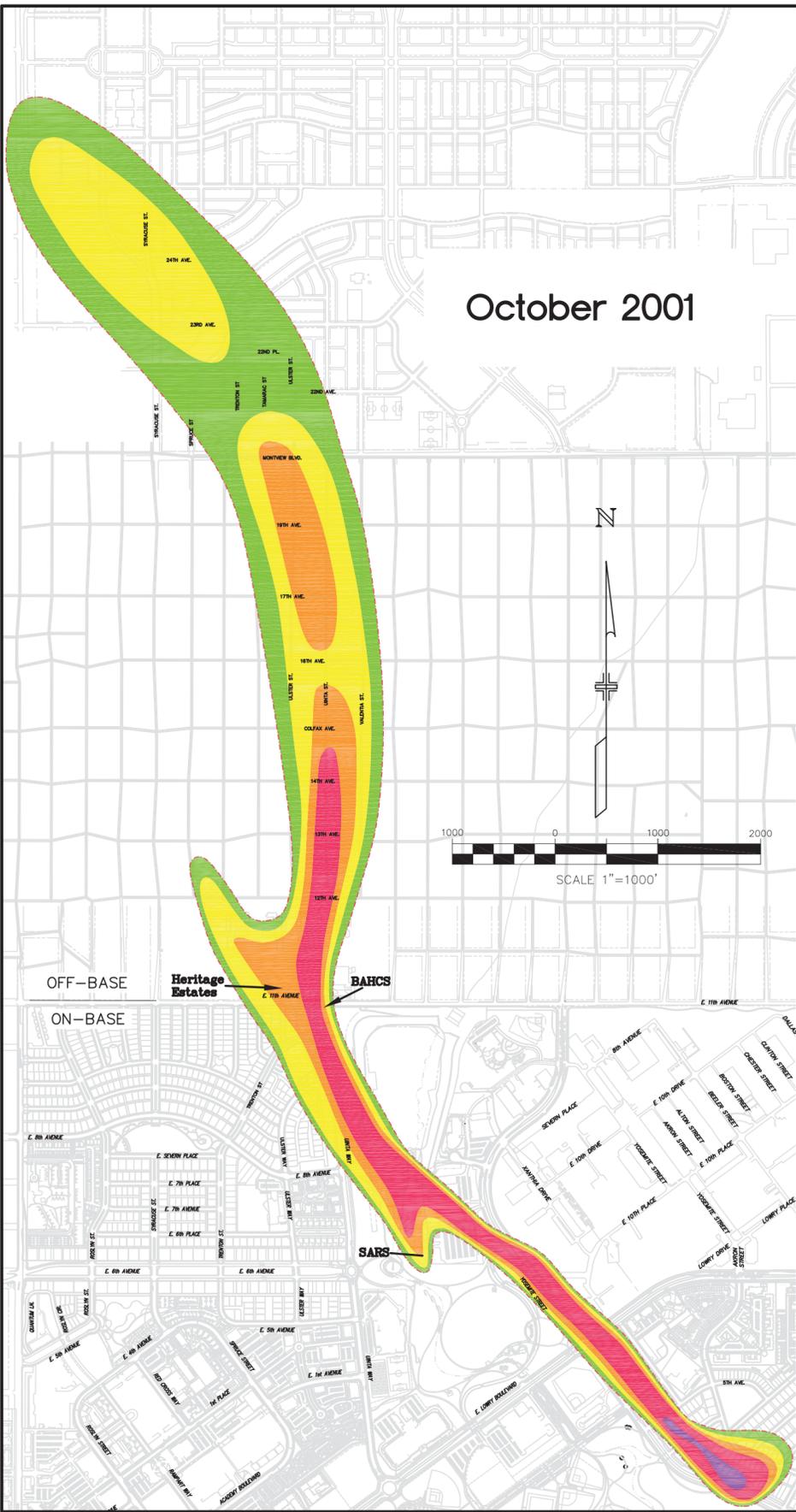
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CHECKED BY: ADJ

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VERT: n/g

DATE ISSUED: August 2013  
SHEET NO. 1 OF 1 SHEETS

**EX1**





LOWRY ASSUMPTION, LLC

Figure 7  
Main TCE Plume Timeline  
2001 through 2013  
Second Five Year Review

TCE Concentration (ug/L)

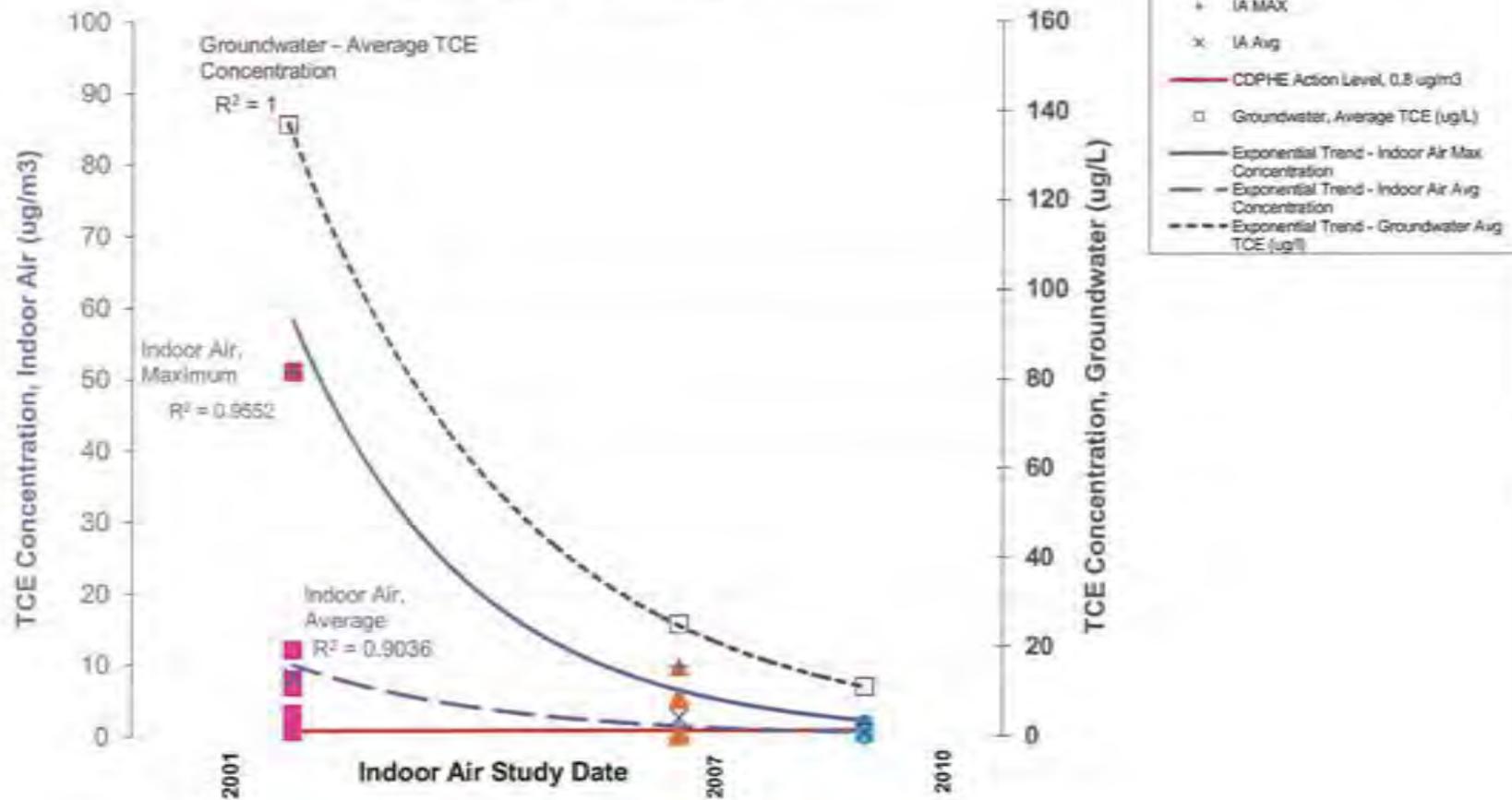
- >1000
- >100
- >48
- >18
- >5

--- 2001 PLUME BOUNDARY  
(TCE > 5 ug/L)

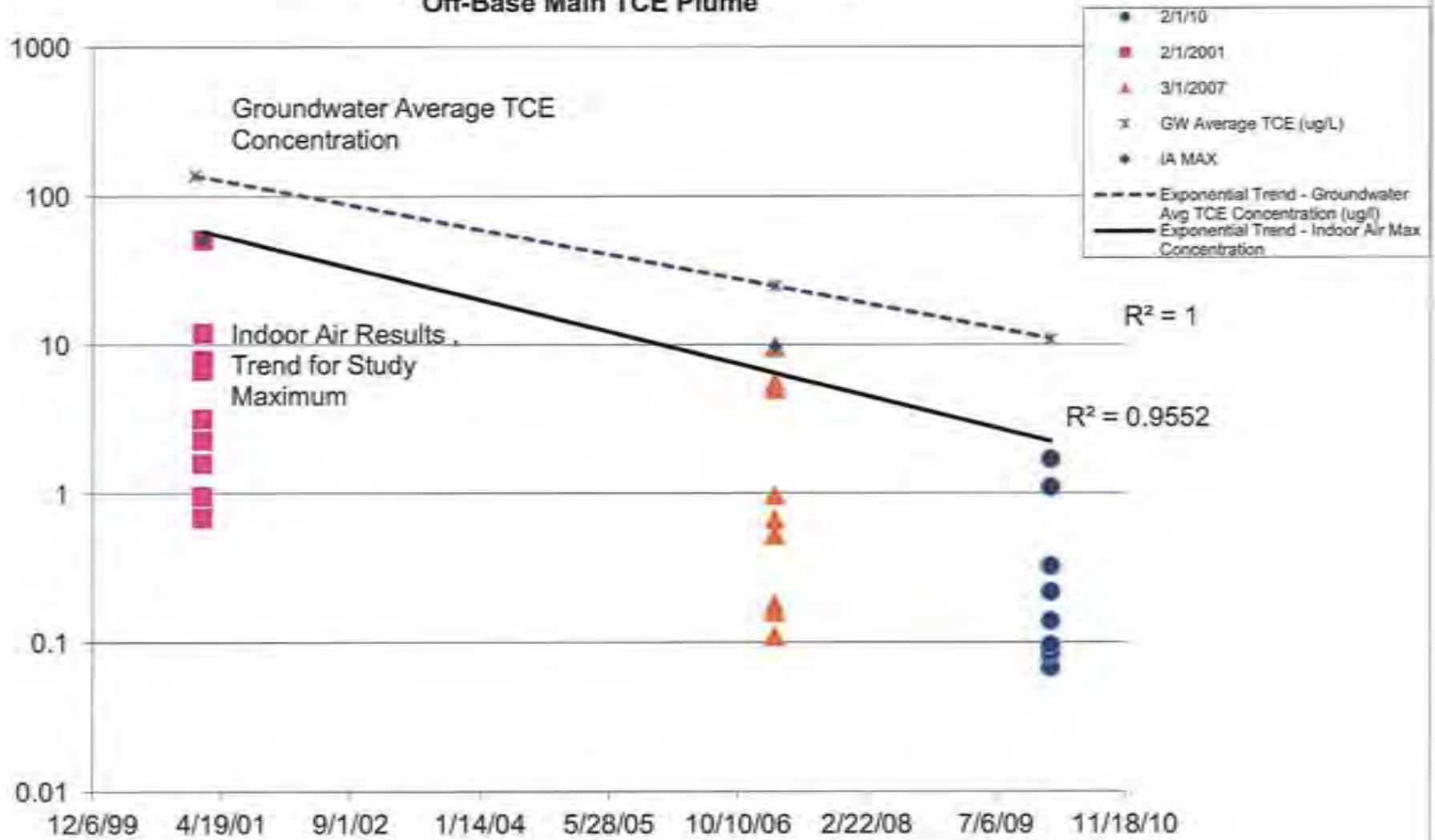
Active Plume-wide Treatment 2004-2009  
-Treatability Studies  
-KMnO4 Treatment

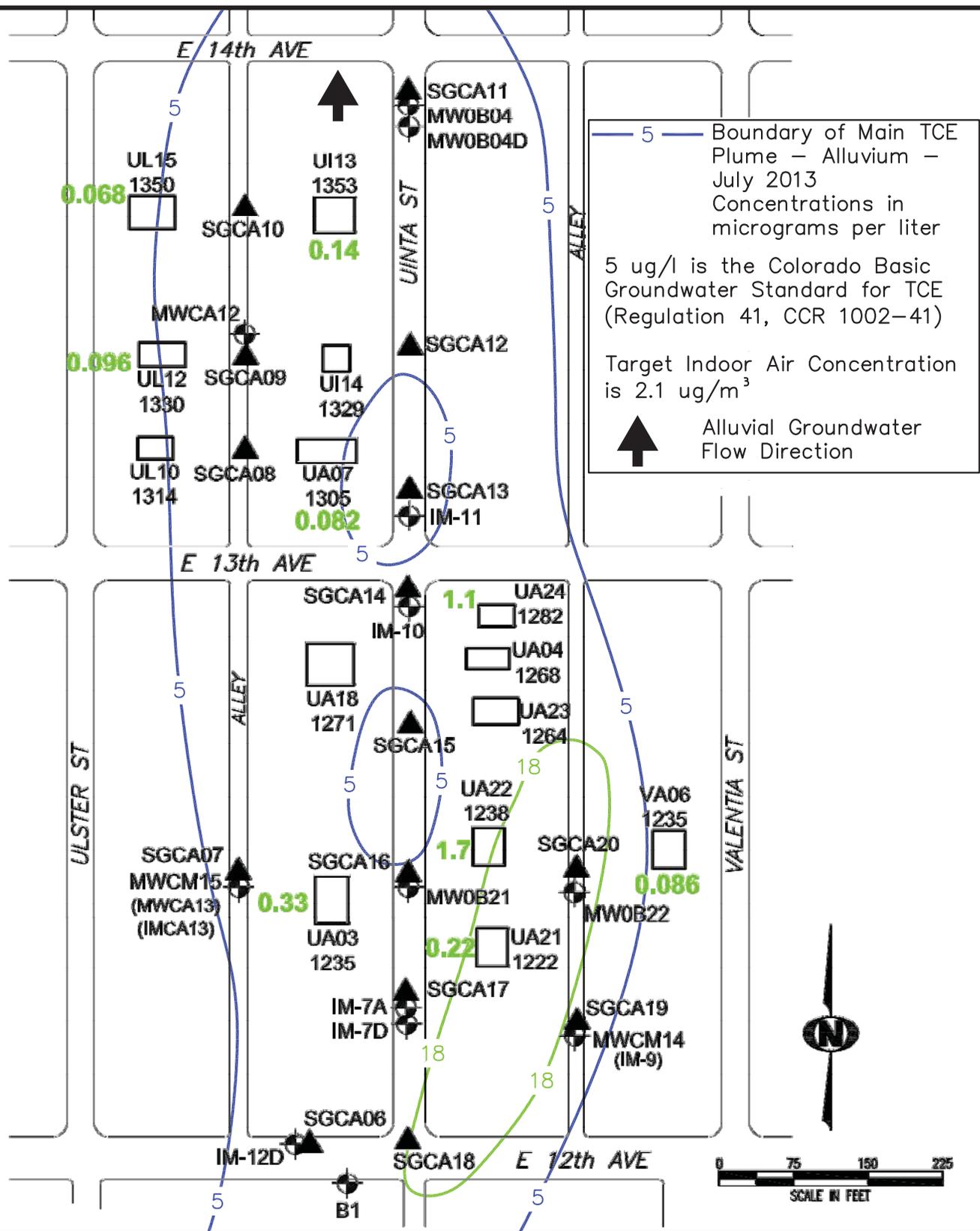
- 2004 Site-wide, 404 locations, 77,000 lbs
- 2006 On-base, 366 locations, 44,000 lbs
- 2007 Off-base, 299 locations, 99,000 lbs
- 2008 On-base, 206 locations, 68,000 lbs
- 2009 Site-wide, 580 locations, 195,000 lbs
- 2010 On-base, 306 locations, 109,000 lbs

**Figure 8**  
**Indoor Air Results and Groundwater Results**  
**Off-Base Main TCE Plume**



**FIGURE 9**  
**Indoor Air Results and Groundwater Average**  
**Off-Base Main TCE Plume**





5 — Boundary of Main TCE Plume – Alluvium – July 2013  
 Concentrations in micrograms per liter  
 5 ug/l is the Colorado Basic Groundwater Standard for TCE (Regulation 41, CCR 1002-41)  
 Target Indoor Air Concentration is 2.1 ug/m<sup>3</sup>  
 ↑ Alluvial Groundwater Flow Direction

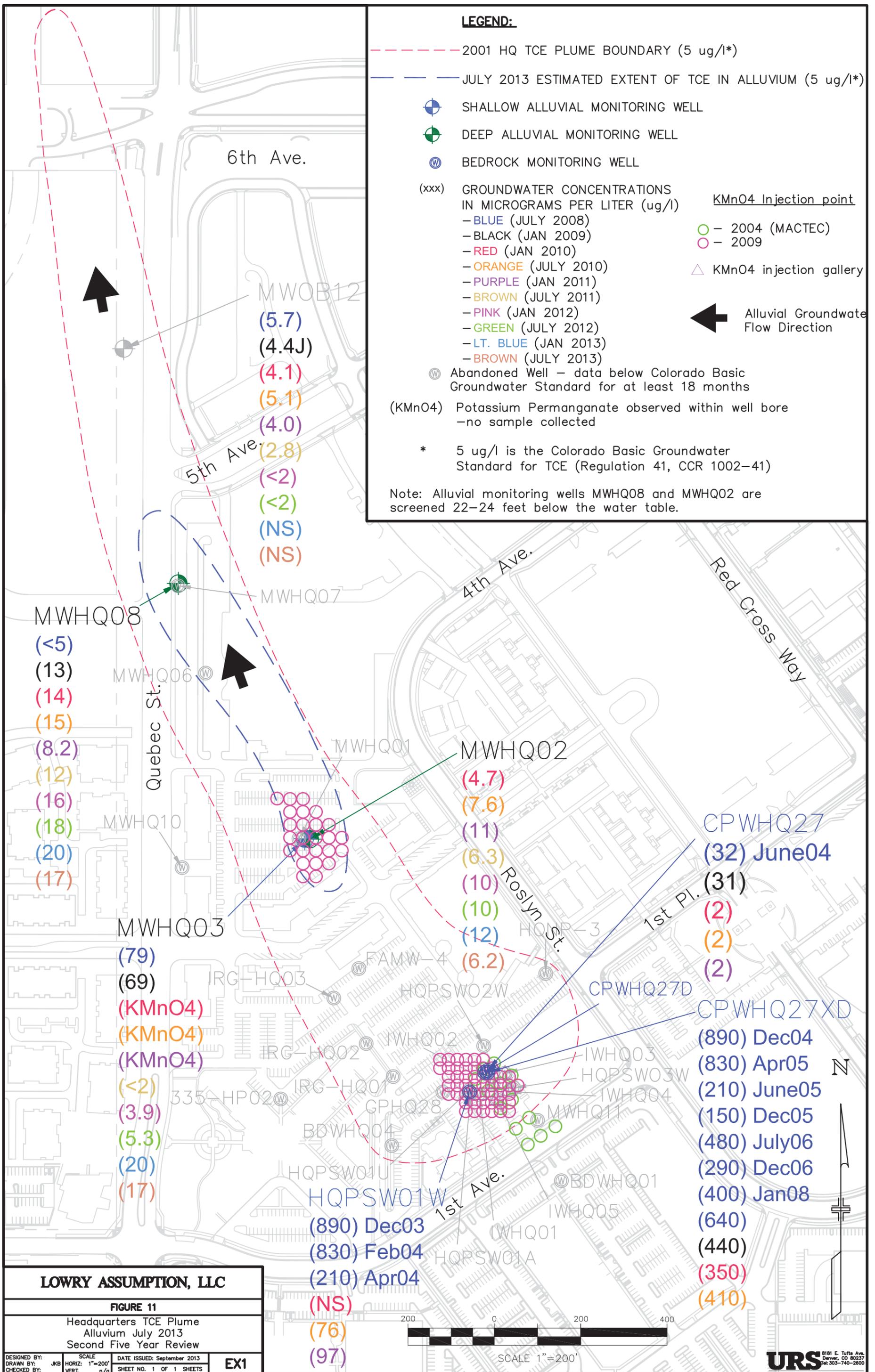
**LEGEND**

- MWCM14 (IM-9) MONITORING WELL LOCATION (PREVIOUS MONITORING WELL IDENTIFIER)
- SGCA12 2010 SOIL GAS SAMPLE LOCATION
- UL14 1329 PREVIOUS SAMPLE IDENTIFIER STREET ADDRESS
- 0.33 MAXIMUM INDOOR AIR TCE CONCENTRATION (µg/m<sup>3</sup>)

**FORMER LOWRY AIR FORCE BASE**  
 Denver, Colorado

**INDOOR AIR  
 TCE CONCENTRATIONS  
 JANUARY 2010**

**Figure 10**  
**Second Five Year Review**

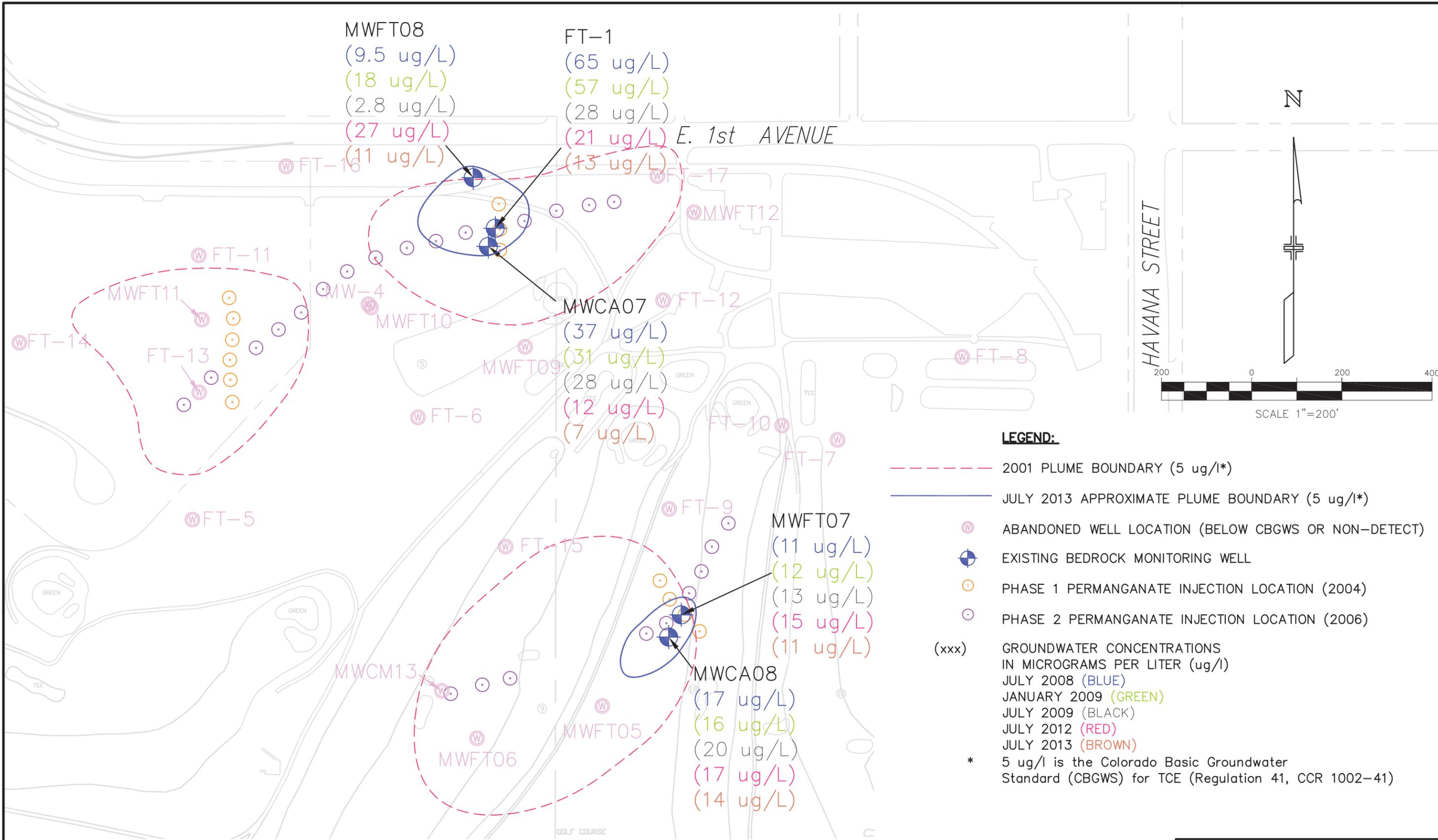


**LOWRY ASSUMPTION, LLC**

**FIGURE 11**

Headquarters TCE Plume  
 Alluvium July 2013  
 Second Five Year Review

DESIGNED BY: JKB	SCALE: HORIZ: 1"=200'	DATE ISSUED: September 2013	<b>EX1</b>
CHECKED BY: n/g	VERT: n/g	SHEET NO. 1 OF 1 SHEETS	



**LOWRY ASSUMPTION, LLC**

**FIGURE 12**

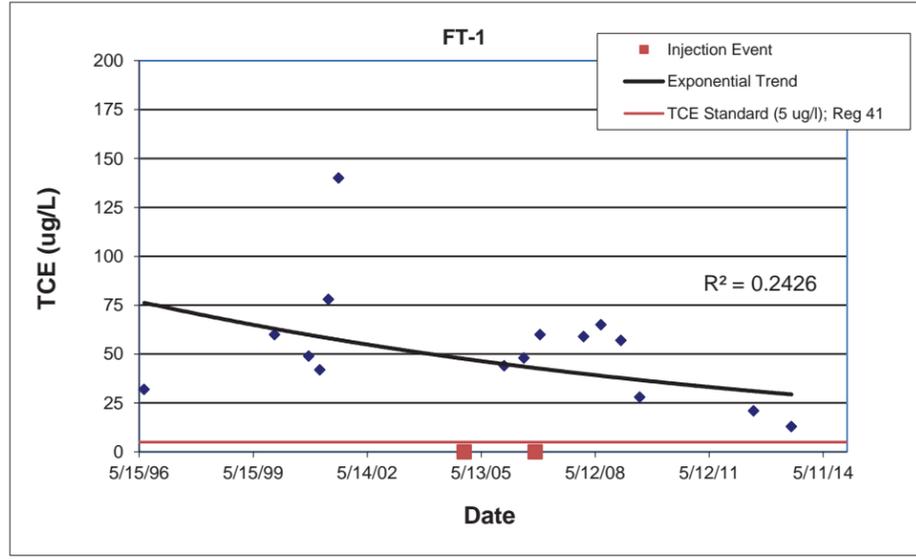
FIRE TRAINING ZONE TCE PLUMES  
 BEDROCK - JULY 2013  
 SECOND FIVE YEAR REVIEW

DESIGNED BY:	SCALE:	DATE ISSUED: September 2013
DRAWN BY: JKB	HORIZ: 1"=200'	SHEET NO. 1 OF 1 SHEETS
CHECKED BY:	VERT: n/g	

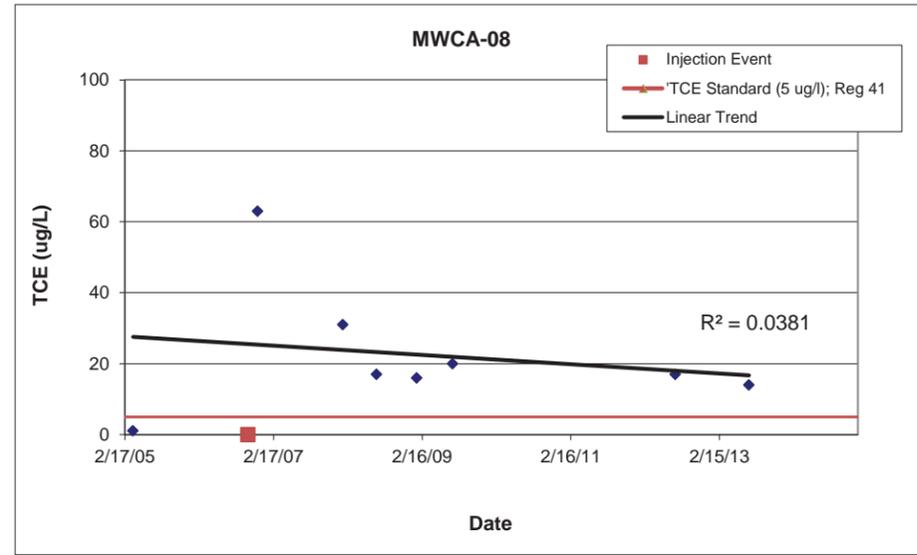
**EX1**



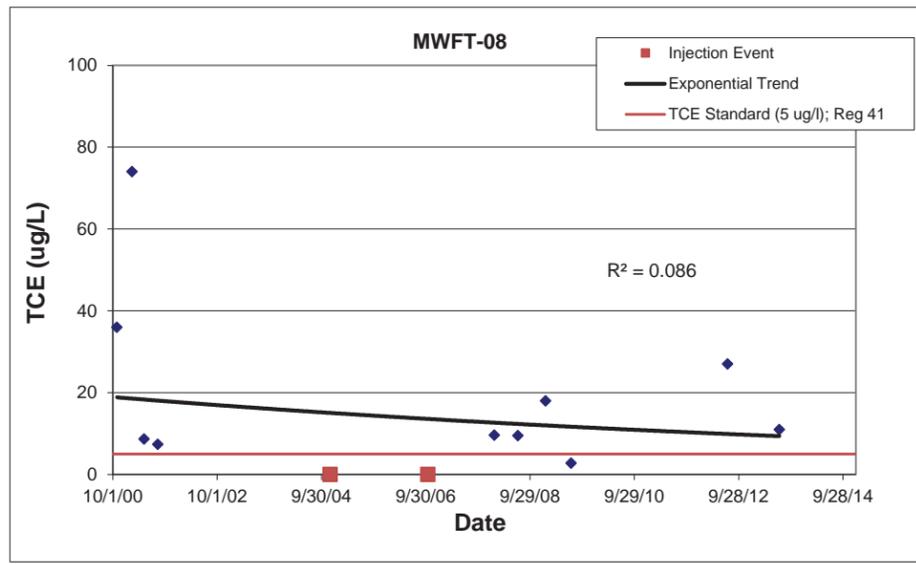
**Figure 13**  
**Fire Training Zone**  
**TCE Concentration Decline Curves**



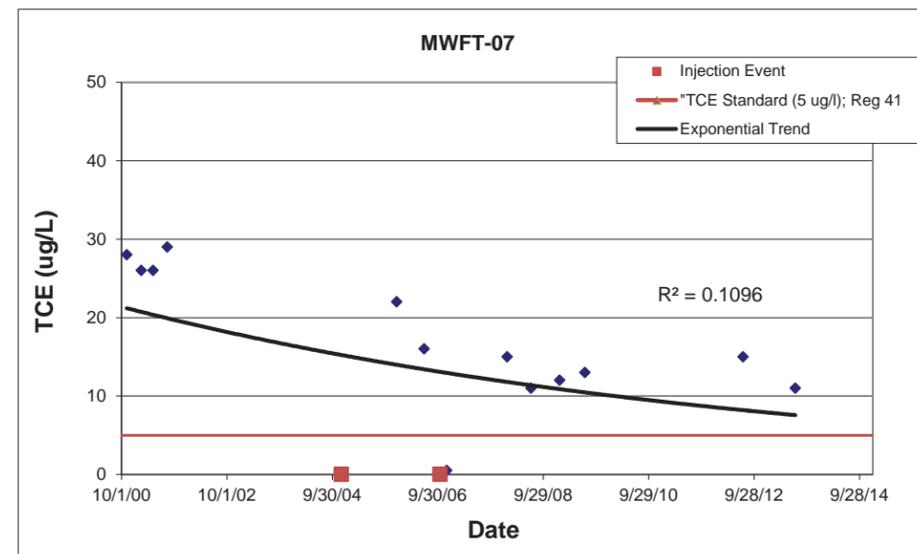
Date	TCE Conc
7/2/96	32
12/7/99	60 J
10/30/00	49 J
2/13/01	42
5/8/01	78
8/13/01	140
12/20/05	44
6/28/06	48
12/1/06	60
1/23/08	59
7/7/08	65
1/16/09	57
7/14/09	28
7/13/12	21
7/10/13	13



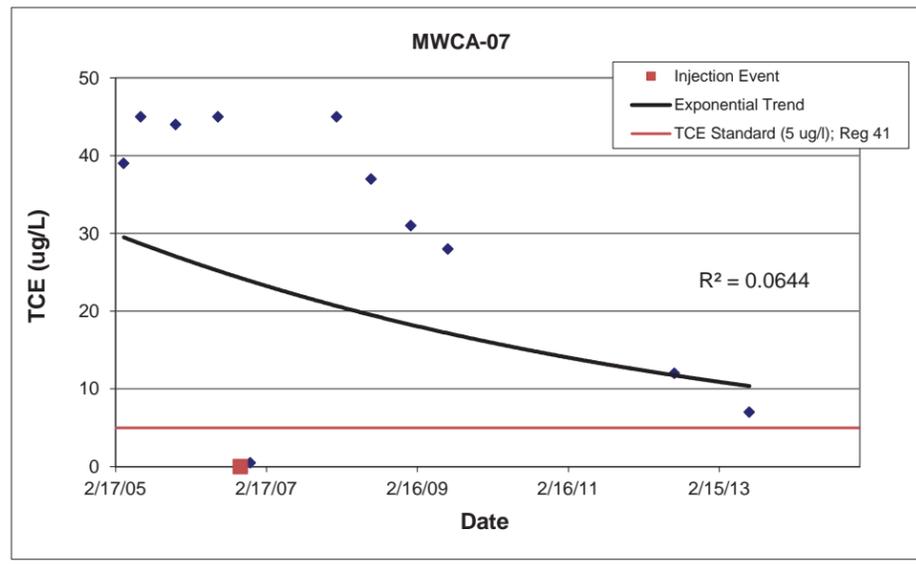
Date	TCE Conc
3/29/05	1.1
12/1/06	63
1/23/08	31
7/7/08	17
1/20/09	16
7/15/09	20
7/13/12	17
7/10/13	14



Date	TCE Conc
10/30/00	36 J
2/13/01	74
5/8/01	8.7
8/13/01	7.4
1/23/08	9.6
7/7/08	9.5
1/16/09	18
7/14/09	2.8
7/13/12	27
7/10/13	11

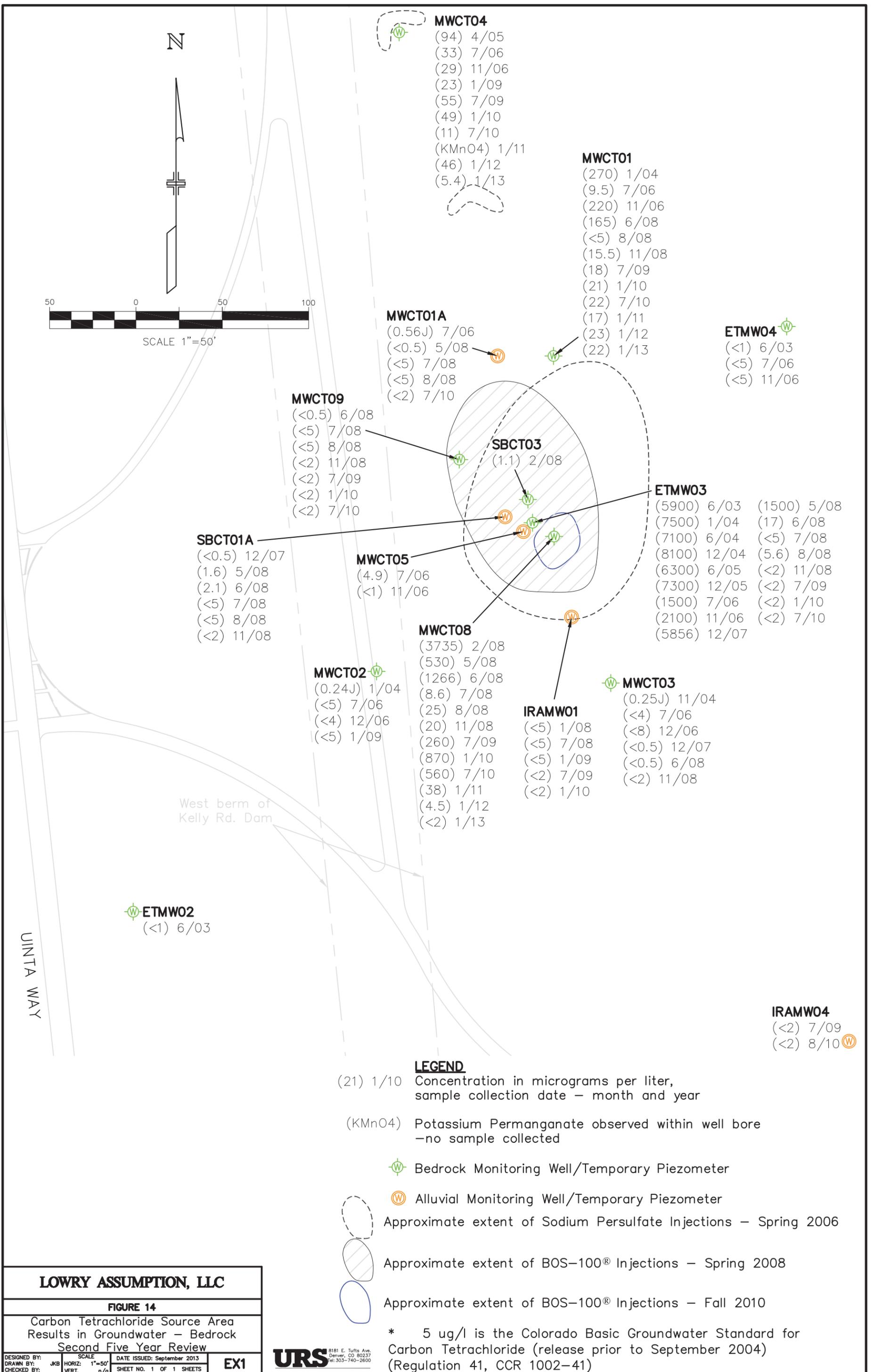


Date	TCE Conc
11/7/00	28
2/15/01	26
5/9/01	26
8/14/01	29
12/20/05	22
6/28/06	16
12/1/06	0.5 U
1/23/08	15
7/7/08	11
1/20/09	12
7/14/09	13
7/13/12	15
7/10/13	11



Date	TCE Conc
3/29/05	39
6/20/05	45
12/5/05	44
6/28/06	45
12/1/06	0.5 U
1/23/08	45
7/7/08	37
1/16/09	31
7/14/09	28
7/13/12	12
7/10/13	7

Concentrations are in micrograms per liter (µg/l)  
 Concentrations in **bold** font exceed the Colorado Basic Groundwater Standard for TCE  
**Note: 5 micrograms per liter (µg/l) is the Colorado Basic Groundwater Standard for TCE (Regulation 41, CCR 1002-41)**



**MWCT04**  
 (94) 4/05  
 (33) 7/06  
 (29) 11/06  
 (23) 1/09  
 (55) 7/09  
 (49) 1/10  
 (11) 7/10  
 (KMnO4) 1/11  
 (46) 1/12  
 (5.4) 1/13

**MWCT01**  
 (270) 1/04  
 (9.5) 7/06  
 (220) 11/06  
 (165) 6/08  
 (<5) 8/08  
 (15.5) 11/08  
 (18) 7/09  
 (21) 1/10  
 (22) 7/10  
 (17) 1/11  
 (23) 1/12  
 (22) 1/13

**ETMW04** ⊕  
 (<1) 6/03  
 (<5) 7/06  
 (<5) 11/06

**MWCT01A** ⊗  
 (0.56J) 7/06  
 (<0.5) 5/08  
 (<5) 7/08  
 (<5) 8/08  
 (<2) 7/10

**MWCT09** ⊕  
 (<0.5) 6/08  
 (<5) 7/08  
 (<5) 8/08  
 (<2) 11/08  
 (<2) 7/09  
 (<2) 1/10  
 (<2) 7/10

**SBCT03** ⊕  
 (1.1) 2/08

**ETMW03**  
 (5900) 6/03 (1500) 5/08  
 (7500) 1/04 (17) 6/08  
 (7100) 6/04 (<5) 7/08  
 (8100) 12/04 (5.6) 8/08  
 (6300) 6/05 (<2) 11/08  
 (7300) 12/05 (<2) 7/09  
 (1500) 7/06 (<2) 1/10  
 (2100) 11/06 (<2) 7/10  
 (5856) 12/07

**SBCT01A** ⊕  
 (<0.5) 12/07  
 (1.6) 5/08  
 (2.1) 6/08  
 (<5) 7/08  
 (<5) 8/08  
 (<2) 11/08

**MWCT05** ⊕  
 (4.9) 7/06  
 (<1) 11/06

**MWCT08** ⊕  
 (3735) 2/08  
 (530) 5/08  
 (1266) 6/08  
 (8.6) 7/08  
 (25) 8/08  
 (20) 11/08  
 (260) 7/09  
 (870) 1/10  
 (560) 7/10  
 (38) 1/11  
 (4.5) 1/12  
 (<2) 1/13

**MWCT02** ⊕  
 (0.24J) 1/04  
 (<5) 7/06  
 (<4) 12/06  
 (<5) 1/09

**IRAMW01** ⊗  
 (<5) 1/08  
 (<5) 7/08  
 (<5) 1/09  
 (<2) 7/09  
 (<2) 1/10

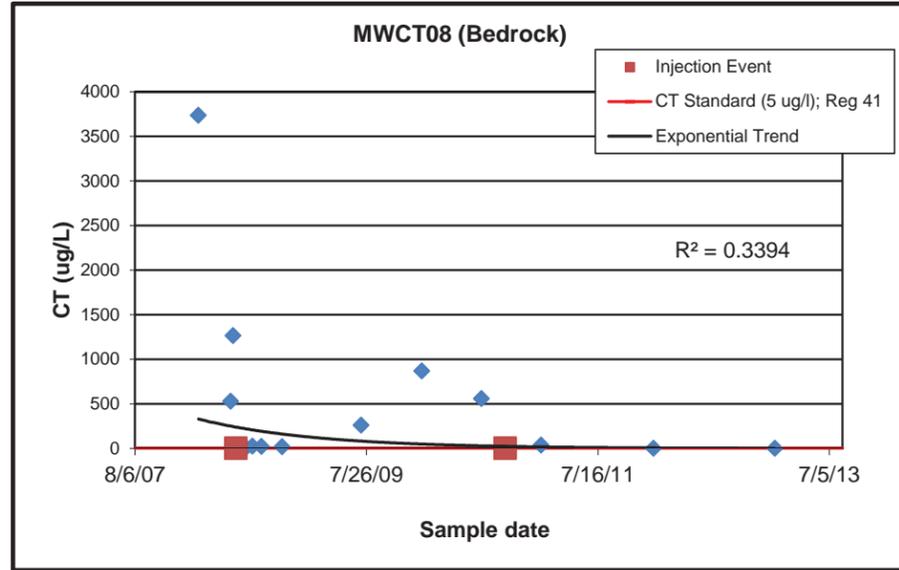
**MWCT03** ⊕  
 (0.25J) 11/04  
 (<4) 7/06  
 (<8) 12/06  
 (<0.5) 12/07  
 (<0.5) 6/08  
 (<2) 11/08

**ETMW02** ⊕  
 (<1) 6/03

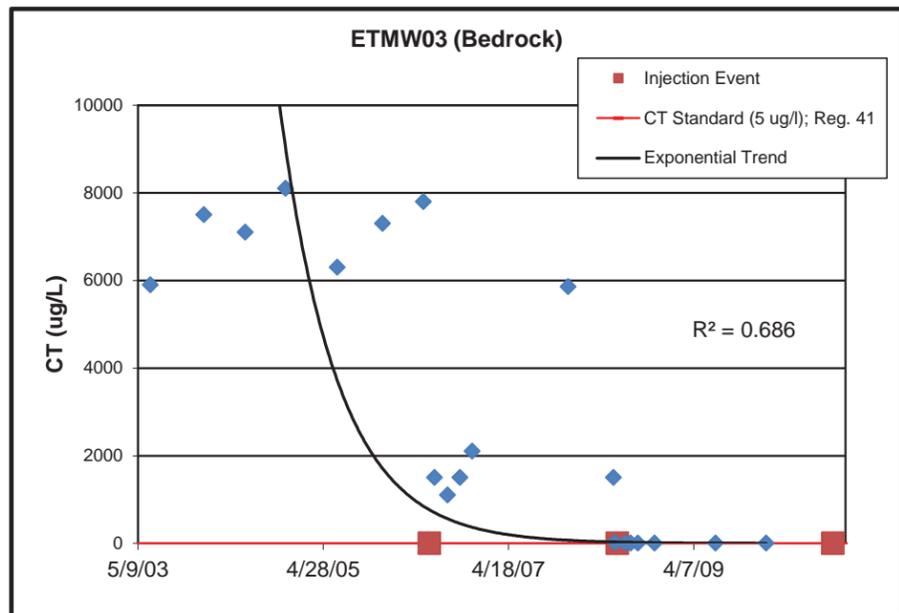
**IRAMW04** ⊗  
 (<2) 7/09  
 (<2) 8/10

**FIGURE 15  
CARBON TETRACHLORIDE SOURCE AREA  
CONCENTRATION DECLINE CURVES**

Source Area Monitoring Wells - Bedrock

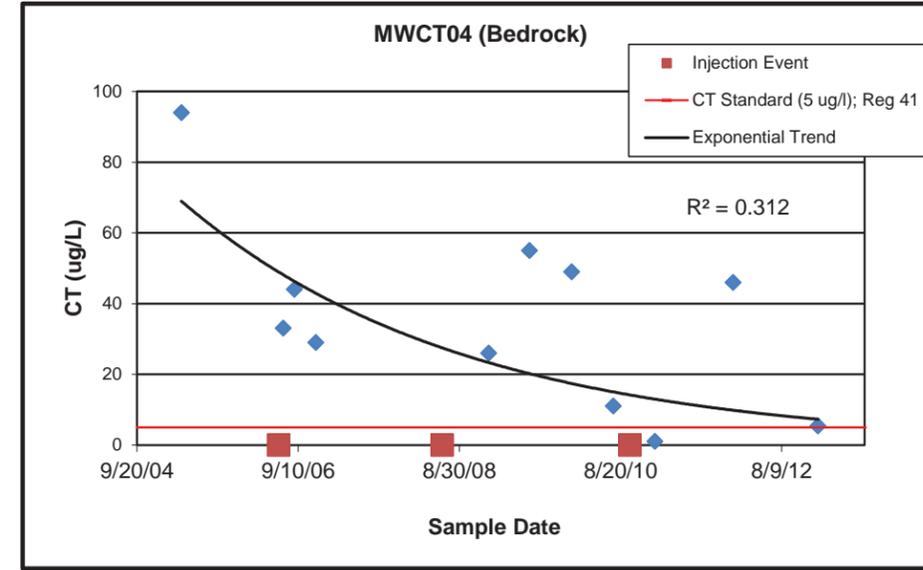


Date	CT Conc
2/19/08	<b>3735</b>
5/30/08	<b>530</b>
6/6/08	<b>1266</b>
7/16/08	<b>8.6</b>
8/5/08	<b>25</b>
9/2/08	<b>22</b>
11/6/08	<b>20</b>
7/9/09	<b>260</b>
1/14/10	<b>870</b>
7/19/10	<b>560</b>
1/20/11	<b>38</b>
1/5/12	<2
1/16/13	<2

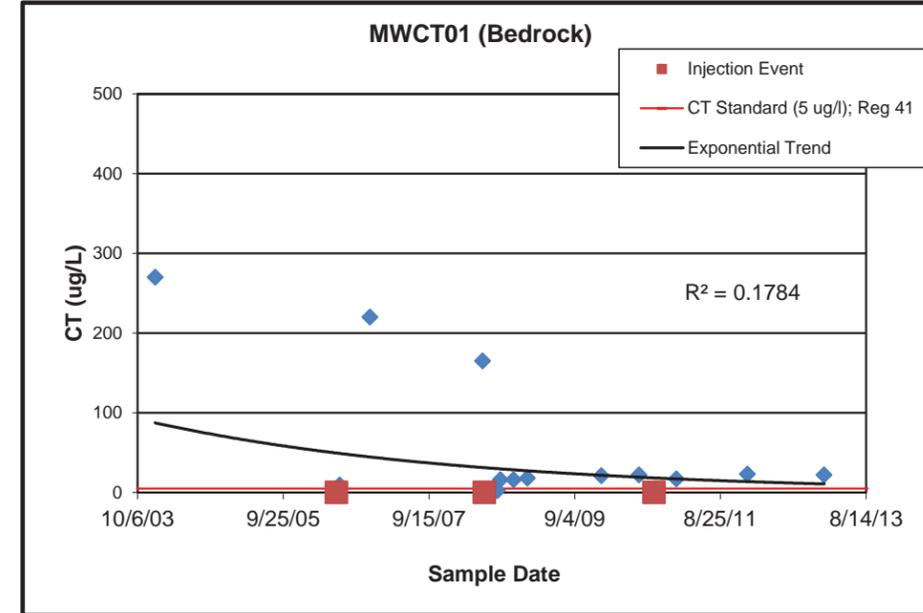


Date	CT Conc
6/26/03	<b>5900</b>
1/20/04	<b>7500</b>
6/29/04	<b>7100</b>
12/2/04	<b>8100</b>
6/21/05	<b>6300</b>
12/15/05	<b>7300</b>
5/22/06	<b>7800</b>
7/5/06	<b>1500</b>
8/24/06	<b>1100</b>
10/12/06	<b>1500</b>
11/28/06	<b>2100</b>
12/6/07	<b>5856</b>
5/30/08	<b>1500</b>
6/6/08	<b>17</b>
7/16/08	<5
8/5/08	<b>5.6</b>
9/2/08	4.3
11/6/08	<2
7/1/09	<2
1/14/10	<2

'Downgradient' Monitoring Wells - Bedrock



Date	CT Conc
4/6/05	<b>94</b>
7/5/06	<b>33</b>
8/24/06	<b>44</b>
11/28/06	<b>29</b>
1/8/09	<b>26</b>
7/9/09	<b>55</b>
1/14/10	<b>49</b>
7/19/10	<b>11</b>
1/20/11	<b>KMnO4</b>
1/5/12	<b>46</b>
1/18/13	<b>5.4</b>



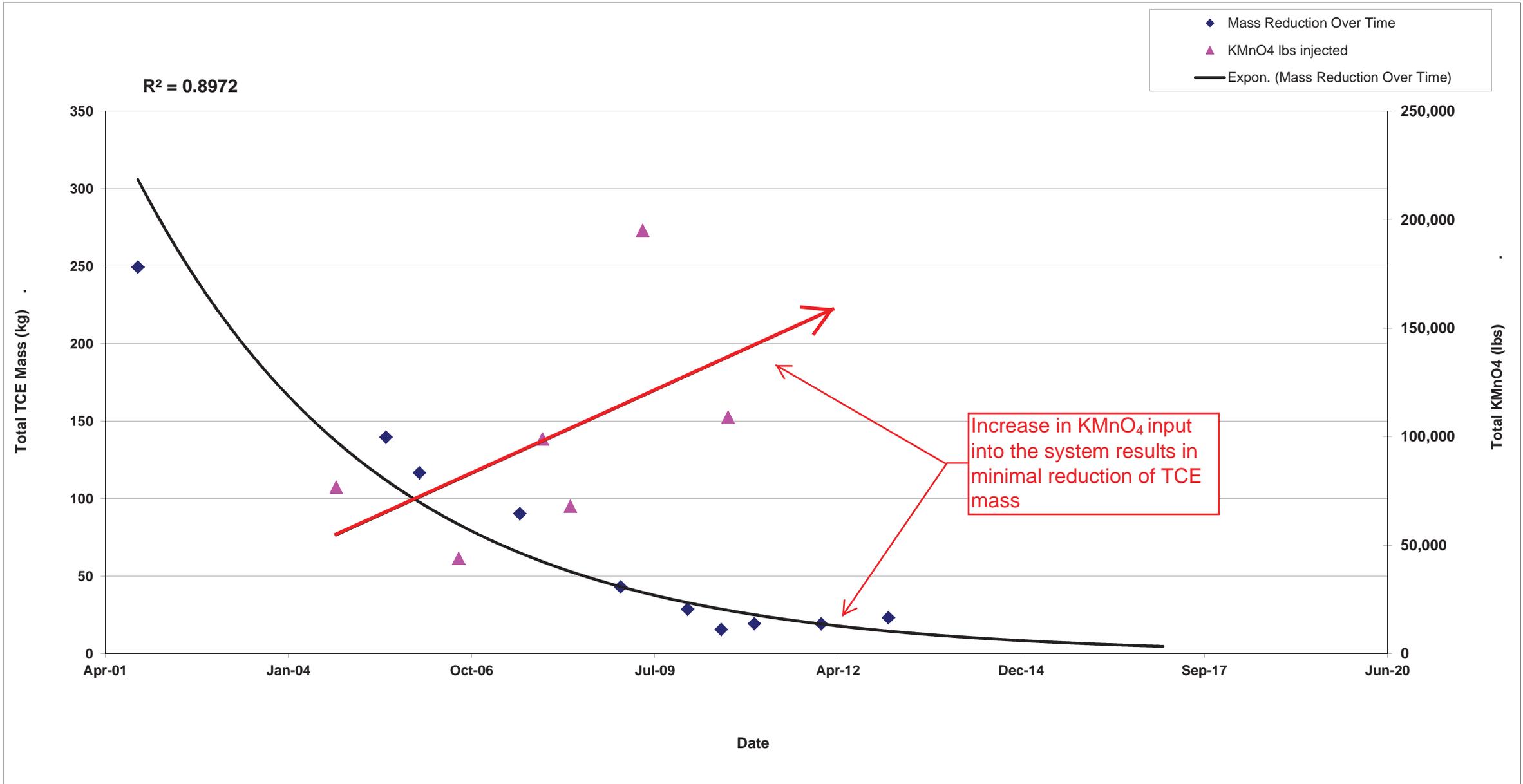
Date	CT Conc
1/1/2004	<b>270</b>
7/1/2006	<b>9.5</b>
11/28/06	<b>220</b>
6/6/08	<b>165</b>
8/19/08	<5
9/2/08	<b>16</b>
11/6/08	<b>16</b>
1/14/09	<b>18</b>
1/14/10	<b>21</b>
7/19/10	<b>22</b>
1/20/11	<b>17</b>
1/5/12	<b>23</b>
1/18/13	<b>22</b>

Concentrations are in micrograms per liter (ug/l)

Concentrations in **bold** font exceed the Colorado Basic Groundwater Standard for CT

**Note: 5 micrograms per liter (ug/l) is the Colorado Basic Groundwater Standard for CT (Regulation 41, CCR 1002-41)**

FIGURE 16  
INJECTION EFFORT VS. MASS REDUCTION CURVE  
MAIN PLUME  
SECOND FIVE YEAR REVIEW



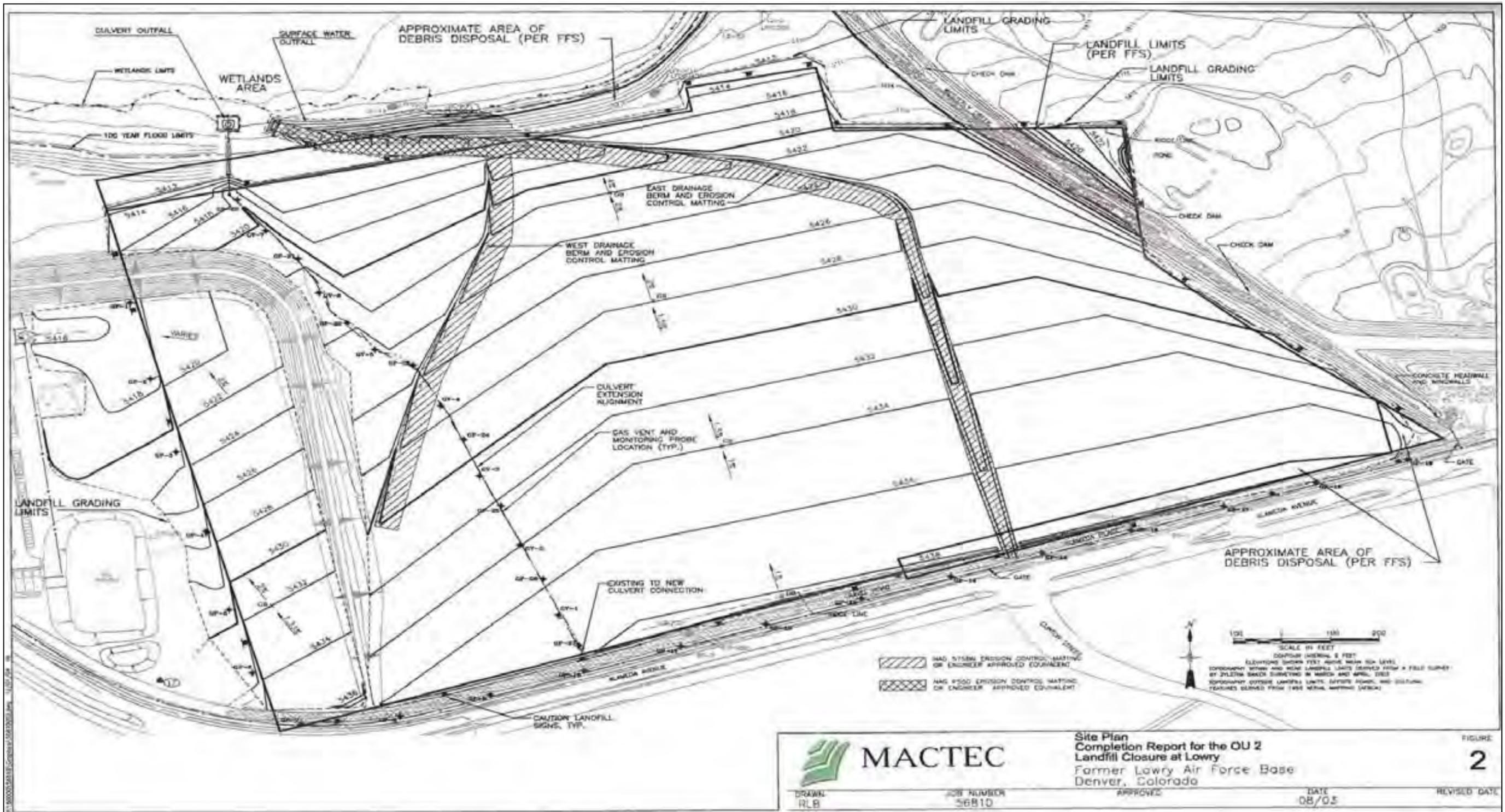
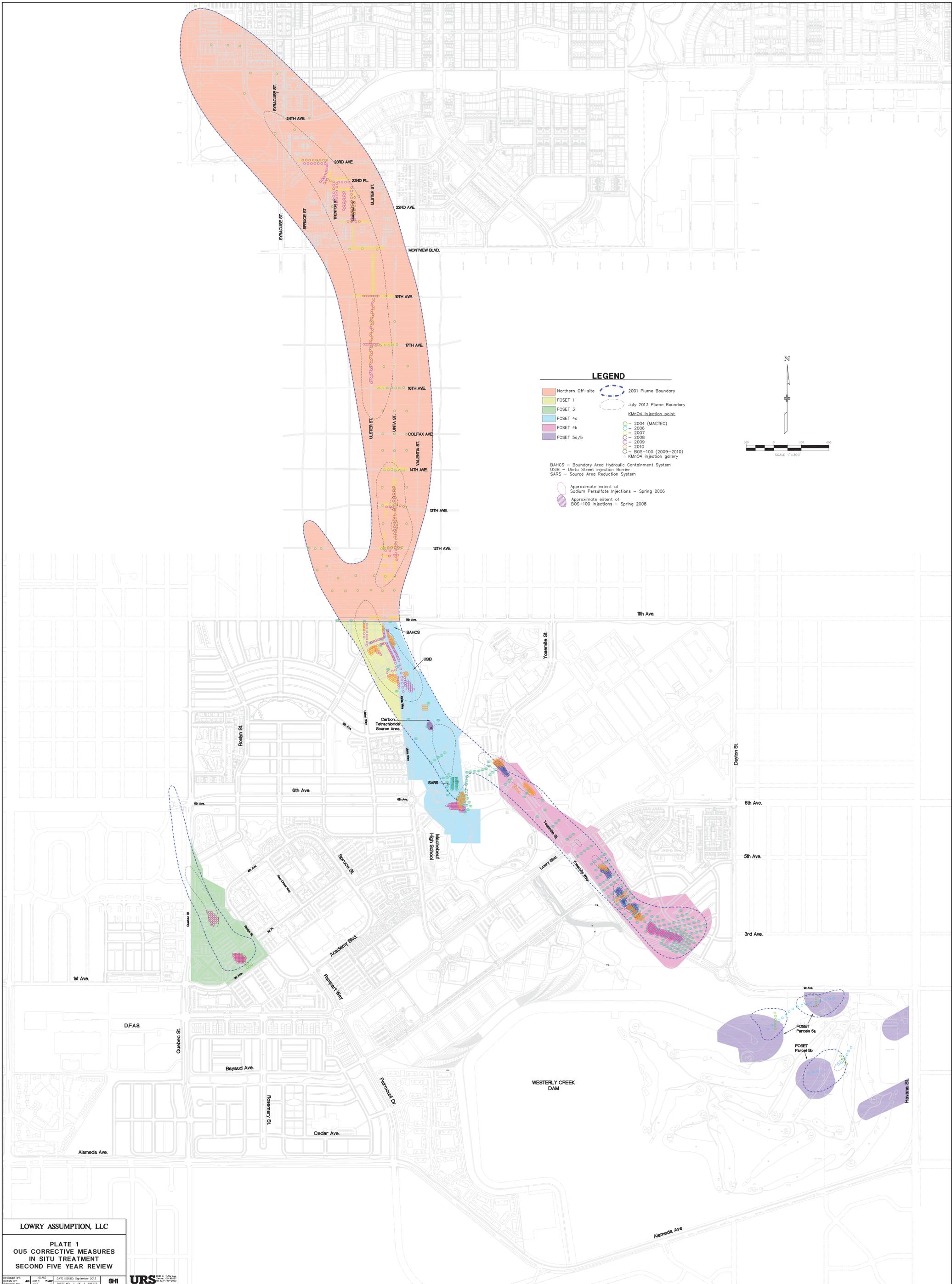


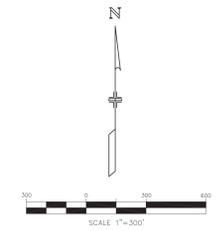
Figure 17 —OU2 Site Plan  
Second Five Year Review  
August 2013





**LEGEND**

- Northern Off-site
- FOSET 1
- FOSET 3
- FOSET 4a
- FOSET 4b
- FOSET 5a/b
- 2001 Plume Boundary
- July 2013 Plume Boundary
- KMnO4 Injection point
- 2004 (MACTEC)
- 2006
- 2007
- 2008
- 2009
- 2010
- BOS-100 (2009-2010)
- KMnO4 injection gallery
- BAHCS - Boundary Area Hydraulic Containment System
- USB - Uinto Street Injection Barrier
- SARs - Source Area Reduction System
- Approximate extent of Sodium Persulfate Injections - Spring 2006
- Approximate extent of BOS-100 Injections - Spring 2008



LOWRY ASSUMPTION, LLC

PLATE 1  
OVS CORRECTIVE MEASURES  
IN SITU TREATMENT  
SECOND FIVE YEAR REVIEW

DATE: 09/20/2013  
DRAWN BY: JAS  
CHECKED BY: JAS

SCALE: AS SHOWN  
SHEET NO. 1 OF 1 SHEETS

URS

**APPENDIX A**  
**PUBLIC NOTICES**

# The Denver Newspaper Agency

## PUBLISHER'S AFFIDAVIT

City and County of Denver )  
State of Colorado )

The undersigned Jean Birch  
being first duly sworn under oath, states  
and affirms as follows:

1. He/she is the legal Advertising Reviewer of the Denver Newspaper Agency, publisher of *The Denver Post* and *Your Hub*.
2. *The Denver Post* and *Your Hub* are newspapers of general circulation that have been published continuously and without interruption for at least fifty-two weeks in Denver County and meet the legal requisites for a legal newspaper under Colo. Rev. Stat. 24-70-103.
3. The notice that is attached hereto is a true copy, published in *The Denver Post* on the following date(s):

April 7, 2013

Jean Birch  
Signature

Subscribed and sworn to before me this 8  
day of April, 2013.

Cheryl L. Schmidt  
Notary Public

My commission expires September 14, 2013.

(SEAL)



### PUBLIC NOTICE

THE AIR FORCE CIVIL ENGINEER CENTER IS CONDUCTING A FIVE-YEAR REVIEW AT THE FORMER LOWRY AIR FORCE BASE, DENVER AND AURORA, COLORADO, APRIL 2013.

On behalf of the Air Force Civil Engineer Center (AFCEC) (formerly Air Force Civil Property Agency) Lewis Association, LLC (LAC) conducted the first Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base in 2008. Under an agreement between LAC and AFCEC with oversight from the U.S. Environmental Protection Agency (EPA), a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

Five-year reviews are conducted at sites where the remedial actions completed, but where residual subsurface, surficial or contaminants remain at the site above levels that pose an identified risk and are expected to occur regardless of whether the remedial action is completed or not expected to occur regardless of whether the remedial action is completed or not expected to occur but require five or more years to complete. The review provides an assessment of the implementation and the status of a remedy in order to determine if the remedy is or will be able to protect human health and the environment. In this document, all remedies completed at Lowry are evaluated and assessed in terms of the Landfill Zone and Database (LZDB) water (CERCLA Units 1 and 2), respectively, as a remedial remedy at a full remedy. The Landfill Cell and (CERCLA) (1) Landfill Zone Over site Unit 2, and all the remedies, with Operable Units.

The second five-year review is now being conducted by LAC on behalf of the AFCEC. The Five-Year Review will be available for review (10/14/13) on the AFCEC administrative website.

PLEASE NOTE WEBSITE ADDRESS:  
<http://afcecclearlockandoflowry.ac/docsearch.aspx>

The administrative website of the LAC (array at 7290 East 31st Ave, Aurora, Colorado).

If you have any questions, or would like more information for the Five-Year Review for the former Lowry Air Force Base, please contact:

Project Team: AFCEC Civil Engineer Center (AFCEC-CERB) 2211 South Arapahoe Ave, 155 Aurora, Colorado, 80014 (303) 755-4100 (303) 755-4100	Project Staff: LAC V. Schmitt, P.E. (781) 437-3333 (781) 437-3333 (781) 437-3333 (781) 437-3333
---	--

## PUBLIC NOTICE

**THE AIR FORCE CIVIL ENGINEER CENTER IS CONDUCTING A FIVE-YEAR REVIEW AT THE FORMER LOWRY AIR FORCE BASE, DENVER AND AURORA, COLORADO, APRIL 2013.**

On behalf of the Air Force Civil Engineer Center (AFCEC) (formerly Air Force Real Property Agency), Lowry Assumption, LLC (LAC) conducted the first Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base in 2008. Under an Agreement between LAC and AFCEC with oversight from the U.S. Environmental Protection Agency Region 8, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

Five-year reviews are conducted for sites where the remedial action is complete, but where hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure; or for sites at which the remedy, upon completion, is not expected to leave hazardous substances on site above levels that allow for unrestricted use but require five or more years to complete. The review provides an assessment of the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment. In this document, all remedies implemented at Lowry are evaluated and remedies in place at the Landfill Zone and Basewide Groundwater (Operable Units 2 and 5), respectively, are carried forward into a full review. The remedies carried forward are (1) Landfill Zone Operable Unit 2; and (2) the groundwater within Operable Unit 5.

The second five year review is now being prepared by LAC on behalf of the AFCEC. The Five-Year Review will be available for review in early 2014 on the Air Force administrative record:

PLEASE NOTE WEBSITE ADDRESS: <https://afarpaar.lackland.af.mil/ar/docsearch.aspx>

The document will also be available at the LAC library at 7290 East 1<sup>st</sup> Ave, by appointment.

If you have any questions, or would like more information on the sites under review for the former Lowry Air Force Base, please contact:

Stanley Pehl  
Air Force Civil Engineer Center  
(AFCEC/CZRB)  
2261 Hughes Ave Suite 155  
JBSA Lackland, TX 78236-9853  
[stanley.pehl@us.af.mil](mailto:stanley.pehl@us.af.mil)  
(210) 395-8238 (phone)

John Yerton  
Lowry Assumption, LLC  
7290 E 1<sup>st</sup> Ave  
Denver, CO 80230  
[jyerton@irgco.com](mailto:jyerton@irgco.com)  
(303) 972-6633 (phone)

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SEARCH



**AIR FORCE CIVIL ENGINEER CENTER TO CONDUCT 5-YEAR REVIEW OF LOWRY**

**THE AIR FORCE CIVIL ENGINEER CENTER IS CONDUCTING A FIVE-YEAR REVIEW AT THE FORMER LOWRY AIR FORCE BASE, DENVER AND AURORA, COLORADO, APRIL 2013.**

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- [CALENDAR](#)
- [LONA INFO](#)
- [DESIGN REVIEW REQUIREMENTS](#)
- [TAY YOUR HOME OWNS](#)

*upcoming events*

[Doors Open Eisenhower Chapel - Sat, April 14th 2-5P 14-Apr-2013](#)

Curious about the Eisenhower Chapel in the Lowry Town Center? Come to Doors Open.

[Lowry's CommonGround Women's Golf Club - Tues, Apr 16th 8A 16-Apr-2013](#)

Join the CommonGround Women's Golf Club league for play on Tuesday mornings. There i

[Town Hall with Senator Pat Spewman - Tues, Apr 16th 8P 16-Apr-2013](#)

Town Hall with Senator Pat Steadman Joint Budget Committee Chairman o,

[Councilwoman Susan Office Hours in Lowry - Thurs, Apr 18th 10A 18-Apr-2013](#)

District 5 Councilwoman Mary Beth Susman will hold office hours on Thursday, April 18.

The second Lowry Air Force Base Five Year review is now being prepared by Lowry Assumption, LLC (LAC) on behalf of the Air Force Civil Engineer Center (AFCEC). LAC completed the first Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base in 2008. Under an agreement between AFCEC and the U.S. Environmental Protection Agency, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment. LAC, on behalf of AFCEC, works cooperatively with the Colorado Department of Public Health and Environment and U.S. EPA Region 8 on Five-Year Reviews.

Five-year Reviews are conducted for sites where remedial actions are complete, but where hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure; or for sites at which remedies, upon completion, are not expected to leave hazardous substances on site above levels that allow for unrestricted use but require five or more years to complete. The Five-year Review provides an assessment of the effectiveness of protective measures at the sites. In this document, all remedies implemented at Lowry are evaluated, including remedies implemented to address (1) Landfill Zone Operable Unit 2; and (2) the groundwater within Operable Unit 5.

The Five-Year Review will be available for review in early 2014 on the Air Force administrative record:

PLEASE NOTE WEBSITE ADDRESS:  
<https://afpacar.lackland.af.mil/afdocssearch.aspx>

The document will also be available at the LAC library at 7290 East 1<sup>st</sup> Ave, by appointment.

If you have any questions about the five year review process or would like more information on the sites under review for the former Lowry Air Force Base, please contact:

Stanley Pehl  
Air Force Civil Engineer Center  
(AFCEC/CZRB)  
2261 Hughes Ave Suite 155  
JBSA Lackland, TX 78236-9853  
[stanley.pehl@us.af.mil](mailto:stanley.pehl@us.af.mil)  
(210) 395-8238 (phone)  
John Yerton  
Lowry Assumption, LLC  
7290 E 1<sup>st</sup> Ave  
Denver, CO 80230  
[jyerton@lurgco.com](mailto:jyerton@lurgco.com)

Jeannine Natterman  
Colorado Department of Public Health and Environment  
4300 Cherry Creek Drive South  
Denver, CO 80246  
[Jeannine.Natterman@state.co.us](mailto:Jeannine.Natterman@state.co.us)  
(303) 692-3303 (phone)  
Patricia Smith  
U.S. EPA Region 8  
Mail Code EPR-F  
1595 Wynkoop Street  
Denver, CO 80303-1129

(303) 972-6633 (phone)

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**APPENDIX B**  
**COMMUNITY INVOLVEMENT PLAN - 2009**

**UPDATED  
COMMUNITY INVOLVEMENT PLAN  
FOR THE  
FORMER LOWRY AIR FORCE BASE**

DECEMBER 2009

PREPARED BY  
LOWRY ASSUMPTION, LLC

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# SECTION 1: OVERVIEW OF COMMUNITY INVOLVEMENT PLAN

Pursuant to Paragraph 52 of Consent Agreement No. 01-07-08-02, Lowry Assumption, LLC (LAC) submits this Community Involvement Plan (CIP) for the Former Lowry Air Force Base. The original *Draft Final Lowry Community Relations Plan* was released in 1997 by the Air Force Real Property Agency (Air Force) to facilitate two-way communication with the community on and surrounding Lowry. The Community Relations Plan was updated in April 2005 due to the privatization of environmental services by the Air Force with the Lowry Redevelopment Authority (LRA) and LAC (Air Force 2005). This CIP is based upon and meets the recent OWSER directives associated with Community Involvement Plans. This CIP replaces the Community Relations Plan released by the Air Force in April 2005 and has been updated to reflect the perspective of the current Lowry community. The plan addresses community involvement for the environmental program in LAC's scope as defined in its Consent Agreement with the State which excludes the Buckley Annex, and other specific conditions.

## Summary

In cooperation with CDPHE and LAC conducted one-on-one interviews with 29 community members in April and May 2009 representing a broad cross-section of stakeholders. Data collected during the interviews showed several trends in public interest with respect to environmental cleanup program. The interviews also provided insight into how communication for Lowry could be structured to ensure all interested parties are informed and involved. In general, the participants in the community interview process believed that the environmental cleanup at Lowry was near completion. Most of those interviewed were interested in periodic updates about the cleanup process. Of those interested in updates, all indicated that they would prefer the information to be brief and appropriate for the layperson with references to websites or documents where more detailed information could be found. All participants were asked about the RAB and generally supported its adjournment, documented in the RAB Adjournment Memo (LAC, 2009 and provided in Appendix E for reference) because of the status of the environmental program.

Three principal interests in the environmental program emerged as themes during the community interview process. These included: the landfill (Operable Unit [OU] 2), groundwater contamination, and the future discovery of contaminants in soil and groundwater. These are the three remaining on-going projects at Lowry and are described in Section 2.3.

Based on the information gathered through interviews, LAC developed three goals to provide interested parties with regular information about the cleanup program and to provide opportunities for continued community input. Specific goals and the associated public involvement activities detailed in this plan include:

- Identify residents and community members interested in the environmental program at Lowry; increase awareness of current resources for information; and distribute information to all interested parties.
- Provide regularly updated information on site activities.

- Provide continued opportunities for dialogue and community input appropriate to the level of activity in the cleanup program at Lowry.

## **SECTION 2: SITE DESCRIPTION**

### **2.1 Site Description/Location**

Lowry is located 6 miles southeast of downtown Denver and includes approximately 1,866 acres in Arapahoe and Denver counties. The base is bounded by 11<sup>th</sup> Avenue on the north, Dayton and Havana Streets on the east, Alameda Avenue on the south, and, generally, Quebec Street on the west (Figure 1).

Since closure of the base in 1994, Colorado Community College System (CCCS) and the City of Aurora Parks have taken ownership of the northeast portion of the property and approximately 89% of the remainder of property has been built out, with development scheduled for completion in 2011. Development at Lowry is mixed-use and includes single family homes and apartments, 3.4 million square feet of commercial space, nearly 800 acres of parks and recreational areas, and schools including campuses for the CCCS and public and private schools.

### **2.2 Site History**

Lowry AFB was established in 1937 as a training facility for the Army Air Corps Technical School and was used primarily as a technical training and airfields operations facility. In many ways, the activities at Lowry AFB were similar to other communities of the time. A coal-powered steam plant provided heat, gas stations fueled vehicles, municipal waste was taken to a landfill, and machine parts were cleaned with solvents. Fuels and chemicals were stored and used to support the training activities, and disposal of these liquids was conducted using standard waste-handling procedures of the day. These activities were undertaken according to what were then generally accepted practices. However, some of these practices resulted in environmental issues that are being addressed under today's regulatory standards. In 1992, Lowry AFB was scheduled for permanent closure under the Base Realignment and Closure (BRAC) Act of 1988 and the Defense Base Realignment and Closure Act of 1990 and on September 20, 1994, Lowry AFB was formally closed.

### **2.3 Environmental Program Status**

The environmental program at Lowry, which began in the early 1980's, has been performed in accordance with Federal and State regulations. The following agencies have provided oversight, review and/or advice throughout the program:

- U.S. Air Force
- LRA
- CDPHE
- EPA
- City and County of Denver Department of Environmental Health
- City of Aurora

Until 2002, the Air Force managed all of the cleanup work at Lowry. In 2002, the Air Force privatized cleanup of the base-wide groundwater (OU5) and closure of the former landfill (OU2) (known as Privatization 1), turning management over to the LRA and its privatization partner, LAC. LAC entered into a Consent Agreement (01-08-07-02) with CDPHE to accomplish this work. In 2005, Air Force privatized most of the remaining environmental investigation and cleanup work (Privatization 2).

The specific scope of the privatizations are detailed in the Consent Agreement, as amended (2005), and generally included closure of the landfill; remediation of base-wide groundwater; and soil issues including remediation and closure of the Outdoor Firing Range and Fire Training Zone; investigation and remediation, if necessary, of RCRA Facility Assessment (RFA) Unknowns; and implementation of a Soils Management Program, including construction oversight.

Since the privatized cleanup began in 2002, the landfill was closed and groundwater treatment has been successful in achieving 85-95% reduction in contaminant mass (Figure 2). In addition, investigation and/or remediation has been completed for all but one of the scoped items in Privatization 2. More than 40 sites/buildings have received a determination from CDPHE that no further remedial action is required (NFA). These NFA sites are listed, with their dates of approval, in Appendix F. Complete records for these sites are available in the Administrative Record at the Air Forces website: <https://afarpaar.lackland.af.mil/ar/docsearch.aspx>.

## Ongoing Projects

The only ongoing environmental projects at Lowry include:

- Groundwater remediation and monitoring (OU5),
- Long term monitoring at the Landfill Zone (OU2), and
- Environmental management activities including construction oversight.

A summary of the ongoing projects is provided below.

**Groundwater - Operable Unit 5** - There are several groundwater plumes at Lowry containing solvents, primarily trichloroethylene (TCE). The nature and extent of groundwater contamination as well as remediation alternatives for OU5 have been studied extensively and a summary is provided in the Five Year Review (LAC 2008) as well as numerous other documents in the record. Since privatization of OU5, the focus of the remediation program has been to eliminate contaminant mass through in situ destruction of the contaminants. This is achieved by the injection of oxidizing agents (potassium permanganate) into the groundwater plume. Implementation of the remediation program began in the fall of 2004 and additional treatments were performed in 2006, 2007, and 2008. A fifth round of groundwater treatment was completed in July 2009 and included injection of potassium permanganate at over 500 locations. Additional off-base groundwater treatment was conducted in October, 2009. Groundwater monitoring is conducted semiannually at Lowry as part of the ongoing cleanup activities. Groundwater monitoring provides data to help in evaluating progress and to verify the effectiveness of various corrective measures. Results of groundwater monitoring indicate that the overall groundwater treatment program at Lowry has been successful, resulting in an average decrease in TCE concentrations of 90% and a decrease in the area of contaminated groundwater by 65%.

Concentrations in many areas are approaching the State standard of 5 micrograms per liter (ug/L).

**Landfill -- OU 2** - The landfill, a 74.5 acre parcel in the south-central portion of Lowry, was historically used for the disposal of base-related waste and associated construction debris. The nature and extent of contamination within the landfill zone as well as remediation alternatives for OU2 have been studied extensively and a summary are provided in the Five Year Review (LAC 2008) and in the Summary of the Long-term Monitoring for Radiological Parameters, OU2 (LAC 2008). The landfill was closed with a low permeability soil cap in 2005 and an NFA for the closure was issued in September 2006. The remedy includes post-closure cover inspection/maintenance and gas, surface water, and groundwater monitoring for 30 years, which is underway, and no releases have been detected from the landfill.

**Construction Oversight/Environmental Management:** Under the terms of the Soils Management Program (SMP) (LAC 2006, as amended July 2008), LAC oversees all soil excavations on the former base as defined in the program. The SMP also provides the framework for any cleanup resulting from the discovery of contamination at the site. To date, LAC has provided over 45,000 hours of oversight to various land owners. This task also includes general environmental management activities such as community relations, handling of issues related to deed restrictions, institutional controls and land use controls; maintenance of the information repository, and updating the Air Force administrative record.

## SECTION 3: COMMUNITY BACKGROUND

### 3.1 Community Profile

Lowry occupies approximately 1,866 acres in Arapahoe and Denver counties. The western and central portions of the former base (approximately 89 percent of the property) are within the City and County of Denver, while the northeastern and southeastern portions are within the City of Aurora in Arapahoe County. Lowry is now a mixed-use community. More than 20,000 people live, work, recreate and attend school at Lowry. There are more 140 businesses within Lowry, with approximately 7,000 workers. In addition to residential and businesses, there are a variety of schools and the campus for the Colorado Community College System

Since closure in 1994, more than 3,500 homes and apartments have been built with approximately 8,500 residents. Thirty-one percent of the population is under the age of 18 years and only 5 percent of the population is over 65 years. The ethnicity of Lowry includes Non-latino/white (76 %), African American (7%) and Latino (13%). The average household income at Lowry is \$69,034 and 33 percent of the residents own their own homes. Because of the growth and development of Lowry, 58 percent of the population had not been living at the current address in 2006. Almost 55 percent of the Lowry population lived in a city other than Denver in 1995 (piron.org data from 2007).

### 3.2 Community Involvement History

Following the initial community involvement outreach by the Air Force at the time of base closure, the RAB was the primary mechanism to involve the public in the environmental cleanup process. The involvement of RAB community members provided for two-way communication and input to the decision-makers on restoration issues. The RAB held monthly meetings from 1995 until 2007 when RAB attendance dropped below a functioning level. Following several failed attempts to recruit new members the meetings ended. CDPHE and LAC worked together to develop a website ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com)) where updated cleanup program information is available. The RAB was formally adjourned in December 2009 (LAC 2009 and Appendix E).

### Current Community Involvement Activities

With the privatization and the future sunseting of the LRA, some of the environmental community involvement functions formerly performed by the LRA have been transitioned to LAC and the Lowry Community Master Association (LCMA). The organizations currently use a number of tools for providing information on cleanup activities and opportunities for involvement in the process. These tools are described below.

The **environmental community relations specialist** performs a variety of tasks, including creating community outreach products and responding to requests from the public, homeowners and potential buyers regarding the environmental cleanup at Lowry. In addition, the environmental community relations specialist conducts environmental presentations to

community groups on and off Lowry. Originally part of the LRA, LAC now supports the Specialist who is housed in the LAC offices in the Lowry Town Center.

In order to increase access to environmental information and recent documents, LAC set up a **Lowry cleanup information website** in 2008. It is maintained by the technical support contractor, and contains summary information on the environmental program as well as recent documents, maps and links to other information sources. The address for the site is [www.lowryAFBcleanup.com](http://www.lowryAFBcleanup.com).

The **Lowry Redevelopment Authority web site** is available to the community at <http://www.lowry.org>, and general information about the environmental cleanup is catalogued under “Ecology at Lowry.” Information includes a description of cleanup sites, contaminants associated with the site, and a status of cleanup. Also available are links to the regulatory agencies (CDPHE and the EPA) and contact information for Environmental Community Relations Specialist for more information about Lowry’s cleanup program.

The **Lowry Link community network** is a website designed to serve people living, working, or going to school at Lowry, operated by the LCMA. A weekly electronic newsletter is e-mailed to every registered user, and news is posted regularly on the site. Content also includes a list of upcoming public meetings and agendas, updates on the environmental cleanup and property development, pages for Lowry employers, nonprofit organizations and neighborhood organizations, a community directory, and discussions.

The **Re:Developments e-newsletter** is posted bi-monthly and emailed to all Lowry neighborhood associations, HOAs and Lowry business owners. It is also available online at [Lowry.org](http://Lowry.org). Content includes news items on new development projects, updates on the environmental cleanup and current projects, contact information and a schedule of upcoming public meetings.

**Environmental fact sheets** are used to communicate specific issues on cleanup sites. Fact sheets are distributed through the various venues depending on the subject matter, including the LRA, public meetings, and the environmental community relations specialist, as well as being posted on the Lowry website, Lowry Link, LAC cleanup website and CDPHE’s Lowry webpage.

**Legal Notices** have been printed in The Denver Post to announce completion of major milestones in the cleanup process (e.g. Proposed Plans, Finding of Suitability to Early Transfer, and RAB Adjournment) and to announce public meetings. In each public notice there is contact information provided for the environmental community relations specialist for answering any questions concerning the announcement.

The **Administrative Record (AR)** is the complete record or legal file of all documents and correspondence used in the environmental restoration decision-making process by the Base Realignment and Closure (BRAC) Cleanup Team (BCT) and its post-privatization successor, the Lowry Cleanup Team (LCT). The Lowry AR is provided on the Air Forces website: <https://afrpaar.lackland.af.mil/ar/docsearch.aspx>

Hard copies of many of the documents contained in the Administrative Record are also stored at for public viewing in **information repositories** at LAC and CDPHE at the following addresses

Lowry Assumption, LLC  
125 Rampart Way, Suite 302  
Denver, CO 80230  
303 972 6633

Diana Huber  
Public Review (CORA) & Environmental Records Search Specialist  
Hazardous Materials and Waste Management Division  
Colorado Department of Public Health and Environment  
4300 Cherry Creek Drive South Denver, CO 80246-1530  
303-692-3331

**Public Comments** may be made through the following avenues:

In writing to LAC or CDPHE, or through the comment cards provided at public/neighborhood meetings or presentations; or by email or telephone to the LAC's environmental community relations specialist. Contact information is provided below:

LAC Environmental Community Relations Specialist  
125 Rampart Way, Suite 302  
Denver CO 80230  
esopher@irgco.com  
303 972 6633

CDPHE Community Involvement Specialist  
Hazardous Materials and Waste Management Division  
Colorado Department of Public Health and Environment  
4300 Cherry Creek Drive South  
Denver, CO 80246-1530  
marilyn.null@state.co.us  
303-692-3304

**Presentations** on the status of the environmental cleanup at Lowry are offered to neighborhood groups both on and off Lowry by the environmental community relations specialist and other technical staff. The content of these presentations is tailored to the specific group, and they may include poster-boards, maps, and handouts to assist understanding of the cleanup status. Presentations have been given and offered to homeowners' associations, businesses at Lowry, real estate personnel, Lowry Board of Directors, Lowry Community Advisory Committee, and LCMA.

The **Technical Support Contractor** is available to work with community members who would like a better understanding of technical issues. Initiated as part of the RAB program, the contractor provides an objective viewpoint and can be an advocate for the community by clearly understanding and then voicing their concerns in the context of a technical program. The

contractor also maintains the LAC cleanup website and can be contacted there or through the environmental community relations specialist.

### 3.3 Interview Feedback/Key Community Concerns

As part of the CIP process, 29 interviews were conducted in April and May 2009. Interview participants included residents, professionals involved with the cleanup program (EPA, CDPHE, Air Force), public officials, faculty at schools within Lowry, business owners and employees working at Lowry, former RAB members, and members of neighborhood associations within Lowry and surrounding neighborhoods. Detailed responses of the interviews are provided in Appendix D.

#### 3.3.1 Priority Issues

Within the series of questions, interviewees were asked if there are other environmental issues about which they would like more information. Responses indicated that the interviewees were primarily interested in the three on-going projects at Lowry: OU2, groundwater contamination, and the future discovery of contaminants in soil and water. The following is a summary of the priority issues identified.

**OU2.** The potential OU2 landfill redevelopment was of great interest to some of the interviewees. The environmental program at Lowry, LAC's work, and therefore this CIP, only address the environmental restoration/closure aspects of the landfill. Within this context, interviewees had questions or concerns about the landfill that fell into these categories:

- Integrity of the Cap
- Disturbance of the Waste Material
- Regulatory Program with CDPHE Oversight

**Groundwater Contamination.** Almost all of the participants were aware of the active treatment of the groundwater at Lowry and were pleased with the progress of treatment and groundwater monitoring. Most participants did not have specific concerns about the groundwater contamination but were interested in seeing an updated map of the plume. There was some interest in whether the current groundwater treatment program had a role in any construction delays.

**Discovery of Contaminants in the Future.** Several participants were concerned that soil and groundwater contaminants discovered in future redevelopment would not be identified and treated correctly. Some interviewees were not aware of the current Soil Management Program that was put into place with Privatization which provides a process to identify and mitigate any unknown environmental conditions encountered during the redevelopment.

#### 3.3.2 Communication Preferences

The interview questions were designed to identify the preferred methods for communication for the members of the Lowry community; while many interviewees said they use the internet to get

information, many prefer to receive information directly through email, direct mail, or through neighborhood association or organization newsletters. Most interviewees said that they want information directly rather than having to search websites or Administrative Records files for the status of activities. A summary of suggestions/responses regarding outreach tools is provided below.

**Web-Based Tools:** Overall, interview participants preferred Web-based and electronic forms of communication. Suggestions included providing short e-mail notices for new postings to Lowry Web sites or an electronic newsletter. Many participants liked the Lowrylink format and thought it was an effective communication tool. However, several people stated that the password protection might limit participation and an interest based list would be more effective.

**Information Products:** In the past several years, LAC has distributed issue-specific fact sheets, and participants who read these fact sheets found them appropriate, useful and an effective communication tool. Almost all participants stated that they would also like more general information about the status of the program and all wanted to be notified if new issues emerge. The participants stated that these should be distributed regularly (i.e. annually) and suggested different methods of distribution. These suggestions included electronic newsletters, posts to Lowrylink, articles in a Lowry newsletter (e.g. Re:Developments), and neighborhood association newsletters (e.g. Windsor Gardens newsletter). Although most people preferred an electronic version of the update, several participants indicated that both electronic and hardcopies were important to reach all members of the community.

**Public Meetings:** Most interviewees said they are not interested in attending formal public meetings and would prefer to get regular updates through email, mail or newsletter articles. However, some suggested that informal meetings with individuals and small groups (neighborhood groups, schools, business owners, Lowry Community Master Association (LCMA), Lowry United Neighborhoods (LUN), etc.) might be useful on specific issues.

## SECTION 4: LOWRY COMMUNITY INVOLVEMENT PLAN

The overall goal of this community involvement effort is to promote continued communication and involvement between LAC and interested community members. The following goals and associated activities are based on results of the 2009 community interviews.

**Goal 1:** Identify residents and community members interested in the environmental program at Lowry; increase awareness of current resources for information; and distribute information to all interested parties.

**Activity 1A: Develop a distribution list (email and regular mail) for people interested in receiving updated environmental information.**

**Objective:** To facilitate the distribution of information to people who want to be kept regularly informed about the cleanup program.

**Method:** LAC accesses mass email and mailing lists already established for Lowry by the LRA and LCMA. LAC will provide opportunities to those people on the current distribution list to request information on the environmental program.

**Timing:** Ongoing

**Activity 1B: Provide a venue for all interested parties to request updated environmental information.**

**Objective:** Provide a mechanism for people, not currently on LRA, LCMA, or current neighborhood association lists, to sign-up for information about the cleanup program.

**Method:** LAC will provide a mechanism for people to sign-up for information on the Lowry websites (Lowryafbcleanup.com, Lowrylink.com, and Lowry.org). In addition, LAC will also solicit additional contact information for interested parties through notices to neighborhood associations, businesses, and in local media.

**Timing:** Ongoing

**Activity 1C: Increase awareness of current resources for information**

**Objective:** To provide residents with access to the documents and resources used and created by LAC to reach decisions about the site cleanup.

**Method:** The Air Force maintains the Administrative Record online at <https://afarpaar.lackland.af.mil/ar/docsearch.aspx> with the official record of the cleanup documents. LAC will provide a link to the online Administrative Record on the Lowry websites, in all fact-sheets, and in the annual status reports. In addition, addresses for information repositories kept at both LAC and CDPHE will also be posted on all websites and distributed materials.

**Timing:** The on-line administrative records and information repositories are updated as documents become available. Links and information repository locations on Lowry websites and in status reports will be ongoing.

### **Activity 1D: Distribute information about the Lowry cleanup program**

**Objective:** To notify interested parties about new fact sheets and website updates as well as distribute annual status reports.

**Method:** People interested in the cleanup program at Lowry will be notified about new fact sheets, updates to the Lowryafbcleanup.com website, and upcoming status reports. Methods of distribution may include email notices or electronic newsletters, direct mail, posting through local media and newsletters, and through established neighborhood groups.

**Timing:** Fact sheets are issue-specific and will be distributed as needed. Updates to the website and status reports will be prepared and distributed on a regular basis, appropriate to the activity of the program.

**Goal 2:** Provide regularly updated information on environmental restoration activities.

### **Activity 2A: Prepare status reports on the cleanup program at Lowry**

**Objective:** To provide community members with regular information about the cleanup at Lowry.

**Method:** LAC will prepare annual status reports on the current cleanup program at Lowry. Information in the update will include the status of the groundwater program, post-closure maintenance activities and monitoring of OU2 landfill, summary of any new data, schedules for planned activities and a Frequently Asked Questions (FAQ) section.

**Timing:** Status reports on the Lowry cleanup program will be prepared annually.

### **Activity 2B: Prepare fact sheets and updates to Lowry websites**

**Objective:** To provide information on specific issues and regular updates on the cleanup program.

**Method:** Currently LAC prepares fact sheets to address specific issues about the cleanup program at Lowry. In addition, LAC maintains a website dedicated to cleanup program at Lowry ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com)). LAC will continue to prepare fact sheets, as needed, and update the Lowry website quarterly, at a minimum. Updates on the website will include a “What’s New” section, posting of the latest documents and documents list, and any other project-specific information. Additionally, LAC will continue to coordinate with the appropriate contacts to place the information on the Lowry.org website, LowryLink web network, and in active neighborhood group newsletters.

**Timing:** Fact sheets are issue specific and will be prepared, as needed. The website will be updated quarterly.

**Goal 3:** Provide continued opportunities for dialogue and community input appropriate to the level of activity in the cleanup program at Lowry.

**Activity 3A: Provide Information, Presentations, and Technical Support to Interested Neighborhood Groups.**

**Objective:** To maintain an open dialogue with Lowry neighborhood groups about the environmental program.

**Method:** At the request of a neighborhood group, LAC will meet with the group to provide updates and presentations about the environmental program, listen to stakeholder concerns, answer questions and help foster the understanding of technical information as requested by the community..

**Timing:** As needed

**Activity 3B: Hold Public Meetings**

**Objective:** To communicate with the community on a specific issue in a format that allows for real time two-way communication and feedback.

**Method:** Meetings will be held as appropriate to the activity in the restoration program. Notices announcing meetings will be distributed through the interest based list, neighborhood organizations and posted on current/active information sites, and newsletters as appropriate (e.g. Lowry.org website, Lowrylink.com, lowryafbcleanup.com) LAC would hold a public meeting in a location convenient to the community.

**Timing:** As needed

**Activity 3C: Community Involvement Plan Updates**

**Objective:** To identify and address changes in community communication needs or issues and concerns regarding the cleanup program.

**Method:** LAC reexamines its community involvement on an ongoing basis. A revised CIP may be developed to optimize the approach and achieve communication goals.

**Timing:** LAC will revise the CIP as events warrant.

## **4.2 Correlation of Activities to Community Concerns**

Each of the activities described above are or will be used to address the community concerns identified in the interviews (i.e. OU2, Groundwater Remediation, Discovery of Contaminants in the future) as described below.

LAC will continue to prepare information materials, specifically general status reports and fact sheets, that describe the closure and post-closure maintenance and monitoring at the landfill, groundwater remediation and the potential discovery of contaminants in the future. This information will be distributed as both electronic and hardcopies to interested parties within the Lowry community and surrounding areas as well as being posted to the Lowry websites and will provide an opportunity for feed back from the community with active links for additional information and comment. LAC will meet with the community at public or neighborhood meetings, as appropriate.

In addition, LAC will support developers and CDPHE in providing information to the community about the environmental investigations, deed restrictions, groundwater issues, and closure and monitoring of the landfill as they relate to protection of human health and the environment.

Should significant contaminants be discovered in the future, interested parties will be informed through the tools described above, including monthly updates to the Lowryafbcleanup.com website and, when appropriate, with a project-specific fact sheet. Additional project-specific community involvement options may also be considered, as necessary.

#### 4.3 Time Frame Summary for Community Involvement Activities

Table 1 provides a summary reference for when community involvement activities will be performed.

**Table 1. Time Frame Summary for Community Involvement Activities**

<b>Activity</b>	<b>Timeframe</b>
<b>Develop a distribution list</b>	<b>Ongoing</b>
<b>Provide venue to sign-up for information</b>	<b>Ongoing</b>
<b>Prepare status reports</b>	<b>Annually</b>
<b>Prepare fact sheets and website updates</b>	<b>Event-driven; regular interval (e.g. monthly)</b>
<b>Increase awareness of current resources</b>	<b>Ongoing</b>
<b>Meet with Interested Neighborhood Groups to Provide Information, Presentations, and Technical Support and to listen to community concerns</b>	<b>As needed</b>
<b>Hold Public Meetings</b>	<b>As needed</b>
<b>Community Involvement Plan Updates</b>	<b>As needed</b>

## **SECTION 5.0 REFERENCES**

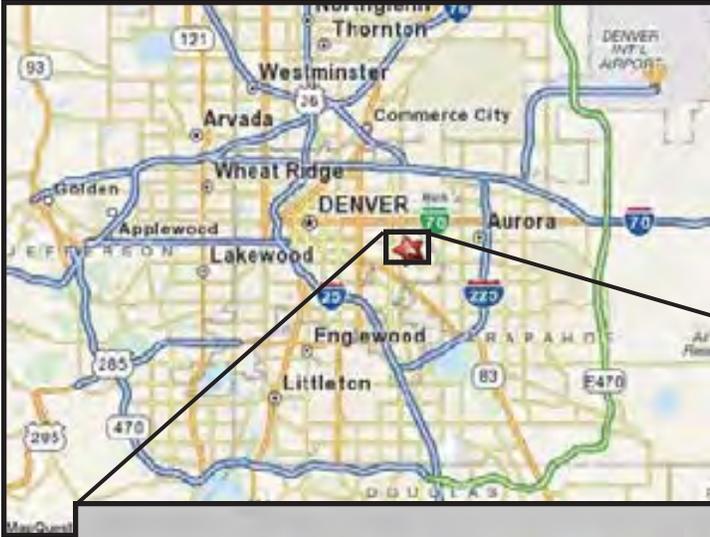
LAC December 2006, Final Transition Plan II

LAC June 2008, Evaluation of Radiological Parameters at OU2, Follow-up to Meeting Held on April 17, 2008.

LAC August 2008, Final Five Year Review.

LAC December 2009, Memorandum, Restoration Advisory Board Adjournment.

U.S. Air Force April 2005. Community Relations Plan for the Former Lowry Air Force Base.



**Community Involvement Plan  
Former Lowry Air Force Base  
Location Map  
Figure 1**

# Main TCE Plume Reduction (Alluvium) - 2001 through 2012



October 2001

January 2009

Projected 2012

TCE Concentration (ug/L)

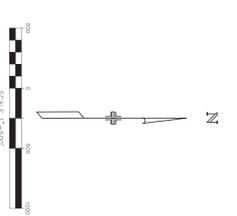
- >1000
- >100
- >40
- >20
- >5

**Treatment Summary**

- Base Closed 1994
- Plume Delineation 1990-1999
- Interim Actions 1996-2002
- -BAHCS, SARS
- -Heritage Estates Soil Gas Mitigation

**Active Plume-wide Treatment 2003-2009**

- -Treatability Studies
- -KMnO4 Treatment
- October 2004 Site-wide, 404 locations, 120,000 lbs
- August 2006 On-base, 366 locations, 44,000 lbs
- November 2007 Off-base, 299 locations, 99,000 lbs
- May 2008 On-base, 206 locations, 68,000 lbs
- 2009 On-base and Off-base, 580 locations, 193,000 lbs



LOWRY ASSUMPTION, LLC

Community Involvement Plan  
Main TCE Plume Timeline  
2001 through 2012  
Figure 2

SH1

URS

DATE ISSUED: November 2009  
SHEET NO. 1 OF 1 SHEETS

SCALE: 1"=400'

PROJECT: SH1

DATE: 11/10/09

SCALE: 1"=400'

PROJECT: SH1

DATE: 11/10/09

SCALE: 1"=400'

# APPENDIX A: CDPHE AND EPA REGION 8 CONTACTS

## CDPHE Contacts

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## EPA Region 8 Contacts

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## APPENDIX B: FEDERAL, STATE, AND LOCAL OFFICIALS

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The Honorable Diana Degette  
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### State Elected Officials

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Brad Pierce	<a href="mailto:bpierce@auroragov.org">bpierce@auroragov.org</a>

## APPENDIX C: NEIGHBORHOOD ASSOCIATIONS IN LOWRY AND SURROUNDING AREAS

<p><b>Lowry Community Masters Assoc.</b> Stacie Loucks 55 Uinta St. Denver, CO 80230 303-326-7103 <a href="mailto:Stacie.loucks@gmail.com">Stacie.loucks@gmail.com</a></p>	<p><b>Windsor Gardens Assoc.</b> Tami Blake 595 S. Clinton St. Denver, CO 80247 303-364-7485 <a href="mailto:tblake@wgmail.com">tblake@wgmail.com</a></p>
<p><b>Lowry United Neighbors</b> Jay Clapper 8094 E. Bayaud Ave. Denver, CO80230 303-918-2027 <a href="mailto:cjenjay@mac.com">cjenjay@mac.com</a></p>	<p><b>Mayfair Park Neighborhood Assoc.</b> Kathleen Ruby P.O. Box 202453 Denver, CO 80220 303-355-5517 <a href="mailto:ruby@kathleenruby.com">ruby@kathleenruby.com</a></p>
<p><b>George Washington HOA</b> Lew Gaiter Jr. P.O. Box 200073 Denver, CO 80222 303-908-4208 <a href="mailto:lewjr@msn.com">lewjr@msn.com</a></p>	<p><b>Mayfair Neighborhood Inc.</b> Wayne Simons 940 Ivanhoe St. Denver, CO 80220 303-956-0965 <a href="mailto:wsimons@comcast.net">wsimons@comcast.net</a></p>
<p><b>Historic Monclair Community Assoc.</b> Carrie O'Shea 1347 Olive St. Denver, CO 80220 303-355-9096 <a href="mailto:caroshea@msn">caroshea@msn</a></p>	<p><b>Rangeview Neighborhood Assoc.</b> Vince Kumagai 1030 S. Florence St. Denver, CO 80247 303-341-5320 <a href="mailto:sonofullr@q.com">sonofullr@q.com</a></p>
<p><b>East Montclair Neighborhood Assoc.</b> Jan Franklin P.O. Box 201273 Denver, CO 80020 303-377-4895 <a href="mailto:emna@comcast.net">emna@comcast.net</a></p>	<p><b>Stapleton Masters Community Assoc.</b> Keven A. Burnett 2823 Roslyn St. Denver, CO 80238 720-272-8767 <a href="mailto:kburnett@stapletoncommunity.com">kburnett@stapletoncommunity.com</a></p>
<p><b>Crestmoor Park Neighborhood Assoc.</b> Ruby Loch 210 S. Krameria St. Denver, CO 80224 303-355-5677 <a href="mailto:ruby@crestmoorpark.com">ruby@crestmoorpark.com</a></p>	<p><b>Stapleton United Neighbors</b> Mark Mehringer 8998 E. 25<sup>th</sup> Dr. Denver, CO 80238 720-941-0341 <a href="mailto:stapletonunitedneighbors@gmail.com">stapletonunitedneighbors@gmail.com</a></p>

# APPENDIX D: COMMUNITY INPUT METHODOLOGY, RESULTS, AND INTERVIEW GUIDE

## Methodology

In accordance with the guidance for developing a CIP, LAC performed interviews to gather information from members of the community. EPA guidance advises that 15–20 community members be interviewed to gather information surrounding public concerns, information needs, and preferred methods of communication. With CDPHE involvement, LAC’s technical support contractor conducted one-on-one interviews with members of the community representing a broad cross-section of stakeholders, including people active and inactive in the Lowry cleanup, public officials, local business representatives, members of the educational community and members of neighborhood associations.

In all, 60 community members were contacted to participate in the interview process. Along with several Lowry residents, community members with the following affiliations/groups were asked to participate. Interviews were scheduled through follow-up phone calls and emails. As a result, in April and May 2009, a total of 29 community members were interviewed.

### Lowry Interview Participant Affiliations

Category	Interviewed
RAB members	2
Business	4
Residents (including neighborhood assoc. and realtors)	13
Elected officials	1
Involved in Env. Cleanup Process	3
Schools	2
Involved in Redevelopment	4
Total	29

## Results

Outside of specific environmental concerns, there were several topics or themes, mentioned by interview participants. Many participants showed distrust in at least one of the four main agencies or organizations involved in the Lowry cleanup and redevelopment process (the Air Force, the LRA, CDPHE/EPA, and the RAB). In most cases, where levels of trust were low regarding one agency, levels of trust were high regarding another.

The following table details some of the more direct comments captured during the interview process concerning the participation of these agencies or organizations. Also captured are some specific public perceptions/opinions concerning cleanup status, communication, and development. In addition to the environmental concerns, methods of communication, and information needs outlined in Section 3, all of these comments were considered in the development of the communication approaches and activities outlined in Section 4

Topic	Specific Comments
Awareness of the Progress of the Cleanup Program	<ul style="list-style-type: none"> <li>• I don't think about environmental issues daily</li> <li>• The work is close to completion</li> <li>• I have been out of the loop since my time on the RAB</li> <li>• I have current knowledge of the progress as of the 5-year review</li> <li>• Yes, I have been involved with the program at Lowry since 2002</li> <li>• Everything seems to be going well</li> <li>• I think I know what is happening with the cleanup program but I don't know as much as I would like</li> <li>• Yes, I keep track because I am involved in real estate at Lowry</li> <li>• Yes, I read about the groundwater treatment in a flyer at the grocery store</li> <li>• Not beyond what I read in my neighborhood newsletter</li> </ul>
Receiving Current Information	<ul style="list-style-type: none"> <li>• I read the community papers that are delivered and in the mail. I am also neighborhood email lists and I also subscribe to Lowrylink. These are the ways I find out about environmental issues</li> <li>• In the past I got my information from the RAB meetings. Since then, the only information that I have gotten is when I ask. I talk to Elizabeth Sopher (LAC) and Sheila Gaston (CDPHE). I don't feel comfortable going to the library at the LRA building but I do access documents through the Administrative Record.</li> <li>• I read the Lowrylink and the Lowry newsletter that is published. I cannot think of other ways that I would want to receive information.</li> <li>• I talk to Elizabeth Sopher and I read the updates in the Lowry newsletter and Lowrylink. I rarely use the library. I prefer to receive my information through email.</li> <li>• I subscribe to Lowryliving but I don't read it all the time. I read Living at Lowry, RE:Development, Cherry Creek Times and newspapers online. I don't use Lowryliving that much because you have to register. Because I am a realtor, it is important to find out information about my neighborhood.</li> <li>• I get the Tapestry Flats newsletter from the HOA board but that is not on any set schedule.</li> <li>• I get information from Lowry News, Lowrylink, LUN emails, email updates on Hangar 2, Buckley Annex, Lowry Vista, little papers (Lowry Living), Cherry Creek Chronicle, and emails from community groups.</li> <li>• I get information mostly from my committee involvement. I am involved with the focus group for Lowry Vista. In the last 2 or 3 years, it seems that there are not many issues - mostly LRA sunsetting.</li> <li>• I get information however I can - from newsletters and flyers, word of mouth, community meetings, and</li> </ul>

Topic	Specific Comments
	<p>Lowrylink. I don't think that Lowrylink gives in depth information.</p> <ul style="list-style-type: none"> <li>• Elizabeth Sopher contacts me when there are updates that I need to know about. I also have used the Lowryafbcleanup website and I use Lowrylink</li> <li>• I get information from my neighborhood newsletter, from Marcia Johnson's newsletter, and Lowrylink.</li> <li>• I am not aware of the Lowry News or Lowry Living. I am a subscriber to Lowrylink and I am on the LUN email list. I also receive intermittent things from LCMA</li> <li>• No, I don't read Lowry News and I don't think that many people do. It is extremely biased and I think that Lowrylink is confusing.</li> <li>• I receive Lowry News, Lowry Living, and subscribe to Lowrylink. I get onto the LCMA website but I get frustrated because I cannot get a list of meetings from the LRA website. I am also on the email list for LUN and will be continuing that in the future.</li> <li>• I subscribe to Lowrylink and the newsletter is delivered to the museum. I am on an email list with the Lowry business group and also the Friends of Hangar 2 email list.</li> <li>• I am not a subscriber to Lowrylink but I am on the Park Heights neighborhood email list. There is nothing about environmental issues on those emails.</li> <li>• I do not subscribe to any email lists or Lowryliving. I just read Lowry News. The current information that is out there is not written for the layman. The information should be clear and easily understandable. More people might be interested in the work if it is more easily understood.</li> </ul>
Effective Methods for Communication	<ul style="list-style-type: none"> <li>• I think it is important to use the tools that are currently in place instead of creating new ones. In addition, I think it would be important to have the information in a push page instead of something where I have to go find it. Add links to the current sites so that people could pursue an issue if they wanted.</li> <li>• These methods do not have someone who is providing environmental specific information. There is no information coming from LAC on these [Lowry] websites/newsletters. I have to go find that information.</li> <li>• I think these provide good and timely information.</li> <li>• Other people might be interested in having a website but I will read something if it is sent to me but will not pursue it otherwise.</li> <li>• I think the current methods are good. However, there should be an expectation around communications - a more scheduled approach, perhaps 1 to 2 issues per year.</li> <li>• I would be happy to get email updates however I would guess that 70% of Windsor Gardens would prefer paper</li> <li>• There is inconsistency with information. It would be good to have 1 or 2 locations/sources where all the</li> </ul>

Topic	Specific Comments
	<p>information comes from. It would be good to have a location where all the meetings were listed. I think something like The Front Porch, which Stapleton has, is effective.</p> <ul style="list-style-type: none"> <li>• I think that it is important that the community hear about the successes.</li> <li>• If I were given information, I would put it into my paper and people would get it. I not only have the hardcopy paper but also now have an internet newsletter with a blog.</li> <li>• I think the current methods provide good and timely information.</li> <li>• I think that there should be a combined use of newspaper and internet to highlight what is happening at Lowry</li> <li>• I think that the LCMA is the way to get information out to the community. They are providing the vision for the future of the community and they could get the information out.</li> <li>• I think that LUN might be the best mechanism for getting information out to the community. I think that the LCMA is another good mechanism but the LUN provides an additional channel besides LCMA. I would also like to see a repository of information that everyone could have access to. We need a venue to provide more up to date information to people and shows a desire to communicate with the community.</li> <li>• I think email pushes through neighborhood email lists is good</li> <li>• I think that LAC could piggyback on Lowry.org and create a link. LAC should be updating everyone. I think that there needs to be more accessible information to everyone, mostly to clear up misinformation. Right now, the people getting involved and looking for information are only a few who care about these issues.</li> <li>• I think it is important to provide the information preemptively. You could provide information on a semi-annual basis. It is important to reach all the people who do not have internet access. You could also have a public comment period for the CRP and have an "Open House" with small groups.</li> <li>• I think that annual update/bi-annual update as an email or Lowrylink item would be effective. In the past, LAC has posted important issues to Lowrylink but I think it would be good to have more consistent information going out, not just big issues.</li> <li>• Email is the best because you don't have to use as much paper. You could use Lowrylink or send something to Heather or Tom Russell or using a state or city website to host. I go to Denver.org a lot. Because Lowry has high speed, I would think that a majority of people would access information online.</li> <li>• I think an emailed newsletter with a status report would be good. I am not hearing of concerns from the parents at school or people in my neighborhood.</li> <li>• Getting people interested in issues is hard - it would be important to find a method that is not pushing and</li> </ul>

Topic	Specific Comments
	not too many meetings.
Attending Community Meetings	<ul style="list-style-type: none"> <li>• I have attended the Lowry Vista meeting</li> <li>• I have been going to neighborhood and public meetings for the last 10 years</li> <li>• No, not since the RAB</li> <li>• Rarely. I would only attend a meeting if there were an issue that concerned me</li> <li>• Yes - I attend monthly and annual HOA meetings as well as any other development related meeting.</li> <li>• Not in the last couple of years.</li> <li>• I have not been to LCMA meetings for a while - they are more interested in business and do not spend a lot of time of residential issues. I went to the update meeting for Hangar 2 and the Lowry Vista meeting.</li> <li>• Yes, I go to LRA meetings, public meeting for Hangar 2, and if there is a meeting with the Mayor or Council people. I am not as engaged with LCMA. In general, unless there is an issue or concern, the businesses have a greater amount of say in the meetings.</li> <li>• Not for a long time - last meeting that I went to was for Parcel T as a community member and as a resident.</li> <li>• I don't attend meetings anymore. I get my information from my neighborhood newsletter.</li> <li>• I used to go to meetings with the Air Force was conducting the work at Lowry. I have been to the Lowry Vista meeting and the Hangar 2 meeting.</li> </ul>
RAB Adjournment	<ul style="list-style-type: none"> <li>• I actually felt that even when RAB was active, the information from the RAB did not go out to the public - even when we were meeting the information did not get disseminated. I don't think RAB meetings should have ended. I liked it because I could get my questions answered. I am concerned that there still needs to be community input into the process.</li> <li>• Yes- I have been involved with the program at Lowry since 2002 and I wanted to disband the RAB in the past as part of the privatization. Sheila did not want to get rid of the RAB at that time.</li> <li>• Yes - even when there was an active RAB, there was more personnel there than community members. Where the program is at this point, it is time to close down the RAB and find other venues to get information out. Those who are interested will follow-up.</li> </ul>
Groundwater Contamination and Treatment	<ul style="list-style-type: none"> <li>• I think that we need to put more information out there about the successes that are happening at Lowry - how we are achieving goals at OU5.</li> <li>• I would like to hear more about what is going on with the TCE plume under the Great Lawn.</li> <li>• I would also be interested to know how things are going at OU5 and if we have reached cleanup levels yet.</li> <li>• I would like to be informed about anything that pertains to the cleanup of the plume.</li> <li>• I would like an update on the TCE under the Town Center.</li> </ul>

Topic	Specific Comments
	<ul style="list-style-type: none"> <li>• I would like more information on the status of the groundwater, the latest map showing where the issues are.</li> <li>• We need more information about the groundwater plume and the potential effects on homes and plants.</li> </ul>
Landfill	<ul style="list-style-type: none"> <li>• I would like to hear more about what is happening with the landfill.</li> <li>• I am interested to hear about CDPHE's role out at Lowry Vista - I would like to hear about their evaluation of and review process for development on the landfill.</li> <li>• I am curious how Lowry Vista can be built without disturbing the cap. People want to know how this will work. It would be great to see a diagram that shows the trenches with trash, where the building would be, what is in the landfill. IRG is coming up for zoning. This is something that they should look into before they start that process. I also want to know how the landfill work will be monitored by LAC and CDPHE.</li> <li>• Lowry Vista - could you compare it to other landfill sites that have been developed in the Denver area?</li> <li>• I know that people wish more would be done to investigate potential drums of radioactive waste at OU2 so perhaps more information on that.</li> <li>• I would like an update on Lowry Vista. I also think it is important that Joe Aiken not confuse his involvement with the cleanup with the development at Lowry Vista.</li> </ul>
Discovery of Contamination in the Future	<ul style="list-style-type: none"> <li>• I would like to be informed about anything that pertains to the cleanup of the plume, anything that is found while doing the development work.</li> <li>• I would like to hear if any asbestos has been discovered during new construction</li> <li>• Nothing except perhaps making sure that you are environmentally conscientious when doing redevelopment.</li> <li>• I think that LCMA should be used as a resource. I think it is important to have people who are responsible/accountable to monitoring the environmental issues. I think that this could/should be done through LCMA. We would just need to determine if LCMA would be willing to accept that responsibility.</li> </ul>

## Interview Guide

### Background

As the environmental program at Lowry enters its last phases, and the Lowry community approaches build-out, Lowry Assumption, LLC (LAC) has been asked by the Colorado Department of Public Health and Environment (CDPHE) to assess the effectiveness of current environmental communications efforts and to update communications methods if necessary to fit the current Lowry community.

Lowry is a former Air Force base, which operated until 1994 and was closed under the Base Closure and Realignment Act. LAC, in association with the Lowry Redevelopment Authority (LRA), took over most cleanup responsibilities from the Air Force through privatizations in 2002 and 2005. Since the privatization, all known soil issues have been addressed, the landfill has been capped and a post-closure monitoring program is on-going; the overall groundwater remediation has resulted in average declines in solvent concentrations of 90%.

In 1997, the Air Force developed a Community Relations Plan (CRP) to facilitate two-way communication about the Air Force environmental program with the Lowry community. In addition, the CRP encouraged community input on key environmental restoration activities. Since the privatizations, LAC has worked with the State, LRA, community and other stakeholders to disseminate information and provide opportunities for input related to its work. Over time, the Lowry community has changed significantly, and LAC is looking for input from a variety of community and Lowry stakeholders regarding public outreach and updates to the Community Relations Plan. To this end, we will be conducting short, one-on-one interviews (less than 10 questions).

In order to ensure a broad cross section of the Lowry community in this effort, LAC developed a list of people representing the diverse interests of the community. You have been identified as a potential candidate for an interview. If you choose to participate in the interview process, your responses will be pooled with all the other community interview responses and will be kept confidential.

(Please note that the CRP does not address communication or public outreach on any of the redevelopment issues at Lowry. Such issues and concerns are addressed separately by individual developers.)

If you are willing to be interviewed, please review and update the following contact information and let us know what are good days and times for you to be contacted. We will follow up within the next week to schedule a specific interview time.

## Interview Questions

1. Are you a resident? If yes, how long have you lived here?
2. Are you aware of the progress/status of the environmental program at Lowry?
3. How did you get this information? (Have you used the web, libraries, environmental community relations coordinator, seen info in newsletters, etc.?) Are there other ways that you would like to receive this information?
4. Do you attend neighborhood/public meetings?
5. How do you receive general information about the Lowry neighborhoods? Do you read the Lowry News or other local newsletter? Do you belong to Lowrylink or any of the neighborhood email lists?
6. Do you think that these methods are effective at getting you the information you need?
7. Do you know of or have you used the Lowry website dedicated to providing updated information on the environmental cleanup ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com))?
8. Have you heard of the Lowry Restoration Advisory Board (RAB)? (If not, explain about the RAB) The RAB held monthly meetings until 2007 when the meetings ended due to a lack of participation by the community members; therefore, the Lowry RAB will be officially adjourned this year. -- Do you have suggestions on additional outreach tools that you would find useful for continuing effective communication on the environmental activities?
9. Are there other environmental issues that you would like to see/hear more information about?
10. Is there anyone else you suggest we talk to? About what?

*We'll give you a copy of the plan when complete.*

## **MEMO**

**To:** Lowry RAB Members

**From:** Elizabeth Sopher, Lowry Assumption, LLC

**Date:** December 11, 2009

**Re:** Restoration Advisory Board Adjournment  
Former Lowry Air Force Base, Colorado

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In accordance with 32 C.F.R. §202.10, RAB Adjournment and Dissolution, the former Lowry Air Force Base (Lowry) RAB has been adjourned. The basis for this adjournment is three-fold. First, there is no longer sufficient community interest to sustain the RAB as further described below (See 32 CFR §202.10(a)(v)). In addition, the environmental remediation program at Lowry has been successfully implemented through the efforts of the U.S. Air Force and the environmental privatization efforts of Lowry Assumption, LLC (LAC), with all required investigations completed. LAC has received Site Closure for all the known issues associated with soils, completed closure of the base landfill, and is in the process of remediating the groundwater plumes under remedies approved by the State of Colorado Department of Public Health and Environment (CDPHE). Based upon this progress, there are few, if any, restoration decisions left to be made (See 32 CFR §202.10(a)(i)). Lastly, the property at Lowry has all been transferred out of DoD control and day-to-day responsibility for making restoration decisions has been assumed by the Lowry Redevelopment Authority (LRA) and LAC, the environmental privatization contractor (See 32 CFR §202.10(a)(vi)).

This memorandum documents this adjournment decision including providing community consultations/input; rationale; notifications; and the information on ongoing public involvement opportunities through completion of the environmental remediation program. The memorandum has been sent to all current RAB members, and was posted on [www.lowryafbcleanup.com](http://www.lowryafbcleanup.com), Lowrylink, Lowry.org and CDPHE's Lowry environmental webpage and has been submitted for posting on the US Air Force Administrative Record. In addition, a formal public notice was placed in the Denver Post in accordance with 32 CFR §202.10.

### **Community Involvement History**

In 1993, the Lowry AFB Technical Review Committee (TRC) was established pursuant to the Superfund Amendment and Reauthorization Act (SARA) Section 211 to provide collective review and comment on proposed environmental actions/remediation at Lowry. In April 1994, in accordance with DoD/EPA initiatives to promote greater public involvement, the TRC became the Lowry RAB. In general, the RAB was developed as the primary mechanism to involve the

public throughout the environmental restoration process at closing and realigning military installations. The RAB community members provided input to the decision-makers on restoration issues, and the RAB forum allowed the expression and careful consideration of diverse points of view.

The Lowry RAB was active through 2007 with monthly meetings; however, there was a steady decline in membership and community involvement within the RAB. From its inception through 2007, there has been recurrent work to recruit and retain members (Attachment 1). In the spring of 2007, LAC technical support contractor contacted the remaining RAB members (Attachment 1) to ask their opinions on continuation of the Lowry RAB. At that time, only one RAB member wanted to continue with RAB meetings. Because the member level dropped below any sustainable level, formal RAB meetings ended at that time.

Following the cessation of the RAB meetings, LAC worked together with the various regulators to develop a website to inform and involve public in the cleanup progress at Lowry and distribute information as it becomes available. The website ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com)) provides current information on the environmental program and contact information for both LAC's environmental community relations specialist and CDPHE.

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## **Restoration Progress**

As stated above, LAC has achieved Site Closeout of all of the remaining known soils issues associated with Lowry under its Consent Agreement with CDPHE. In addition, LAC has received Site Closeout of the Yosemite Gate Plume, and a closure of the former base landfill. The following is a list of the no further action determinations:

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- ❖ Havana 1,2-DCA Plume - August 19, 2008
- ❖ RCRA Facility Assessment Groundwater Data Gaps - Sump Inspections in Buildings 849, 905, and 959 - February 27, 2009
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The remaining scope of work associated with the environmental program at Lowry is associated with contaminated groundwater plumes. LAC has been remediating these contaminated groundwater plumes under a Corrective Action Plan approved by CDPHE in accordance with its Consent Agreement. LAC is in the process of addressing the cleanup objectives associated with these plumes. In addition, LAC is performing post-closure monitoring of the former base landfill in accordance with the approved Post-Closure Monitoring Plan and the State environmental covenant.

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In 2006, the U.S. Air Force transferred all remaining acreage at Lowry to the LRA. Since that time, the LRA has transferred most, if not all, of this remaining acreage to developers, the City and County of Denver, and the various Public Conveyance Recipients. Lowry is 90% complete with its redevelopment efforts.

## **RAB Adjournment Procedures**

The following sections document the procedures taken for RAB Adjournment as identified in 32 CFR Section 202.10.

***32 CFR § 202.10(2)(i) Consult with EPA, state, tribes, RAB Members, and the local community, as appropriate, regarding adjourning the RAB and consider all responses before making a final decision.***

EPA, State, RAB members, and the community were consulted as part of the Community Involvement Plan update in 2009. In preparing the CIP, LAC's technical support contractor, in cooperation with CDPHE and LAC, conducted one-on-one interviews with 29 community members in April and May 2009. Interview participants included representatives from EPA, CDPHE, and the Air Force, as well as former RAB and community members. All participants were asked about the RAB and generally supported its adjournment because of the status of the environmental program. Only one interviewee wanted the RAB to continue. All comments provided in the interviews were taken into consideration in the development of the updated CIP goals and activities.

***Document the Rationale for Adjournment (See 32 CFR § 202.10(2)(ii))***

Formal adjournment of the Lowry RAB is considered under three factors:

1. 32 CFR § 202.10(a)(v) which states that adjournment of the RAB may be considered if "there is no longer sufficient, sustained community interest, as documented by the installation with the RAB community members and community-at-large input, to sustain the RAB;"
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3. 32 CFR § 202.10(a)(vi) which states the "installation has been transferred out of DoD control and day-to-day responsibility for making restoration response decisions has been assumed by the transferee."

The RAB was active from before 1994 until 2007, with continued active recruitment of RAB members (Attachment 1). Membership levels throughout the life of the RAB often did not meet the charter goal of 13 to 19 community members, and by 2005 had dropped to approximately four community members. Beginning at that time a series of efforts were pursued to contact all members and adjust meeting times and or formats to better suit the members and increase participation. In 2007, a representative from CDPHE contacted RAB members to discuss low community RAB member involvement. Based on that conversation, the community RAB co-chair contacted the other members to emphasize the need to recruit more people for the RAB to continue. Despite these efforts, only one RAB member remained interested in sustaining the RAB meetings. Therefore in May 2007, RAB members were contacted to announce the cancellation of the RAB meetings. Despite continued attempts by LAC, CDPHE, and RAB members to

maintain active participation in the RAB, sufficient community interest was not demonstrated.

In addition, there are final remedy decisions being implemented with respect to all the former DERP sites associated with Lowry under the current Consent Agreement with CDPHE. Lastly, all the property has been transferred out of DoD control, and now is owned by various third parties, and the responsibility for those cleanup decisions is controlled by the transferee (the LRA) through a Consent Agreement with CDPHE. Thus, the requirements and procedures for RAB adjournment have been met.

### ***Notify Public***

To notify both the RAB and the public, this memorandum was sent to RAB members and was posted on the [www.lowryafbcleanup.com](http://www.lowryafbcleanup.com) website, Lowrylink, Lowry.org, and CDPHE's Lowry environmental webpage and has been submitted for posting on the US Air Force Administrative Record. In addition, a legal notice was placed in the Denver Post.

### ***Describe Ongoing Public Involvement Opportunities***

Since the cessation of RAB meetings, LAC has worked to provide ongoing public involvement in the cleanup program through the development of a website dedicated to the environmental cleanup program ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com)), continued production of environmental factsheets, involvement with neighborhood organizations and the Lowry Redevelopment Authority and development of the updated CIP (LAC 2009).

The Lowry cleanup information website was launched in 2008 to increase access to environmental information and recent program documents. It is updated when new information is available and contains summary information on the environmental program as well as recent documents, maps, links to other information sources, and contact information for additional information. It also provides an opportunity for stakeholders to express their interest in the cleanup and request updates and information on meetings, etc when available.

To inform interested/affected stakeholders on specific cleanup issues, LAC prepares environmental fact sheets. Fact sheets are distributed through the various venues, as appropriate depending on the subject matter, including public meetings, builder/developers sales offices, and door-to-door delivery as well as being posted on the Lowry Redevelopment Authority website, Lowry Link, LAC cleanup website and CDPHE's Lowry webpage. All fact sheets provide contact information and links for more information or comment.

To address changes in community involvement to meet the needs of the current Lowry community, LAC has updated the Community Relations Plan (now called a Community Involvement Plan), prepared by the Air Force in 2005 (Air Force 2005). Based on the information gathered through the interviews, three goals were developed to provide interested parties with regular information about the cleanup program and to provide opportunities for continued community input. Activities associated with these goals are described in detail in the CIP (LAC 2009)

## **References**

LAC, August 2008, Final Five Year Review.

LAC, December 2009, Updated Community Involvement Plan for the Former Lowry Air Force Base.

DoD, 2006, 32 CFR Part 202 pp. 27610-27621 Department of Defense Restoration Advisory Board Final Rule.

U.S. Air Force, April 2005. Community Relations Plan for the Former Lowry Air Force Base.

## RAB ADJOURNMENT MEMO - ATTACHMENT 1 RECRUITMENT HISTORY EXCERPTS

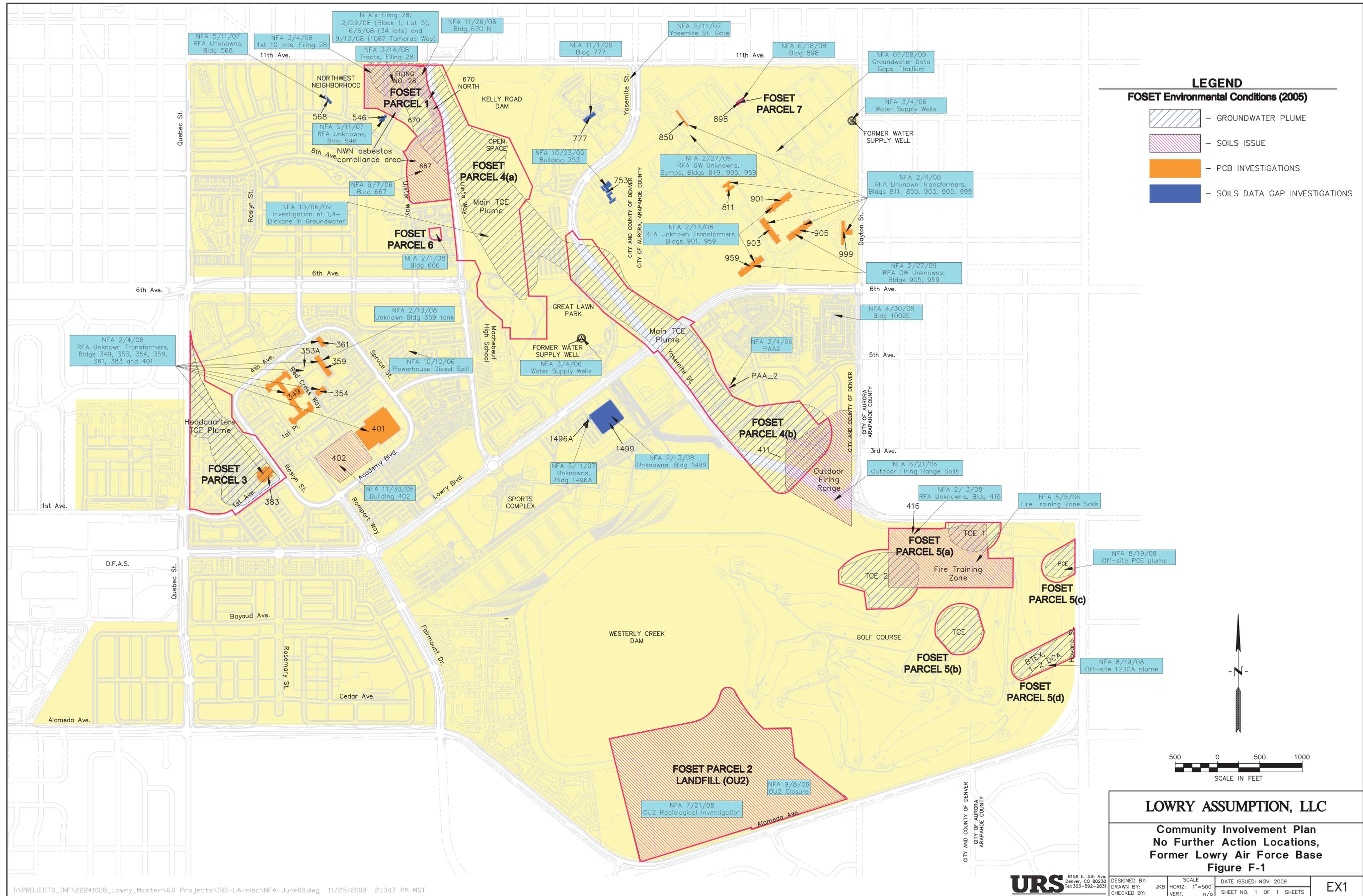
Date	Source	Activity
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20-May-02	RAB Transcript	Discussion of non-active members and RAB charter
1-Sep-02	RAB applications	Several applications in response to membership drive and submittal to membership subcommittee
17-Sep-04	Letter from Lowry Neighbors HOA	"RAB has struggled to attract and keep members" proposal for comm input to be incorporated with LCMA
5-Oct-04	email from Sheila Gaston	P2 stakeholder process re:discussion with Lowry Neighbors ; SG noting that RAB "desperately need[s] representation from on-site committees which are currently not RAB members and continue to grow exponentially".
18-Jan-05	RAB Minutes	Discussion of possible interaction with LCMA to get adequate representation from community
19-Jan-05	RAB meeting minutes for January	Report of E Sopher (LAC) and Derek Boer (CDPHE); discussion of membership drive
1-Feb-05	Re:Developments Newsletter	Ad for members
17-Feb-05	Lowrylink.com	Ad for members

1-Mar-05	emails from three Lowry residents in response to ads, one application	Responses to RAB recruitment ads
15-Jun-05	Email from Sarah Jones (RAB Tech Support contractor)	Contact attempts to all RAB members for meeting to discuss format, requesting input
1-Jun-06	email to RAB (example of process for last few years of meetings)	requested RSVPs, only David K was to attend
14-May-07	Emails with Chris O and S Gaston	Discussion of how to handle having only 1 RAB member in attendance
15-May-07	Email from ESopher	Announcing cancellation of the RAB meeting and asking when they would like the next meeting.
18-May-07	RAB letter	Discussion and request for input of format going forward, reporting lack of participation, 8 mtgs in 2006 with average of 2.6 attendees; 2 members at Jan 07, 1 member in March 07, 0 RSVPs for May 07
19-Jun-07	Email from ESopher to Sheila Gaston	Reporting on conversation with David K re:his discussion with RAB members Chris O and Jan F and his understanding that if they want to continue they will have to recruit more people - ball is in their court - they will let us know what they want or when they would like to discuss. We offered our support and tech support contractor
17-Sep-07	Email from Sheila Gaston to RAB members	"we have not hear back from anyone after trying to schedule this meeting. We are trying to have a meeting with all the current RAB members (it may be only 3 people right now) .... we need some feedback from all of the RAB members as to how we move forward with getting the information out to the group or whether the group is still interested". (Email trail also offers individual meetings)

## APPENDIX F: NO FURTHER ACTION SITES

More than 40 sites/buildings have received a determination from CDPHE that no further remedial action is required (NFA) and are listed with their dates. The locations of the sites are provided in Figure F-1.

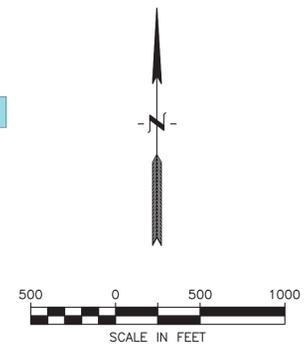
- RFA Area PAA-2 – March 14, 2006
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- RFA Soil Unknowns Buildings (Transformers at Bldgs. 901, 959 and 1499) and Soil investigations at Bldgs. 1499, 359 and 416 - February 13, 2008
- Building 1002E – April 30, 2008
- Building 898 – June 18, 2008
- Evaluation of Radiological Parameters, Operable Unit (OU) 2 – July 21, 2008
- Havana Perchloroethylene (PCE) Plume (Offsite) – August 19, 2008
- Havana 1,2-Dichloroethane (DCA) Plume (Offsite) – August 19, 2008
- RFA Groundwater Data Gaps – Sumps Inspection in Buildings 849, 905, and 959 – February 27, 2009
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**LEGEND**

**FOSET Environmental Conditions (2005)**

- GROUNDWATER PLUME
- SOILS ISSUE
- PCB INVESTIGATIONS
- SOILS DATA GAP INVESTIGATIONS



<b>LOWRY ASSUMPTION, LLC</b>			
<b>Community Involvement Plan No Further Action Locations, Former Lowry Air Force Base Figure F-1</b>			
DESIGNED BY: JKB	SCALE HORIZ: 1"=500' VERT: n/c	DATE ISSUED: NOV. 2009	<b>EX1</b>
CHECKED BY:		SHEET NO. 1 OF 1 SHEETS	

## **MEMO**

**To:** Lowry RAB Members

**From:** Elizabeth Sopher, Lowry Assumption, LLC

**Date:** December 11, 2009

**Re:** Restoration Advisory Board Adjournment  
Former Lowry Air Force Base, Colorado

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In accordance with 32 C.F.R. §202.10, RAB Adjournment and Dissolution, the former Lowry Air Force Base (Lowry) RAB has been adjourned. The basis for this adjournment is three-fold. First, there is no longer sufficient community interest to sustain the RAB as further described below (See 32 CFR §202.10(a)(v)). In addition, the environmental remediation program at Lowry has been successfully implemented through the efforts of the U.S. Air Force and the environmental privatization efforts of Lowry Assumption, LLC (LAC), with all required investigations completed. LAC has received Site Closure for all the known issues associated with soils, completed closure of the base landfill, and is in the process of remediating the groundwater plumes under remedies approved by the State of Colorado Department of Public Health and Environment (CDPHE). Based upon this progress, there are few, if any, restoration decisions left to be made (See 32 CFR §202.10(a)(i)). Lastly, the property at Lowry has all been transferred out of DoD control and day-to-day responsibility for making restoration decisions has been assumed by the Lowry Redevelopment Authority (LRA) and LAC, the environmental privatization contractor (See 32 CFR §202.10(a)(vi)).

This memorandum documents this adjournment decision including providing community consultations/input; rationale; notifications; and the information on ongoing public involvement opportunities through completion of the environmental remediation program. The memorandum has been sent to all current RAB members, and was posted on [www.lowryafbcleanup.com](http://www.lowryafbcleanup.com), Lowrylink, Lowry.org and CDPHE's Lowry environmental webpage and has been submitted for posting on the US Air Force Administrative Record. In addition, a formal public notice was placed in the Denver Post in accordance with 32 CFR §202.10.

### **Community Involvement History**

In 1993, the Lowry AFB Technical Review Committee (TRC) was established pursuant to the Superfund Amendment and Reauthorization Act (SARA) Section 211 to provide collective review and comment on proposed environmental actions/remediation at Lowry. In April 1994, in accordance with DoD/EPA initiatives to promote greater public involvement, the TRC became the Lowry RAB. In general, the RAB was developed as the primary mechanism to involve the

public throughout the environmental restoration process at closing and realigning military installations. The RAB community members provided input to the decision-makers on restoration issues, and the RAB forum allowed the expression and careful consideration of diverse points of view.

The Lowry RAB was active through 2007 with monthly meetings; however, there was a steady decline in membership and community involvement within the RAB. From its inception through 2007, there has been recurrent work to recruit and retain members (Attachment 1). In the spring of 2007, LAC technical support contractor contacted the remaining RAB members (Attachment 1) to ask their opinions on continuation of the Lowry RAB. At that time, only one RAB member wanted to continue with RAB meetings. Because the member level dropped below any sustainable level, formal RAB meetings ended at that time.

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### **RAB Adjournment Procedures**

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***Document the Rationale for Adjournment (See 32 CFR § 202.10(2)(ii))***

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### ***Notify Public***

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### ***Describe Ongoing Public Involvement Opportunities***

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Attachment 1  
RAB Recruitment History  
Selected Referrences

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1-Sep-02	RAB applications	Several applications in response to membership drive and submittal to membership subcommittee
17-Sep-04	Letter from Lowry Neighbors HOA	"RAB has struggled to attract and keep members" proposal for comm input to be incorporated with LCMA
5-Oct-04	email from Sheila Gaston	P2 stakeholder process re:discussion with Lowry Neighbors ; SG noting that RAB "desperately need[s] representation from on-site committees which are currently not RAB members and continue to grow exponentially".
18-Jan-05	RAB Minutes	Discussion of possible interaction with LCMA to get adequate representation from community
19-Jan-05	RAB meeting minutes for January	Report of E Sopher (LAC) and Derek Boer (CDPHE); discussion of membership drive
1-Feb-05	Re:Developments Newsletter	Ad for members
17-Feb-05	Lowrylink.com	Ad for members
1-Mar-05	emails from three Lowry residents in response to ads, one application	Responses to RAB recruitment ads
15-Jun-05	Email from Sarah Jones (RAB Tech Support contractor)	Contact attempts to all RAB members for meeting to discuss format, requesting input
1-Jun-06	email to RAB (example of process for last few years of meetings)	requested RSVPs, only David K was to attend

Attachment 1  
RAB Recruitment History  
Selected Referernces

Date	Source	Activity
14-May-07	Emails with Chris O and S Gaston	Discussion of how to handle having only 1 RAB member in attendance
15-May-07	Email from ESopher	Announcing cancellation of the RAB meeting and asking when they would like the next meeting.
18-May-07	RAB letter	Discussion and request for input of format going forward, reporting lack of participation, 8 mtgs in 2006 with average of 2.6 attendees; 2 members at Jan 07, 1 member in March 07, 0 RSVPs for May 07
19-Jun-07	Email from ESopher to Sheila Gaston	Reporting on conversation with David K re:his discussion with RAB members Chris O and Jan F and his understanding that if they want to continue they will have to recruit more people - ball is in their court - they will let us know what they want or when they would like to discuss. We offered our support and tech support contractor
17-Sep-07	Email from Sheila Gaston to RAB members	"we have not hear back from anyone after trying to schedule this meeting. We are trying to have a meeting with all the current RAB members (it may be only 3 people right now) .... we need some feedback from all of the RAB members as to how we move forward with getting the information out to the group or whether the group is still interested". (Email trail also offers individual meetings)

**APPENDIX C**  
**INTERVIEW REQUESTS AND COMPLETED**  
**QUESTIONNAIRES**

## INTERVIEW DOCUMENTATION FORM

Page 1

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

<u>Mary Carr</u> Name	<u>Executive Director</u> Title/Position	<u>LCMA</u> Organization	<u>6/4/13</u> Date
<u>Tracy Richard</u> Name	<u>Dir. Agronomy</u> Title/Position	<u>CGA</u> Organization	<u>5/13/13</u> Date
<u>Marty Force</u> Name	<u>Executive Director</u> Title/Position	<u>LRA</u> Organization	<u>5/13/13</u> Date
<u>Stanley Pohl</u> Name	<u>Program Manager</u> Title/Position	<u>AFCEC/CIBW</u> Organization	<u>5/16/13</u> Date
<u>Pat Smith</u> Name	<u>RPM</u> Title/Position	<u>U.S. EPA Region 8</u> Organization	<u>5/9/13</u> Date
<u>Lee Pisonka</u> Name	<u>Hydrogeologist</u> Title/Position	<u>Fed. Facilities Ut. MWMMD CDPHE</u> Organization	<u>5/13/13</u> Date

## INTERVIEW DOCUMENTATION FORM

Page 2

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

<u>David Erickson</u>	<u>ESA PM</u>	<u>City and County Denver Dept. Env. Health</u>	<u>6/11/13</u>
Name	Title/Position	Organization	Date
<u>Doug Roche</u>		<u>City of Aurora Planning Dept.</u>	<u>No response</u>
Name	Title/Position	Organization	Date
<u>Brent Anderson</u>	<u>President</u>	<u>IRG Redevelopment LLC</u>	<u>6/7/13</u>
Name	Title/Position	Organization	Date
<u>Paul Weaverling</u>	<u>Sr. Project Mgr.</u>	<u>Lorrey Assumption, LLC</u>	<u>6/11/13</u>
Name	Title/Position	Organization	Date
<u>Mark Superka</u>		<u>CCCS</u>	<u>No response</u>
Name	Title/Position	Organization	Date
<u>Christine O'Connor</u>		<u>Lorrey United Neighborhoods</u>	<u>9/5/13</u>
Name	Title/Position	Organization	Date

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:24 PM  
**To:** monty.force@lowry.org  
**Cc:** Paul Weaverling; Ann Wei; Tom Berger  
**Subject:** Lowry 5 Year Review Stakeholder Questionnaire  
**Attachments:** Interview questions\_General Questions.doc

### VIA Email

RE: 5 Year Review Interviews

Dear Monte:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:35 PM  
**To:** PEHL, STANLEY G GS-13 USAF HAF AFCEC/CIBW  
**Cc:** Paul Weaverling, Ann Wei  
**Subject:** 5 Year Review Stakeholder Interviews  
**Attachments:** Interview questions\_General Questions.doc

VIA Email

RE: 5 Year Review Interviews

Dear Stanley:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

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**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:37 PM  
**To:** Patricia Smith (Smith.Patricia@epamail.epa.gov)  
**Cc:** Ann Wei, Paul Weaverling  
**Subject:** Lowry 5 Year Review Stakeholder Interviews  
**Attachments:** Interview questions\_General Questions.doc

### VIA Email

RE: 5 Year Review Interviews

Dear Pat:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:34 PM  
**To:** 'Lee.Pivonka@dph.state.co.us'  
**Cc:** Ann Wei, Paul Weaverling  
**Subject:** Lowry 5-Year Review Stakeholder Interviews  
**Attachments:** Interview questions\_General Questions.doc

VIA Email

RE: 5 Year Review Interviews

Dear Lee:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:09 PM  
**To:** Erickson, David  
**Cc:** Ann Wei; Paul Weaverling  
**Subject:** 5 Year Review Stakeholder Questionnaire  
**Attachments:** Interview questions\_General Questions.doc

VIA Email

RE: 5 Year Review Interviews

Dear David:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Tuesday, June 11, 2013 11:44 AM  
**To:** Paul Weaverling  
**Subject:** FW: 5 Year Review Questionnaire  
**Attachments:** Interview questions\_General Questions.doc

Here is why.

*John Yerton*  
*Project Manager*  
*Lowry Assumption, LLC*  
*303-972-6633*  
*303-948-4155 (f)*  
*7290 E 1<sup>st</sup> Ave (enter at Quebec St and Lowry Blvd)*  
*Denver, CO 80230*  
[iyerton@iraqco.com](mailto:iyerton@iraqco.com)  
[www.iraqco.com](http://www.iraqco.com)

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:23 PM  
**To:** Don Roche ([droche@auroragov.org](mailto:droche@auroragov.org))  
**Subject:** FW: 5 Year Review Questionnaire

Don,

Sorry I forgot the questionnaire.

*John Yerton*  
*Project Manager*  
*Lowry Assumption, LLC*  
*303-972-6633*  
*303-948-4155 (f)*  
*7290 E 1<sup>st</sup> Ave (enter at Quebec St and Lowry Blvd)*  
*Denver, CO 80230*  
[iyerton@iraqco.com](mailto:iyerton@iraqco.com)  
[www.iraqco.com](http://www.iraqco.com)

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:11 PM  
**To:** Don Roche ([droche@auroragov.org](mailto:droche@auroragov.org))  
**Cc:** Ann Wei; Paul Weaverling  
**Subject:** 5 Year Review Questionnaire

VIA Email

RE: 5 Year Review Interviews

Dear Don:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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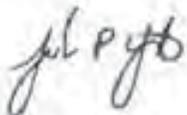
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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**



John Yerton  
Project Manager

Cc: Lowry Project file

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:32 PM  
**To:** Brent Anderson  
**Cc:** Ann Wei; Paul Weaverling  
**Subject:** Lowry 5 Year Review Stakeholder Interviews  
**Attachments:** Interview questions\_General Questions.doc

VIA Email

RE: 5 Year Review Interviews

Dear Brent:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:39 PM  
**To:** Paul Weaverling  
**Cc:** Ann Wei  
**Subject:** Lowry 5 year Review Stakeholder Interviews  
**Attachments:** Interview questions\_O&MQuestions.doc

VIA Email

RE: 5 Year Review Interviews

Dear Paul:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Wednesday, May 08, 2013 3:30 PM  
**To:** mark.superka@cccs.edu  
**Cc:** cody.neuhold@cccs.edu; Ann Wei; Paul Weaverling  
**Subject:** Lowry 5 Year Review Stakeholder Questionnaire  
**Attachments:** Interview questions\_General Questions.doc

VIA Email

RE: 5 Year Review Interviews

Dear Mark:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

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Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

## Paul Weaverling

---

**From:** John Yerton  
**Sent:** Thursday, September 05, 2013 1:12 PM  
**To:** mitz\_4@mac.com  
**Cc:** Paul Weaverling, PEHL, STANLEY G GS-13 USAF HAF AFCEC/CIBW  
**Subject:** 5 Year Review Interview Questionnaire  
**Attachments:** Interview questions\_General Questions.doc

### VIA Email

RE: 5 Year Review Interviews

Dear Christine:

On behalf of the Air Force Civil Engineer Center (AFCEC), Lowry Assumption, LLC (LAC) is conducting the second Five-Year Review of environmental remedies that have been implemented at the former Lowry Air Force Base (Lowry). Under an Agreement between LAC and AFCEC, a review of long-term remedial activities is required every five years to ensure continued protection of human health and the environment.

Required by statute for former federal facilities such as Lowry, Five-Year Reviews are conducted for sites where the remedial action is complete, but where hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure; or, for sites at which the remedy, upon completion, is not expected to leave hazardous substances on site above levels that allow for unrestricted use but require five or more years to complete. The review provides an assessment of the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment. In this document, all remedies implemented at Lowry are evaluated and remedies in place at the Landfill Zone and Base-wide Groundwater (Operable Units 2 and 5), respectively, are carried forward into a full review. The remedies carried forward in the second Five-Year Review are (1) Landfill Zone Operable Unit 2; and (2) the groundwater within Operable Unit 5.

One requirement of the Five-Year Review is to conduct interviews with members of the Lowry community to gain information that is key to understanding and documenting site status. As a member of the Lowry community you have been identified as a major stakeholder at the Former Lowry Air Force Base Redevelopment. Your views about the site and any related concerns that you may have are valuable in conducting this second Five Year Review process.

Please take a moment to answer the brief questionnaire below about the Lowry Air Force Base Redevelopment Project. We would ask that you complete this questionnaire and send it back to my attention within fourteen (7) days from receipt of this letter. If you have any questions, or would like more information on the sites under review for the former Lowry Air Force Base, please contact John Yerton or Paul Weaverling at 303-972-6633. Please email your responses to: [jyerton@irgco.com](mailto:jyerton@irgco.com) at your convenience. LAC may contact you by telephone for a follow-up telephone interview based upon your responses.

Thank you for your time.

Sincerely,

**Lowry Assumption, LLC**

# LAFB Five-Year Review Questionnaire

Name: Mary Carr

Agency/Company: Lowry Community Master Association

Address: 7581 E Academy Blvd., Ste 211, Denver, CO 80230

Phone: 720-583-5262

Date Interviewed: June 4, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB? Somewhat
2. What is your general impression of the project? It worked.
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. No. There is concern about developing the Lowry Vista site, but there have been no concerns from existing property owners.
4. Do you feel well informed about the site's activities and progress? No.
5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far? No, other than ongoing monitoring of Lowry Vista.
6. Do you know who to contact if you have any questions or concerns about the area? No.
7. How do you keep informed about site progress? We don't because we don't know where to go to find information. We assumed the cleanup was finished and no further work would be done.
8. Do you have any comments, suggestions or recommendations regarding the site's management or operation? No. Perhaps an annual email with any updates?
9. Can you think of any additional stakeholders we should interview? Besides the LRA, no.

# LAFB Five-Year Review Questionnaire

Name: Tracy Richard

Agency/Company: CCGO LLC, dba CommonGround Golf Course

Address: 10300 East Golfers Way Aurora, Colorado 80010

Phone: 303-513-7060

Date Interviewed: May 13, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB? Yes I am familiar with the history and cleanup efforts at LAFB.
2. What is your general impression of the project? I believe the project has been very well done.
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. I have no concerns and have not heard any.
4. Do you feel well informed about the site's activities and progress? Yes I do feel informed.
5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far? I have no concerns related to the cleanup efforts at LAFB.
6. Do you know who to contact if you have any questions or concerns about the area? I have a list of contacts that I feel comfortable could answer questions I may have.
7. How do you keep informed about site progress? Through my time on the site as part of the community, through media outlets, and through the interactions with other stake holders and community members.
8. Do you have any comments, suggestions or recommendations regarding the site's management or operation? I do not have any suggestions at this time.
9. Can you think of any additional stakeholders we should interview? I do not.

# LAFB Five-Year Review Questionnaire

Name: Monty Force

Agency/Company: Lowry Economic Redevelopment Authority

Address: 7290 E. First Avenue Denver, CO 80230

Phone: 303-343-0276

Date Interviewed: May 13, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB? Yes
2. What is your general impression of the project? LAC has conducted an aggressive remediation resulting in the close out of several areas with concurrence from the Colorado Department of Public Health and Environment.
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. No
4. Do you feel well informed about the site's activities and progress? Yes
5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far? No
6. Do you know who to contact if you have any questions or concerns about the area? Yes, I know who to contact.
7. How do you keep informed about site progress? I am well informed by receiving copies of all action plans and reports and having a representative attend environmental closure team meetings.
8. Do you have any comments, suggestions or recommendations regarding the site's management or operation? No
9. Can you think of any additional stakeholders we should interview? Lee Pivonka at CDPHE

# LAFB Five-Year Review Questionnaire

Name: Stanley Pehl

Agency/Company: AFCEC/CIBW

Address: 2261 Hughes Ave, Ste 155  
JBSA Lackland TX 78236-9853

Phone: 210-395-8238

Date Interviewed: 16 May 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB?

I am integrally familiar with the LAFB cleanup efforts through providing over 12 years of direct Air Force contractual support and/or technical oversight to the restoration program.

2. What is your general impression of the project?

This program has been very successful in aggressively closing all restoration sites except for the OU 2 landfill and OU 5 groundwater plumes. While closure of the landfill is not possible due to long-term care requirements, ongoing monitoring and maintenance meets all regulatory requirements. The groundwater plumes, which have been reduced in excess of 80%, are expected to close in the next few years. These timely cleanup efforts have permitted significant redevelopment of the former LAFB property resulting in the creation of a new community with thousands of jobs.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

In the past, there have been numerous public forums, including the former RAB, which have questioned or complained about the selected remedies, but I am unaware of any current concerns specific to the LAFB restoration program. There has been limited public opposition to a proposed commercial development on a portion of the landfill which is expected to continue as the project moves forward.

4. Do you feel well informed about the site's activities and progress?

Yes. Aside from direct communications with stakeholders and regulatory agencies, I receive copies of all technical documents and progress reports. Additional information is also available through several websites.

5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far?

No. The selected remedies have been successful in obtaining site closures and significantly reducing the size and concentrations of the groundwater plumes. The only remaining issue is achieving regulatory closure of the residual plume areas above MCLs.

6. Do you know who to contact if you have any questions or concerns about the area?

Yes.

7. How do you keep informed about site progress?

Telephonic and e-mail communications with the reuse authority, privatization contractor, and regulators as needed plus receipt of technical documents and progress reports.

8. Do you have any comments, suggestions or recommendations regarding the site's management or operation?

Continue to pursue alternate means or technologies to remediate the remaining groundwater plumes as quickly as possible and ensure any landfill redevelopment activities are conducted in such a manner that will safeguard the integrity of the cap and contents.

9. Can you think of any additional stakeholders we should interview?  
Landowners on or adjacent to LAFB which may be directly impacted by existing contamination.

# LAFB Five-Year Review Questionnaire

Name: Pat Smith

Agency/Company: US EPA

Address: [smith.patricia@epa.gov](mailto:smith.patricia@epa.gov)  
Denver, CO

Phone: 303-312-6504

Date Interviewed: May 9, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB?

I recall when Lowry was in Site Assessment under Superfund, before BRAC. But I haven't been around for all the activity in between. The FOSET agreements were just finishing up when I was assigned to the base closure (BRAC) work.

2. What is your general impression of the project?

Lowry has changed a lot since the BRAC process began. In the course of returning the land to uses valued by the community, the privatization has involved the clean-up of ground water, removal of asbestos, tank removals, building closeouts, and a landfill cap project. The size of the ground water plume on a map has shrunk appreciably, and concentrations where it remains have dropped. Aggressive ground water treatment has minimized the need for vapor mitigation controls in buildings above contaminated zones. The northwest neighborhood had an asbestos removal, and many hours of other oversight has taken place site-wide as new structures and infrastructure has gone up.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There has been some concern over the landfill redevelopment project. Landfills have been successfully redeveloped into recreation areas, malls, even school grounds in other places. Redevelopment in this case will require a more robust landfill cap. IRG is well aware of the coordination needed with the State Hazardous Waste program to successfully plan and manage the transition. The project has the potential to improve maintenance issues at the

landfill. As it is, there have been repeated breaches of the fence which have required repair, and repeated trespass on a cap that is not designed for that.

4. Do you feel well informed about the site's activities and progress?

EPA is no longer funded to participate in this project, but I attend the RAB a few times a year, and take a quick look at select reports and letters.

5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far?

The ground water injections responsible for improvements within the plume may return less and less benefit as time goes on. Limited areas of low level contamination remain which may be very difficult to bring below the MCL. There are no exposures of concern related to this, since the ground water in this area is not used for drinking and potential vapor intrusion into buildings above the plumes can be managed. This concerns difficulty in completing restoration of the ground water resource.

6. Do you know who to contact if you have any questions or concerns about the area?

yes

7. How do you keep informed about site progress?

Email, reports, occasional meetings

8. Do you have any comments, suggestions or recommendations regarding the site's management or operation?

IRG has worked very hard to bring the site to its current state of clean up. The reductions in the ground water plume are impressive. Pending redevelopment of the landfill is manageable. The public can still be vocal at times, but concern has dropped off a lot in the last 5 years.

9. Can you think of any additional stakeholders we should interview?

Maybe City permit departments---someone who can tell you if the land use controls (LUCs) aren't working. You would need different questions for them.

# LAFB Five-Year Review Questionnaire

Name: Lee Pivonka

Agency/Company: Federal Facilities Unit, Hazardous Materials and Waste Management Division, Colorado Department of Public Health and Environment

Address: HMWMD-HMC-B2, 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530

Phone: 303 692-3453

Date Interviewed: May 13, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB? *Yes*
2. What is your general impression of the project? *The Operable Unit 2 (OU2: landfill) remedy appears effective and protective. The Operable Unit 5 (OU5: TCE groundwater plume) remedy progress continues and potential routes of human exposure have been limited. While the OU5 remedy continues to be implemented and progress has been made toward achieving groundwater standards, but standards have not yet been achieved in all on-base or off-base portions of the plume.*
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. *In general, there are limited community concerns associated with the site, specific to the OU2 and OU5 remedies, with one notable exception; the proposed development of the OU2 landfill as the Lowry Vista development. In summary, on-base and off-base community members did not like the nuisance dust conditions associated with OU2 landfill cover construction. Similarly, they will not like possible future major earthwork associated with Lowry Vista, if and when it occurs. Additionally, many on-base and off-base community members incorrectly consider OU2 to be open space, available for public use. They do not like being isolated by fences from this private property. Although unfounded, this is a concern and often an emotional issue for the community next to OU2.*
4. Do you feel well informed about the site's activities and progress? *Yes*
5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far? *See answers to questions 2 and 3, above.*
6. Do you know who to contact if you have any questions or concerns about the area? *Yes*

7. How do you keep informed about site progress? *Regular meetings with LAC staff and management as well as document reviews and site inspections.*
8. Do you have any comments, suggestions or recommendations regarding the site's management or operation? *No*
9. Can you think of any additional stakeholders we should interview? *Yes, if not already on your list, please contact Ms. Christine O'Connor, Lowry United Neighborhood Zoning Chair, 720/859-8821.*

## Paul Weaverling

---

**From:** Pivonka - CDPHE, Lee <lee.pivonka@state.co.us>  
**Sent:** Thursday, June 06, 2013 3:46 PM  
**To:** John Yerton  
**Cc:** Ann Wei; Paul Weaverling; Jeannine Natterman - CDPHE; Pehl, Stanley; Curtis Stovall - CDPHE; Jennifer Robbins; Smith, Pat  
**Subject:** Re: Lowry 5 Year Review Stakeholder Interviews

John,

Based on recent discussions and historic discussions regarding the former Lowry AFB, I would like to amend my May 13, 2013 answer to Five-Year Review Interview Question #8. The question and my May 13, 2013 answer follow:

Q8: Do you have any comments, suggestions or recommendations regarding the site's management or operation? A8: No

My June 6, 2013 amended answer to Question 8 is as follows:

Yes, solid waste was left in place at the Flyash Disposal Area (Operable Unit 3 or OU3) and solid waste was also apparently left in place beneath the 6th Avenue portion of the Coal Storage Yard (West) (OU4). It is the Division's understanding that because solid waste was left in place at OU3, an Environmental Covenant may be appropriate for this operable unit to ensure long-term protectiveness. Regarding the portion of OU4 beneath 6th Avenue, it is the Division's understanding that an Environmental Covenant was proposed in the OU4 decision document to ensure long-term protectiveness, but an Environmental Covenant was not attained. It may now be appropriate to develop an Environmental Covenant for this portion of OU4 to ensure long-term protectiveness. As I only have the benefit of working on the Former Lowry AFB since March 2009, and Records of Decision (e.g., OU3 and OU4) predate my involvement, I would also suggest a complete review of any and all decision documents, related to Lowry AFB, to ensure Land Use Controls (e.g., Environmental Covenants) anticipated and/or needed have been appropriately addressed.

Thank you in advance for considering my amended answer to Five-Year Review Question 8 and please let me know if you have any questions or need anything else from me.

Sincerely,

Lee

Lee J. Pivonka  
Hydrogeologist  
Federal Facility Remediation & Restoration Unit  
Remediation Program  
Hazardous Materials and Waste Management Division  
Colorado Department of Public Health and Environment  
HMWMD-HWC-B2  
4300 Cherry Creek Drive South

# LAFB Five-Year Review Questionnaire

Name: David C. Erickson

Agency/Company: City and County of Denver, Department of Environmental Health

Address: 200 West 14<sup>th</sup> Avenue, Dept 310

Phone: 720 865 5433

Date Interviewed: June 11, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB?  
Yes – reasonably familiar.

2. What is your general impression of the project?  
Very favorable. The project has resulted in significant developable property within Denver where resulting residential, commercial development along with new parks and open space are a great asset for Denver.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.  
I believe there are few community concerns regarding operation and administration. Although, future development of Lowry Vista probably will still raise issues with some community members.

4. Do you feel well informed about the site's activities and progress?  
Yes – reasonably familiar

5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far?  
Limited concerns. The ultimate fate of OU5 seems to be in question; also, Denver's acceptance of OU3 is a concern because of the petroleum and asbestos known to exist there.

6. Do you know who to contact if you have any questions or concerns about the area?  
Yes

7. How do you keep informed about site progress?  
I meet periodically with the LAC; also I periodically review site assessment information for parcels of ROW Denver accepts.

8. Do you have any comments, suggestions or recommendations regarding the site's management or operation?

Overall I believe the management and operation of the site has been performed well.

9. Can you think of any additional stakeholders we should interview?

No.

# LAFB Five-Year Review Questionnaire

Name: Brent C. Anderson

Agency/Company: IRG Redevelopment I, LLC (IRGI)

Address: 7991 Shaffer Parkway, Suite 300  
Littleton, CO 80127

Phone: 303-972-6633

Date Interviewed: June 7, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB?

Yes. IRGI is an affiliated entity of Lowry Assumption, LLC. In 2006, IRGI purchased the former landfill (OU2) and Building 667 from the Lowry Redevelopment Authority. IRGI is in the process of planning for the redevelopment of the former landfill, and has started the process of approvals under the deed and State Environmental Covenant.

2. What is your general impression of the project?

As a whole, the project is meeting its milestones and completing the work. For OU2, LAC is implementing the Post-Closure plans under the approved Phase 2 Corrective Action Plan.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

IRGI is aware of a number of concerns regarding the redevelopment of OU2 related to its change in use and protection of human health and the environment; however, these community concerns do not impact the implementation of the current remedies and monitoring programs by LAC.

4. Do you feel well informed about the site's activities and progress?

As the owner, IRGI is well informed about OU2 and OU5 and the activities to date.

5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far?

No.

6. Do you know who to contact if you have any questions or concerns about the area?

Yes.

7. How do you keep informed about site progress?

Websites; administrative record; progress reports; meetings with regulators

8. Do you have any comments, suggestions or recommendations regarding the site's management or operation?

No.

9. Can you think of any additional stakeholders we should interview?

No.

# LAFB Five-Year Review Questionnaire

Name: Paul Weaverling

Agency/Company: Lowry Assumption, LLC

Address: 7991 Schaffer Parkway Suite 300, Littleton, CO 80127

Phone: 303-972-6633

Date Interviewed: June 11, 2013

## Performance, Operation and Maintenance Questions:

1. What is your general impression of the project?

The status of the project is good. Significant progress has been achieved in the environmental program to allow the near complete redevelopment of the Former Lowry Air Force Base. Closure has been achieved for Operable Unit 2 (Landfill) and is in year seven of post-closure monitoring. Operable Unit 5 groundwater remediation has progressed with very good results throughout the program.

2. Is the remedy functioning as expected?

The overall remedies implemented for Operable Unit 2 (Landfill) and Operable Unit 5 (Site-wide Groundwater) are performing as intended. Through six years of post-closure monitoring at OU2, there have been no detected releases or statistically significant increases to indicate a release. The TCE concentrations in OU5 have been significantly reduced in both the source areas and the alluvial plumes. The source mass in the Carbon Tetrachloride area has effectively been eliminated.

3. Do you feel well informed about the site's activities and progress?

Yes, I am in daily contact with the field project manager regarding the status of the project and participate in the LCT meetings with the regulatory agencies and the local government entities.

4. What do the monitoring data show? Are there any trends that show contaminant levels are decreasing?

For OU2, six years of post-closure monitoring data indicate **no** releases are occurring from the landfill.

For OU5, the overall data show significant contaminant decreases in the identified plume areas. Concentration decline curves prepared for each of the areas evaluated in the Second Five Year review demonstrate both long-term decline of contaminant concentrations.

5. Is there a continuous on-site O&M presence? If so please describe the staff and activities? If there is not a continuous on-site presence, please describe the staff and frequency of site inspections and activities.

LAC maintains a field office at the Former Lowry Air Force Base with a project manager on-site daily to address any issues that may arise. There is no active O&M associated with the OU5 remedy other than the semiannual groundwater monitoring. The OU2 O&M program is done according to scheduled actions with quarterly site inspections and semiannual sampling.

6. Have there been significant changes in the O&M requirements, maintenance schedules, or sampling routines since the start-up or in the last 5 years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

No significant changes have occurred.

7. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last 5 years? If so, please give details.

At OU2, a 2009 grass fire started in the Westerly Creek Dam wetlands encroached on the surface of the landfill cover. The fire caused some minor damage to synthetic matting in drainage areas. The damage was repaired in accordance with the specifications of the design engineer.

8. Have there been opportunities to optimize the O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

The O&M for OU2 is scheduled per the Phase 2 Corrective Action Plan and is currently optimized per that schedule. There is no active O&M for OU5 outside of semiannual groundwater sampling.

9. Do you have any comments, suggestions, or recommendations regarding this project

No additional comments.

# LAFB Five-Year Review Questionnaire

Name: Christine O'Connor

Agency/Company: Lowry United Neighborhoods and Self (resident within ¼ mile)

Address: 144 S. Ulster St. Denver CO 80230

Phone: 303 906-6627

Date Interviewed: Sept. 5, 2013

## Questions:

1. Are you familiar with the history and cleanup efforts concerning the LAFB?  
*Yes*
2. What is your general impression of the project? *That is lots of work and involved many many parties. I did not agree with the ultimate decision to build over the TCE plume, and made my objections clear, but to date I know of no problems with the vent systems. (How would I know anyway?) Regarding the landfill, I am aware of the 30 year protective covenant and everything "looks" well maintained there, but since RAB was disbanded it is difficult to know how the monitoring is going. I do not receive reports.*
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details. *In general, as I said above, the site appears to be very well maintained. But yes, I have concerns. I understand that IRG wants to modify the protective covenant and do exploratory work and maybe build on pilons on the landfill. I am aware that Alliance (a developer from Texas) met with the Lowry Design Review Committee about a year ago with preliminary plans for an apartment complex on the SE corner of the site. I contacted CDPHE which claimed to have no knowledge of this potential development. My concern stems from the conduct of the land owner IRG that proceeds to assume it will get through all these changes in covenants etc. without doing any real remediation in the sense of carting off the waste materials and doing a thorough cleanup. IRG obviously led Alliance to believe it could proceed to process development plans through the City and Lowry Design Review Committee. I don't know what has happened since, and I would like to have a way to find out but the CDPHE removed (or changed) its website so I cannot find the Lowry Vista section where you could see all things filed pertaining to that parcel. And I have no way of finding out if IRG is working on the Air Force again – and Urban Drainage perhaps – to modify agreements and modify the flood plain etc. I feel I have lost all ability to monitor the parcel. I do not feel confident that CDPHE will deny the request to modify the covenants and I do not feel confident that IRG will stop marketing and trying to sell/lease land.*

*They just keep at it. They know that eventually all the people who were concerned will stop paying attention, and it will fade from the collective memory of surrounding residents. Most importantly, if there is no ability to check on actions being taken by IRG, we will be blindsided when we find out that CDPHE agreed to modify covenants and the Air Force worked some deal out about liability so that IRG can develop. Very disconcerting.*

4. Do you feel well informed about the site's activities and progress? *Not at all.*
5. Do you have any concerns or issues with the cleanup efforts that have been conducted so far? *No.*
6. Do you know who to contact if you have any questions or concerns about the area? *Other than CDPHE, no. I guess perhaps LAC still has Elizabeth Sopher around, I don't really know. But LAC's cleanup responsibility is all she would tell me about, not IRG's marketing plans.*
7. How do you keep informed about site progress? *I used to check CDPHE's website. Now I pray. Only kidding, Now I am not informed. I haven't checked in with Monica Sheets in awhile, but guess I better.*
8. Do you have any comments, suggestions or recommendations regarding the site's management or operation? *Operationally, all looks good.*
9. Can you think of any additional stakeholders we should interview? *Yes,*

Linda Rea [linda.rea8@gmail.com](mailto:linda.rea8@gmail.com)  
Charles Gatto [csg-wga@inbox.com](mailto:csg-wga@inbox.com)  
Erma Goff [egoff@mymailstation.com](mailto:egoff@mymailstation.com)  
RJ Ours [rjourn80247@yahoo.com](mailto:rjourn80247@yahoo.com)  
David Mitzner [david.mitzner165@gmail.com](mailto:david.mitzner165@gmail.com)  
Darlyn Boss [darlyn.boss@gmail.com](mailto:darlyn.boss@gmail.com)  
Joyce Evans [jevans@lowrynews.com](mailto:jevans@lowrynews.com)  
Anne Callison [awbarbour@aol.com](mailto:awbarbour@aol.com)  
Mary Hawk [hawk\\_mary@yahoo.com](mailto:hawk_mary@yahoo.com)  
Betsy Shaw [betsyshaw92@hotmail.com](mailto:betsyshaw92@hotmail.com)  
Decker Swan [deckerswann@earthlink.net](mailto:deckerswann@earthlink.net)  
Damoni Rems [dmoneyrems@comcast.net](mailto:dmoneyrems@comcast.net)  
Linda Cantrell [lcantrell@q.com](mailto:lcantrell@q.com)

*Most people have given up. I don't even know if those above are still active at these emails, but if they are, I am sure they would like to do the survey.....*

**APPENDIX D**  
**SITE INSPECTION FORMS**

Site Name: \_\_\_\_\_

Location: \_\_\_\_\_

Project Description: \_\_\_\_\_  
 \_\_\_\_\_

Contractor: \_\_\_\_\_

Builder/Developer: \_\_\_\_\_

**TIME: NOTES:** (use ADDENDUM SHEET for more time/notes)

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**OTHER NOTES:**

\_\_\_\_\_

\_\_\_\_\_

**Lowry Assumption Contacts:**

David Matteocci      720-309-1550  
 John Yerton..... 303-304-2933  
 Main Office..... 303-972-6633

**EMERGENCY**

**CALL 911**

**HOURS – Date:** \_\_\_\_\_

TOTAL HOURS: \_\_\_\_\_

Regular Hours: \_\_\_\_\_

Overtime Hours: \_\_\_\_\_

Downtime Hours: \_\_\_\_\_

Inspector: \_\_\_\_\_  
 (print full name)

**Environmental History Notes:**

\_\_\_\_\_

**OTHER OBSERVATIONS:**

(describe fully at left)

Equipment Used: \_\_\_\_\_

Excavation Size: \_\_\_\_\_

Depth: \_\_\_\_\_

Depth to Native Soil: \_\_\_\_\_

Soils moved to other location?  
 NA  No  Yes, to: \_\_\_\_\_

Stockpile observed?  NA  No  
 Yes, located: \_\_\_\_\_

Construction/Building debris?  NA  No  
 Yes, describe: \_\_\_\_\_

Suspect ACM Observed?  NA  No  
 Yes, describe: \_\_\_\_\_

Suspect ACM Wetted  Yes  No

Suspect ACM Bagged  Yes  No

Impacted Soil?  NA  No  
 Yes, color: \_\_\_\_\_

Odor observed?  NA  No  
 Yes, describe: \_\_\_\_\_

PID Used?  NA  No  
 Yes, PPM readings: \_\_\_\_\_

Samples Collected?  NA  No  
 Yes, total number collected: \_\_\_\_\_

Sample No. \_\_\_\_\_

Describe: \_\_\_\_\_

**NA PROJECTS IN NORTHWEST NEIGHBORHOOD:**

Wind speed monitored? .....  Yes  No

Job shut down due to wind? .....  Yes  No

Job restarted later in day? .....  Yes  No

Visible Emissions? .....  Yes  No

Water Applied? .....  Yes  No

Visited by State Inspector? .....  Yes  No



**INSPECTION REPORT  
OU5**

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

### Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: <u>Former Lowry AFB OUS</u>	Date of inspection: <u>May 14, 2013</u>
Location and Region: <u>Denver CO</u>	EPA ID:
Agency, office, or company leading the five-year review: <u>USAF AFCEC</u>	Weather/temperature: <u>Clear, 75°F</u>
<b>Remedy Includes:</b> (Check all that apply) <input type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input type="checkbox"/> Other _____ <input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls	
<b>Attachments:</b>	<input type="checkbox"/> Inspection team roster attached <input type="checkbox"/> Site map attached
II. INTERVIEWS (Check all that apply)	
1. O&M site manager <u>John Gerton</u> <u>Project mgr</u> <u>5/14/13</u> <small>Name Title Date</small> Interviewed at site <input checked="" type="checkbox"/> at office <input type="checkbox"/> by phone <input type="checkbox"/> Phone no. _____ Problems, suggestions; Report attached _____	
2. O&M staff _____ <small>Name Title Date</small> Interviewed at site <input type="checkbox"/> at office <input type="checkbox"/> by phone <input type="checkbox"/> Phone no. _____ Problems, suggestions; Report attached _____	

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

Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; Report attached \_\_\_\_\_

Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; Report attached \_\_\_\_\_

Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; Report attached \_\_\_\_\_

Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; Report attached \_\_\_\_\_

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


III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	<b>O&amp;M Documents</b> <input checked="" type="checkbox"/> O&M manual <i>Workplan</i> <input type="checkbox"/> As-built drawings <input type="checkbox"/> Maintenance logs Remarks _____	<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A
2.	<b>Site-Specific Health and Safety Plan</b> <input type="checkbox"/> Contingency plan/emergency response plan Remarks: <i>Contractor(s)</i>	<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input type="checkbox"/> N/A <input type="checkbox"/> N/A
3.	<b>O&amp;M and OSHA Training Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
4.	<b>Permits and Service Agreements</b> <input type="checkbox"/> Air discharge permit <input type="checkbox"/> Effluent discharge <input type="checkbox"/> Waste disposal, POTW <input type="checkbox"/> Other permits _____ Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
5.	<b>Gas Generation Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
6.	<b>Settlement Monument Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
7.	<b>Groundwater Monitoring Records</b> Remarks _____	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
8.	<b>Leachate Extraction Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
9.	<b>Discharge Compliance Records</b> <input type="checkbox"/> Air <input type="checkbox"/> Water (effluent) Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
10.	<b>Daily Access/Security Logs</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A

<b>IV. O&amp;M COSTS</b>			
1.	<b>O&amp;M Organization</b>		
	State in-house	Contractor for State	
	PRP in-house	<input checked="" type="checkbox"/> Contractor for PRP	
	Federal Facility in-house	Contractor for Federal Facility	
	Other <u>LAC for WAF</u>		
2.	<b>O&amp;M Cost Records</b>		
	Readily available	<input checked="" type="checkbox"/> Up to date	
	Funding mechanism/agreement in place.		
	Original O&M cost estimate <u>Fixed Price</u>	Breakdown attached	
	Total annual cost by year for review period if available		
	From _____	To _____	Breakdown attached
	Date	Date	Total cost
	From _____	To _____	Breakdown attached
	Date	Date	Total cost
	From _____	To _____	Breakdown attached
	Date	Date	Total cost
	From _____	To _____	Breakdown attached
	Date	Date	Total cost
	From _____	To _____	Breakdown attached
	Date	Date	Total cost
3.	<b>Unanticipated or Unusually High O&amp;M Costs During Review Period</b>		
	Describe costs and reasons:		
	<u>N/A</u>		
<b>V. ACCESS AND INSTITUTIONAL CONTROLS</b>			
		Applicable	N/A
<b>A. Fencing</b>			
1.	<b>Fencing damaged</b>	Location shown on site map	Gates secured <input checked="" type="checkbox"/> <u>N/A</u>
	Remarks _____		
<b>B. Other Access Restrictions</b>			
1.	<b>Signs and other security measures</b>	Location shown on site map	<input checked="" type="checkbox"/> <u>N/A</u>
	Remarks _____		

C. Institutional Controls (ICs)				
<b>1. Implementation and enforcement</b>				
Site conditions imply ICs not properly implemented	Yes	<del>No</del>	N/A	
Site conditions imply ICs not being fully enforced	Yes	<del>No</del>	N/A	
Type of monitoring (e.g., self-reporting, drive by)	<i>Self reporting</i>			
Frequency				
Responsible party/agency	<i>Owner</i>			
Contact	Name	Title	Date	Phone no.
Reporting is up-to-date	Yes	No	<del>N/A</del>	
Reports are verified by the lead agency	Yes	No	<del>N/A</del>	
Specific requirements in deed or decision documents have been met	Yes	No	<del>N/A</del>	
Violations have been reported	Yes	No	<del>N/A</del>	
Other problems or suggestions:	<i>Report attached</i>			
<hr/> <hr/> <hr/>				
<b>2. Adequacy</b>	<del>ICs are adequate</del>	ICs are inadequate	N/A	
Remarks	<hr/> <hr/>			
<b>D. General</b>				
<b>1. Vandalism/trespassing</b>	Location shown on site map	No vandalism evident		
Remarks	<i>N/A</i>			
<b>2. Land use changes on site</b>	N/A			
Remarks	<i>Residential construction nearing completion - ICs in place for use</i>			
<b>3. Land use changes off site</b>	N/A			
Remarks	<i>No</i>			
<b>VI. GENERAL SITE CONDITIONS</b>				
<b>A. Roads</b>	Applicable	N/A		
<b>1. Roads damaged</b>	Location shown on site map	Roads adequate	<del>N/A</del>	
Remarks	<hr/> <hr/>			

<b>B. Other Site Conditions</b>			
Remarks _____ _____ _____ _____ _____			
<b>VII. LANDFILL COVERS</b> Applicable <input checked="" type="checkbox"/> N/A			
<b>A. Landfill Surface</b>			
1.	<b>Settlement</b> (Low spots) Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	Settlement not evident
2.	<b>Cracks</b> Lengths _____ Widths _____ Remarks _____	Location shown on site map _____ Depths _____	Cracking not evident
3.	<b>Erosion</b> Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	Erosion not evident
4.	<b>Holes</b> Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	Holes not evident
5.	<b>Vegetative Cover</b> Trees/Shrubs (indicate size and locations on a diagram) Remarks _____	Grass _____ Cover properly established _____	No signs of stress
6.	<b>Alternative Cover</b> (armored rock, concrete, etc.) Remarks _____	N/A	
7.	<b>Bulges</b> Areal extent _____ Remarks _____	Location shown on site map _____ Height _____	Bulges not evident

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

4.	<b>Undercutting</b> Areal extent _____ Remarks _____	Location shown on site map Depth _____	No evidence of undercutting
5.	<b>Obstructions</b> Type _____ Location shown on site map Size _____ Remarks _____	Areal extent _____	No obstructions
6.	<b>Excessive Vegetative Growth</b> No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Remarks _____	Type _____ Areal extent _____	
<b>D. Cover Penetrations</b> Applicable <input checked="" type="checkbox"/> N/A			
1.	<b>Gas Vents</b> Properly secured/locked Evidence of leakage at penetration N/A Remarks _____	Active Functioning	Passive Routinely sampled Needs Maintenance Good condition
2.	<b>Gas Monitoring Probes</b> Properly secured/locked Evidence of leakage at penetration Remarks _____	Functioning	Routinely sampled Needs Maintenance Good condition N/A
3.	<b>Monitoring Wells (within surface area of landfill)</b> Properly secured/locked Evidence of leakage at penetration Remarks _____	Functioning	Routinely sampled Needs Maintenance Good condition N/A
4.	<b>Leachate Extraction Wells</b> Properly secured/locked Evidence of leakage at penetration Remarks _____	Functioning	Routinely sampled Needs Maintenance Good condition N/A
5.	<b>Settlement Monuments</b> Remarks _____	Located	Routinely surveyed N/A

<b>E. Gas Collection and Treatment</b>		Applicable	<u>N/A</u>
1.	<b>Gas Treatment Facilities</b> Flaring Good condition Remarks _____	Thermal destruction Needs Maintenance	Collection for reuse
2.	<b>Gas Collection Wells, Manifolds and Piping</b> Good condition Remarks _____	Needs Maintenance	
3.	<b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings) Good condition Remarks _____	Needs Maintenance	N/A
<b>F. Cover Drainage Layer</b>		Applicable	<u>N/A</u>
1.	<b>Outlet Pipes Inspected</b> Remarks _____	Functioning	N/A
2.	<b>Outlet Rock Inspected</b> Remarks _____	Functioning	N/A
<b>G. Detention/Sedimentation Ponds</b>		Applicable	<u>N/A</u>
1.	<b>Siltation</b> Areal extent _____ Depth _____ Siltation not evident Remarks _____		N/A
2.	<b>Erosion</b> Areal extent _____ Depth _____ Erosion not evident Remarks _____		
3.	<b>Outlet Works</b> Remarks _____	Functioning	N/A
4.	<b>Dam</b> Remarks _____	Functioning	N/A

<b>H. Retaining Walls</b>		Applicable	<u>N/A</u>
1.	<b>Deformations</b> Horizontal displacement _____ Rotational displacement _____ Remarks _____	Location shown on site map	Deformation not evident Vertical displacement _____
2.	<b>Degradation</b> Remarks _____	Location shown on site map	Degradation not evident
<b>I. Perimeter Ditches/Off-Site Discharge</b>		Applicable	<u>N/A</u>
1.	<b>Siltation</b> Areal extent _____ Remarks _____	Location shown on site map	Siltation not evident Depth _____
2.	<b>Vegetative Growth</b> Vegetation does not impede flow Areal extent _____ Remarks _____	Location shown on site map	N/A Type _____
3.	<b>Erosion</b> Areal extent _____ Remarks _____	Location shown on site map	Erosion not evident Depth _____
4.	<b>Discharge Structure</b> Remarks _____	Functioning	N/A
<b>VIII. VERTICAL BARRIER WALLS</b>		Applicable	<u>N/A</u>
1.	<b>Settlement</b> Areal extent _____ Remarks _____	Location shown on site map	Settlement not evident Depth _____
2.	<b>Performance Monitoring</b> Performance not monitored Frequency _____ Head differential _____ Remarks _____	Type of monitoring _____	Evidence of breaching

<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>		← Applicable	N/A
<b>A. Groundwater Extraction Wells, Pumps, and Pipelines</b>		Applicable	N/A
1.	<b>Pumps, Wellhead Plumbing, and Electrical</b> Good condition      All required wells properly operating      Needs Maintenance		← N/A
	Remarks <u>Remediation by in situ treatment - geo probe injections</u>		
2.	<b>Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> Good condition      Needs Maintenance		
	Remarks <u>N/A</u>		
3.	<b>Spare Parts and Equipment</b> Readily available      Good condition      Requires upgrade      Needs to be provided		
	Remarks <u>N/A</u>		
<b>B. Surface Water Collection Structures, Pumps, and Pipelines</b>		Applicable	N/A
1.	<b>Collection Structures, Pumps, and Electrical</b> Good condition      Needs Maintenance		
	Remarks _____		
2.	<b>Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> Good condition      Needs Maintenance		
	Remarks _____		
3.	<b>Spare Parts and Equipment</b> Readily available      Good condition      Requires upgrade      Needs to be provided		
	Remarks _____		

<b>C. Treatment System</b>		Applicable	<u>N/A</u>
1.	<b>Treatment Train</b> (Check components that apply) Metals removal _____ Oil/water separation _____ Bioremediation _____ Air stripping _____ Carbon adsorbers _____ Filters _____ Additive (e.g., chelation agent, flocculent) _____ Others _____ Good condition _____ Needs Maintenance _____ Sampling ports properly marked and functional _____ Sampling/maintenance log displayed and up to date _____ Equipment properly identified _____ Quantity of groundwater treated annually _____ Quantity of surface water treated annually _____ Remarks _____		
2.	<b>Electrical Enclosures and Panels</b> (properly rated and functional) N/A _____ Good condition _____ Needs Maintenance _____ Remarks _____		
3.	<b>Tanks, Vaults, Storage Vessels</b> N/A _____ Good condition _____ Proper secondary containment _____ Needs Maintenance _____ Remarks _____		
4.	<b>Discharge Structure and Appurtenances</b> N/A _____ Good condition _____ Needs Maintenance _____ Remarks _____		
5.	<b>Treatment Building(s)</b> N/A _____ Good condition (esp. roof and doorways) _____ Needs repair _____ Chemicals and equipment properly stored _____ Remarks _____		
6.	<b>Monitoring Wells</b> (pump and treatment remedy) Properly secured/locked _____ Functioning _____ Routinely sampled _____ Good condition _____ All required wells located _____ Needs Maintenance _____ N/A _____ Remarks _____		
<b>D. Monitoring Data</b>			
1.	Monitoring Data	<input checked="" type="checkbox"/> Is routinely submitted on time	<input checked="" type="checkbox"/> Is of acceptable quality
2.	Monitoring data suggests:	<input checked="" type="checkbox"/> Groundwater plume is effectively contained	<input checked="" type="checkbox"/> Contaminant concentrations are declining

<b>D. Monitored Natural Attenuation</b> <i>N/A</i>	
1.	<p><b>Monitoring Wells</b> (<del>natural attenuation remedy</del>)</p> <p><input checked="" type="checkbox"/> Properly secured/locked    <input checked="" type="checkbox"/> Functioning    <input checked="" type="checkbox"/> Routinely sampled    <input checked="" type="checkbox"/> Good condition</p> <p><input checked="" type="checkbox"/> All required wells located    Needs Maintenance</p> <p>Remarks: <i>Semiannual sampling for GMP - wells last inspected Jan 2013 by subcontractor</i></p>
<b>X. OTHER REMEDIES</b>	
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.	
<b>XI. OVERALL OBSERVATIONS</b>	
<b>A. Implementation of the Remedy</b>	
<p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).</p> <p><i>Remedy focused on aggressive reduction of TCE concentrations (debruy mass) in groundwater to levels acceptable to OPAE. By doing so, also reduce/eliminate potential vapor intrusion pathway. Data presented in Section 4 demonstrate significant concentration reduction.</i></p>	
<b>B. Adequacy of O&amp;M</b>	
<p>Describe issues and observations related to the implementation and scope of O&amp;M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><i>O&amp;M consists of semiannual groundwater monitoring, periodic inspections of residential indoor air mitigation systems (external sun lights) and Institutional Controls. All are indicative of adequate protectiveness of the remedy.</i></p>	

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A - Active injections have been completed. Currently in post-remediation monitoring and evaluating O&M for closure with the regulatory agency.

**INSPECTION REPORT**  
**OU2**





III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	<b>O&amp;M Documents</b> <input checked="" type="checkbox"/> O&M manual <input checked="" type="checkbox"/> As-built drawings <input checked="" type="checkbox"/> Maintenance logs Remarks _____	<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	Up to date Up to date Up to date	N/A N/A N/A
2.	<b>Site-Specific Health and Safety Plan</b> Contingency plan/emergency response plan Remarks _____	<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available	Up to date Up to date	N/A N/A
3.	<b>O&amp;M and OSHA Training Records</b> Remarks <u>LTE - training (Contractor for O&amp;M)</u>	<input type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	N/A
4.	<b>Permits and Service Agreements</b> Air discharge permit Effluent discharge Waste disposal, POTW Other permits _____ Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	Up to date Up to date Up to date Up to date	<input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
5.	<b>Gas Generation Records</b> Remarks <u>Semiannual O&amp;M Reports - no gas generation</u>	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	N/A
6.	<b>Settlement Monument Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
7.	<b>Groundwater Monitoring Records</b> Remarks _____	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	N/A
8.	<b>Leachate Extraction Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
9.	<b>Discharge Compliance Records</b> Air Water (effluent) Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	Up to date Up to date	<input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
10.	<b>Daily Access/Security Logs</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A

IV. O&M COSTS			
1.	<b>O&amp;M Organization</b>		
	State in-house	Contractor for State	
	<input checked="" type="checkbox"/> PRP in-house	<input checked="" type="checkbox"/> Contractor for PRP	
	Federal Facility in-house	Contractor for Federal Facility	
	Other	<u>LTE is O&amp;M contractor for LAC</u>	
2.	<b>O&amp;M Cost Records</b>		
	Readily available	<u>Up to date</u>	
	Funding mechanism/agreement in place		
	Original O&M cost estimate	<u>Fixed Price</u>	Breakdown attached
	Total annual cost by year for review period if available		
	From _____ Date	To _____ Date	Total cost _____ Breakdown attached
	From _____ Date	To _____ Date	Total cost _____ Breakdown attached
	From _____ Date	To _____ Date	Total cost _____ Breakdown attached
	From _____ Date	To _____ Date	Total cost _____ Breakdown attached
	From _____ Date	To _____ Date	Total cost _____ Breakdown attached
3.	<b>Unanticipated or Unusually High O&amp;M Costs During Review Period</b>		
	Describe costs and reasons: <u>N/A</u>		
	_____		
	_____		
	_____		
	_____		
	_____		
V. ACCESS AND INSTITUTIONAL CONTROLS			
	Applicable	N/A	
<b>A. Fencing</b>			
1.	<b>Fencing damaged</b>	Location shown on site map	Gates secured <u>N/A</u>
	Remarks <u>See attached quarterly inspection logs - periodic damage by transients is repaired as needed</u>		
<b>B. Other Access Restrictions</b>			
1.	<b>Signs and other security measures</b>	Location shown on site map	N/A
	Remarks <u>in good condition</u>		

C. Institutional Controls (ICs)			
<b>1. Implementation and enforcement</b>			
Site conditions imply ICs not properly implemented	Yes	<input checked="" type="radio"/> No	N/A
Site conditions imply ICs not being fully enforced	Yes	<input checked="" type="radio"/> No	N/A
Type of monitoring (e.g., self-reporting, drive by) <u>GW, personnel, Surface Water</u>			
Frequency <u>Semiannual, Soil Gas quarterly, Surface inspection quarterly</u>			
Responsible party/agency <u>LAC</u>			
Contact <u>John Gordon</u>	<u>Project Mgr</u>	Date	Phone no.
	Name	Title	
Reporting is up-to-date	<input checked="" type="radio"/> Yes	No	N/A
Reports are verified by the lead agency	<input checked="" type="radio"/> Yes	No	N/A
Specific requirements in deed or decision documents have been met	<input checked="" type="radio"/> Yes	No	N/A
Violations have been reported	Yes	No	<input checked="" type="radio"/> N/A
Other problems or suggestions: Report attached			
<hr/> <hr/> <hr/>			
<b>2. Adequacy</b>	<input checked="" type="checkbox"/> ICs are adequate	ICs are inadequate	N/A
Remarks			
<hr/> <hr/>			
D. General			
<b>1. Vandalism/trespassing</b>	Location shown on site map	<input checked="" type="checkbox"/> No vandalism evident	
Remarks <u>Occasional transient trespass</u>			
<b>2. Land use changes on site</b>	<input checked="" type="checkbox"/> N/A		
Remarks <u>None during 2nd five year review cycle</u>			
<b>3. Land use changes off site</b>	<input checked="" type="checkbox"/> N/A		
Remarks			
<hr/> <hr/>			
VI. GENERAL SITE CONDITIONS			
<b>A. Roads</b>	Applicable	N/A	
<b>1. Roads damaged</b>	Location shown on site map	<input checked="" type="checkbox"/> Roads adequate	N/A
Remarks			
<hr/> <hr/>			

<b>B. Other Site Conditions</b>			
Remarks <u>See LFE quarterly/semiannual reports - attached</u>			
<b>VII. LANDFILL COVERS</b> Applicable      N/A			
<b>A. Landfill Surface</b>			
1.	<b>Settlement</b> (Low spots) Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	<input checked="" type="checkbox"/> Settlement not evident
2.	<b>Cracks</b> Lengths _____ Widths _____ Remarks _____	Location shown on site map _____ Depths _____	<input checked="" type="checkbox"/> Cracking not evident
3.	<b>Erosion</b> Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	<input checked="" type="checkbox"/> Erosion not evident
4.	<b>Holes</b> Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	<input checked="" type="checkbox"/> Holes not evident
5.	<b>Vegetative Cover</b> Trees/Shrubs (indicate size and locations on a diagram) Remarks _____	<input checked="" type="checkbox"/> Grass <input checked="" type="checkbox"/> Cover properly established	No signs of stress
6.	<b>Alternative Cover</b> (armored rock, concrete, etc.) Remarks <u>Riprap placed at outfalls to Westerly Creek Dam good condition</u>	N/A	
7.	<b>Bulges</b> Areal extent _____ Remarks _____	Location shown on site map _____ Height _____	<input checked="" type="checkbox"/> Bulges not evident

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

4.	<b>Undercutting</b> Areal extent _____ Remarks _____	Location shown on site map _____ Depth _____	<input checked="" type="checkbox"/> No evidence of undercutting
5.	<b>Obstructions</b> Type _____ Location shown on site map _____ Size _____ Remarks _____	Areal extent _____	<input checked="" type="checkbox"/> No obstructions
6.	<b>Excessive Vegetative Growth</b> Type _____ <input checked="" type="checkbox"/> No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map _____ Remarks <u>Cover is mowed at least once annually</u>	Areal extent _____	
<b>D. Cover Penetrations</b> Applicable    N/A			
1.	<b>Gas Vents</b> <input checked="" type="checkbox"/> Properly secured/locked Evidence of leakage at penetration N/A Remarks _____	Active <input checked="" type="checkbox"/> Functioning	<input checked="" type="checkbox"/> Passive Routinely sampled <input checked="" type="checkbox"/> Good condition Needs Maintenance
2.	<b>Gas Monitoring Probes</b> <input checked="" type="checkbox"/> Properly secured/locked Evidence of leakage at penetration Remarks <u>sampled quarterly</u>	Functioning	<input checked="" type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition Needs Maintenance    N/A
3.	<b>Monitoring Wells (within surface area of landfill)</b> <input checked="" type="checkbox"/> Properly secured/locked Evidence of leakage at penetration Remarks <u>sampled semiannually</u>	<input checked="" type="checkbox"/> Functioning	<input checked="" type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition Needs Maintenance    N/A
4.	<b>Leachate Extraction Wells</b> Properly secured/locked    Functioning Evidence of leakage at penetration Remarks _____		Routinely sampled    Good condition Needs Maintenance <input checked="" type="checkbox"/> N/A
5.	<b>Settlement Monuments</b> Remarks _____	Located	Routinely surveyed <input checked="" type="checkbox"/> N/A

<b>E. Gas Collection and Treatment</b>		Applicable	<u>N/A</u>
1.	<b>Gas Treatment Facilities</b> Flaring Good condition Remarks _____	Thermal destruction Needs Maintenance	Collection for reuse
2.	<b>Gas Collection Wells, Manifolds and Piping</b> Good condition Remarks _____	Needs Maintenance	
3.	<b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings) Good condition Remarks _____	Needs Maintenance	N/A
<b>F. Cover Drainage Layer</b>		<input checked="" type="checkbox"/> Applicable	N/A
1.	<b>Outlet Pipes Inspected</b> Remarks _____	Functioning	<u>N/A</u>
2.	<b>Outlet Rock Inspected</b> Remarks _____	<input checked="" type="checkbox"/> Functioning	N/A
<b>G. Detention/Sedimentation Ponds</b>		Applicable	<u>N/A</u>
1.	<b>Siltation</b> Areal extent _____ Depth _____ Siltation not evident Remarks _____		N/A
2.	<b>Erosion</b> Areal extent _____ Depth _____ Erosion not evident Remarks _____		
3.	<b>Outlet Works</b> Remarks _____	Functioning	N/A
4.	<b>Dam</b> Remarks _____	Functioning	N/A

<b>H. Retaining Walls</b>		Applicable	<input checked="" type="radio"/> N/A
1.	<b>Deformations</b> Horizontal displacement _____ Rotational displacement _____ Remarks _____	Location shown on site map	Deformation not evident Vertical displacement _____
2.	<b>Degradation</b> Remarks _____	Location shown on site map	Degradation not evident
<b>I. Perimeter Ditches/Off-Site Discharge</b>		<input checked="" type="radio"/> Applicable	<input type="radio"/> N/A
1.	<b>Siltation</b> Areal extent _____ Remarks _____	Location shown on site map	<input checked="" type="radio"/> Siltation not evident Depth _____
2.	<b>Vegetative Growth</b> <input checked="" type="checkbox"/> Vegetation does not impede flow Areal extent _____ Remarks _____	Location shown on site map	<input type="radio"/> N/A Type _____
3.	<b>Erosion</b> Areal extent _____ Remarks _____	Location shown on site map	<input checked="" type="radio"/> Erosion not evident Depth _____
4.	<b>Discharge Structure</b> Remarks _____	<input checked="" type="radio"/> Functioning	<input type="radio"/> N/A
<b>VIII. VERTICAL BARRIER WALLS</b>		Applicable	<input checked="" type="radio"/> N/A
1.	<b>Settlement</b> Areal extent _____ Remarks _____	Location shown on site map	Settlement not evident Depth _____
2.	<b>Performance Monitoring</b> Type of monitoring _____ Performance not monitored Frequency _____ Head differential _____ Remarks _____		Evidence of breaching _____

<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>		Applicable	<u>N/A</u>
<b>A. Groundwater Extraction Wells, Pumps, and Pipelines</b>		Applicable	N/A
1.	<b>Pumps, Wellhead Plumbing, and Electrical</b> Good condition      All required wells properly operating      Needs Maintenance      N/A Remarks _____		
2.	<b>Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> Good condition      Needs Maintenance Remarks _____		
3.	<b>Spare Parts and Equipment</b> Readily available      Good condition      Requires upgrade      Needs to be provided Remarks _____		
<b>B. Surface Water Collection Structures, Pumps, and Pipelines</b>		Applicable	<u>N/A</u>
1.	<b>Collection Structures, Pumps, and Electrical</b> Good condition      Needs Maintenance Remarks <i>Urban Drainage maintains adjacent Westley Creek for Aurora/Denver</i>		
2.	<b>Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> Good condition      Needs Maintenance Remarks _____		
3.	<b>Spare Parts and Equipment</b> Readily available      Good condition      Requires upgrade      Needs to be provided Remarks _____		

C. Treatment System		Applicable	N/A
1.	<b>Treatment Train</b> (Check components that apply) Metals removal _____ Oil/water separation _____ Bioremediation _____ Air stripping _____ Carbon adsorbers _____ Filters _____ Additive (e.g., chelation agent, flocculent) _____ Others _____ Good condition _____ Needs Maintenance _____ Sampling ports properly marked and functional _____ Sampling/maintenance log displayed and up to date _____ Equipment properly identified _____ Quantity of groundwater treated annually _____ Quantity of surface water treated annually _____ Remarks _____		
2.	<b>Electrical Enclosures and Panels</b> (properly rated and functional) N/A _____ Good condition _____ Needs Maintenance _____ Remarks _____		
3.	<b>Tanks, Vaults, Storage Vessels</b> N/A _____ Good condition _____ Proper secondary containment _____ Needs Maintenance _____ Remarks _____		
4.	<b>Discharge Structure and Appurtenances</b> N/A _____ Good condition _____ Needs Maintenance _____ Remarks _____		
5.	<b>Treatment Building(s)</b> N/A _____ Good condition (esp. roof and doorways) _____ Needs repair _____ Chemicals and equipment properly stored _____ Remarks _____		
6.	<b>Monitoring Wells</b> (pump and treatment remedy) Properly secured/locked _____ Functioning _____ Routinely sampled _____ Good condition _____ All required wells located _____ Needs Maintenance _____ N/A _____ Remarks _____		
<b>D. Monitoring Data</b>			
1.	Monitoring Data	Is routinely submitted on time	Is of acceptable quality
2.	Monitoring data suggests: <i>No discharges from 042</i> Groundwater plume is effectively contained Contaminant concentrations are declining		

<b>D. Monitored Natural Attenuation</b>			
1.	<b>Monitoring Wells</b> (natural attenuation remedy)		
	Properly secured/locked	Functioning	Routinely sampled
	All required wells located	Needs Maintenance	Good condition
	Remarks _____		(N/A)
<b>X. OTHER REMEDIES</b>			
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.			
<b>XI. OVERALL OBSERVATIONS</b>			
<b>A. Implementation of the Remedy</b>			
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).			
<i>OU2 landfill cover and drainage conveyance is functioning as designed.</i>			
_____			
_____			
_____			
_____			
_____			
_____			
<b>B. Adequacy of O&amp;M</b>			
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.			
<i>The O&amp;M program implemented by LAC and LTE (contractor) ensures the effectiveness and protectiveness of the remedy.</i>			
_____			
_____			
_____			
_____			

<b>C. Early Indicators of Potential Remedy Problems</b>
<p>Describe issues and observations such as unexpected changes in the cost or scope of O&amp;M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.</p> <p><i>None</i></p> <hr/>
<b>D. Opportunities for Optimization</b>
<p>Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.</p> <p><i>None</i></p> <hr/>

# MONITORING AND MAINTENANCE ACTIVITY REPORT

LANDFILL: Lowry

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	63°F	32-50°F	50-75°F	75-100°F
WIND	Calim	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

INSPECTOR(S) NAME(S): Matt Garland  
(Print Name(s))

Staff Geologist  
(Title(s))

INSPECTION DATE: 1/25/08

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	/				
2. Woody Vegetation	/				
B. Erosion	/				
C. Seepage	/				
D. Settlement/Ponding	/				
E. Animal Burrowing Activity	/				
F. Monuments and Control Points	/				
G. Tire Ruts	/				
H. Debris, Litter, and Waste	/				
I. Maintenance	/				
J. Other	/				
2. Drainage Control System					
A. Site Drainage System					
1. Channels	/				
2. Culverts	/				
B. Other					
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	/		/		Fence Materials Required on west end.
2. Wire	/		/		Maintenance Required by GP 08 & GP 19

## MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates					
1. Gate Locks	✓				
2. Gate Operation	✓				
C. Warning Signs	✓				
D. Access Roads					
1. Erosion	✓				
2. Rutting	✓				
3. Settlement	✓				
E. Debris, Litter, and Waste	✓				
F. Other					
1. Unauthorized Access	✓				
2. Illegal Dumping	✓				
3. Vandalism	✓				
4. Monitoring System					
A. Protective Well/Probe Casing	✓				
B. Well/Probe Casing	✓				
C. Lock (s)	✓				
D. Gas Risers/Vents (if applicable)	✓				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES

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COMPLETED BY MAT Gerlach  
(Print Name)

Mat Gerlach  
(Signature)

1/28/08  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU	FRI	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: OPERABLE UNIT 2

INSPECTOR(S) NAME(S): (redacted)

INSPECTION DATE: April 29, 2008

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	X				early vegetative growth
2. Woody Vegetation	X				
B. Erosion	X				
C. Seepage	X				
D. Settlement/Ponding	X				
E. Animal Burrowing Activity	X				
F. Monuments and Control Points	X				
G. Tire Ruts	X				
H. Debris, Litter, and Waste		X		X	Minor animal burrows (~2" diam)
I. Maintenance	X				Some random trash blown in
J. Other					
2. Drainage Control System					
A. Site Drainage System					
1. Channels	X				
2. Culverts	X				
B. Other					
3. Facility Access Control System					
A. Perimeter Fence		X			Fence down again on SW corner
1. Fence Posts		X			
2. Wire		X			



# MONITORING AND MAINTENANCE ACTIVITY REPORT

## Findings of Inspection and Recommendations

Watch areas of slightly ~~toen~~ <sup>toen</sup> mat in North Drainage at landfill (ongoing)  
Fix SW corner of fence again (Fixed late 2007)

## Action Taken

Pick up trash

COMPLETED BY \_\_\_\_\_

(Print Name)

(Signature)

(Date)



### SITE INSPECTION REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Rutting	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Settlement	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Other					
1. Unauthorized Access		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	fire trucks on top of landfill in multiple locations
2. Illegal Dumping	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Vandalism	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
4. Monitoring System					
A. Protective Well Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Well Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Lock (s)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Other Items (e.g. surface water markers)					
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES Vegetative is dry, fire trucks on top of a around landfill. Not LTE marks. One sign down on western edge. Slight wear in drive next to 6"

COMPLETED BY Chris Rocchi  
(Print Name)

  
(Signature)

7/29/08  
(Date)

# SITE INSPECTION REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU	FRI	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	45-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

SITE: Lansy Ave

INSPECTOR NAME(S): Chris Russell Geologist  
(Print Name(s))

INSPECTION DATE: 10/30/08

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Surface System					
A. Vegetative Cover	<input checked="" type="checkbox"/>				
B. Erosion	<input checked="" type="checkbox"/>				
C. Settlement	<input checked="" type="checkbox"/>				
D. Monuments and Control Points	<input checked="" type="checkbox"/>				
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
I. Maintenance	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<u>one sign broken by truck/mower</u>
J. Other					
2. Run-On/Run-Off Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>				
2. Culverts	<input checked="" type="checkbox"/>				
B. Other					
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<u>Some wires/fence along road</u>
2. Wire	<input checked="" type="checkbox"/>				
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>				
2. Gate Operation	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<u>loss</u>
C. Warning Signs	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<u>one sign damaged along road</u>
D. Access Roads					

### SITE INSPECTION REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Erosion	✓				
2. Rutting	✓				
3. Settlement	✓				
E. Debris, Litter, and Waste	✓				
F. Other					
1. Unauthorized Access	✓				
2. Illegal Dumping	✓				
3. Vandalism	✓				
4. Monitoring System					
A. Protective Well Casing	✓				
B. Well Casing	✓				
C. Lock (s)	✓				
D. Other Items (e.g. surface water markers)					
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES \_\_\_\_\_

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\_\_\_\_\_

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\_\_\_\_\_

COMPLETED BY Chris Rank  
(Print Name)

  
(Signature)

10/30/00  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	-
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: OPERABLE UNIT 2

INSPECTOR(S) NAME(S): MIKE HUPP (Print Name)

INSPECTION DATE: January 21, 2009

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
I. Cover System	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
A. Vegetation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1. Vegetative Cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Woody Vegetation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
C. Seepage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
D. Settlement/Ponding	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
F. Monuments and Control Points	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
G. Tire Ruts	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
J. Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Drainage Control System	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
A. Site Drainage System	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1. Channels	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
B. Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Facility Access Control System	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
A. Perimeter Fence	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1. Fence Posts	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Wire	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

*Minimal Field Micro Burrows*

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates					
1. Gate Locks	✓				
2. Gate Operation	✓				
C. Warning Signs	✓				
D. Access Roads	✓				
1. Erosion	✓				
2. Rutting	✓				
3. Settlement	✓				
E. Debris, Litter, and Waste	✓				
F. Other					
1. Unauthorized Access	✓				
2. Illegal Dumping	✓				
3. Vandalism	✓				
4. Monitoring System	✓				
A. Protective Well/Probe Casing	✓				
B. Well/Probe Casing	✓				
C. Lock (s)	✓	✓			New Locks
D. Gas Risers/Vents (if applicable)					
5. Other					
A.					
B.					
C.					

*2 Signs slightly damaged*

**COMMENTS/NOTES**

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COMPLETED BY Mike Hupp  
(Print Name)

*Mike Hupp*  
(Signature)

1/21/09  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Califn	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: 002

INSPECTOR(S) NAME(S): Chris Russell Geologist  
(Print Name(s)) (Title)

INSPECTION DATE: 3/4/05

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover		X		X	Burned to root base
2. Woody Vegetation		X		X	Spaced
B. Erosion		X		X	Monthly destroy and 60-70%
C. Seepage	X				
D. Settlement/Ponding	X				
E. Animal Burrowing Activity	X				
F. Monuments and Control Points		X	X	X	
G. Tire Ruts	X				minimal
H. Debris, Litter, and Waste	X				
I. Maintenance	X				
J. Other					
2. Drainage Control System					
A. Site Drainage System					
1. Channels		X		X	under water
2. Culverts		X		X	under water
B. Other					
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	X				
2. Wire	X				

## MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates					
1. Gate Locks	X				
2. Gate Operation	X				
C. Warning Signs		X	X		3 signs down/damaged
D. Access Roads					
1. Erosion	X				
2. Rutting	X				
3. Settlement	X				
E. Debris, Litter, and Waste	X				
F. Other					
1. Unauthorized Access	X				
2. Illegal Dumping	X				
3. Vandalism	X				
4. Monitoring System					
A. Protective Well/Probe Casing	X				
B. Well/Probe Casing	X				
C. Lock (s)	X				
D. Gas Risers/Vents (if applicable)	X				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES 60-70% Lembitk burned; All well, work, park are not damaged  
erosion within destroyed.

COMPLETED BY Chris Russell  
(Print Name)



(Signature)

7/1/03

(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI.	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: OPERABLE UNIT 2

INSPECTOR(S) NAME(S): Mike Hull  
(Print Name(s))

INSPECTION DATE: April 24, 2009

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System	<input checked="" type="checkbox"/>				
A. Vegetation	<input checked="" type="checkbox"/>				
1. Vegetative Cover	<input checked="" type="checkbox"/>				
2. Woody Vegetation	<input checked="" type="checkbox"/>				
B. Erosion	<input checked="" type="checkbox"/>				
C. Seepage	<input checked="" type="checkbox"/>				
D. Settlement/Ponding	<input checked="" type="checkbox"/>				
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>				
F. Monuments and Control Points	<input checked="" type="checkbox"/>				
G. Tire Ruts		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
I. Maintenance	<input checked="" type="checkbox"/>				
J. Other	<input checked="" type="checkbox"/>				
2. Drainage Control System	<input checked="" type="checkbox"/>				
A. Site Drainage System	<input checked="" type="checkbox"/>				
1. Channels	<input checked="" type="checkbox"/>				
2. Culverts	<input checked="" type="checkbox"/>				
B. Other	<input checked="" type="checkbox"/>				
3. Facility Access Control System	<input checked="" type="checkbox"/>				
A. Perimeter Fence	<input checked="" type="checkbox"/>				
1. Fence Posts	<input checked="" type="checkbox"/>				
2. Wire	<input checked="" type="checkbox"/>				

## MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates	<input checked="" type="checkbox"/>				
1. Gate Locks	<input checked="" type="checkbox"/>				
2. Gate Operation	<input checked="" type="checkbox"/>				
C. Warning Signs	<input checked="" type="checkbox"/>				
D. Access Roads	<input checked="" type="checkbox"/>				
1. Erosion	<input checked="" type="checkbox"/>				
2. Rutting	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
3. Settlement	<input checked="" type="checkbox"/>				
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
F. Other	<input checked="" type="checkbox"/>				
1. Unauthorized Access	<input checked="" type="checkbox"/>				
2. Illegal Dumping	<input checked="" type="checkbox"/>				
3. Vandalism	<input checked="" type="checkbox"/>				
4. Monitoring System	<input checked="" type="checkbox"/>				
A. Protective Well/Probe Casing	<input checked="" type="checkbox"/>				
B. Well/Probe Casing	<input checked="" type="checkbox"/>				
C. Lock (s)	<input checked="" type="checkbox"/>				
D. Gas Risers/Vents (if applicable)	<input checked="" type="checkbox"/>				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES

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COMPLETED BY MIKE HUPP  
(Print Name)

  
(Signature)

4/21/09  
(Date)

# SITE INSPECTION REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	-
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calms	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

SITE: OU-2

INSPECTOR NAME(S): MIKE HOPP (Print Name)  
Const Mgr (Title)

INSPECTION DATE: 7/28/09

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Surface System					
A. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Settlement	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Run-On/Run-Off Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Wire		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<i>SW corner adjacent to Almonds</i>
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Gate Operation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Warning Signs					
D. Access Roads					<i>Signs (landfill do not disturb) needs replaced North of GP-13</i>

## SITE INSPECTION REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Rutting	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Settlement	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Other					
1. Unauthorized Access	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Illegal Dumping	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Vandalism	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
4. Monitoring System					
A. Protective Well Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Well Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Lock (s)					
D. Other Items (e.g. surface water markers)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES \_\_\_\_\_

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COMPLETED BY Mike Hopp  
(Print Name)

  
(Signature)

3/28/09  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU	FRI	SAT	—
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: 002

INSPECTOR(S) NAME(S): Mike Hugg (Print Name(s))

INSPECTION DATE: 10/23/03

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
I. Cover System	<input checked="" type="checkbox"/>				
A. Vegetation	<input checked="" type="checkbox"/>				
1. Vegetative Cover	<input checked="" type="checkbox"/>				
2. Woody Vegetation	<input checked="" type="checkbox"/>				
B. Erosion	<input checked="" type="checkbox"/>				
C. Seepage	<input checked="" type="checkbox"/>				
D. Settlement/Ponding	<input checked="" type="checkbox"/>				
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>				
F. Monuments and Control Points	<input checked="" type="checkbox"/>				
G. Tire Ruts	<input checked="" type="checkbox"/>				
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
I. Maintenance	<input checked="" type="checkbox"/>				
J. Other	<input checked="" type="checkbox"/>				
2. Drainage Control System	<input checked="" type="checkbox"/>				
A. Site Drainage System	<input checked="" type="checkbox"/>				
1. Channels	<input checked="" type="checkbox"/>				
2. Culverts	<input checked="" type="checkbox"/>				
B. Other	<input checked="" type="checkbox"/>				
3. Facility Access Control System	<input checked="" type="checkbox"/>				
A. Perimeter Fence	<input checked="" type="checkbox"/>				
1. Fence Posts	<input checked="" type="checkbox"/>				
2. Wire	<input checked="" type="checkbox"/>				

## MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates	<input checked="" type="checkbox"/>				
1. Gate Locks	<input checked="" type="checkbox"/>				
2. Gate Operation	<input checked="" type="checkbox"/>				
C. Warning Signs	<input checked="" type="checkbox"/>				
D. Access Roads	<input checked="" type="checkbox"/>				Sign (North (un)sub) replaced
1. Erosion	<input checked="" type="checkbox"/>				
2. Rutting	<input checked="" type="checkbox"/>				
3. Settlement	<input checked="" type="checkbox"/>				
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
F. Other	<input checked="" type="checkbox"/>				
1. Unauthorized Access	<input checked="" type="checkbox"/>				
2. Illegal Dumping	<input checked="" type="checkbox"/>				
3. Vandalism	<input checked="" type="checkbox"/>				
4. Monitoring System	<input checked="" type="checkbox"/>				
A. Protective Well/Probe Casing	<input checked="" type="checkbox"/>				
B. Well/Probe Casing	<input checked="" type="checkbox"/>				
C. Lock (s)	<input checked="" type="checkbox"/>				
D. Gas Risers/Vents (if applicable)	<input checked="" type="checkbox"/>				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES

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COMPLETED BY MIKE HOPP  
(Print Name)

  
(Signature)

10/27/09  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

LANDFILL: \_\_\_\_\_

INSPECTOR(S) NAME(S): Mike Hopp  
(Print Name(s))

INSPECTION DATE: 4/27/10

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Woody Vegetation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Seepage	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Settlement/Ponding	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
G. Tire Ruts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other					
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other					
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Wire	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Gate Operation		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Entry - cross bar on gate broken/bent
C. Warning Signs	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Access Roads					
1. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Rutting	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Settlement	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Other					
1. Unauthorized Access	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Illegal Dumping	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Vandalism	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
4. Monitoring System					
A. Protective Well/Probe Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Well/Probe Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Lock (s)					
D. Gas Risers/Vents (if applicable)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES \_\_\_\_\_

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COMPLETED BY Mike Hull *(Print Name)* 2/8/10 *(Date)*

*(Signature)*

# SITE INSPECTION REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI.	SAT	-
WEATHER	Clear	Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

SITE: Lowry 00-2

INSPECTOR NAME(S): Mike Hupp (Print Name(s)) Const. Mng'r. (Title)

INSPECTION DATE: 4/30/10

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Surface System					
A. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Settlement	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Run-On/Run-Off Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Fence post repair east of GP-15
2. Wire	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Gate Operation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Warning Signs					
D. Access Roads		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Sign + post down along east side of claim

# SITE INSPECTION REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Rutting	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Settlement	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Other					
1. Unauthorized Access	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Illegal Dumping	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Vandalism	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
4. Monitoring System					
A. Protective Well Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Well Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Lock (s)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Other Items (e.g. surface water markers)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
5. Other					
A.					
B.					
C.					

**COMMENTS/NOTES**

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COMPLETED BY Mike Hupp  
(Print Name)

  
(Signature)

5/3/10  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

LANDFILL: \_\_\_\_\_

*Coop Dr. Canhill*

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	-
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

INSPECTOR(S) NAME(S): \_\_\_\_\_

*MIKE HUPP Const. Mgr.*

INSPECTION DATE: \_\_\_\_\_

*July 27, 2010*

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
I. Cover System					
A. Vegetation					
1. Vegetative Cover	X				
2. Woody Vegetation	X				
B. Erosion	X				
C. Seepage	X				
D. Settlement/Ponding	X				
E. Animal Burrowing Activity	X				
F. Monuments and Control Points	X				
G. Tire Ruts	X				
H. Debris, Litter, and Waste	X				
I. Maintenance	X				
J. Other	X				
2. Drainage Control System					
A. Site Drainage System					
1. Channels	X				
2. Culverts	X				
B. Other	X				
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts		X	X		West of GP-7
2. Wire		X	X		Between GP-8 and GP-7

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
B. Site Access Gates					
1. Gate Locks	X				
2. Gate Operation	X				
C. Warning Signs		X	X		Sign down East of Dam Road Southeast end.
D. Access Roads					
1. Erosion	X				
2. Rutting	X				
3. Settlement	X				
E. Debris, Litter, and Waste	X				
F. Other	X				Sinkhole repaired S. of GP 6 & W. of GP 7
4. Monitoring System					
A. Protective Well/Probe Casing	X				
B. Well/Probe Casing	X				
C. Lock (s)	X				
D. Gas Risers/Vents (if applicable)					
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES Watch sinkhole South of GP 6 and West of GP 7 during  
next inspection events

COMPLETED BY M. E. Huff  
(Print Name)

  
(Signature)

7/22/10  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	--
WEATHER	Clear	P. Clouds	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: OU2

INSPECTOR(S) NAME(S): MIKE HOLL Staff Const. Mgr.  
(Print Name(s)) (Title)

INSPECTION DATE: 10/29/10

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>				
2. Woody Vegetation	<input checked="" type="checkbox"/>				
B. Erosion	<input checked="" type="checkbox"/>				
C. Seepage	<input checked="" type="checkbox"/>				
D. Settlement/Ponding	<input checked="" type="checkbox"/>				
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>				
F. Monuments and Control Points	<input checked="" type="checkbox"/>				
G. Tire Ruts	<input checked="" type="checkbox"/>				
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
I. Maintenance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Mending repair needed along North Drainage Run
J. Other	<input checked="" type="checkbox"/>				
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>				
2. Culverts	<input checked="" type="checkbox"/>				
B. Other	<input checked="" type="checkbox"/>				
3. Facility Access Control System					
A. Perimeter Fence	<input checked="" type="checkbox"/>				
1. Fence Posts			<input checked="" type="checkbox"/>		
2. Wire			<input checked="" type="checkbox"/>		Fence Repair needed - See notes
B. Site Access Gates					
1. Gate Locks		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

LTE

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	<input checked="" type="checkbox"/>				
C. Warning Signs	<input checked="" type="checkbox"/>				
D. Access Roads	<input checked="" type="checkbox"/>				
1. Erosion	<input checked="" type="checkbox"/>				
2. Rutting	<input checked="" type="checkbox"/>				
3. Settlement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Between GP7 and GP-6 along fence
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
F. Other					
1. Unauthorized Access					
2. Illegal Dumping	<input checked="" type="checkbox"/>				
3. Vandalism	<input checked="" type="checkbox"/>				
4. Monitoring System					
A. Protective Well/Probe Casing	<input checked="" type="checkbox"/>				
B. Well/Probe Casing	<input checked="" type="checkbox"/>				
C. Lock (s)	<input checked="" type="checkbox"/>				
D. Gas Risers/Vents (if applicable)	<input checked="" type="checkbox"/>				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES Fence Repair needed between GP-8 and GP-7

COMPLETED BY Mike Kopp  
(Print Name)

Mike Kopp  
(Signature)

10/29/10  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	50-75°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: Larry Ouz

INSPECTOR(S) NAME(S): Mike Hull

Const. Mng.  
(Print Name(s))

INSPECTION DATE: 1-25-11

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>				
2. Woody Vegetation	<input checked="" type="checkbox"/>				
B. Erosion	<input checked="" type="checkbox"/>				
C. Seepage	<input checked="" type="checkbox"/>				
D. Settlement/Ponding	<input checked="" type="checkbox"/>				
E. Animal Burrowing Activity					
F. Monuments and Control Points	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Along down basin (N <sub>2</sub> -th side)
G. Tire Ruts	<input checked="" type="checkbox"/>				
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
I. Maintenance	<input checked="" type="checkbox"/>				
J. Other	<input checked="" type="checkbox"/>				
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>				
2. Culverts	<input checked="" type="checkbox"/>				
B. Other	<input checked="" type="checkbox"/>				
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>				
2. Wire					
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		between SP-7 and SP-8

LTE

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	<input checked="" type="checkbox"/>				
C. Warning Signs		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Along Dan Road Sign down
D. Access Roads					
1. Erosion	<input checked="" type="checkbox"/>				
2. Rutting	<input checked="" type="checkbox"/>				
3. Settlement		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
E. Debris, Litter, and Waste		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		approx 40' W of GP-7 along fence line (Alameda)
F. Other					
1. Unauthorized Access					
2. Illegal Dumping	<input checked="" type="checkbox"/>				
3. Vandalism	<input checked="" type="checkbox"/>				
4. Monitoring System					
A. Protective Well/Probe Casing	<input checked="" type="checkbox"/>				
B. Well/Probe Casing	<input checked="" type="checkbox"/>				
C. Lock (s)					
D. Gas Risers/Vents (if applicable)	<input checked="" type="checkbox"/>				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES

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COMPLETED BY Mike Huff  
(Print Name)

  
(Signature)

1-25-11  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	-
WEATHER	Clear	Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	30-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: Lowry Ave Landfill

INSPECTOR(S) NAME(S): Mike Hupp Construction Manager  
(Print Name)

INSPECTION DATE: 4/30/11

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
<b>1. Cover System</b>					
A. Vegetation					
1. Vegetative Cover	X			X	
2. Woody Vegetation	X			X	
B. Erosion	X			X	
C. Seepage	X			X	
D. Settlement/Ponding	X			X	
E. Animal Burrowing Activity					
F. Monuments and Control Points					
G. Tire Ruts	X		X	X	Sign down E at Dun Rd. & N or Dun Rd (GPI)
H. Debris, Litter, and Waste			X	X	N. Side of Road along Alameda
I. Maintenance			X	X	Along seam between G-224 & G-223
J. Other	X			X	
<b>2. Drainage Control System</b>					
A. Site Drainage System					
1. Channels	X			X	
2. Culverts	X			X	
B. Other	X			X	
<b>3. Facility Access Control System</b>					
A. Perimeter Fence					
1. Fence Posts	X			X	
2. Wire		X		X	Fence Repair south of Dun Rd.
B. Site Access Gates					
1. Gate Locks	X			X	

LTE

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Warning Signs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		SAA IF
D. Access Roads					
1. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Rutting	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Settlement		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		Settling between GR-7 and GR-8, GR-8 & GR-7
F. Other					
1. Unauthorized Access	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Illegal Dumping	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Vandalism	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
4. Monitoring System					
A. Protective Well/Probe Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Well/Probe Casing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Lock(s)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Gas Risers/Vents (if applicable)	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
5. Other					
A.					
B.					
C.					

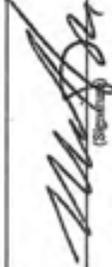
COMMENTS/NOTES \_\_\_\_\_

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COMPLETED BY MIKE HUAN  
(Print Name)



4/30/11  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU	FRJ	SAT	-
WEATHER	Clear	Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: Lowry Ouz Landfill

INSPECTOR(S) NAME(S): Mike Hugg Constr. Mgr.  
(Print Name)

INSPECTION DATE: 7/26/11

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Woody Vegetation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Seepage	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Settlement/Ponding	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
G. Tire Ruts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Wire		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Post fence between 608 & 607
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	

## MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	X			X	
C. Warning Signs	X			X	
D. Access Roads					
1. Erosion	X			X	
2. Rutting	X			X	
3. Settlement	X			X	
E. Debris, Litter, and Waste	X			X	
F. Other					
1. Unauthorized Access	X			X	
2. Illegal Dumping	X			X	
3. Vandalism	X			X	
4. Monitoring System					
A. Protective Well/Probe Casing	X			X	
B. Well/Probe Casing	X			X	
C. Lock (s)	X			X	
D. Gas Risers/Vents (if applicable)	X			X	
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES \_\_\_\_\_

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\_\_\_\_\_

COMPLETED BY MIKE HOPP  
(Print Name)



7/26/11  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	-
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: Leamy Dr Landfill

INSPECTOR(S) NAME(S): Mike Hugg Cont. Miss.  
(Print Name(s))

INSPECTION DATE: 10/28/11

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Woody Vegetation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Seepage	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Settlement/Ponding	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
F. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
G. Tire Ruts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Wells along site to be seen needs repair
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Wire		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Between 687d 687e SW Corner of page 1
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	X			X	
C. Warning Signs	X			X	
D. Access Roads					
1. Erosion	X			X	
2. Rutting	X			X	
3. Settlement	X			X	
E. Debris, Litter, and Waste	X			X	
F. Other					
1. Unauthorized Access	X			X	
2. Illegal Dumping	X			X	
3. Vandalism	X			X	
4. Monitoring System					
A. Protective Well/Probe Casing	X			X	
B. Well/Probe Casing	X			X	
C. Lock (s)	X			X	
D. Gas Risers/Vents (if applicable)	X			X	
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES

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COMPLETED BY MIKE HOFF  
(Print Name)

  
(Signature)

10/28/11  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	--
WEATHER	Clear	Cloudy	Cloudy	Fog
TEMP.	0-32°F	2-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: DUZ

INSPECTOR(S) NAME(S): MIKE HULL COVST. MARR  
(Print Name(s)) (Title)

INSPECTION DATE: 1/30/12

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>				
2. Woody Vegetation	<input checked="" type="checkbox"/>				
B. Erosion	<input checked="" type="checkbox"/>				
C. Seepage	<input checked="" type="checkbox"/>				
D. Settlement/Ponding	<input checked="" type="checkbox"/>				
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>				
F. Monuments and Control Points	<input checked="" type="checkbox"/>				
G. Tire Ruts	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<u>Sign down E of Park Rd, Edge of Drain, 60887</u>
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
I. Maintenance	<input checked="" type="checkbox"/>				
J. Other	<input checked="" type="checkbox"/>				
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>				
2. Culverts	<input checked="" type="checkbox"/>				
B. Other	<input checked="" type="checkbox"/>				
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>				
2. Wire		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<u>BT 60887+607 SW Corner along Alameda</u>
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>				

LTE

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	X				
C. Warning Signs		X			
D. Access Roads					
1. Erosion	X				
2. Rutting	X				
3. Settlement	X				
E. Debris, Litter, and Waste	X				
F. Other					
1. Unauthorized Access	X				
2. Illegal Dumping	X				
3. Vandalism	X				
4. Monitoring System					
A. Protective Well/Probe Casing	X				
B. Well/Probe Casing	X				
C. Lock (s)					
D. Gas Risers/Vents (if applicable)	X				
5. Other					
A.	X				
B.					
C.					

*By GPS-607, E of Park St, Miss. Ridge of George*

COMMENTS/NOTES \_\_\_\_\_

COMPLETED BY MIKE KAO  
(Print Name)

*Mike Kao*  
(Signature)

7/30/12  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRJ	SAT	-
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: 022 Landfill

INSPECTOR(S) NAME(S): Chris Russell Project Geologist  
(Print Name(s))

INSPECTION DATE: 4/27/2011

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
A. Vegetation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
1. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Woody Vegetation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		minor damage to erosion mat along waste drain
C. Seepage	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Settlement/Ponding	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Animal Burrowing Activity	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		minor burrowing, NE corner at land fill
F. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
G. Tire Ruts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other					
2. Drainage Control System	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
A. Site Drainage System	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
1. Chamnels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other					
3. Facility Access Control System	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
A. Perimeter Fence	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
1. Fence Posts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Wire	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Site Access Gates	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	

LTE

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	X			X	
C. Warning Signs		X	X		Two signs damaged and down
D. Access Roads	X			X	
1. Erosion	X			X	
2. Rutting	X			X	
3. Settlement	X			X	
E. Debris, Litter, and Waste	X			X	
F. Other					
1. Unauthorized Access	X			X	
2. Illegal Dumping	X			X	
3. Vandalism	X			X	
4. Monitoring System					
A. Protective Well/Probe Casing	X			X	
B. Well/Probe Casing	X			X	
C. Lock (s)	X			X	
D. Gas Risers/Vents (if applicable)		X	X		Two valves damaged (10, 15)
5. Other					
A.					
B.					
C.					

**COMMENTS/NOTES** Two signs damaged & down. Two valves with in Soil Gas wells damaged. Minor rust damaged along double doors. Minor animal damage on NE corner.

COMPLETED BY Chris Purcell  
(Print Name)

CRP  
(Signature)

4/27/12  
(Date)

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED
DAY	THU.	FRI	SAT	--
WEATHER	Clear	P. Cloudy	Cloudy	Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	Breeze	Moderate	High
WIND DIR.	North	South	East	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

LANDFILL: 002

INSPECTOR(S) NAME(S): Chris Porcetti Project Geologist  
(Print Name(s))

INSPECTION DATE: July 25, 2017

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Cover System					
A. Vegetation					
1. Vegetative Cover	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Woody Vegetation	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Erosion	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
C. Seepage	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
D. Settlement/Ponding	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
E. Animal Burrowing Activity		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
F. Monuments and Control Points	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
G. Tire Rats	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
H. Debris, Litter, and Waste	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
I. Maintenance	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
J. Other					
2. Drainage Control System					
A. Site Drainage System					
1. Channels	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Culverts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Other					
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
2. Wire	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
B. Site Access Gates					
1. Gate Locks	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	

LTE

# MONITORING AND MAINTENANCE ACTIVITY REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
2. Gate Operation	Y			X	
C. Warning Signs	Y			X	
D. Access Roads					
1. Erosion	X			X	
2. Rutting	Y			X	
3. Settlement	Y			X	
E. Debris, Litter, and Waste					
F. Other					
1. Unauthorized Access	X			X	
2. Illegal Dumping	X			X	
3. Vandalism	Y			X	
4. Monitoring System					
A. Protective Well/Probe Casing	Y			X	
B. Well/Probe Casing	X			X	
C. Lock (s)	Y			X	
D. Gas Risers/Vents (if applicable)		Y	Y		
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES minor to moderate erosion marking along the top of well in channel on north side of land fill. minor eroded surrounding along Alameda in 2 two locations

COMPLETED BY Chris Runkle  
(Print Name)



7/25/11  
(Date)

# SITE INSPECTION REPORT

SITE:

Larry Duz

INSPECTOR NAME(S):

Miss Hupp Staff Capt. Mungr.  
(Print Name(s)) (Title)

INSPECTION DATE:

10/30/12

Day and Weather Information  
(Mark appropriate descriptions)

DAY	SUN	MON	TUES	WED.
DAY	THU.	FRI	SAT	
WEATHER	P. Cloudy	Cloudy		Fog
TEMP.	0-32°F	32-50°F	50-75°F	75-100°F
WIND	Calm	breeze	Moderate	High
WIND DIR.	North	South	<del>East</del>	West
RAIN	Trace	Light	Moderate	Heavy
SNOW	Trace	Light	Moderate	Heavy

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Surface System					
A. Vegetative Cover	X				
B. Erosion	X				
C. Settlement	X				
D. Monuments and Control Points		X	X		<u>Behind @ 9120 behind over</u>
E. Debris, Litter, and Waste	X				
I. Maintenance	X				
J. Other	X				
2. Run-On/Run-Off Drainage Control System					
A. Site Drainage System					
1. Channels	X				
2. Culverts	X				
B. Other	X				
3. Facility Access Control System					
A. Perimeter Fence					
1. Fence Posts	X				
2. Wire		X	X		<u>Fence post between 6P7 and 6P8</u>
B. Site Access Gates					
1. Gate Locks	X				
2. Gate Operation	X				
C. Warning Signs	X				
D. Access Roads					

# SITE INSPECTION REPORT

Inspection Item (Complete Unshaded Boxes)	Condition (Check One)		Action Required? (If Yes, Add Comments)		Locations/Comments
	Satisfactory	Unsatisfactory	Yes	No	
1. Erosion	<input checked="" type="checkbox"/>				
2. Ruttling	<input checked="" type="checkbox"/>				
3. Settlement	<input checked="" type="checkbox"/>				
E. Debris, Litter, and Waste	<input checked="" type="checkbox"/>				
F. Other					
1. Unauthorized Access	<input checked="" type="checkbox"/>				
2. Illegal Dumping	<input checked="" type="checkbox"/>				
3. Vandalism	<input checked="" type="checkbox"/>				
4. Monitoring System					
A. Protective Well Casing	<input checked="" type="checkbox"/>				
B. Well Casing	<input checked="" type="checkbox"/>				
C. Lock (s)	<input checked="" type="checkbox"/>				
D. Other Items (e.g. surface water markers)	<input checked="" type="checkbox"/>				
5. Other					
A.					
B.					
C.					

COMMENTS/NOTES

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COMPLETED BY Mike Hupp  
(Print Name)

  
(Signature)

(Date)

**APPENDIX E**  
**ASSESSMENT OF RISK**  
**From FINDING OF SUITABILITY FOR EARLY**  
**TRANSFER (FOSET) Attachment 3A**  
**(LAC, December2005)**

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**APPENDIX**

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3-A GROUNDWATER-TO-OUTDOOR AIR MODEL FOR CONSTRUCTION WORKER  
TRENCH EXPOSURE

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## ACRONYMS AND ABBREVIATIONS

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µg/L	Microgram per liter
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
CDPHE	Colorado Department of Public Health and Environment
EPA	U.S. Environmental Protection Agency
FOSET	Finding of Suitability for Early Transfer
HJ	Hazard index
HQ	Hazard quotient
IRIS	Integrated Risk Information System
KMnO <sub>4</sub>	Potassium permanganate
LAFB	Lowry Air Force Base
mg/kg-day	Milligrams of chemical per kilogram body weight per day
mg/kg	Milligram per kilogram
PPRTV	Provisional Peer-Reviewed Toxicity Value
PRG	Preliminary remediation goal
RfD	Reference dose
SF	Slope factor
SRAC	Selected risk assessment concentration
TCE	Trichloroethene
VDEQ	Virginia Department of Environmental Quality
VF	Volatilization factor

## 1.0 INTRODUCTION AND OBJECTIVES

This attachment presents the methods, assumptions, and findings of the assessment of risks summarized in Section 5.0 of the Finding of Suitability for Early Transfer (FOSET) report for the former Lowry Air Force Base (LAFB). The parcels addressed in this attachment are limited to the following FOSET parcels for which risks were assessed quantitatively:

- Parcel No. 1 - Northwest Neighborhood (groundwater)
- Parcel No. 3 - Headquarters Plume (groundwater)
- Parcel No. 4 - Outdoor Firing Range (groundwater)
- Parcel No. 5 - Fire Training Zone (groundwater)
- Parcel No. 6 - Building 606 (soil and groundwater)

Risks were not quantitatively assessed for soil at Parcels No. 1, 2 (Landfill Zone), 3, 4, 5, and 7 (Building 898). Table 5-1 of the FOSET report provides further details on planned and existing remedies for the parcels for which risks were not quantitatively assessed.

The assessment of risks was completed in accordance with State of Colorado Executive Order D-013-98, Sections 1.B.2 and 1.B.3., which requires the following as part of the Deferral Application:

An assessment of risk, pertinent to the parcel proposed for early transfer, which considers unrestricted use and reasonably anticipated use scenarios pursuant to the Reuse Plan for the parcel

As such, this assessment of risk does not meet the requirements of a formal risk assessment as that term is utilized under the Comprehensive Environmental Response, Compensation, and Liability Act. In general, methods used for assessing risks are based on standard U.S. Environmental Protection Agency (EPA) methodology and exposure assumptions (EPA, 1989, 2002a, and 2004a) where appropriate.

The objective of this assessment is to develop a conservative assessment of risk for each of the early transfer parcels. The Colorado Department of Public Health and Environmental (CDPHE) will use the results of this conservative assessment of risk to determine whether the planned land use and institutional controls associated with the planned land use for each parcel are protective of human health and the environment. To accomplish this objective, this assessment estimates risk based on (1) unrestricted land use, (2) reasonably anticipated land-use scenarios, (3) primary target chemicals known to exist and known to pose potential risk, and (4) reasonably anticipated exposure pathways. For each FOSET parcel, potential exposure pathways for residential and commercial/industrial scenarios were identified and evaluated for risk. Default EPA exposure assumptions for construction worker exposure to groundwater are not currently available. For this reason, an assessment of risks for a construction worker scenario was not included in the formal presentation and discussion of risks in the FOSET report. However, a qualitative/semi-quantitative, screening-level evaluation of risks for a construction worker scenario was developed as part of an analysis of uncertainties (see Section 5.9.5 of the FOSET report). The

methods, assumptions, and findings of the screening-level evaluation for the construction worker scenario is included in this attachment.

Based on guidance from CDPHE, this assessment provides a conservative estimate of risk through the use of worst-case concentrations for each target chemical. Worst-case concentrations were selected to represent some of the maximum historically measured concentrations of target chemicals for each parcel or the maximum concentrations detected in an area during recent sampling.

This remainder of this attachment identifies the target chemicals evaluated in the assessment of risk (Section 2.0), assesses potential exposures (Section 3.0), presents the toxicity assessment for the target chemicals (Section 4.0), and characterizes potential risks from exposure to the target chemicals (Section 5.0). References used to prepare this attachment are cited after Section 5.0, and tables are presented after the references.

## **2.0 TARGET CHEMICALS**

Table 1 summarizes the affected environmental media at each parcel and the target chemicals known to exist and pose risk. The target chemicals were selected based on findings from previous investigations at each parcel.

## **3.0 EXPOSURE ASSESSMENT**

This section identifies the potential human receptors that could be exposed to the target chemicals at each parcel as well as the exposure pathways, concentrations used for the assessment of risk, and chemical intake estimates.

### **3.1 POTENTIAL RECEPTORS**

Future land use at each parcel may involve residential or commercial/industrial use. Hence, both residential (adult and child) and commercial/industrial receptors were evaluated for each parcel. It was assumed that development of each parcel may involve intrusive excavation, construction, or regarding activities; therefore, a future construction worker receptor was also evaluated for each parcel. As discussed in Section 1.0, default EPA exposure assumptions for construction worker exposure to groundwater are not currently available. Potential risks for this scenario were evaluated using professional judgment. Therefore, the construction worker evaluation presented in this attachment represents a qualitative/semi-quantitative, screening-level evaluation.

### **3.2 EXPOSURE PATHWAYS**

Table 1 presents summarizes the potential exposure pathways identified for each receptor. Risks were quantified for each pathway identified as potentially complete. The pathways identified as potentially complete are discussed below for each receptor.

### 3.2.1 Adult and Child Resident Exposure

The following exposure pathways are potentially complete for residential adult and child receptors. For groundwater exposure pathways, groundwater is assumed to be the only source of water for residential domestic use.

#### Soil Pathways (Parcel No. 6 only)

- Incidental ingestion of soil
- Dermal contact with soil
- Inhalation of chemicals volatilized from soil to outdoor air

#### Groundwater Pathways (Parcels No. 1, 3, 4, 5, and 6)

- Ingestion of groundwater as a source of drinking water
- Dermal contact with groundwater during domestic use
- Inhalation of vapors released from groundwater to indoor air during domestic use
- Inhalation of indoor air vapors as a result of vapor intrusion from groundwater

### 3.2.2 Commercial/Industrial Worker Exposure

The following exposure pathways are potentially complete for commercial/industrial worker receptors.

#### Soil Pathways (Parcel No. 6 only)

- Incidental ingestion of soil
- Dermal contact with soil
- Inhalation of chemicals volatilized from soil to outdoor air

#### Groundwater Pathways (Parcels No. 1, 3, 4, 5, and 6)

- Ingestion of groundwater as a source of drinking water
- Dermal contact with groundwater during domestic use
- Inhalation of indoor air vapors as a result of vapor intrusion from groundwater

### 3.2.3 Construction Worker Exposure

The exposure pathways listed below are potentially complete for construction receptors. Because the depth to groundwater is relatively shallow throughout the LAFB (approximately 10 to 50 feet below ground surface [bgs]), it is assumed that exposure to groundwater may occur during construction activities involving trenching.

#### Soil Pathways (Parcel No. 6 only)

- Incidental ingestion of soil
- Dermal contact with soil
- Inhalation of chemicals volatilized from soil to outdoor air

#### Groundwater Pathways (Parcels No. 1, 3, 4, 5, and 6)

- Incidental ingestion of groundwater during trenching activities
- Dermal contact with groundwater during trenching activities
- Inhalation of air vapors released from groundwater to outdoor air during trenching activities

The assessment of risks for the construction worker scenario is a qualitative/semi-quantitative, screening-level evaluation that is included as an uncertainty analysis in this assessment of risk because EPA default exposure assumptions and vapor intrusion models are not available for a trench exposure scenario.

### **3.3 CONCENTRATIONS USED FOR ASSESSMENT OF RISK**

Based on CDPHE guidance, this assessment provides a conservative estimate of risks through the use of worst-case concentrations for each target chemical. Selected risk assessment concentrations (SRAC) were used to represent concentrations of each target chemical through each impacted medium. Worst-case concentrations were used as SRACs to represent some of the maximum historically measured concentrations of target chemicals for each parcel or the maximum concentrations detected in an area during recent sampling. Table 2 summarizes the SRACs. Sections 3.3.1 through 3.3.5 describe the bases for each SRAC. Section 3.3.6 presents the methodology used to derive SRACs for media without sampling data.

#### **3.3.1 Parcel No. 1 – Northwest Neighborhood**

TCE in groundwater is the target chemical for the Northwest Neighborhood. Potential worst-case risks were calculated for this parcel using pre- and post-remedy groundwater concentrations that represent the historical concentration and current conditions, respectively. In October 2004, active remediation of groundwater beneath the Northwest Neighborhood was initiated by injecting a chemical oxidant, potassium permanganate ( $KMnO_4$ ), into the groundwater to destroy TCE. TCE concentrations have not yet stabilized since the initiation of this remedy; however, TCE concentrations have declined significantly based on sampling results from December 2004 (MACTEC, 2005). Pre- and post-remedy TCE SRACs of 280 and 7.1 micrograms per liter ( $\mu g/L$ ), respectively, were used to assess risks. The pre-remedy SRAC is based on the maximum TCE concentration measured in monitoring well IRAMW02 in August 2001 (USAF, 2003). The post-remedy SRAC is based on the most recent TCE concentration measured in this same well in December 2004 (MACTEC, 2005). The TCE concentration measured in well IRAMW02 in December 2004 may not be representative of post-remedy TCE concentrations because plume

conditions have not yet stabilized after implementation of the remedy; however, this concentration was used to represent the likely current risks at this parcel.

### **3.3.2 Parcel No. 3 – Headquarters Plume**

TCE in groundwater is the target chemical for the Headquarters Plume. In October 2004, active remediation of groundwater at the Headquarters Plume was initiated by injecting  $\text{KMnO}_4$  into the groundwater to destroy TCE. TCE concentrations have not yet stabilized since the initiation of this remedy; however, TCE concentrations have declined significantly based on sampling results from December 2004 (MACTEC, 2005). Potential risks from exposure to TCE were assessed for the Headquarters Plume using a post-remedy SRAC for TCE of 890  $\mu\text{g/L}$  because this was one of the highest historical TCE concentrations for this area. This concentration was measured in monitoring well CPWHQ27XD in December 2004 (MACTEC, 2005) and is limited to a small area; the TCE concentrations in the rest of the Headquarters Plume are significantly lower than the concentration measured in this well.

### **3.3.3 Parcel No. 4 – Outdoor Firing Range**

TCE in groundwater is the target chemical for the Outdoor Firing Range. This parcel is impacted by the main TCE plume at LAFB. In October 2004, active remediation of groundwater at the main TCE plume was initiated by injecting  $\text{KMnO}_4$  into the groundwater to destroy TCE. TCE concentrations have not yet stabilized since the initiation of this remedy; however, TCE concentrations have declined significantly based on sampling results from December 2004 (MACTEC, 2005). Potential risks from exposure to TCE were assessed for Outdoor Firing Range using post-remedy SRACs for both the source area of the main TCE plume and the area downgradient of the main TCE plume. These SRACs were determined to be representative of worst-case conditions in the plume because several remedial activities have been initiated and have significantly reduced the overall contaminant mass in the main TCE plume, including the area of the Outdoor Firing Range. For the source area, a TCE SRAC of 610  $\mu\text{g/L}$  was used to assess risks. This TCE concentration was measured in monitoring well ETMW03 in December 2004 (MACTEC, 2005). For the downgradient area, a TCE SRAC of 130  $\mu\text{g/L}$  was used to assess risks. The downgradient TCE concentration was measured in monitoring well MWOB04D in December 2004 (MACTEC, 2005). The concentrations of TCE measured in these wells in December 2004 may not be representative of post-remedy concentrations because plume conditions have not yet stabilized after implementation of the remedy.

### **3.3.4 Parcel No. 5 – Fire Training Zone**

TCE in groundwater is the target chemical for the Fire Training Zone. In October 2004, active remediation of groundwater at the Fire Training Zone was initiated by injecting  $\text{KMnO}_4$  into the groundwater to destroy TCE. TCE concentrations have not yet stabilized since the initiation of this remedy; however, TCE concentrations have declined significantly based on sampling results from December 2004 (MACTEC, 2005). Potential risks from exposure to TCE were assessed for the Fire Training Zone using pre- and post-remedy SRACs of 140 and 0.54  $\mu\text{g/L}$ , respectively. The pre-remedy SRAC is based on the maximum TCE concentration measured in monitoring well FT-1 in August 2001 (USAF, 2003). The post-remedy SRAC is based on the

most recent TCE concentration measured in monitoring well FT-14 in December 2004 (MACTEC, 2005). The TCE concentrations measured in groundwater at well FT-14 may not be representative of post-remedy concentrations because this well is located outside of the Fire Training Zone plume area and plume conditions have not yet stabilized after implementation of the remedy.

### 3.3.5 Parcel No. 6 – Building 606

Benzene, toluene, ethylbenzene, and xylene (BTEX) in soil and groundwater are the target chemicals for this parcel. SRACs of these chemicals used for the assessment of risks from exposure to soil were based on results for a sample collected from 14 to 16 feet bgs at sampling location 606US-SB04 (Dames & Moore, 1998). Based on results for this sample, the following concentrations were selected for BTEX in soil: 23 milligrams per kilogram (mg/kg) for benzene; 230 mg/kg for toluene; 72 mg/kg for ethylbenzene; and 50 mg/kg for total xylenes. Concentrations for groundwater were based on maximum concentrations reported for groundwater well 606US-WP03 for October 1997 (Dames & Moore, 1998). Based on the sample results for this well, the following concentrations were selected for BTEX in groundwater: 9,500 µg/L for benzene; 18,000 µg/L for toluene; 2,900 µg/L for ethylbenzene; and 18,000 µg/L for total xylenes.

### 3.3.6 Selected Risk Assessment Concentrations for Media Not Sampled

The target chemicals in soil (BTEX) and groundwater (TCE and BTEX) may be transferred to outdoor and indoor air through the following mechanisms:

- Volatilization from soil to outdoor air
- Vapor intrusion from groundwater to indoor air
- Volatilization from groundwater in a construction worker trench to outdoor air

Samples of outdoor or indoor air were not collected at any of the FOSET parcels. In the absence of direct measurements of target chemical concentrations in outdoor and indoor air, transport models were used to estimate SRACs in outdoor and indoor air as a result of these transfer mechanisms. These models are discussed below.

#### Outdoor Air – Volatile Chemicals Released from Soil

Chemical-specific volatilization factors (VF) were used to estimate concentrations in outdoor air from BTEX in soil at Parcel No. 7. VFs relate concentrations of volatile chemicals in soil to airborne concentrations that may be inhaled. VFs were taken from the EPA Region 9 preliminary goal (PRG) table (EPA, 2004a) and are summarized in Table 3. To estimate SRACs of target chemicals in outdoor air, the soil SRAC was multiplied by the reciprocal of the VF. Calculations for SRACs for volatile chemicals released from soil to outdoor air were incorporated into the chemical intake equations described in Section 3.4; therefore SRACs for outdoor air are not presented separately in this risk evaluation.

#### Indoor Air – Vapor Intrusion of Volatile Chemicals in Groundwater

For residential and commercial receptors, subsurface vapor intrusion of TCE in groundwater at Parcels No. 1, 3, 4, and 5 and BTEX in groundwater at Parcel No. 6 was evaluated. SRACs for these target chemicals in indoor air were modeled using the EPA (2003a) groundwater vapor intrusion model, which is based on Johnson and Ettinger (1991). The EPA (2003a) model estimates convective and diffusive transport of chemical vapors emanating from groundwater into indoor spaces located directly above or near the source of contamination. Table 4 provides a summary of the values used for the model input parameters; EPA (2002b) default values were used for all parameters except source concentration for groundwater, soil type, and depth to groundwater. The soil type for all parcels was assumed to be sand. The SRACs for groundwater described in Sections 3.3.1 through 3.3.5 were used as groundwater source concentrations. The depth to groundwater at the LAFB varies from 10 to 30 feet bgs for Parcel No. 1 to 10 to 50 feet bgs at the other parcels. To account for the varying depth to groundwater at each parcel, SRACs from intrusion of groundwater were modeled for each parcel based on both the shallowest and deepest depths to groundwater.

The EPA (2003a) groundwater vapor intrusion model incorporates risk algorithms for estimating the potential cancer risks and/or noncancer hazard quotients from inhalation of the estimated indoor air concentrations. For this reason, chemical intake quantities described in Section 3.4 were not calculated for vapor intrusion; rather, the model was used to directly calculate cancer risks and noncancer hazards from vapor intrusion for each parcel. Section 5.3 discusses the cancer risks and noncancer hazards results from the vapor modeling.

#### Outdoor Air – Volatile Chemicals Released from Groundwater in a Construction Trench

As part of the screening-level evaluation for construction worker exposure to groundwater, chemical-specific VFs were used to estimate SRACs from TCE in groundwater at Parcels No. 1, 3, 4, 5, and 6 and BTEX in groundwater at Parcel No. 7. VFs relate concentrations of volatile chemicals in groundwater accumulated in a construction trench to airborne concentrations that may be inhaled by construction workers. Calculations of the VFs for this scenario were based on Virginia Department of Environmental Quality (VDEQ) guidance, which provides a combination of a vadose zone model to estimate volatilization of gaseous chemicals from groundwater into a trench, and a box model to estimate dispersion of the chemicals from the air inside the trench into aboveground air (VDEQ, 2005). A description of this model, including assumptions for model parameters, is provided in Appendix 3A-1. Table 3 summarizes the calculated VFs for outdoor air in a construction trench. To estimate SRACs of target chemicals in outdoor air in a construction trench, the SRACs for groundwater (described in Sections 3.3.1 through 3.3.5) were multiplied by the calculated VFs for construction trench air. Calculations for SRACs for target chemicals in construction trench air were incorporated into the chemical intake equations described in Section 3.4; therefore, SRACs for construction trench air are not presented separately in this risk evaluation.

### 3.4 CHEMICAL INTAKE ESTIMATES

Estimates of exposure are based on the SRACs (as described in Section 3.3) and scenario-specific assumptions and intake parameters. Exposure estimates (chemical intakes) were calculated for each receptor and complete exposure pathway using EPA-derived exposure algorithms. The following equation is a generic equation for calculating chemical intake (EPA, 1989):

$$I = \frac{C \times CR \times EF \times ED}{BW \times AT} \quad (3-1)$$

where

- I = Intake: the amount of chemical at the exchange boundary (milligrams per kilogram per day [mg/kg-day])
- C = Chemical concentration: the SRAC (for example, mg/kg for soil)
- CR = Contact rate: the amount of contaminated medium contacted per unit of time or event; may be the ingestion rate, inhalation rate, or dermal contact rate (for example, mg/day for the ingestion rate of soil)
- EF = Exposure frequency: how often the exposure occurs (days/year)
- ED = Exposure duration: the number of years in which a receptor comes in contact with the contaminated medium (years)
- BW = Body weight: the average body weight of the receptor over the exposure period (kilograms)
- AT = Averaging time: the period over which exposure is averaged (days); for carcinogens, the averaging time is 25,550 days on the basis of a lifetime exposure of 70 years (average life expectancy), and for noncarcinogens, the averaging time is equal to the exposure duration multiplied by the number of days in a year (365 days)

Pathway-specific variations of Equation 3-1 were used to calculate intakes of target chemicals. Table 5 summarizes the assumptions used in this assessment for each exposure parameter. EPA default exposure assumptions were used for all parameters except for the three parameters discussed below for estimating exposure to a construction worker from contact with groundwater during trenching activities. EPA default exposure assumptions are not available for these parameters; therefore, professional judgment was used based on the rationales discussed below. Because the assumptions used to evaluate construction worker exposure to groundwater are based on professional judgment, the construction worker evaluation presented in this attachment represents a qualitative/semi-quantitative, screening-level evaluation.

Construction worker incidental groundwater ingestion rate during trenching activities: A rate of 0.05 liter per day was assumed, based on EPA (1989). This rate represents the rate of incidental

surface water ingestion during wading activities and is a conservative estimate for construction worker ingestion of water during trenching activities because it is unlikely that trenching activities will involve wading.

Construction worker exposed skin surface area for contact with groundwater during trenching activities: An exposed skin surface area of 2,370 square centimeters was assumed, which corresponds to the surface area of lower legs (EPA, 2004b).

Construction worker exposure frequency for contact with groundwater during trenching activities: The EPA default exposure frequency for construction worker exposure to soil is 250 days per year (EPA, 2002a). An exposure frequency of 125 days per year was assumed for contact with groundwater during trenching activities.

#### 4.0 TOXICITY ASSESSMENT

The toxicity assessment identifies the reference doses (RfD) and slope factors (SF) used to evaluate adverse noncancer health effects and cancer risks. The following hierarchy was used to establish toxicity values for this assessment (EPA, 2003b):

- EPA's Integrated Risk Information System (IRIS): IRIS is an on-line database that contains EPA-approved RfDs and SFs (EPA, 2005). The RfDs and SFs have undergone review and are recognized as agency-wide consensus information.
- EPA's Provisional Peer-Reviewed Toxicity Values (PPRTV) Database: The PPRTV database is an on-line database that contains approved RfDs and SFs (EPA, 2004c). The RfDs and SFs have undergone review and are recognized as consensus information.
- Other EPA Toxicity Values: These values are presented in the EPA Region IX PRG table (EPA, 2004a).

Tables 6 through 9 present the toxicity values used for this assessment.

TCE is a target chemical in groundwater for four of the FOSET Parcels. This target chemical presents a difficult challenge for the assessment of risk because of the number of different opinions regarding the assessment of TCE risk. This difference of opinion is based on the fact that there is no EPA-approved toxicity value for TCE. EPA withdrew its previously published toxicity values for TCE in 1988, and since then, most assessments of risk have used the withdrawn values in the absence of other values. EPA has not published finalized toxicity values for TCE since withdrawing the original values because of uncertainties relating to the science of TCE toxicity. In 2001, EPA's Office of Research and Development completed a preliminary draft reassessment of health risks posed by TCE (EPA, 2001). This preliminary draft reassessment proposes toxicity values that are much more conservative than the values withdrawn by EPA, and these suggested toxicity values are now the subject of much debate. As

such, the scientific community is divided on whether to use the withdrawn values, the new suggested values, or some other values for calculating risks.

In August 2004, CDPHE issued a policy that addresses screening and remediation levels for TCE that may be present in indoor air (CDPHE, 2004). CDPHE uses an indoor air concentration range of 0.8 to 1.6 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) of TCE as the level at which cleanup is required. This concentration corresponds to a cancer risk level of  $5\text{E-}05$  to  $1\text{E-}04$ , using the high end inhalation toxicity value for cancer risk from the EPA (2001) preliminary draft reassessment of TCE.

Because the reassessment has not been completed and in the absence of EPA-approved toxicity values for TCE, this "worst-case" assessment of risk uses both EPA's withdrawn toxicity criteria for TCE and EPA's draft proposed toxicity criteria. Because the CDPHE policy for TCE relies on the EPA (2001) draft proposed toxicity criteria for TCE for the determination of an action level, separate calculations are not provided based on CDPHE's policy. Tables 6 through 9 show the EPA withdrawn and draft toxicity criteria for TCE.

## 5.0 RISK CHARACTERIZATION

This section quantifies the potential noncancer health hazards and cancer risks associated with exposure to the identified target chemicals. Noncancer health hazards (represented by noncancer hazard indices [HI]) and cancer risks are quantified separately. Sections 5.1 and 5.2 discuss the general methodology for estimating HIs and cancer risks, respectively. The results of risk characterization are then presented in Section 5.3.

### 5.1 CHARACTERIZATION OF NONCANCER HAZARDS

The potential for exposure that may result in adverse health effects other than cancer is evaluated by comparing the intake with an RfD for chemicals not classified as carcinogens and for carcinogens known to cause adverse health effects other than cancer. When it is calculated for a single chemical, the comparison yields a ratio termed the hazard quotient (HQ), which is calculated using the following equation:

$$\text{Hazard Quotient} = \frac{\text{Intake (mg/kg-day)}}{\text{RfD (mg/kg-day)}} \quad (5-1)$$

The HQs for all chemicals are summed to evaluate the potential for adverse health effects other than cancer from simultaneous exposure to multiple chemicals, yielding an HI as follows:

$$\text{Hazard Index} = \sum \text{HQ} \quad (5-2)$$

Pathway-specific HIs are then summed to estimate a total HI for each receptor. The CDPHE threshold level for noncancer hazards is 1.0. An HI of 1.0 or less indicates that adverse noncarcinogenic health effects are not expected. If the total HI exceeds 1.0, further evaluation in

the form of a segregation of the HI through a target organ analysis may be performed to assess whether the noncancer HIs are a concern (EPA, 1989). Target organ HIs greater than 1.0 may indicate a potential adverse effect. When the total HI exceeded 1.0 and the HQ for an individual target chemical also exceeded 1.0, a target organ analysis was not conducted because the HQ results for the individual target chemical already indicate that concern may be warranted.

Estimated HIs associated with the industrial worker, construction worker, and residential exposure scenarios are presented in Section 5.3. The total noncancer HI for the future residential receptor is based on the total HI estimated for the child residential receptor because the intake for children of soil, groundwater, and air per unit body mass is higher than the intake for adults (hence, noncancer HIs for a child resident are always higher than noncancer HIs for an adult resident).

## 5.2 CHARACTERIZATION OF CANCER RISKS

Risks associated with exposure to chemicals classified as carcinogens are estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure (EPA, 1989). The estimated risk is expressed as a unitless probability.

Three steps are used to estimate cancer risks for chemicals classified as carcinogens. First, the chemical intake is multiplied by the chemical-specific SF to derive a cancer risk estimate for a single chemical and pathway. The calculation is based on the following relationship:

$$\text{Chemical-Specific Cancer Risk} = \text{Intake (mg/kg-day)} \times \text{SF (mg/kg-day)}^{-1} \quad (5-3)$$

Second, the individual chemical cancer risks are assumed to be additive to estimate the cancer risk associated with exposure to multiple carcinogens for a single exposure pathway as follows:

$$\text{Pathway-Specific Cancer Risk} = \sum \text{Chemical-Specific Cancer Risk} \quad (5-4)$$

Third, pathway-specific risks are summed to estimate the total cancer risk. Estimated risks associated with the industrial worker, construction worker, and residential exposure scenarios are presented in Section 5.3. The estimated cancer risk for the future residential exposure scenario is based on the sum of the risks estimated for the child and adult residential receptors. The CDPHE threshold level for cancer risk is 1E-06. A cancer risk of 1E-06 or less indicates no unacceptable risk.

## 5.3 ASSESSMENT OF RISK RESULTS

This section presents the assessment of risk results for each of the FOSET Parcels quantitatively evaluated for risk. As discussed in Section 4.0, in the absence of EPA-approved toxicity values for TCE because EPA's reassessment of health risks posed by TCE has not been completed, this assessment of risk uses both EPA's withdrawn toxicity criteria for TCE and EPA's draft

proposed toxicity criteria. For parcels for which TCE was identified as a target chemical, calculations of risk are provided based on both the EPA withdrawn toxicity criteria for TCE and EPA draft toxicity criteria for TCE.

Tables 10 and 11 summarize the chemical-specific risk calculations for the residential receptor, Tables 12 and 13 for the commercial/industrial receptor, and Tables 14 and 15 for the construction worker receptor. Tables 16 and 17 present an overall summary of the residential, commercial/industrial, and construction worker risk results for each parcel based on the EPA withdrawn and draft toxicity criteria for TCE, respectively. As discussed in Section 3.3.6, cancer risks and noncancer HIs from groundwater vapor intrusion are calculated directly in the EPA (2003a) vapor intrusion model; modeled results are presented in Tables 10 through 13. The following sections discuss the assessment of risk results for each parcel. Because the assumptions used to evaluate construction worker exposure to groundwater are based on professional judgment, the results of the construction worker evaluation discussed below represent a qualitative/semi-quantitative, screening-level results.

### **5.3.1 Parcel No. 1 – Northwest Neighborhood**

Table 16 summarizes the estimated cancer risks and noncancer HIs for exposure to TCE in groundwater at the Northwest Neighborhood calculated using EPA's withdrawn toxicity criteria for TCE. Table 17 present risks and HIs for TCE calculated using EPA's draft toxicity criteria.

Based on EPA's withdrawn toxicity criteria (Table 16), under pre-remedy conditions, cancer risks and noncancer HIs for both residential and commercial/industrial exposure exceed CDPHE's threshold cancer risk and noncancer HI levels of  $1E-06$  and 1.0, respectively. Risks for construction worker exposure are below risk and HI thresholds for pre-remedy conditions. Based on EPA's withdrawn toxicity criteria and under post-remedy conditions, cancer risks for residential exposure also exceed CDPHE's threshold cancer risk and noncancer HI levels; however, risks and HIs for the both commercial/industrial and construction worker exposure are below risk and HI thresholds for post-remedy conditions.

Under the worst-case assessment of risk, based on EPA's draft toxicity criteria for TCE (Table 17), and based on pre-remedy conditions (highest historical concentrations), cancer risks and noncancer HIs for all exposure scenarios except the HI for the construction worker scenario exceed CDPHE's threshold cancer risk and noncancer HI levels of  $1E-06$  and 1.0, respectively. Under post-remedy conditions, elevated risks and hazards are limited to residential exposure through the domestic use of groundwater, residential exposure through vapor intrusion (cancer risk only), and commercial/industrial exposure through vapor intrusion (cancer risk only).

### **5.3.2 Parcel No. 3 – Headquarters Plume**

Table 16 presents the estimated cancer risks and noncancer HIs for exposure to TCE in groundwater at the Headquarters Plume calculated using EPA's withdrawn toxicity criteria for TCE. Table 17 presents risks and hazards for TCE calculated using EPA's draft toxicity criteria.

Based on EPA's withdrawn toxicity criteria for TCE (Table 16), cancer risks and noncancer HIs for both residential and commercial/industrial exposure exceed CDPHE's threshold cancer risk and noncancer HI levels of 1E-06 and 1.0, respectively. The risk for the construction worker exposure scenario is below the risk threshold but exceeds the HI threshold.

Based on the worst-case TCE concentration of 890 µg/L and on EPA's withdrawn toxicity criteria (Table 17), cancer risks and noncancer HIs for all exposure scenarios exceed CDPHE's threshold cancer risk and noncancer HI levels of 1E-06 and 1.0, respectively.

### 5.3.3 Parcel No. 4 – Outdoor Firing Range

Table 16 presents the estimated cancer risks and noncancer HIs for exposure to TCE in groundwater at the Outdoor Firing Range calculated using EPA's withdrawn toxicity criteria for TCE. Table 17 presents risks and hazards for TCE calculated using EPA's draft toxicity criteria.

In the source area, based on EPA's withdrawn toxicity criteria for TCE (Table 16), cancer risks both residential and commercial/industrial exposure exceed CDPHE's threshold cancer risk level of 1E-06, whereas the risk for the construction worker exposure scenario is below the cancer risk threshold. Only the noncancer hazard for the residential exposure scenario exceeds the CDPHE threshold HI of 1.0.

In the downgradient area, based on EPA's withdrawn toxicity criteria for TCE (Table 16), cancer risks for residential exposures also exceed CDPHE's threshold cancer risk and noncancer HI levels; however, risks and HIs for the commercial/industrial exposure scenario are below risk and HI thresholds under post-remedy conditions. The risks for the construction worker exposure scenario are below risk and HI thresholds for the downgradient area.

Under the worst-case assessment of risk, based on EPA's draft toxicity criteria for TCE, and based on groundwater TCE concentrations measured in the source area are higher than typically found throughout the plume, cancer risks and noncancer HIs for all exposure scenarios exceed CDPHE's threshold cancer risk and noncancer HI levels of 1E-06 and 1.0, respectively (Table 17). In the downgradient area, results for all exposure scenarios exceed CDPHE's threshold risk and HI levels except the noncancer hazard for residential and commercial/industrial exposure from groundwater vapor intrusion and construction worker exposure to groundwater.

### 5.3.4 Parcel No. 5 – Fire Training Zone

Table 16 presents the estimated cancer risks and noncancer HIs for exposure to TCE in groundwater at the Fire Training Zone calculated using EPA's withdrawn toxicity criteria for TCE. Table 17 presents risks and hazards for TCE calculated using EPA's draft toxicity criteria.

Based on EPA's withdrawn toxicity criteria for TCE (Table 16), under pre-remedy conditions, cancer risks and noncancer HIs for both residential and commercial/industrial exposure exceed CDPHE's threshold cancer risk and noncancer HI levels of 1E-06 and 1.0, respectively. Risks for the construction worker exposure scenario are below risk and HI thresholds for pre-remedy conditions.

Based on EPA's withdrawn toxicity criteria for TCE (Table 17), under post-remedy conditions, cancer risks and noncancer HIs for all exposure scenarios are below risk and HI thresholds.

Based on EPA's draft toxicity criteria under pre- and post-remedy conditions, cancer risks for all scenarios except the construction worker exposure scenario exceed CDPHE's threshold cancer risk level of 1E-06 (Table 17). Cancer risks for the construction worker exposure scenario only exceeds the threshold cancer risk level of 1E-06 under pre-remedy conditions. The CDPHE noncancer HI threshold of 1.0 is exceeded only under pre-remedy conditions for the residential groundwater domestic use exposure scenario.

### **5.3.5 Parcel No. 6 – Building 606**

Table 16 presents the estimated cancer risks and noncancer HIs for exposure to BTEX in soil and groundwater at Building 606. Risks for residential exposure to soil exceeds CDPHE's threshold cancer risk and noncancer HI levels of 1E-06 and 1.0, respectively. For commercial/industrial exposure, only the cancer risk exceeds threshold levels. Risks for construction worker exposure to soil are below risk and HI thresholds. Cancer risks and noncancer HIs for all exposure scenarios for groundwater exceed CDPHE's threshold cancer risk and noncancer HI levels of 1E-06 and 1.0, respectively.

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**TABLES**

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**Table 3A-1**

**Summary of Impacted Media, Target Chemicals, Exposure Scenarios, and Exposure Pathways for FOSET Parcels Evaluated Quantitatively for Risk**

FOSET Parcel	Description	Impacted Media	Target Chemical	Exposure Scenario <sup>a</sup>	Exposure Pathways		
					Ingestion	Dermal Contact	Inhalation
1	Northwest Neighborhood	Groundwater	TCE	Residential	X	X	X (DU, VI)
				Commercial/Industrial			X (VI)
				Construction	X	X	X (Trench)
3	Headquarters Plume	Groundwater	TCE	Residential	X	X	X (DU, VI)
				Commercial/Industrial			X (VI)
				Construction	X	X	X (Trench)
4	Outdoor Firing Range	Groundwater	TCE	Residential	X	X	X (DU, VI)
				Commercial/Industrial			X (VI)
				Construction	X	X	X (Trench)
5	Fire Training Zone	Groundwater	TCE	Residential	X	X	X (DU, VI)
				Commercial/Industrial			X (VI)
				Construction	X	X	X (Trench)
6	Building 606	Soil	BTEX	Residential	X	X	X (OA)
				Commercial/Industrial	X	X	X (OA)
				Construction	X	X	X (OA)
		Groundwater	BTEX	Residential	X	X	X (DU, VI)
				Commercial/Industrial			X (VI)
				Construction	X	X	X (Trench)

**Notes:**

- <sup>a</sup> The assessment of risks for the construction worker scenario is a qualitative/semi-quantitative, screening-level evaluation
- BTEX Benzene, ethylbenzene, toluene, and xylenes
- DU Domestic use
- FOSET Finding of Suitability for Early Transfer
- OA Outdoor air
- TCE Trichloroethene
- VI Vapor intrusion
- X Potentially complete exposure pathway

**Table 3A-2  
Selected Risk Assessment Concentrations**

FOSET Parcel	Parcel Description	Exposure Medium	Chemical of Potential Concern	Units	Selected Risk Assessment Concentration	
1	Northwest Neighborhood	Groundwater	Trichloroethene	Pre-R	mg/L	2.6E-01
				Post-R	mg/L	7.1E-03
3	Headquarters Plume	Groundwater	Trichloroethene	mg/L	8.9E-01	
4	Outdoor Firing Range	Groundwater	Trichloroethene	SA	mg/L	6.1E-01
				DA	mg/L	1.3E-01
5	Fire Training Zone	Groundwater	Trichloroethene	Pre-R	mg/L	1.4E-01
				Post-R	mg/L	8.4E-04
6	Building 606	Groundwater	Benzene	mg/L	9.5E+00	
			Ethylbenzene	mg/L	1.8E+01	
			Toluene	mg/L	2.9E+00	
			Xylenes	mg/L	1.8E+01	
		Soil	Benzene	mg/kg	2.3E+01	
			Ethylbenzene	mg/kg	2.3E+02	
			Toluene	mg/kg	7.2E+01	
			Xylenes	mg/kg	4.5E+02	

**Notes:**

DA Downgradient area  
FOSET Finding of Suitability for Early Transfer  
mg/kg Milligram per kilogram  
mg/L Milligram per liter  
Pre-R Pre-remedy  
Post-R Post-remedy  
SA Source area

**Table 3A-3  
Chemical-Specific Factors**

Analyte	Kp <sup>a</sup> (cm <sup>2</sup> /hr)	Trench VF <sup>b</sup> (L/m <sup>2</sup> )	Soil-to-Outdoor Air VF <sup>c</sup> (m <sup>3</sup> /kg)
Benzene	1.80E-02	1.43E-01	2.73E+03
Ethylbenzene	4.93E-02	1.23E-02	5.40E+03
Toluene	3.10E-02	1.32E-01	3.88E+03
Trichloroethene	1.20E-02	1.11E-01	NE
Xylenes	5.30E-02	1.23E-01	6.10E+03

**Notes:**

- a Based on EPA (2004b)
  - b The chemical-specific volatilization factor was determined using the VDEC (2003) guidance for exposure of workers to volatile chemicals in a construction/utility trench. The assessment of risks for the construction worker scenario is a qualitative/semi-quantitative, screening-level evaluation that is included as an uncertainty analysis in this assessment of risk because EPA default exposure assumptions and vapor intrusion models are not available for a trench exposure scenario.
  - c Values based on EPA (2004a)
- cm<sup>2</sup>/hr Centimeter per hour  
 EPA U.S. Environmental Protection Agency  
 Kp Permeability constant  
 L/m<sup>2</sup> Liter per cubic meter  
 m<sup>3</sup>/kg Cubic meter per kilogram  
 NE Not evaluated  
 VF Volatilization factor

**References:**

- EPA, 2004a. "Region IX Preliminary Remediation Goals (PRG) Table," October 1. On-line Address: <http://www.epa.gov/region09/wastewater/index.htm>
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**Table 3A-4  
Groundwater Vapor Intrusion Modeling Assumptions**

Parameter	Abbreviation	Value <sup>a</sup>	Units
<b>Source Concentration</b>			
Groundwater SRAC	$C_w$	Parcel-specific SRAC	µg/L
<b>Soil and Groundwater Properties</b>			
Average soil/groundwater temperature	$T_S$	10	°Celsius
Depth below grade to bottom of enclosed space floor	$L_f$	200	cm
Depth below grade to water table	$L_{wt}$	Parcel-specific <sup>b</sup>	cm
Thickness of soil stratum A	$h_A$	Parcel-specific <sup>b</sup>	cm
Soil stratum A SCS soil type	SCS	S	unitless
SCS soil type directly above water table	SCS	S	unitless
Madras zone soil dry bulk density	$\rho_s^d$	1.56	g/cm <sup>3</sup>
Madras zone soil total porosity	$n^e$	0.375	unitless
Madras zone soil water-filled porosity	$n_w^e$	0.054	cm <sup>3</sup> /cm <sup>3</sup>
<b>Building Properties</b>			
Enclosed space floor thickness	$L_{floor}$	10	cm
Soil-building pressure differential	$\Delta P$	40	g/cm <sup>2</sup>
Enclosed space floor length	$L_f$	1,000	cm
Enclosed space floor width	$W_f$	1,000	cm
Enclosed space height	$H_b$	360	cm
Floor-wall water track width	$W_t$	0.1	cm
Indoor air exchange rate	ER	0.25	1/hour
<b>Exposure Assumptions</b>			
Averaging time for carcinogens	$AT_C$	70	year
Averaging time for noncarcinogens - residential	$AT_{NR,R}$	30	year
Averaging time for noncarcinogens - commercial/industrial	$AT_{NR,C/I}$	25	year
Exposure duration - residential	$ED_R$	30	year
Exposure duration - commercial/industrial	$ED_{C/I}$	25	year
Exposure frequency - residential	$EF_R$	350	days/year
Exposure frequency - commercial/industrial	$EF_{C/I}$	250	days/year
Target risk for carcinogens	TR	1.0E-06	unitless
Target hazard quotient for noncarcinogens	THQ	1	unitless

**Notes:**

<sup>a</sup> Values shown are default values provided in EPA (2002) unless otherwise indicated.

<sup>b</sup> For Parcel No. 1, groundwater vapor intrusion was modeled for 10 feet (305 cm) and 30 feet (914 cm) bgs. For Parcels No. 3, 4, 5, 6, and 7, groundwater vapor intrusion was modeled for 10 feet (304.8 cm) and 50 feet (1,524 cm) feet bgs. The thickness of soil stratum A was assumed to be equivalent to the depth to groundwater.

µg/L Microgram per liter  
 bgs Below ground surface  
 cm Centimeter  
 cm<sup>3</sup>/cm<sup>3</sup> Cubic centimeter-water per cubic centimeter-air  
 EPA U.S. Environmental Protection Agency  
 g/cm<sup>2</sup> Gram per centimeter per square second  
 g/cm<sup>3</sup> Gram per cubic centimeter  
 S Sand  
 SCS Soil Conservation Service  
 SRAC Selected risk assessment concentration

**Reference:**

U.S. Environmental Protection Agency (EPA), 2002. "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." Federal Register, Volume 67, Number 230, Pages 71168 through 71172. November 29.

**Table 3A-5  
Exposure Assumptions for Soil and Groundwater**

Parameter	Units	Exposure Scenario					
		Resident*			Commercial/Industrial Worker*		
		Adult	Child	Construction Worker*	Commercial/Industrial Worker*	Construction Worker*	
Fraction ingested from contaminated source	unitless	1	1	1	1	1	
Soil ingestion rate	mg/day	100	200	100	100	330	
Exposure frequency	days/year	350	350	250	250	250	
Exposure duration	years	24	6	25	25	1	
Conversion factor (soil ingestion)	kg/mg	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	
Averaging time--noncarcinogens	days	8,760	2,190	9,125	9,125	365	
Averaging time--carcinogens	days	25,550	25,550	25,550	25,550	25,550	
Body weight	kg	70	15	70	70	70	
Inhalation rate	m <sup>3</sup> /day	20	10	20	20	20	
Soil-to-outdoor air volatilization factor	m <sup>3</sup> /kg	See Table 3	See Table 3	See Table 3	See Table 3	See Table 3	
Skin surface area--dermal contact with soil	cm <sup>2</sup>	5,700	2,800	3,300	3,300	3,300	
Soil-to-skin adherence factor	mg/cm <sup>2</sup>	0.07	0.2	0.2	0.2	0.3	
Soil contact exposure frequency	days/year	350	350	250	250	250	
Conversion factor--dermal contact with soil	kg/mg	1.00E-08	1.00E-08	1.00E-08	1.00E-08	1.00E-08	
Groundwater ingestion rate	L/day	2	1	1	1	0.05	
Skin surface area--dermal contact with groundwater	cm <sup>2</sup>	18,000	d	6,600	d	2,370	
Groundwater dermal permeability constant	cm <sup>2</sup> /hour	See Table 3	See Table 3	See Table 3	See Table 3	See Table 3	
Exposure time--dermal contact with groundwater	hr/day	0.58	d	1	d	1	
Conversion factor--dermal contact with groundwater	L/cm <sup>2</sup>	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	
Groundwater contact exposure frequency	days/year	350	350	250	250	125	
Groundwater inhalation volatilization factor	L/m <sup>3</sup>	0.5	0.5	1	1	See Table 3	

**Table 3A-5  
Exposure Assumptions for Soil and Groundwater**

<b>Notes:</b>	
a	All exposure parameters are based on EPA (2004a) unless otherwise noted.
b	Values based on EPA (2002) unless otherwise noted. The assessment of risks for the construction worker scenario is a qualitative/semi-quantitative, screening-level evaluation.
c	The value shown represents the quantity of water that may be incidentally ingested while working (EPA 1989).
d	Value based on EPA (2004b).
e	Skin surface area is the 50th percentile for a gender-neutral construction worker based on Exhibit C-1 of EPA (2004b).
f	Based on professional judgment. The value shown represents the exposure frequency for incidental ingestion of, dermal contact with, and inhalation of volatile chemicals released from groundwater during trenching activities.
g	The chemical-specific volatilization factor was determined using the VDEC (2005) guidance for exposure of workers to volatile chemicals in a construction/utility trench.
-	Not applicable
cm <sup>2</sup>	Square centimeter
cm/hr	Centimeter per hour
EPA	U.S. Environmental Protection Agency
hr/day	Hour per day
kg	Kilogram
kg/mg	Kilogram per milligram
L/cm <sup>2</sup>	Liter per cubic centimeter
L/day	Liter per day
L/m <sup>2</sup>	Liter per cubic meter
m <sup>2</sup> /day	Cubic meter per day
m <sup>3</sup> /kg	Cubic meter per kilogram
mg/cm <sup>2</sup>	Milligram per square centimeter
mg/day	Milligram per day

**References:**

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**Table 3A-6  
Non-Cancer Toxicity Data - Oral / Dermal**

Target Chemical	Dermal Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal *	Accepted RfD for Dermal		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Benzene	Chronic	4.0E-03	mg/kg-day	100%	4.0E-03	mg/kg-day	Blood	300	IRIS	07/11/2008
Ethylbenzene	Chronic	1.0E-01	mg/kg-day	100%	1.0E-01	mg/kg-day	Liver and kidneys	1,000	IRIS	07/11/2008
Toluene	Chronic	2.0E-01	mg/kg-day	100%	2.0E-01	mg/kg-day	Organ weight	1,000	IRIS	07/11/2008
Trichloroethene (VOC toxicity criteria)	Chronic	8.0E-03	mg/kg-day	100%	8.0E-03	mg/kg-day	Liver, kidneys, and testis	3,000	IRIS	07/01/1998 (VOC)
Trichloroethene (drift toxicity criteria)	Chronic	3.0E-04	mg/kg-day	100%	3.0E-04	mg/kg-day	Liver, kidneys, and testis	3,000	EPA	08/01/2004
Xylenes (total)	Chronic	2.0E-01	mg/kg-day	100%	2.0E-01	mg/kg-day	Body weight and skin	1,300	IRIS	07/11/2008

**Notes:**

1. Assumed most conservative gastrointestinal absorption of 100 percent; values obtained from EPA (2004b)

EPA, U.S. Environmental Protection Agency

IRIS Integrated Risk Information System (EPA, 2005)

mg/kg-day Milligram per kilogram per day

RfD Reference dose

VOC Volatile organic compounds

**References:**

EPA, 2001. "Trichloroethylene Health Risk Assessment, Synthesis and Characterization." External Review Draft. Office of Research and Development, EPA/600/R-01/022A. August

EPA, 2004b. "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)." Final. Office of

Emergency and Remedial Response, Washington, D.C. 20460. EPA/540/R-99-003. OSWER 9205.1-02EP. PB99-90012. September.

On-line Address: <http://www.epa.gov/epaosopr/remediation/rlg/rlg.html>

EPA, 2005. "Integrated Risk Information System." On-line Address: <http://www.epa.gov/iris/index.html>

**Table 3A-7  
Non-Cancer Toxicity Data - Inhalation**

Target Chemical	Chemical Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	RfC - Target Organ(s)	
		Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzene	Chronic	3.9E-02	mg/m <sup>3</sup>	8.6E-02	mg/kg-day	Blood	RfC	07/11/2005
Ethylbenzene	Chronic	1.0E+00	mg/m <sup>3</sup>	2.9E-01	mg/kg-day	Developmental	RfC	07/11/2005
Toluene	Chronic	4.9E-01	mg/m <sup>3</sup>	1.1E-01	mg/kg-day	CNS	RfC	07/11/2005
Trichloroethene (MD toxicity criteria)	Chronic	-	-	6.0E-03	mg/kg-day	CNS, liver, and endocrine	RfC	07/01/1989 (WQ)
Trichloroethane (draft toxicity criteria)	Chronic	3.5E-02	mg/m <sup>3</sup>	1.0E-02	mg/kg-day	CNS, liver, and endocrine	EPA	08/01/2001
Xylene (total)	Chronic	1.9E-01	mg/m <sup>3</sup>	2.9E-02	mg/kg-day	CNS	RfC	07/11/2005

**Notes:**

- Not available or not applicable
- CNS Central nervous system
- EPA U.S. Environmental Protection Agency
- RfC Reference Concentration
- RfD Reference Dose
- WQ Withdrawn toxicity criteria
- mg/kg-day Milligram per kilogram per day
- mg/m<sup>3</sup> Milligram per cubic meter
- mg/m<sup>3</sup> Reference concentration
- RfC Reference dose
- WQ Withdrawn toxicity criteria

**References:**

EPA, 2001. "Trichloroethylene Health Risk Assessment: Symptom and Characterization." External Review Draft. Office of Research and Development. EPA/600/P-01/003A. August.  
 EPA, 2005. "Integrated Risk Information System." Online Address: <http://www.epa.gov/iris/index.html>

**Table 3A-3  
Cancer Toxicity Data - Oral / Dermal**

Target Chemical	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal <sup>a</sup>	Absorbed Cancer Slope Factor for Dermal		Weight of Evidential Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzene	5.0E-02	(mg/kg-day) <sup>a</sup>	100%	5.0E-02	(mg/kg-day) <sup>b</sup>	A	IRIS	07/11/2003
Ethylbenzene	-	-	-	-	-	D	IRIS	07/11/2005
Toluene	-	-	-	-	-	D	IRIS	03/09/2005
Trichloroethylene (MD toxicity criteria)	1.1E-03	(mg/kg-day) <sup>c</sup>	100%	1.1E-02	(mg/kg-day) <sup>d</sup>	-	IRIS	07/20/1989 (MD)
Trichloroethylene (oral toxicity criteria)	4.0E-01	(mg/kg-day) <sup>e</sup>	100%	4.0E-01	(mg/kg-day) <sup>f</sup>	-	EPA	08/01/2001
Xylene (total)	-	-	-	-	-	D	IRIS	03/09/2005

**Notes:**

- a Assumed most conservative gastrointestinal absorption of 100 percent, value obtained from EPA (2004b)
- Not available or not applicable
- EPA U.S. Environmental Protection Agency
- IRIS Integrated Risk Information System (EPA, 2005)
- mg/kg-day Milligram per kilogram per day
- MD Withdrawn toxicity criteria

**References:**

- EPA, 2001. "Trichloroethylene Health Risk Assessment: Synthesis and Characterization." External Review Draft. Office of Research and Development. EPA/600/P-01/002A. August.
- EPA, 2004b. "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)." Final. Office of Emergency and Remedial Response, Washington, D.C. 20460. EPA/540/R-99/005. OSWER 9285.7-02EP. PB99-963312. July.
- EPA, 2005. "Integrated Risk Information System." On-line Address. <http://www.epa.gov/iris/index.html>

**Table 3A-9  
Cancer Toxicity Data - Inhalation**

Target Chemical	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units		Source(s)	Delete(s) (MM/DD/YYYY)
Benzene	7.7E-06	( $\mu\text{g}/\text{m}^3 \text{ y}^{-1}$ )	2.7E-02	( $\text{mg}/\text{kg}\text{-day}^{-1}$ )	A	IRIS	07/11/2005
Ethylbenzene	-	-	-	-	D	IRIS	07/11/2005
Toluene	-	-	-	-	D	IRIS	07/11/2005
Trichloroethene (WD toxicity criteria)	1.7E-06	( $\mu\text{g}/\text{m}^3 \text{ y}^{-1}$ )	6.0E-03	( $\text{mg}/\text{kg}\text{-day}^{-1}$ )	-	IRIS	07/01/1989 (WD)
Trichloroethene (draft toxicity criteria)	1.1E-04	( $\mu\text{g}/\text{m}^3 \text{ y}^{-1}$ )	4.0E-01	( $\text{mg}/\text{kg}\text{-day}^{-1}$ )	-	EPA	08/01/2001
Xylene (total)	-	-	-	-	D	IRIS	07/11/2005

**Notes:**

- Not available or not applicable
- $\mu\text{g}/\text{m}^3$  Microgram per cubic meter
- EPA U.S. Environmental Protection Agency
- IRIS Integrated Risk Information System (EPA, 2005)
- $\text{mg}/\text{kg}\text{-day}$  Milligram per kilogram per day
- RAGS Risk Assessment Guidance for Superfund
- WD Withdrawn toxicity criteria

**References:**

- EPA, 2001. "Trichloroethylene Health Risk Assessment: Synthesis and Characterization." External Review Draft. Office of Research and Development. EPA/600/P-01/002A. August.
- EPA, 2005. "Integrated Risk Information System." On-line Address. <http://www.epa.gov/iris/index.html>

Table 3A-10  
 Cancer Risks and Noncancer Hazard Indices for the Residential Exposure Scenario  
 Calculated Using EPA Withdrawn Toxicity Criteria for TCE

FOBET Panel No.	Panel Description	Exposure Medium	Target Chemical	SAR	Cancer Risk						Noncancer Hazard							
					Exposure Pathway			Total All Exposure Pathways (DTH=10)	Exposure Pathway			Total All Exposure Pathways (DTH=10)						
					Incidental Ingestion	Dermal Contact	Inhalation (DTH=0)		Inhalation (DTH=0)	Dermal Contact	Inhalation (DTH=0)		Inhalation (DTH=0)	Incidental Ingestion	Dermal Contact	Inhalation (DTH=0)	Inhalation (DTH=0)	
1	Northwest Neighborhood (Pre-Remedy)	DVI	Toluene	2.8E-01	4.6E-02	3.1E-06	1.2E-04	4.6E-08	2.9E-02	3.2E-04	2.0E-04	3.0E+00	1.5E+01	2.5E+00	1.7E+00	2.1E+01	2.9E+01	
					1.2E-02	8.0E-06	2.1E-05	1.2E-08	8.0E-07	3.8E-06	5.1E-06	7.8E-02	4.0E-02	8.4E-01	3.9E-01	4.0E-02	8.4E-01	3.9E-01
					1.5E-04	1.0E-03	4.2E-04	1.0E-04	8.0E-05	7.0E-04	8.1E-04	8.5E+00	7.8E+01	4.6E+01	8.8E+00	8.8E+01	8.8E+00	8.8E+01
2	Headwaters Flume	DVI	Toluene	8.9E-01	1.2E-04	8.0E-06	2.1E-04	1.2E-04	3.9E-05	4.2E-04	4.2E-04	1.5E+01	3.3E+01	8.8E+00	2.9E+00	4.6E+01	4.2E+01	
					2.0E-05	1.5E-05	5.6E-05	2.1E-05	8.0E-06	1.0E-04	8.9E-05	1.4E+00	1.3E+01	7.6E+00	1.4E+00	3.0E+01	8.9E+00	9.0E+00
					2.3E-05	1.6E-06	9.2E-05	3.3E-05	9.1E-06	1.1E-04	9.2E-05	1.5E+00	1.2E+01	7.1E+00	1.3E+00	8.9E-01	1.1E+01	8.7E+00
3	Fire Training Zone (Pre-Remedy)	DVI	Toluene	2.4E-04	8.8E-09	6.1E-09	2.4E-07	8.8E-09	3.0E-08	4.2E-07	3.2E-07	3.8E-03	4.6E-04	2.9E-02	2.0E-02	4.1E-02	3.7E-02	
					7.8E-03	8.1E-04	1.9E-03	4.3E-03	1.7E-03	3.2E-02	2.9E-02	1.5E+02	1.5E+01	3.6E+02	4.3E+01	3.6E+02	4.3E+01	
					1.8E+01	1.8E+01	2.1E+01	1.8E+01	2.1E+01	2.1E+01	2.1E+01	3.7E+01	3.7E+01	3.0E+01	3.7E+01	3.7E+01	3.7E+01	
4	Building 100	Soil	Benzene	2.3E+02	3.9E-06	—	5.4E-08	—	—	3.6E-06	3.6E-06	3.6E-06	7.4E-02	—	8.5E-01	—	7.5E-01	
					—	—	—	—	—	—	—	—	—	—	—	—	—	—
					—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	Building 100	Soil	Benzene	2.3E+02	3.9E-06	—	5.4E-08	—	—	3.6E-06	3.6E-06	3.6E-06	7.4E-02	—	8.5E-01	—	7.5E-01	
					—	—	—	—	—	—	—	—	—	—	—	—	—	—
					—	—	—	—	—	—	—	—	—	—	—	—	—	—

**Table 3A-10**  
**Cancer Risks and Noncancer Hazard Indices for the Residential Exposure Scenario**  
**Calculated Using EPA Withdrawn Toxicity Criteria for TCE**

- Notes:**
- a. Groundwater limits are shown in mg/L, and soils are shown in mg/kg
  - b. DTW for Parcel No. 1 (Marwood Neighborhood) is 30 feet
  - Not applicable
  - DTW Depth to groundwater (feet)
  - EPA U.S. Environmental Protection Agency
  - ROSET Finding of Suitability for Early Transfer
  - DW Groundwater
  - mg/kg Milligram per kilogram
  - mg/L Milligram per liter
  - SPAC Selected site assessment concentration
  - V. Vapor intrusion

Table 3A-11  
 Cancer Risks and Noncancer Hazard Indices for the Residential Exposure Scenario  
 Calculated Using EPA Draft Toxicity Criteria for TCE

FOSET Parcel No.	Parcel Description	Exposure Medium	Target Chemicals	DRAFC	Cancer Risk						Noncancer Hazard					
					Exposure Pathway			Total, All Exposure Pathways (DTM-15)			Exposure Pathway			Total, All Exposure Pathways (DTM-15)		
					Inhalation	Ingestion	Dermal Contact	Inhalation (DTM-15)	Ingestion (DTM-15)	Dermal Contact (DTM-15)	Inhalation	Ingestion	Dermal Contact	Inhalation (DTM-15)	Ingestion (DTM-15)	Dermal Contact (DTM-15)
1	Northeast Highschool (Pre-Renov)	GW	Trichloroethene	2.6E-01	1.7E-03	1.1E-04	8.3E-03	3.1E-03	1.7E-03	1.3E-02	6.0E-01	4.7E-03	6.5E-03	1.8E-02	1.8E-02	7.8E-01
					4.3E-03	2.8E-06	1.1E-04	6.1E-04	4.6E-04	5.4E-04	1.9E-02	2.3E-01	6.9E-02	2.0E-02	1.9E-03	1.9E-03
2	Headwater Pumph	GW	Trichloroethene	8.9E-01	9.3E-03	2.6E-04	7.8E-04	1.9E-02	3.90E-03	4.2E-02	1.9E-02	1.9E-01	2.9E-01	3.7E-02	2.3E-02	2.4E-02
					3.6E-03	3.5E-04	1.8E-02	6.7E-03	2.90E-03	2.8E-02	1.3E-02	1.0E-04	4.0E-02	4.6E-02	1.6E-02	1.6E-02
3	Dulles-Fing Range (School Area)	GW	Trichloroethene	9.1E-01	7.7E-04	5.2E-05	2.8E-03	1.4E-03	5.80E-04	6.1E-03	3.6E-01	2.2E-02	4.2E-02	6.0E-01	3.6E-01	3.4E-01
					8.3E-04	3.7E-05	4.2E-03	1.8E-03	6.10E-04	6.6E-03	3.0E-01	2.4E-02	4.5E-02	6.0E-01	9.0E-01	9.0E-01
4	Dulles-Fing Range (School Area)	GW	Trichloroethene	1.3E-01	3.2E-08	2.2E-07	1.6E-03	6.6E-08	2.20E-06	2.2E-06	1.2E-01	6.1E-03	1.7E-02	6.0E-03	1.0E-03	1.4E-03
					7.3E-03	6.7E-04	1.8E-02	4.3E-03	1.70E-03	3.2E-02	1.5E-02	1.8E-01	3.5E-02	4.3E-03	6.7E-02	8.7E-02
5	Building 606	GW	Benzene	1.8E-01	-	-	-	-	-	-	-	1.3E-01	3.7E-03	2.7E-03	4.2E-01	9.8E-02
					1.8E-01	-	-	-	-	-	-	8.2E-01	6.5E-02	4.2E-01	1.6E-01	1.6E-01
6	Building 606	GW	Benzene	3.1E-01	2.9E-08	-	5.4E-09	-	-	3.6E-08	3.6E-08	7.4E-09	-	8.9E-01	-	7.0E-01
					2.9E-08	-	-	-	-	-	-	2.9E-02	-	8.9E-02	-	1.2E-01
7	Building 606	GW	Benzene	4.9E-02	-	-	-	-	-	-	-	2.9E-02	-	1.9E-01	-	5.1E-01
					4.9E-02	-	-	-	-	-	-	2.9E-02	-	1.9E-02	-	1.7E-02



Table 3A-12  
 Cancer Risks and Noncancer Hazard Indices for the Commercial / Industrial Worker Exposure Scenario  
 Calculated Using EPA Withdrawn Toxicity Criteria for TCE

FOSET Parcel No.	Parcel Description	Exposure Medium	Target Chemical	RBA/C	Cancer Risk						Noncancer Hazard						
					Exposure Pathway			Total, All Exposure Pathways (DTHweq)	Exposure Pathway			Total, All Exposure Pathways (DTHweq)	Exposure Pathway			Total, All Exposure Pathways (DTHweq)	
					Incidental Ingestion	Dermal Contact	Inhalation (DTHweq)		Incidental Ingestion	Dermal Contact	Inhalation (DTHweq)		Incidental Ingestion	Dermal Contact	Inhalation (DTHweq)		
1	Northwest Neighborhood (Pre-Remedy)	GW	Trichloroethene	3.8E-31	-	-	2.7E-05	1.30E-05	2.7E-05	1.6E-05	-	-	2.1E+00	1.2E+03	2.1E+00	1.2E+00	
					-	-	6.9E-07	3.99E-07	6.9E-07	3.8E-07	-	-	3.0E-02	3.0E-02	3.0E-02	3.0E-02	
					-	-	8.79E-05	3.40E-05	8.7E-05	3.4E-05	-	-	6.6E+00	2.7E+08	6.6E+00	2.7E+08	
2	Northwest Neighborhood (Post-Remedy)	GW	Trichloroethene	6.9E-31	-	-	8.79E-05	3.40E-05	8.7E-05	3.4E-05	-	-	6.6E+00	2.7E+08	6.6E+00	2.7E+08	
					-	-	8.79E-05	3.40E-05	8.7E-05	3.4E-05	-	-	6.6E+00	2.7E+08	6.6E+00	2.7E+08	
					-	-	8.79E-05	3.40E-05	8.7E-05	3.4E-05	-	-	6.6E+00	2.7E+08	6.6E+00	2.7E+08	
3	Oxley Fire Station (Pre-Remedy)	GW	Trichloroethene	8.1E-31	-	-	8.0E-05	2.30E-05	8.0E-05	2.3E-05	-	-	6.7E+00	1.6E+08	6.7E+00	1.6E+08	
					-	-	8.0E-05	2.30E-05	8.0E-05	2.3E-05	-	-	6.7E+00	1.6E+08	6.7E+00	1.6E+08	
					-	-	8.0E-05	2.30E-05	8.0E-05	2.3E-05	-	-	6.7E+00	1.6E+08	6.7E+00	1.6E+08	
4	Oxley Fire Station (Downgradient Area)	GW	Trichloroethene	1.3E-31	-	-	1.3E-05	3.00E-06	1.3E-05	3.0E-06	-	-	1.0E+01	4.0E-01	1.0E+01	4.0E-01	
					-	-	1.3E-05	3.00E-06	1.3E-05	3.0E-06	-	-	1.0E+01	4.0E-01	1.0E+01	4.0E-01	
					-	-	1.3E-05	3.00E-06	1.3E-05	3.0E-06	-	-	1.0E+01	4.0E-01	1.0E+01	4.0E-01	
5	Fire Training Zone (Pre-Remedy)	GW	Trichloroethene	1.4E-31	-	-	1.4E-05	4.00E-06	1.4E-05	4.0E-06	-	-	1.0E+01	4.0E-01	1.0E+01	4.0E-01	
					-	-	1.4E-05	4.00E-06	1.4E-05	4.0E-06	-	-	1.0E+01	4.0E-01	1.0E+01	4.0E-01	
					-	-	1.4E-05	4.00E-06	1.4E-05	4.0E-06	-	-	1.0E+01	4.0E-01	1.0E+01	4.0E-01	
6	Fire Training Zone (Post-Remedy)	GW	Trichloroethene	3.4E-31	-	-	3.3E-05	2.19E-05	3.3E-05	2.1E-05	-	-	4.0E-03	2.0E-02	4.0E-03	2.0E-02	
					-	-	3.3E-05	2.19E-05	3.3E-05	2.1E-05	-	-	4.0E-03	2.0E-02	4.0E-03	2.0E-02	
					-	-	3.3E-05	2.19E-05	3.3E-05	2.1E-05	-	-	4.0E-03	2.0E-02	4.0E-03	2.0E-02	
7	Building 108	GW	Benzene	9.0E+00	-	-	2.6E-03	1.07E-03	2.6E-03	1.0E-03	-	-	3.1E+01	1.2E+01	3.1E+01	1.2E+01	
				1.8E+01	-	-	-	-	-	-	-	4.7E+00	1.8E+00	4.7E+00	1.8E+00		
			Toluene	2.8E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
				1.8E+01	-	-	-	-	-	-	-	-	-	-	-	-	-
			Xylenes	1.8E+01	-	-	-	-	-	-	-	-	-	-	-	-	-
				2.3E+01	-	-	-	-	-	-	-	-	-	-	-	-	-
			Naphthalene	2.3E+01	-	-	-	-	-	-	-	-	-	-	-	-	-
				2.3E+02	-	-	-	-	-	-	-	-	-	-	-	-	-
			Toluene	2.3E+01	-	-	-	-	-	-	-	-	-	-	-	-	-
				4.0E+02	-	-	-	-	-	-	-	-	-	-	-	-	-

**Table 3A-12**  
**Cancer Risks and Noncancer Hazard Indices for the Commercial / Industrial Worker Exposure Scenario**  
**Calculated Using EPA Withdrawn Toxicity Criteria for TCE**

- Notes:**
- Concentration units are shown in mg/L, all units are shown in English
  - DTM for Female (1) (Active) is (replaced) is 20 hrs.
  - Not applicable
  - DTM Depth to groundwater (ft)
  - EPA U.S. Environmental Protection Agency
  - FOREF Feeding of Toxicity for Early Reproduction
  - GW Groundwater
  - TMAG Milligram per kilogram
  - mg/L Milligram per liter
  - SEAC Selected Air Assessment Concentration
  - WV Water Volume

Table 3A-13  
 Cancer Risks and Noncancer Hazard Indices for the Commercial / Industrial Worker Exposure Scenario  
 Calculated Using EPA Draft Toxicity Criteria for TCE

FOSET Parcel No.	Parcel Description	Exposure Medium	Target Chemical	BPA/C	Cancer Risk						Noncancer Hazard						
					Exposure Pathway			Total All Exposure Pathways (DTHed) <sup>a</sup>	Exposure Pathway			Total All Exposure Pathways (DTHed) <sup>a</sup>					
					Inhalable Ingestion	Dermal Contact	Inhalation (DTHed) <sup>b</sup>		Inhalation (DTHed) <sup>b</sup>	Dermal Contact	Inhalation (DTHed) <sup>b</sup>						
1	Northwest Neighborhood (Pre-Renewal)	GW	Trichloroethene	1.8E-01	-	-	1.8E-03	1.0E-03	1.8E-03	1.0E-03	-	-	1.8E-03	7.0E-03	1.3E-00	7.0E-01	
					7.4E-03	-	-	4.8E-03	2.6E-03	4.8E-03	2.6E-03	-	-	4.8E-03	2.6E-03	2.0E-02	2.0E-02
						8.9E-01	-	-	8.9E-03	2.3E-03	8.9E-03	2.3E-03	-	-	8.9E-03	2.3E-03	4.1E+00
4	Outdoor Ring Range (Home Area)	Trichloroethene	8.1E-01	-	-		4.0E-03	1.3E-03	4.0E-03	1.3E-03	-	-	4.0E-03	1.3E-03	2.1E+00	1.1E+00	
				1.5E-01	-	-	8.7E-04	2.4E-04	8.7E-04	2.4E-04	-	-	8.7E-04	2.4E-04	8.0E-01	2.0E-01	
					1.4E-01	-	-	3.4E-04	3.0E-04	3.4E-04	3.0E-04	-	-	3.4E-04	3.0E-04	7.0E-01	2.0E-01
3	Fire Training Zone (Pre-Renewal)	Trichloroethene	1.4E-01	-		-	1.6E-06	1.4E-06	3.3E-06	1.4E-06	-	-	3.3E-06	1.0E-03	2.0E-03	1.0E-03	
				8.3E-00	-	-	3.8E-05	1.0E-05	2.1E-05	1.0E-05	-	-	2.1E-05	1.2E+01	3.1E+01	1.2E+01	
					1.8E+00	-	-	-	-	-	-	-	-	-	-	-	-
7	Building 606	Benzene	1.8E+00	-		-	-	-	-	-	-	-	-	-	-	-	-
				3.3E+01	4.4E-07	-	1.8E-09	-	1.8E-09	1.8E-09	5.8E-03	-	5.8E-03	-	5.8E-03	2.0E-01	2.0E-01
					3.3E+02	-	-	-	-	-	-	2.3E+00	-	2.3E+00	-	2.3E+00	3.1E+02
Soil	Toluene	7.2E+01	-	-		-	-	-	-	-	-	-	-	-	-	-	
				4.8E+02	-	-	-	-	-	-	-	-	-	-	-	-	
					-	-	-	-	-	-	-	-	-	-	-	-	-

**Table 3A-13**  
**Cancer Risks and Noncancer Hazard Indices for the Commercial / Industrial Worker Exposure Scenario**  
**Calculated Using EPA Draft Toxicity Criteria for TCE**

- Notes:**
- 1. Concentration units are shown in mg/L; cell units are shown in mg/kg
  - 2. DTH for Pencil No. 1 (pentavalent bismuth) is 30 mg
  - 3. Not applicable
  - 4. DTH for pentachloro (PCP)
  - 5. EPA U.S. Environmental Protection Agency
  - 6. FOSSET Finding of Suitability for Early Transfer
  - 7. GW Groundwater
  - 8. mg/kg Milligram per kilogram
  - 9. mg/L Milligram per liter
  - 10. EPAAC EPA Assessment Criteria
  - 11. \*Open innovation

Table 3A-14  
 Cancer Risks and Noncancer Hazard Indices for the Construction Worker Exposure Scenario\*  
 Calculated Using EPA Withdrawn Toxicity Criteria for TCE

FOSET Parcel No.	Parcel Description	Exposure Medium	Target Chemical	MMA <sup>2</sup>	Cancer Risk						Noncancer Hazard					
					Exposure Pathway						Exposure Pathway					
					Inhalation Ingestion	Dermal Contact	Inhalation - Trunk	Inhalation - W	Inhalation - W	Total, All Exposure Pathways (DTH+D)	Inhalation - Ingestion	Dermal Contact	Inhalation - Trunk	Inhalation - W	Inhalation - W	Total, All Exposure Pathways (DTH+D)
1	Industrial Neighborhood (Pro-Roadway)	GW	Toluene	2.8E-01	6.1E-09	3.6E-07	-	-	3.6E-07	1.1E-09	1.1E-07	5.1E-01	-	-	5.1E-01	3.2E-01
				7.1E-03	1.6E-19	6.1E-09	-	-	7.6E-09	2.8E-04	2.8E-04	1.6E-02	-	-	1.6E-02	1.3E-02
3	Industrial Neighborhood (Pro-Roadway)	GW	Toluene	8.2E-01	1.6E-09	8.3E-07	-	-	8.3E-07	3.4E-09	3.4E-09	1.6E-02	-	-	1.6E-02	1.7E-02
				6.1E-01	1.3E-09	8.7E-07	-	-	9.3E-07	2.5E-09	2.5E-09	1.3E-02	-	-	1.3E-02	1.1E-02
4	Office/Fire Zone (Pro-Roadway)	GW	Toluene	1.3E-01	2.8E-09	1.2E-07	-	-	1.2E-07	5.9E-09	5.9E-09	2.4E-01	-	-	2.4E-01	2.4E-01
				1.4E-01	3.7E-09	1.3E-07	-	-	1.4E-07	6.7E-09	6.7E-09	2.5E-01	-	-	2.5E-01	2.6E-01
5	Fire Training Zone (Pro-Roadway)	GW	Toluene	3.4E-01	1.2E-11	8.6E-10	-	-	3.4E-10	2.1E-11	2.1E-10	8.6E-04	-	-	8.6E-04	1.9E-03
				9.5E-02	1.3E-06	8.1E-05	-	-	9.5E-05	8.6E-01	8.6E-01	1.3E-01	-	-	1.3E-01	1.9E-01
7	Building 008	RW	Ethylbenzene	1.8E-01	-	-	-	-	-	4.4E-02	1.6E-01	7.5E-02	-	-	2.2E-01	2.2E-01
			Toluene	2.9E-05	-	-	-	-	-	3.1E-03	1.3E-03	3.4E-01	-	-	3.4E-01	3.5E-01
			Xylene	1.2E-01	-	-	-	-	-	2.2E-02	6.9E-02	7.5E-02	-	-	7.5E-02	7.5E-02
			Benzene	2.3E-01	5.6E-08	8.6E-07	-	-	8.6E-07	1.9E-02	1.9E-02	1.9E-01	-	-	1.9E-01	2.1E-01
			Ethylbenzene	2.3E-02	-	-	-	-	-	7.4E-01	-	1.9E-02	-	-	1.9E-02	3.6E-02
			Toluene	7.2E-01	-	-	-	-	-	1.2E-03	-	3.6E-02	-	-	3.6E-02	3.9E-02
Xylene	1.2E-02	-	-	-	-	-	7.9E-05	-	5.0E-01	-	-	5.0E-01	5.1E-01			

**Table 3A-14**  
**Cancer Risks and Noncancer Hazard Indices for the Construction Worker Exposure Scenario<sup>a</sup>**  
**Calculated Using EPA Withdrawn Toxicity Criteria for TCE**

**Notes:**

- a. The assessment of risk to the construction worker scenario is a groundwater-only scenario, assuming base conditions.
- b. Groundwater concentrations are shown in µg/L, and soil concentrations are shown in mg/kg.
- c. DTW for Parcel No. 1 (normal background) is 20 feet.
- d. Not applicable.
- e. DTW: Depth to groundwater (feet).
- f. EPA: U.S. Environmental Protection Agency.
- g. RCSEY: Frying of Substrate for Early Toxicity.
- h. DTW: Groundwater.
- i. mg/kg: Milligram per kilogram.
- j. µg/L: Milligram per liter.
- k. BRAC: Selected risk assessment concentration.
- l. V: Vapor intrusion.



**Table 3A-15**  
**Cancer Risks and Noncancer Hazard Indices for the Construction Worker Exposure Scenario<sup>a</sup>**  
**Calculated Using EPA Draft Toxicity Criteria for TOE**

**Notes:**

- a The percentage of total for the construction worker population is a subpopulation-quantitative, scenario-level estimation
- b Groundwater units are shown in mg/L, PCB units are shown in ng/kg
- c DTH for Parcel No. 1 (entire neighborhood is 25 feet)
- d All applicable
- e DTH: Depth to groundwater (feet)
- f EPA: U.S. Environmental Protection Agency
- g OSHA: Occupational Safety and Health Agency
- h GW: Groundwater
- i mg/kg: milligram per kilogram
- j mg/L: milligram per liter
- k BAC: Selected air assessment concentrations
- l V: Vapor density



Table 3A-17  
 Summary of Risks for TCE at FOSET Facility Calculated Using EPA Draft Toxicity Criteria for TCE

FOSET Parcel	Description	Inground Media	Target Chemical	Exposure Scenario	Cancer Risk				Noncancer Hazard						
					Exposure Pathway		TOTAL (D790 - 10) (D790 + 00)	Exposure Pathway		TOTAL (D790 - 10) (D790 + 00)					
					Ingestion	External Contact		Inhalation	Substitution (1) (D790 + 00)		Inhalation	Substitution (1) (D790 + 00)			
1	Industrial Application	GW	TCE	Residential	PAH	1.07E-01	1.10E-04	4.10E-03	4.70E-03	6.97E-01	4.72E-02	1.02E-02	7.00E-01	1.00E-01	
					PAH-1	4.22E-04	2.10E-06	3.17E-04	4.05E-05	1.03E-02	2.02E-01	1.02E-02	1.02E-02	1.02E-02	1.02E-02
					PAH-2	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-3	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-4	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-5	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-6	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-7	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-8	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-9	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
2	Industrial Application	GW	TCE	Residential	PAH	1.07E-01	1.10E-04	4.10E-03	4.70E-03	6.97E-01	4.72E-02	1.02E-02	7.00E-01	1.00E-01	
					PAH-1	4.22E-04	2.10E-06	3.17E-04	4.05E-05	1.03E-02	2.02E-01	1.02E-02	1.02E-02	1.02E-02	1.02E-02
					PAH-2	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-3	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-4	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-5	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-6	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-7	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-8	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-9	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
3	Industrial Application	GW	TCE	Residential	PAH	1.07E-01	1.10E-04	4.10E-03	4.70E-03	6.97E-01	4.72E-02	1.02E-02	7.00E-01	1.00E-01	
					PAH-1	4.22E-04	2.10E-06	3.17E-04	4.05E-05	1.03E-02	2.02E-01	1.02E-02	1.02E-02	1.02E-02	1.02E-02
					PAH-2	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-3	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-4	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-5	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-6	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-7	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-8	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-9	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
4	Industrial Application	GW	TCE	Residential	PAH	1.07E-01	1.10E-04	4.10E-03	4.70E-03	6.97E-01	4.72E-02	1.02E-02	7.00E-01	1.00E-01	
					PAH-1	4.22E-04	2.10E-06	3.17E-04	4.05E-05	1.03E-02	2.02E-01	1.02E-02	1.02E-02	1.02E-02	1.02E-02
					PAH-2	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-3	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-4	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-5	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-6	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-7	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-8	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
					PAH-9	1.00E-05	5.00E-08	1.00E-05	5.00E-06	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05

Notes:  
 1. D790's Parcel for 1 (Industrial Application) is 0.01 ha.  
 2. The assessment is only for the residential media scenario (1) (public-access scenario, assuming 0.01 ha exposure).  
 3. PAH includes:  
 - PAH-1: Benzo(a)anthracene  
 - PAH-2: Benzo(a)fluoranthene  
 - PAH-3: Benzo(b)fluoranthene  
 - PAH-4: Benzo(k)fluoranthene  
 - PAH-5: Benzo(e)pyrene  
 - PAH-6: Benzo(g)perylene  
 - PAH-7: Indeno(1,2,3-cd)perylene  
 - PAH-8: Dibenzo(a,h)perylene  
 - PAH-9: Benzo(ghi)perylene  
 4. TCE: Trichloroethylene  
 5. GW: Groundwater  
 6. Residential: Residential exposure scenario

**APPENDIX F**  
**STATE ENVIRONMENTAL COVENANTS**  
**FOR FORMER LOWRY AIR FORCE BASE**

## Former Lowry Air Force Base Parcel 2 Environmental Covenant Summary

**Covenant ID: HMC0V00023**

### **Covenant Information:**

Covenant Date: 1/4/2006

Self Reporting: Yes

Media of Concern:

Surface Water: No

Groundwater: No

Air: No

Soil: No

Other: No

Contaminants of Concern:

Property Restrictions:

1. Property may only be used as open space/non-irrigated park
2. Owner shall not use or conduct activity on Operating Unit (OU) 2 that will adversely affect the integrity of the cover, the effectiveness of the drainage or erosion controls, slope stability, or groundwater or gas monitoring or control systems
3. Owner shall not extract or utilize in any manner the groundwater from the upper aquifer below the surface of groundwater within OU 2
4. The Air Force shall perform all the requirements of sections 3 and 4 of the Post Closure dated 8/29/03

### **Site Information:**

ID: Landfill OU 2

Name: Former Lowry Air Force Base

Address: Parcel 2

City: Denver

State: CO

Zip Code: NA

Legal Description: See File

County: Denver

### **Site Contact Information:**

Lowry Redevelopment Authority

Name: Greg Palcanis

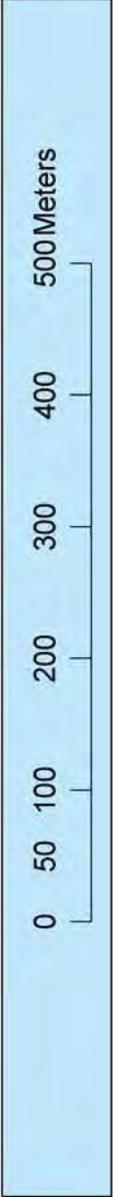
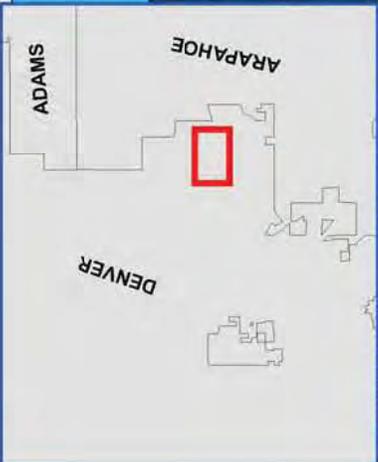
Address: 555 Uinta Way

City: Denver

State: CO Zip Code: 80230



# Colorado Department of Public Health and Environment ENVIRONMENTAL COVENANTS



Denver County  
HMC0V00023

**This property is subject to an Environmental Covenant held by the Colorado Department of Public Health and Environment pursuant to section 25-15-321, C.R.S.**

**ENVIRONMENTAL COVENANT**

The United States of America, acting by and through the Secretary of the Air Force, under and pursuant to the powers and authority contained in the Defense Base Closure and Realignment Act of 1990, as amended (10 U.S.C. § 2687, note) ("Grantor") grants an Environmental Covenant ("Covenant") this 4<sup>th</sup> day of January, 2006 to the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and the Environment ("the Department") pursuant to § 25-15-321 of the Colorado Hazardous Waste Act, § 25-15-101, *et seq.* The Department's address is 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530.

WHEREAS, the Grantor is the owner of certain property associated with the former Lowry Air Force Base ("LAFB"), located in Denver, Colorado, more particularly described in Attachment A, attached hereto and incorporated herein by reference as though fully set forth (hereinafter referred to as the "Property"); and

WHEREAS, pursuant to Consent Agreement Number 01-08-07-02, the Property is the subject of enforcement and remedial action pursuant to the Colorado Hazardous Waste Act, § 25-15-301, *et. seq.* ("CHWA"). The Property was the former base landfill (also known as Operable Unit 2 (OU2)). OU2 was historically used for disposal of Air Force waste, and associated construction waste and debris primarily from training activities conducted at LAFB. OU2 has been closed in accordance with the Phase 2 Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry; and,

WHEREAS, the purpose of this Covenant is to ensure protection of human health and the environment by minimizing the potential for exposure to any hazardous substance, hazardous waste, hazardous constituents, and/or solid waste that remains in the landfill on the Property. The Covenant will accomplish this by prohibiting those activities that may interfere with the landfill cover or its monitoring or control systems and by creating a review and approval process to ensure that any such intrusive activities are conducted with appropriate precautions to avoid or eliminate any hazards; and

WHEREAS, the Grantor desires to subject the Property to certain covenants and restrictions as provided in Article 15 of Title 25, Colorado Revised Statutes, which covenants and restrictions shall burden the Property and bind the Grantor, and all parties having any right, title or interest in the Property, or any part thereof, its heirs, successors, assigns, and any persons using the land, as described herein, for the benefit of the Department.

NOW, THEREFORE, the Grantor hereby grants this Environmental Covenant to the Department, and declares that the Property as described in Attachment A shall hereinafter be bound by, held, sold, and conveyed subject to the following requirements set forth in paragraphs 1 through 10 below, which shall run with the Property in perpetuity and be binding on Grantor and all parties having any right, title, or interest in the Property, or any part thereof, their heirs,

successors and assigns, and any persons using the land, as described herein. As used in this Environmental Covenant, the term OWNER means the record owner of the Property and, if any, any other person or entity legally authorized to make decisions regarding the transfer of the Property or placement of encumbrances on the Property, other than by the exercise of eminent domain.

#### 1. Use restrictions

- a. Unless the Covenant is modified in accordance with the State's statute and regulations, OU2 will only be used as open space/ non-irrigated park following closure.
- b. In general, the OWNER shall not use or conduct any activity on OU2 that will adversely affect:
- i. the integrity of the cover
  - ii. the effectiveness of drainage or erosion controls
  - iii. slope stability, or
  - iv. groundwater or gas monitoring or control systems.

Specifically, no activity shall be conducted or permitted by the OWNER, nor shall the OWNER use OU2 in any manner that is inconsistent with the use designated in the preceding paragraph or that is not in compliance with the requirements of section 3.6.1(A) of 6 CCR 1007-2 or the *Final Closure Plan for the Operable Unit 2 (OU2) Landfill Closure at Lowry*, issued for review August 29, 2003, as finalized after Department review and approval.

- c. The OWNER shall not extract or utilize in any manner whatsoever any water from the upper aquifer below the surface of the ground within OU2 for any purpose whatsoever, unless the OWNER shall first have obtained the prior written approval of the Department.
- d. For the duration of this covenant, the Air Force shall perform all of the requirements set forth in sections 3 and 4 of the Post-Closure Operation and Maintenance Plan, Appendix E of the *Final Closure Plan for the Operable Unit 2 (OU2) Landfill Closure at Lowry*, issued for review August 29, 2003, as finalized after Department review and approval.

2. Modifications This Covenant runs with the land and is perpetual, unless modified or terminated pursuant to this paragraph. The OWNER or its successors and assigns may request that the Department approve a modification or termination of the Covenant. The request shall contain information showing that the proposed modification or termination shall, if implemented, ensure protection of human health and the environment. The Department shall review any submitted information and may request additional information. If the Department determines that the proposal to modify or terminate the Covenant will ensure protection of human health and the environment, it shall approve the proposal. No modification or termination of this Covenant shall be effective unless the Department has approved such modification or termination in writing. Information to support a request for modification or termination may include one or more of the following:

- a) a proposal to perform additional remedial work;
- b) new information regarding the risks posed by the residual contamination;
- c) information demonstrating that residual contamination has diminished;

d) information demonstrating that the proposed modification would not adversely impact the remedy and is protective of human health and the environment; and,  
e) other appropriate supporting information.

3. Conveyances The OWNER shall notify the Department at least fifteen (15) days in advance of any proposed grant, transfer, or conveyance of any interest in any or all of the Property.
4. Notice to Lessees The OWNER agrees to incorporate, either in full or by reference the restrictions of this Covenant in any leases, licenses, or other instruments granting a right to use the Property.
5. Notification for proposed construction and land use The OWNER and/or its transferees shall notify the Department simultaneously when submitting any application to a local government for a building permit or change in land use at the Property.
6. Inspections The Department shall have the right of entry to the Property at reasonable times with prior notice for the purpose of determining compliance with the terms of this Covenant. Nothing in this Covenant shall impair any other authority the Department may otherwise have to enter and inspect the Property.
7. No Liability The Department does not acquire any liability under State law by virtue of accepting this Covenant, nor does any other named beneficiary of this Covenant acquire any liability under State law by virtue of being such a beneficiary.
8. Enforcement The Department may enforce the terms of this Covenant pursuant to §25-15-322, C.R.S. The Grantor and any named beneficiary of this Covenant may file suit in district court to enjoin actual or threatened violations of this Covenant.
9. Owner's Compliance Certification OWNER shall submit an annual Report to the Department, on the anniversary of the date this Covenant was signed by Grantor, detailing OWNER's compliance, and any lack of compliance, with the terms of this Covenant.
10. Notices Any document or communication required under this Covenant shall be sent or directed to:

Hazardous Waste Corrective Action Unit Leader  
Hazardous Materials and Waste Management Leader  
Colorado Department of Public Health and the Environment  
4300 Cherry Creek Drive South  
Denver, Colorado 80246-1530





ATTACHMENT A

## DESCRIPTION

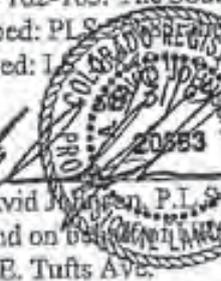
### Parcel 2

A part of the Southeast Quarter of Section 9, part of the Southwest Quarter of Section 10, part of the Northwest Quarter of Section 15 and part of the Northeast Quarter of Section 16, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North  $89^{\circ}58'53''$  West, along the south line of said Southwest Quarter, a distance of 783.22 feet to the **POINT OF BEGINNING**;  
thence South  $07^{\circ}03'57''$  East a distance of 221.72 feet;  
thence South  $51^{\circ}58'32''$  East a distance of 782.86 feet;  
thence South  $72^{\circ}23'13''$  West a distance of 1178.79 feet;  
thence North  $17^{\circ}12'50''$  West a distance of 21.42 feet;  
thence South  $72^{\circ}48'22''$  West a distance of 1336.10 feet to a point on the northerly line of Alameda Avenue described in Book 71 at Page 76 in the Clerk and Records Office of said City and County of Denver and a point of non-tangent curvature;  
thence along said northerly line and along the arc of a curve to the right, having a central angle of  $2^{\circ}11'49''$ , a radius of 904.36 feet, an arc length of 34.68 feet and whose chord bears North  $83^{\circ}39'08''$  West a distance of 34.67 feet;  
thence North  $14^{\circ}07'41''$  West, non-tangent to the previous course, a distance of 1479.84 feet;  
thence North  $78^{\circ}47'16''$  East a distance of 1002.84 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the left having a central angle of  $67^{\circ}12'34''$ , a radius of 420.06 feet, an arc length of 492.74 feet and whose chord bears North  $44^{\circ}26'58''$  East a distance of 464.97 feet to a point of reverse non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of  $144^{\circ}09'24''$ , a radius 92.97 feet, an arc length of 233.90 feet and whose chord bears North  $82^{\circ}51'54''$  East a distance 176.91 feet to a point of reverse non-tangent curvature;  
thence along the arc of a curve to the left having a central angle of  $22^{\circ}39'25''$ , a radius of 1395.92 feet, an arc length of 552.00 feet and whose chord bears South  $37^{\circ}48'58''$  East a distance of 548.41 feet;  
thence North  $89^{\circ}39'24''$  East, non-tangent with the previous course, a distance of 321.63 feet;  
thence South  $07^{\circ}03'57''$  East a distance of 123.98 feet to the **POINT OF BEGINNING**;

Containing 3,038,767 square feet or 69.760 acres, more or less.

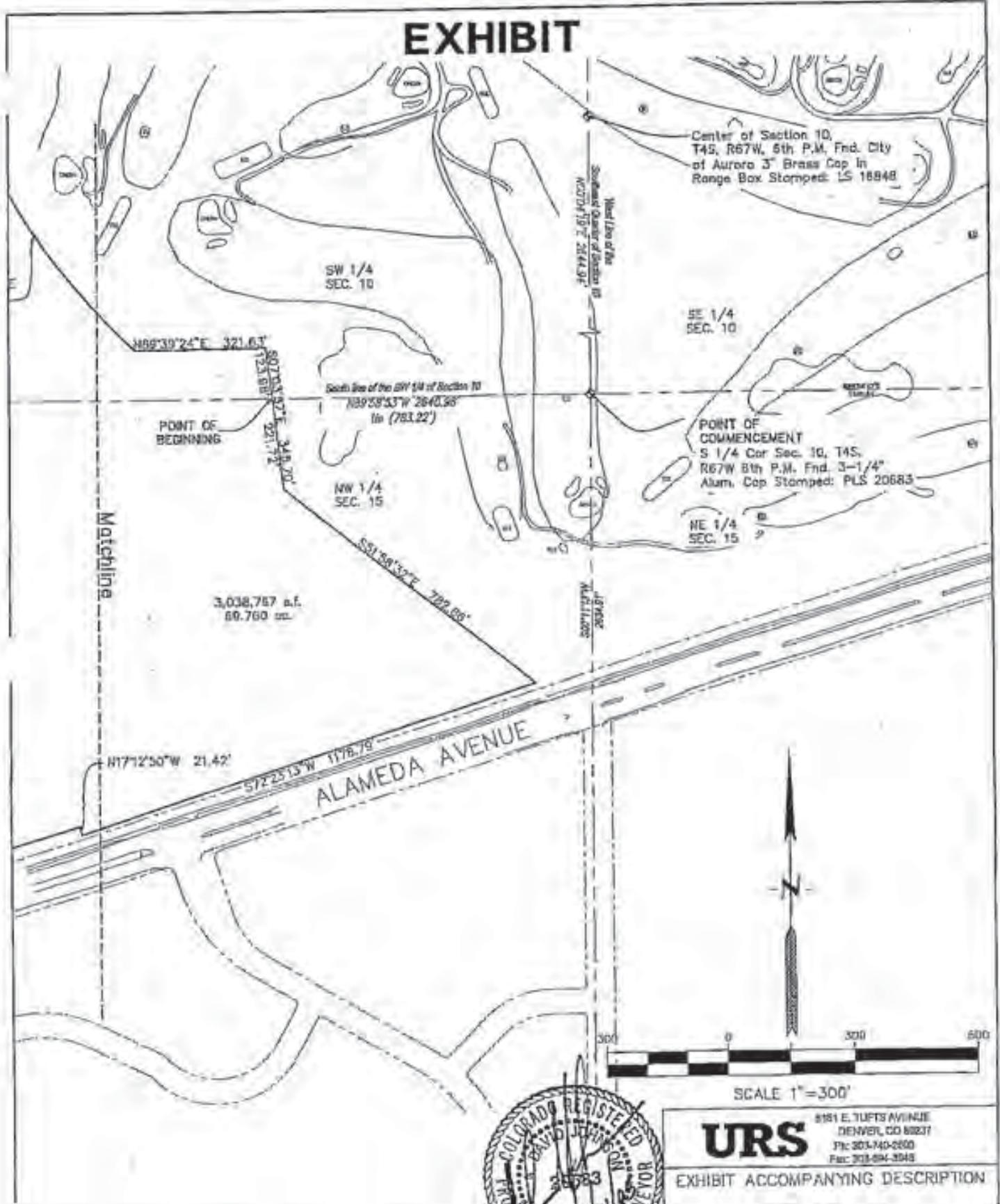
**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°04'19" East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter Corner of Section 10 is a found 3-1/4" Aluminum cap Stamped: PLS and the Center Quarter corner of Section 10 is a found 3" brass cap stamped: L.



A. David Johnson, P.L.S. 20583  
For and on behalf of [redacted] Corp.  
8181 E. Tufts Ave.  
Denver, CO 80237  
Ph. 303.740.2600

K:\Projects\Lowry Undeclared Areas\Landfill\Landfill.doc  
8/30/2005 9:01 AM

# EXHIBIT



**URS**  
 8181 E. TUFTS AVENUE  
 DENVER, CO 80237  
 Tel: 303-740-2600  
 Fax: 303-694-3545

EXHIBIT ACCOMPANYING DESCRIPTION

**PARCEL 2 EXHIBIT**

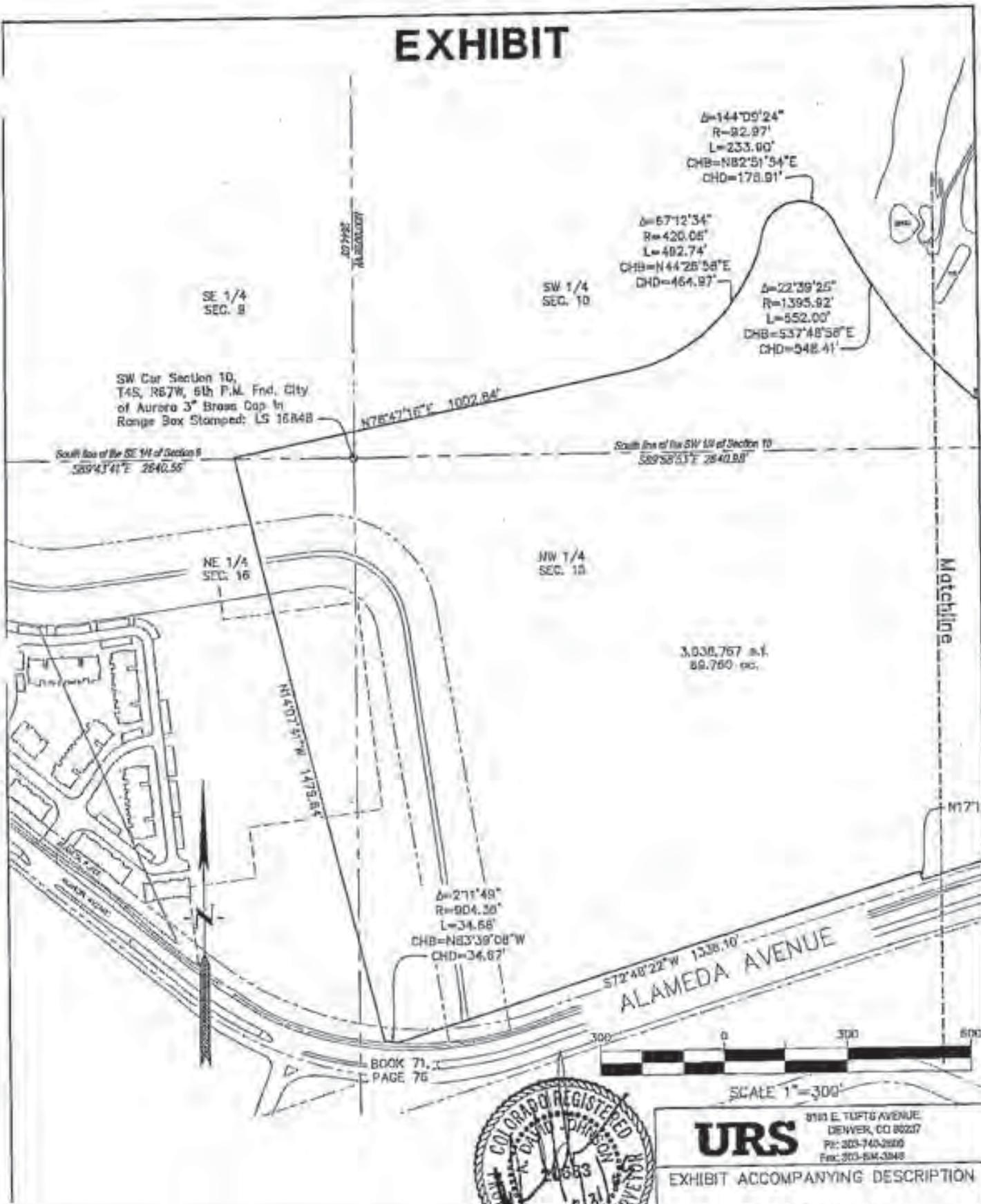
DENVER COLORADO

Drawn by: SEA Checked by: ADJ Sheet No. 1 of 2 Sheet(s)

*This exhibit does not represent a monumented survey, it is intended only to depict the attached description.*

K:\Projects\Larry Underdahl\Access\Land\Blking 6/26/2005 8:00:08 AM MST

# EXHIBIT



**URS** 8180 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2900  
Fax: 303-844-3940

EXHIBIT ACCOMPANYING DESCRIPTION

**PARCEL 2 EXHIBIT**

DENVER COLORADO

Drawn by: BEA Dashed by: AGJ Sheet No. 2 of 2 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

\\A\Projects\Legacy Undeveloped Areas\Land\PL\dwg 8/26/2005 8:00:09 AM MST



## Former Lowry Air Force Base Environmental Covenant Summary

**Covenant ID: HMCOV00022**

### **Covenant Information:**

Covenant Date: 1/13/2006

Self Reporting: Yes

Media of Concern:

Surface Water: No

Groundwater: Yes

Air: No

Soil: No

Other: No

Contaminants of Concern: trichloroethylene (TCE)

Property Restrictions:

1. No excavation, extraction, or utilization of water from alluvial aquifer and the Denver (weathered) aquifer
2. No tampering or damaging of the monitoring wells
3. If groundwater is encountered during soil excavation at Operating Unit (OU) 5, the Department shall be notified within two days; and groundwater must be appropriately disposed of
4. Owner shall notify the Department within 48 hours of the damage of any monitoring well. Wells shall be repaired at owners expense (within 10 days)
5. If structures are built on OU 5, owner is required to install ventilation systems as specified in the environmental covenant.

### **Site Information:**

ID: NA

Name: Former Lowry Air Force Base

Address: See legal description

City: Denver

State: CO

Zip Code: NA

Legal Description: See File

County: Denver

### **Site Contact Information:**

Lowry Redevelopment Authority

Name: Greg Palcanis

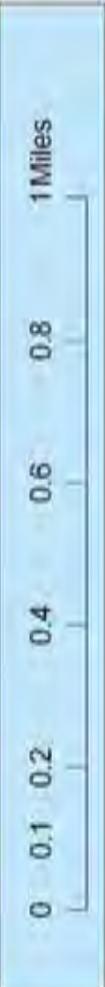
Address: 555 Uinta Way

City: Denver

State: CO Zip Code: 80230



# Colorado Department of Public Health and Environment ENVIRONMENTAL COVENANTS



Denver County  
HMCOV00022

**This property is subject to an Environmental Covenant held by the Colorado Department of Public Health and Environment pursuant to section 25-15-321, C.R.S.**

**ENVIRONMENTAL COVENANT**

The United States of America, acting by and through the Secretary of the Air Force, under and pursuant to the powers and authority contained in the Defense Base Closure and Realignment Act of 1990, as amended (10 U.S.C. § 2687, note) ("Grantor") grants an Environmental Covenant ("Covenant") this 4<sup>th</sup> day of JANUARY, 2006 to the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and the Environment ("the Department") pursuant to § 25-15-321 of the Colorado Hazardous Waste Act, § 25-15-101, *et seq.* The Department's address is 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530.

WHEREAS, the Grantor is the owner of certain property associated with the former Lowry Air Force Base ("LAFB"), located in Denver and Aurora, Colorado, more particularly described in Attachment A, attached hereto and incorporated herein by reference as though fully set forth (hereinafter referred to as the "Property"); and

WHEREAS, pursuant to Consent Agreement Number 01-08-07-02, the Property is the subject of enforcement and remedial action pursuant to the Colorado Hazardous Waste Act, § 25-15-301, *et seq.* ("CHWA"). Historic Air Force activities resulted in chlorinated solvents, with the primary constituent of concern being trichloroethylene (TCE), contaminating the groundwater associated with the Property; and,

WHEREAS, the purpose of this Covenant is to ensure protection of human health and the environment by minimizing the potential for exposure to any hazardous substance, hazardous waste, hazardous constituents, and/or solid waste that remains in the alluvial groundwater beneath the Property. The Covenant will accomplish this by prohibiting those activities that may result in contact with groundwater and by creating a review and approval process to ensure that any such intrusive activities are conducted with appropriate precautions to avoid or eliminate any hazards; and

WHEREAS, the Grantor desires to subject the Property to certain covenants and restrictions as provided in Article 15 of Title 25, Colorado Revised Statutes, which covenants and restrictions shall burden the Property and bind the Grantor, and all parties having any right, title or interest in the Property, or any part thereof, its heirs, successors, assigns, and any persons using the land as described herein, for the benefit of the Department.

NOW, THEREFORE, the Grantor hereby grants this Environmental Covenant to the Department, and declares that the Property as described in Attachment A shall hereinafter be bound by, held, sold, and conveyed subject to the following requirements set forth in paragraphs 1 through 9 below, which shall run with the Property in perpetuity and be binding on Grantor and all parties having any right, title, or interest in the Property, or any part thereof, their heirs, successors and assigns, and any persons using the land, as described herein. As used in this Environmental Covenant, the term OWNER means the record owner of the Property and, if any,

any other person or entity legally authorized to make decisions regarding the transfer of the Property or placement of encumbrances on the Property, other than by the exercise of eminent domain.

1. Use restrictions

- a. The OWNER shall not excavate into, extract or utilize, in any manner whatsoever any water from the alluvial aquifer and weathered Denver aquifer below the surfaces of the ground within the boundary of OU5 for any purpose whatsoever unless the OWNER shall first have obtained the prior written approval of the Department.
- b. The OWNER shall not tamper with or damage in any manner any of the monitoring wells.
- c. If groundwater is encountered during any excavation of soil at OU5, the OWNER shall notify the Department within two (2) business days of the incident, and must dispose of the groundwater in accordance with applicable federal, state, and local law and regulation, at its own cost and expense.
- d. There are a series of monitoring wells on OU5. The OWNER shall notify the Department within forty-eight (48) hours of any damage to these wells of which it has knowledge. Unless otherwise agreed to by the Department, the OWNER, shall repair any damage to such wells or replace such wells at the OWNER's sole expense within ten (10) days.
- e. Unless a written determination is obtained from the Department that such systems are not required, the OWNER shall, at its sole expense, install and arrange for maintenance of the following ventilation systems in structures constructed on OU5 after the date of this Covenant, unless deemed and verified unnecessary in writing by the Department.

1. Newly-constructed residential structures must contain a sub-slab depressurization system ("SSDS").

2. Newly-constructed commercial structures must contain either a heating, ventilating, and air conditioning system ("HVAC") which, while operating, is designed to provide an internal positive pressure in the building, and such HVAC must be operated in accordance with normal and customary operating procedures for similar buildings in Denver, Colorado and Denver City Ordinance or a SSDS.

The term "structures" as utilized herein shall not include garages or other outbuildings used primarily for storage, built slab on grade, where no soil excavation five (5) feet or more below the ground surface is necessary for the construction or operation thereof.

2. Modifications This Covenant runs with the land and is perpetual, unless modified or terminated pursuant to this paragraph. If a Completion Report is approved by the Department under the Consent Agreement No. 01-08-07-02, for all or a portion of the Property, which determines that the Property can be utilized for unrestricted use, this Covenant will be terminated as to that portion or all of the Property. In addition, the OWNER or its successors and assigns may request that the Department approve a modification or termination of the Covenant. The

request shall contain information showing that the proposed modification or termination shall, if implemented, ensure protection of human health and the environment. The Department shall review any submitted information and may request additional information. If the Department determines that the proposal to modify or terminate the Covenant will ensure protection of human health and the environment, it shall approve the proposal. No modification or termination of this Covenant shall be effective unless the Department has approved such modification or termination in writing. Information to support a request for modification or termination may include one or more of the following:

- a) a proposal to perform additional remedial work;
- b) new information regarding the risks posed by the residual contamination;
- c) information demonstrating that residual groundwater contamination has diminished;
- d) information demonstrating that the proposed modification would not adversely impact the remedy and is protective of human health and the environment; and,
- e) other appropriate supporting information.

3. Conveyances The OWNER shall notify the Department at least fifteen (15) days in advance of any proposed grant, transfer, or conveyance of any interest in any or all of the Property.

4. Notice to Lessees The OWNER agrees to incorporate, either in full or by reference the restrictions of this Covenant in any leases, licenses, or other instruments granting a right to use the Property.

5. Notification for proposed construction and land use The OWNER and/or its transferees shall notify the Department simultaneously when submitting any application to a local government for a building permit or change in land use at the Property.

6. Inspections The Department shall have the right of entry to the Property at reasonable times with prior notice for the purpose of determining compliance with the terms of this Covenant. Nothing in this Covenant shall impair any other authority the Department may otherwise have to enter and inspect the Property.

7. No Liability The Department does not acquire any liability under State law by virtue of accepting this Covenant, nor does any other named beneficiary of this Covenant acquire any liability under State law by virtue of being such a beneficiary.

8. Enforcement The Department may enforce the terms of this Covenant pursuant to §25-15-322, C.R.S. The Grantor and any named beneficiary of this Covenant may file suit in district court to enjoin actual or threatened violations of this Covenant.

9. Notices Any document or communication required under this Covenant shall be sent or directed to:

Hazardous Waste Corrective Action Unit Leader  
Hazardous Materials and Waste Management Leader  
Colorado Department of Public Health and the Environment  
4300 Cherry Creek Drive South  
Denver, Colorado 80246-1530

IN WITNESS WHEREOF, I have hereunto set my hand at the direction of the Secretary of the Air Force, the day and year first above written.

THE UNITED STATES OF AMERICA

By: Kath M. Halverson  
KATHRYN M. HALVORSON  
Director  
Air Force Real Property Agency

Witness:

Kathryn Peterson

Commonwealth of Virginia):  
  )ss.  
County of Arlington        ):

The foregoing instrument was acknowledged before me this 4<sup>th</sup> day of January, 2006, by Kathryn M. Halverson as the Director of Air Force Real Property Agency.

Witness my hand and official seal

[Signature]  
Notary Public

My Commissions Expires on September 30, 2009.



PAUL C. MACPHERSON  
NOTARY PUBLIC  
COMMONWEALTH  
OF VIRGINIA  
My Commission Expires  
September 30, 2009

(seal)

Accepted by the Colorado Department of Public Health and Environment this \_\_\_ day of \_\_\_\_\_ 2006.

By: \_\_\_\_\_  
GARY BAUGHMAN  
Director  
Hazardous Materials Waste Division

STATE OF COLORADO)  
  ) ss:  
COUNTY OF DENVER )

The foregoing instrument was acknowledged before me this \_\_\_ day of \_\_\_\_\_ 2006 by \_\_\_\_\_ on behalf of the Colorado Department of Public Health and Environment.

\_\_\_\_\_  
Notary Public  
Address: \_\_\_\_\_  
My commission expires: \_\_\_\_\_

IN WITNESS WHEREOF, I have hereunto set my hand at the direction of the Secretary of the Air Force, the day and year first above written.

THE UNITED STATES OF AMERICA

By: Kathryn M. Halvorson  
KATHRYN M. HALVORSON  
Director  
Air Force Real Property Agency

Witness:

Kathryn Halvorson

Commonwealth of Virginia):  
  )ss.  
County of Arlington            ):

The foregoing instrument was acknowledged before me this 4<sup>th</sup> day of January, 2006, by Kathryn M. Halvorson as the Director of Air Force Real Property Agency.

Witness my hand and official seal



PAUL C. MACPHERSON  
NOTARY PUBLIC  
COMMONWEALTH  
OF VIRGINIA  
My Commission Expires  
September 30, 2009

[Signature]  
Notary Public

My Commissions Expires on SEPTEMBER 30, 2009.

(seal)

Accepted by the Colorado Department of Public Health and Environment this \_\_\_\_\_ day of \_\_\_\_\_ 2006.

By: \_\_\_\_\_  
GARY BAUGHMAN  
Director  
Hazardous Materials Waste Division

STATE OF COLORADO) \_\_\_\_\_  
  ) ss:  
COUNTY OF DENVER )

The foregoing instrument was acknowledged before me this \_\_\_\_\_ day of \_\_\_\_\_ 2006 by \_\_\_\_\_ on behalf of the Colorado Department of Public Health and Environment.

\_\_\_\_\_  
Notary Public  
Address: \_\_\_\_\_  
My commission expires: \_\_\_\_\_

ATTACHMENT A

**DESCRIPTION**  
**Main TCE Plume - Groundwater**  
**within Parcel 1**

A part of Lowry Filing No. 11, City and County of Denver, State of Colorado, being more particularly described as follows:

**Beginning** at the northwest corner of Tract PP of said Lowry Filing No. 11;

thence along the westerly line of said Tract PP the following eight (8) courses:

1. South 82°16'51" East a distance of 90.83 feet;
2. South 89°52'18" East a distance 55.02;
3. South 37°40'40" East a distance of 40.84 feet;
4. South 00°00'00" East a distance of 9.80 feet to a point of curve;
5. along the arc of a curve to the left having a central angle of 27°51'08", a radius of 737.00 feet, an arc length of 358.26 feet and whose chord bears South 13°55'34" East a distance of 354.75 feet;
6. South 27°51'08" East a distance of 92.40 feet to a point of curve;
7. along the arc of a curve to the right having a central angle of 21°39'06", a radius of 663.00 feet, an arc length of 250.54 feet and whose chord bears South 17°01'35" East a distance of 249.06 feet;
8. South 06°12'02" East a distance of 590.66 feet;

thence North 41°30'47" West a distance of 553.53 feet;

thence North 12°41'48" West a distance of 49.74 feet to a point of non-tangent curvature

on the southeasterly line of Lot 1, Block 15 said Lowry Filing No. 11;

thence along said southeasterly line and the arc of a curve to the right having a central

angle of 1°09'17", a radius of 530.00 feet, an arc length of 10.68 feet and whose chord

bears North 48°46'25" East a distance of 10.68 feet to the most southerly corner of the

exception parcel as described at Reception Number 2003029446 in the Clerk and

Recorder's Office of said City and County of Denver;

thence North 41°46'02" West, along the southwesterly line of said exception parcel, a

distance of 46.17 feet;

thence North 14°53'14" West a distance of 187.00 feet to a point of curvature;

thence along the arc of a curve to the left having a central angle of 53°13'20", a radius of

330.00 feet, an arc length of 306.54 feet and whose chord bears North 41°29'54" West a

distance of 295.64 feet;

thence North 68°06'34" West a distance of 64.74 feet to a point of curvature;

thence along the arc of a curve to the right having a central angle of 71°39'12", a radius

of 380.00 feet, an arc length of 475.22 feet and whose chord bears North 32°16'58" West

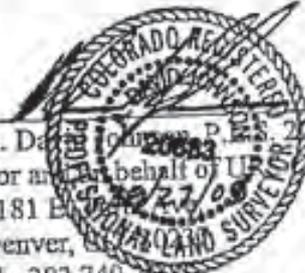
a distance of 444.85 feet to a point on the southerly line of 11<sup>th</sup> Avenue;

thence South 89°52'56" East, along said southerly line, a distance of 506.86 feet to the

**Point of Beginning;**

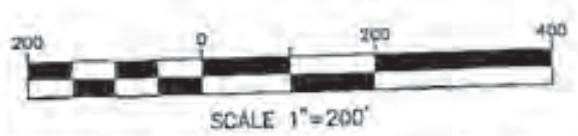
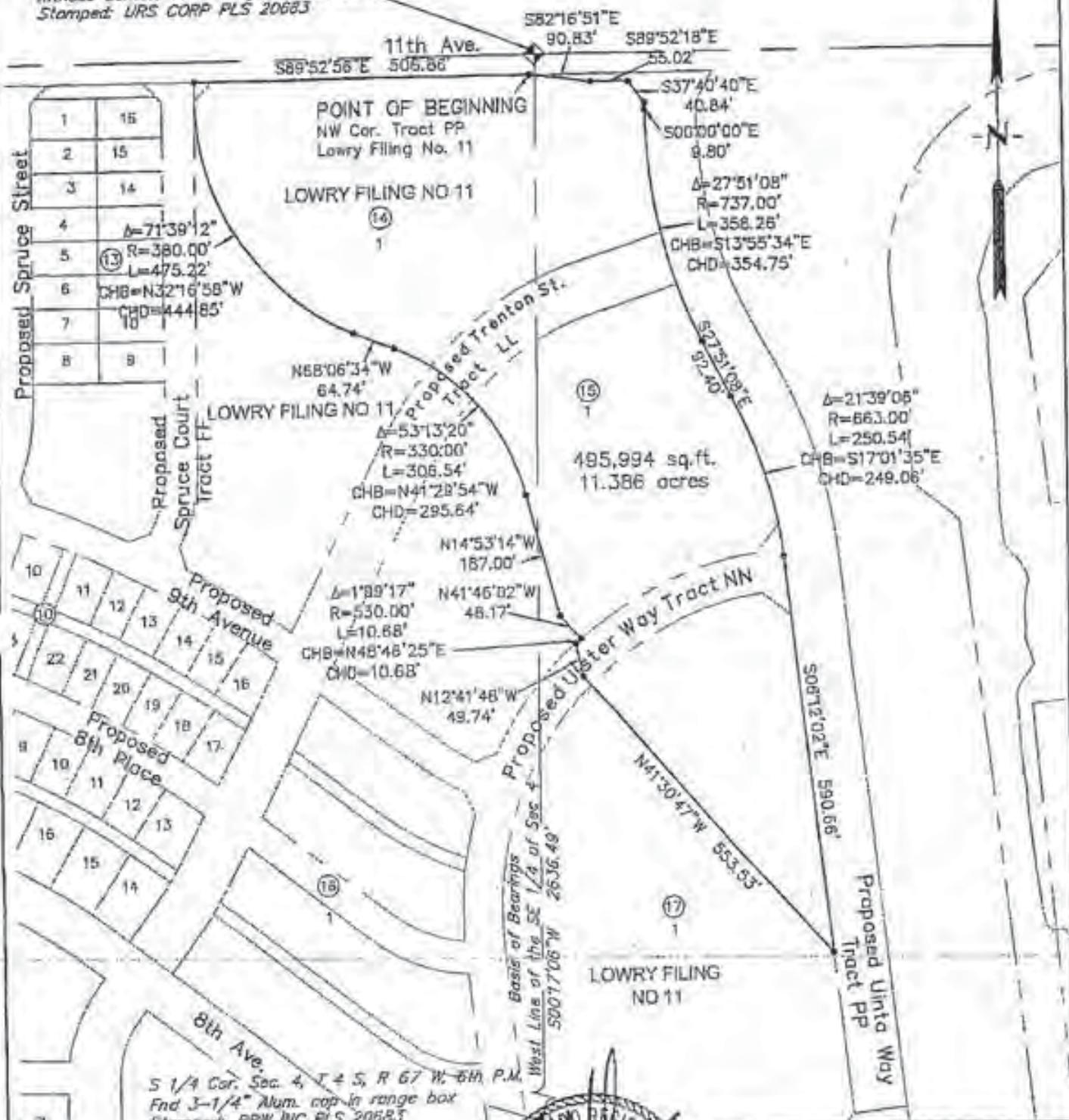
Containing 495,994 square feet or 11.386 acres, more or less.

**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 4, Township 4 South, Range 67 West of the 6<sup>th</sup> Principal Meridian, as bearing South 00°17'06" West. The bearing of said west line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under project No. 94-576, dated April 09, 1996 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The Center of said Section 4 is a 3-1/4" aluminum cap stamped Witness Corner URS CORP. PLS 20683 and the South Quarter Corner of said Section 4 is marked by a 3-1/4" aluminum cap in a range box stamped BRW INC. PLS 20683.

  
A. D. [Name] PLS 20683  
For and on behalf of URS Corp.  
8181 E. [Address]  
Denver, CO  
Ph. 303.740.2000  
K:\LEGALS\Lowry\Lowry Undeveloped Areas\GROUNDWATER\GW-PARCEL 1.doc  
9/27/2005 9:15 AM

# EXHIBIT

Center of Sec. 4, T. 4 S., R. 67 W., 6th P.M.  
 Witness Corner: Fnd. 3-1/4" Alum. Cap  
 Stamped: URS CORP PLS 20683



**URS** 8181 E. TUFTS AVENUE  
 DENVER, CO 80237  
 PH: 303-740-2800  
 FAX: 303-894-3848

EXHIBIT ACCOMPANYING DESCRIPTION  
**MAIN TCE PLUME -  
 GROUNDWATER  
 WITHIN PARCEL 1**

DENVER EXHIBIT COLORADO

Drawn by JKD Checked by ADJ Sheet No. 1 of 1 Sheet(s)

This exhibit does not represent a monumented survey. It is intended only to depict the attached description.

\\Projects\Lowry Undeveloped Areas\Groundwater\GW-PARCEL1.dwg 9/27/2005 10:29:43 AM KGT

**DESCRIPTION**  
**Headquarters TCE Plume - Groundwater**  
**within Parcel 3**

A part of the Northwest Quarter of Section 9, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado being more particularly described as follows:

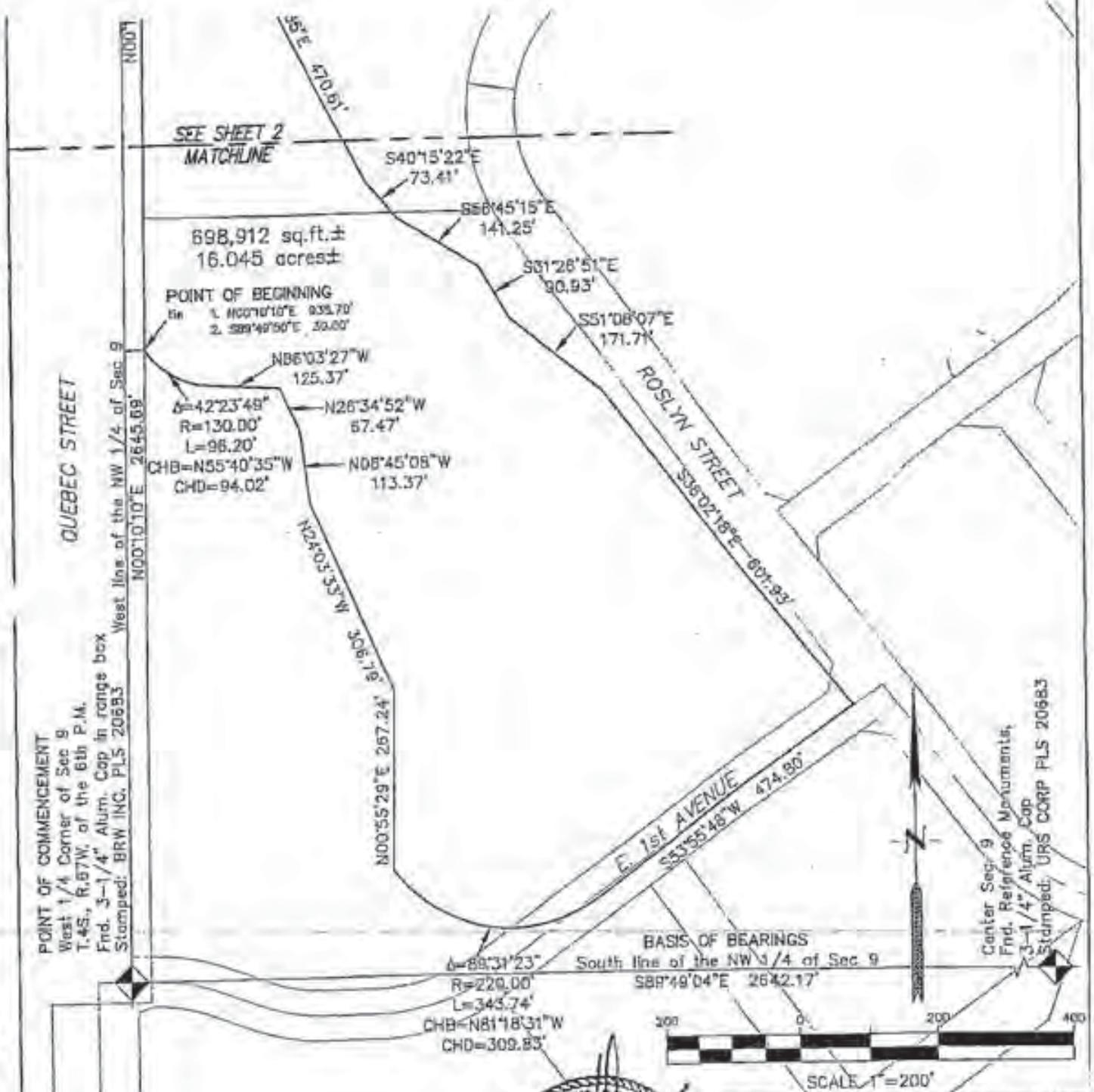
**COMMENCING** at the West Quarter Corner of said Section 9;  
thence North  $00^{\circ}10'10''$  East, along the west line of the Northwest Quarter of said Section 9, a distance of 935.70 feet;  
thence South  $89^{\circ}49'50''$  East a distance of 30.00 feet to the easterly line of Quebec Street and the **POINT OF BEGINNING**;  
thence North  $00^{\circ}10'10''$  East, along said easterly line, a distance of 1113.68 feet;  
thence South  $13^{\circ}49'28''$  East a distance of 473.61 feet;  
thence South  $28^{\circ}27'35''$  East a distance of 470.61 feet;  
thence South  $40^{\circ}15'22''$  East a distance of 73.41 feet;  
thence South  $58^{\circ}45'15''$  East a distance of 141.25 feet;  
thence South  $31^{\circ}26'51''$  East a distance of 90.93 feet;  
thence South  $51^{\circ}08'07''$  East a distance of 171.71 feet;  
thence South  $38^{\circ}02'18''$  East a distance of 601.93 feet;  
thence South  $53^{\circ}55'48''$  West a distance of 474.80 feet to a point of curvature;  
thence along the arc of a curve to the right having a central angle of  $89^{\circ}31'23''$ , a radius of 220.00 feet, an arc length of 343.74 feet and whose chord bears North  $81^{\circ}18'31''$  West a distance of 309.83 feet to a point of non-tangency;  
thence North  $00^{\circ}55'29''$  East a distance of 267.24 feet;  
thence North  $24^{\circ}03'33''$  West a distance of 306.79 feet;  
thence North  $08^{\circ}45'08''$  West a distance of 113.37 feet;  
thence North  $26^{\circ}34'52''$  West a distance of 67.47 feet;  
thence North  $86^{\circ}03'27''$  West a distance of 125.37 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of  $42^{\circ}23'49''$ , a radius of 130.00 feet, an arc length of 96.20 feet and whose chord bears North  $55^{\circ}40'35''$  West a distance of 94.02 feet to the **POINT OF BEGINNING**;

Containing 698,912 square feet or 16.045 acres, more or less.

**Basis of Bearings:** Bearings are based on the south line of the Northwest Quarter of Section 9, Township 4 South, Range 67 West of the 6th Principal Meridian as being S89°49'04"E. The bearing of said south line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 04/09/96 and recorded in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The Center Quarter Corner of Section 9 is marked by reference monuments, found 3-1/4" aluminum caps stamped URS CORP PLS 20683. The West Quarter Corner of Section 9 is a found 3-1/4" aluminum cap in range box stamped BRW INC. PLS 20683.

  
A. David Johnson, P.E. 20683  
For and on behalf of URS Corp.  
8181 E. York Ave.  
Denver, CO 80231  
Ph. 303.740.8000  
K:\LEGALS\Lowry\Lowry Undersized Areas\GROUNDWATER\GW-PARCEL 3.doc  
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# EXHIBIT



**POINT OF COMMENCEMENT**  
West 1/4 Corner of Sec 9  
T.4S., R.87W., of the 6th P.M.  
Fnd. 3-1/4" Alum. Cap in range box  
Stamped: BRW INC. PLS 20683

Center Sec. 9  
Fnd. Reference Monument,  
3-1/4" Alum. Cap  
Stamped: URS CORP PLS 20683



*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

**URS**  
8161 E. TILTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2600  
Fax: 303-694-3946

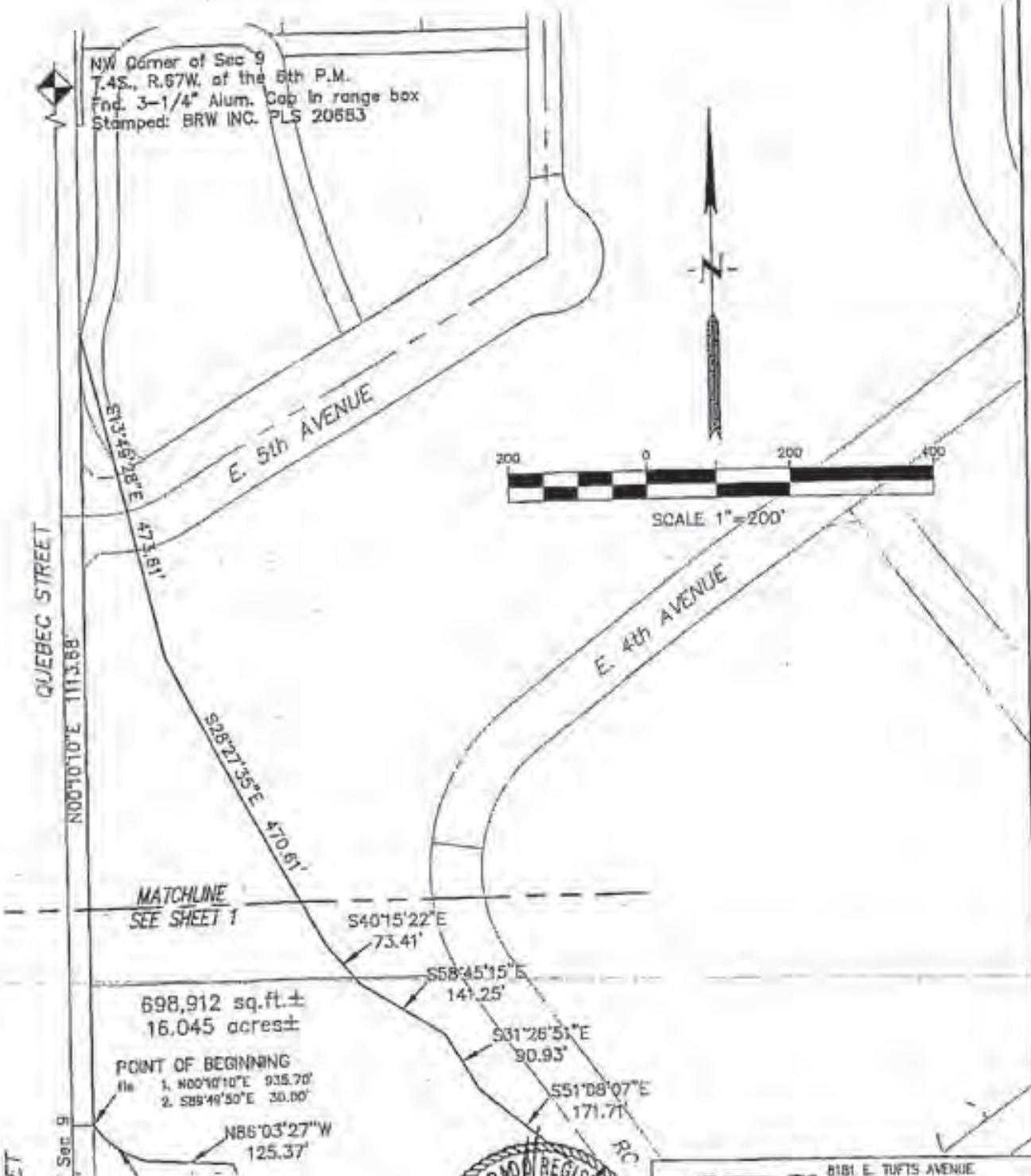
EXHIBIT ACCOMPANYING DESCRIPTION  
**HEADQUARTERS TCE  
PLUME - GROUNDWATER  
WITHIN PARCEL 3**

DENVER **EXHIBIT** COLORADO

Drawn by: JKB | Checked by: ADJ | Sheet No. 1 of 2 Sheet(s)

# EXHIBIT

NW Corner of Sec 9  
 T.4S., R.67W. of the 6th P.M.  
 Fnd. 3-1/4" Alum. Cap in range box  
 Stamped: BRW INC. PLS 20683



**URS** 8181 E. TUFTS AVENUE  
 DENVER, CO 80237  
 Ph: 303-740-2800  
 Fax: 303-694-3945

EXHIBIT ACCOMPANYING DESCRIPTION  
**HEADQUARTERS TCE  
 PLUME - GROUNDWATER  
 WITHIN PARCEL 3**

DENVER EXHIBIT COLORADO

Drawn by: JKB | Checked by: ADJ | Sheet No. 2 of 2 Sheets

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

**DESCRIPTION**  
**Main TCE Plume - Groundwater**  
**Parcel 4(A)**

A part of the Southwest Quarter of Section 4, a part of the Southeast Quarter of Section 4 and a part of the Northeast Quarter of Section 9, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado being more particularly described as follows:

**COMMENCING** at the East Quarter Corner of said Section 4;  
thence North  $89^{\circ}52'18''$  West, along the north line of said Southeast Quarter, a distance of 2370.92 feet;  
thence South  $00^{\circ}07'42''$  West a distance of 30.00 feet to the Northeast corner of Lowry Filing No. 11 of said City and County of Denver and the **POINT OF BEGINNING**;  
thence South  $89^{\circ}52'18''$  East, along the southerly line of 11<sup>th</sup> Avenue, a distance of 89.47 feet;  
thence South  $23^{\circ}44'40''$  East a distance of 769.35 feet;  
thence South  $72^{\circ}21'45''$  East a distance of 501.04 feet;  
thence South  $25^{\circ}49'44''$  East a distance of 631.58 feet to a point on the westerly line of Area 20b described at Reception Number 2002206861 in the Clerk and Records Office of said City and County of Denver;  
thence South  $15^{\circ}28'41''$  West, along said westerly line of Area 20b, a distance of 151.29 feet to a point of non-tangent curvature on the northerly line of a Parcel of Land described at Reception Number 2000137528 in said Clerk and Records Office;

thence along the northerly and westerly line of said Parcel of Land the following three (3) courses:

1. along the arc of a curve to the left having a central angle of  $03^{\circ}25'42''$ , a radius of 712.50 feet, an arc length of 42.63 feet and whose chord bears South  $70^{\circ}11'49''$  West a distance of 42.63 feet;
2. South  $34^{\circ}56'25''$  West a distance of 130.51 feet;
3. South  $06^{\circ}15'42''$  East a distance of 825.13 feet to the southwest corner of said Parcel of Land;

thence South  $06^{\circ}15'42''$  East a distance of 201.30 feet to the southwest corner of said Parcel 6-D-1 described at Reception Number 9700003185 in said Clerk and Records Office;  
thence South  $89^{\circ}44'10''$  East, along the southerly line of said Parcel 6-D-1, a distance of 212.01 feet to a point that is 1038.73 feet west of the east line of said Northeast Quarter;  
thence South  $00^{\circ}04'42''$  West a distance of 502.15 feet to a point that is 1039.24 feet west of said east line of the Northeast Quarter and on the northerly line of Area 3 described at Reception Number 9800174373 in said Clerk and Records Office;  
thence North  $89^{\circ}44'58''$  West, along said northerly line, a distance of 431.06 feet to a point on the easterly line of Area 2 described at Reception Number 9800087078 in said Clerk and Records Office;

thence along said easterly and northerly line of said Area 2 the following two (2) courses:

1. North  $00^{\circ}19'49''$  West a distance of 130.06 feet;
2. North  $89^{\circ}57'23''$  West a distance of 91.72 feet to the southeast corner of Parcel 1, Area 7 described at Reception Number 9900183842 in said Clerk and Records Office;

thence along the northerly and easterly line of said Parcel 1, Area 7 the following seven (7) courses:

1. North 00°00'00" West a distance of 87.47 feet;
2. North 50°16'15" West a distance of 238.52 feet;
3. North 40°45'51" West a distance of 165.09 feet;
4. North 03°40'12" West a distance of 150.35 feet;
5. North 19°29'51" East a distance of 132.64 feet;
6. North 24°50'04" West a distance of 162.56 feet;
7. North 89°36'09" West a distance of 210.32 feet to a point on the westerly line of Tract G of Lowry Filing No. 9 of said City and County of Denver;

thence along said westerly line of Tract G the following three (3) courses:

1. North 00°28'46" East a distance of 12.84 feet to a point of curvature;
2. along the arc of a curve to the left having a central angle of 08°45'59", a radius of 734.75 feet, an arc length of 112.42 feet and whose chord bears North 03°54'13" West a distance of 112.31 feet;
3. North 06°12'02" West a distance of 630.98 feet to the southwest corner of Tract PP of said Lowry Filing No. 11;

thence along the westerly and northerly line of said Tract PP the following ten (10) courses:

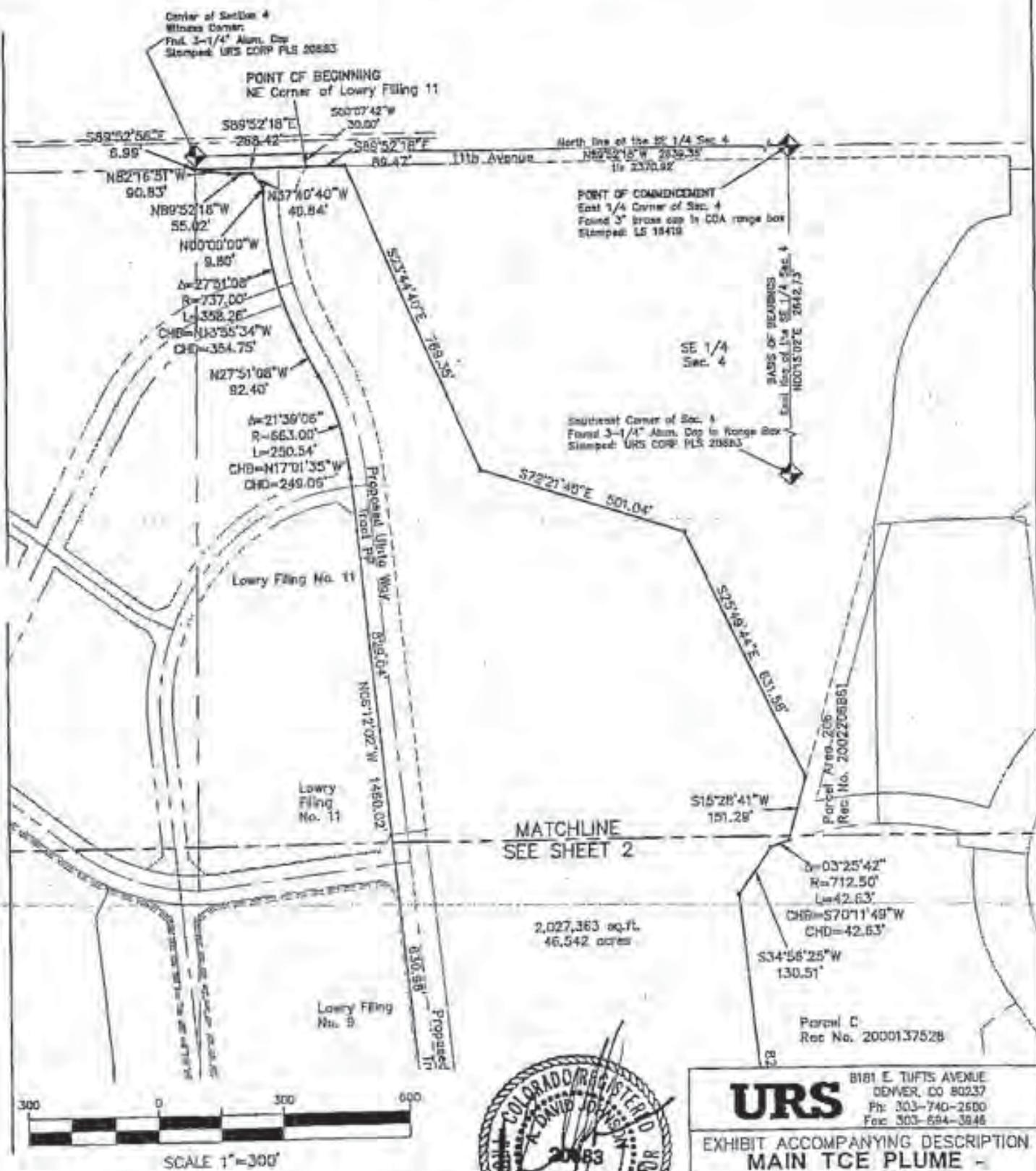
1. North 06°12'02" West a distance of 829.04 feet to a point of curvature;
2. along the arc of a curve to the left having a central angle of 21°39'06", a radius of 663.00 feet, an arc length of 250.54 feet and whose chord bears North 17°01'35" West a distance of 249.06 feet;
3. North 27°51'08" West a distance of 92.40 feet to a point of curvature;
4. along the arc of a curve to the right having a central angle of 27°51'08", a radius of 737.00 feet, an arc length of 358.26 feet and whose chord bears North 13°55'34" West a distance of 354.75 feet;
5. North 00°00'00" West a distance of 9.80 feet;
6. North 37°40'40" West a distance of 40.84 feet;
7. North 89°52'18" West a distance of 55.02 feet;
8. North 82°16'51" West a distance of 90.83 feet to the northwest corner of said Tract PP;
9. South 89°52'56" East a distance of 6.99 feet;
10. South 89°52'18" East a distance of 268.42 feet to the **POINT OF BEGINNING**;

Containing 2,027,363 square feet or 46.542 acres, more or less.

**BASIS OF BEARINGS:** Bearings are based on the east line of the Southeast Quarter of Section 4, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°15'02" East. The bearing of said east line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The East Quarter Corner of Section 4 is a found 3" brass cap in range box stamped LS 16419 and the Southeast Corner of Section 4 is a 3 1/4" aluminum cap in range box stamped URS CORP PLS 20683.

 07/27/05  
A. David Johnson, P.L. 20483  
For and on behalf of URS Corp.  
8181 E. West Ave.  
Denver, CO  
Ph. 303.740.2083  
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# EXHIBIT



**URS** 8181 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2600  
Fax: 303-694-3846

**EXHIBIT ACCOMPANYING DESCRIPTION  
MAIN TCE PLUME -  
GROUNDWATER  
PARCEL 4(A)**

DENVER EXHIBIT COLORADO  
Drawn by: JRF Checked by: ASJ Sheet No. 1 of 2 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

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**DESCRIPTION**  
**Main TCE Plume - Groundwater**  
**within Parcel 4(B)**

A part of the Southeast Quarter of Section 4, a part of the Northeast Quarter of Section 9, and a part of the Northwest Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North  $01^{\circ}41'44''$  West a distance of 2461.64 feet;  
thence North  $60^{\circ}17'45''$  West a distance of 885.52 feet to a point of non-tangent curvature and the **POINT OF BEGINNING**;  
thence along the arc of a curve to the right having a central angle of  $72^{\circ}43'25''$ , a radius of 150.00 feet, an arc length of 190.39 feet and whose chord bears North  $79^{\circ}40'27''$  West a distance of 177.86 feet;  
thence North  $43^{\circ}18'45''$  West a distance of 343.85 feet;  
thence North  $40^{\circ}43'41''$  West a distance of 761.58 feet;  
thence North  $35^{\circ}04'31''$  West a distance of 417.42 feet;  
thence North  $39^{\circ}16'25''$  West a distance of 600.98 feet to a point on the southeasterly line of said "Parcel ROW-2" described at Reception Number 9700003186 in the Clerk and Recorder's Office of said City and County of Denver;  
thence South  $53^{\circ}24'05''$  West, along said southeasterly line, a distance of 58.18 feet;  
thence North  $43^{\circ}35'10''$  West a distance of 146.09 feet to a point on a northwesterly line of said "Parcel ROW-2";  
thence North  $52^{\circ}26'55''$  West a distance of 623.56 feet to a point on a southeasterly line of said "Parcel ROW-2";  
thence North  $41^{\circ}13'02''$  West a distance of 75.00 feet to a point on a northwesterly line of said "Parcel ROW-2";  
thence North  $45^{\circ}55'58''$  West a distance of 470.27 feet to the southeast corner of a Parcel of Land described at Reception Number 2000137528 in said Clerk and Recorder's Office;

thence along the easterly line of said Parcel of Land the following two (2) courses:

1. North  $06^{\circ}28'20''$  West a distance of 513.70 feet;
2. North  $53^{\circ}30'13''$  East a distance of 99.85 feet to a point on a southwesterly line of said "Parcel ROW-2";

thence South  $36^{\circ}29'47''$  East, along said southwesterly line, a distance of 128.17 feet;  
thence South  $90^{\circ}00'00''$  East a distance of 155.49 feet to a point on the southwesterly line of a parcel of land described at Reception Number 2000144000 in said Clerk and Recorder's Office;  
thence South  $36^{\circ}29'47''$  East, along said southwesterly line, a distance of 704.82 feet to the most westerly corner of a parcel of land described at Reception Number 2005009025 in said Clerk and Recorder's Office;

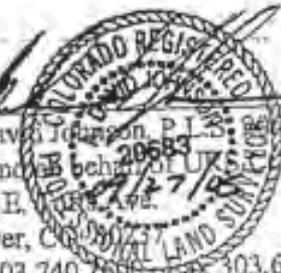
thence along the southwesterly and southeasterly lines of said parcel the following two (2) courses:

1. South 57°31'52" East a distance of 703.51 feet;
2. North 53°24'05" East a distance of 68.43 feet;

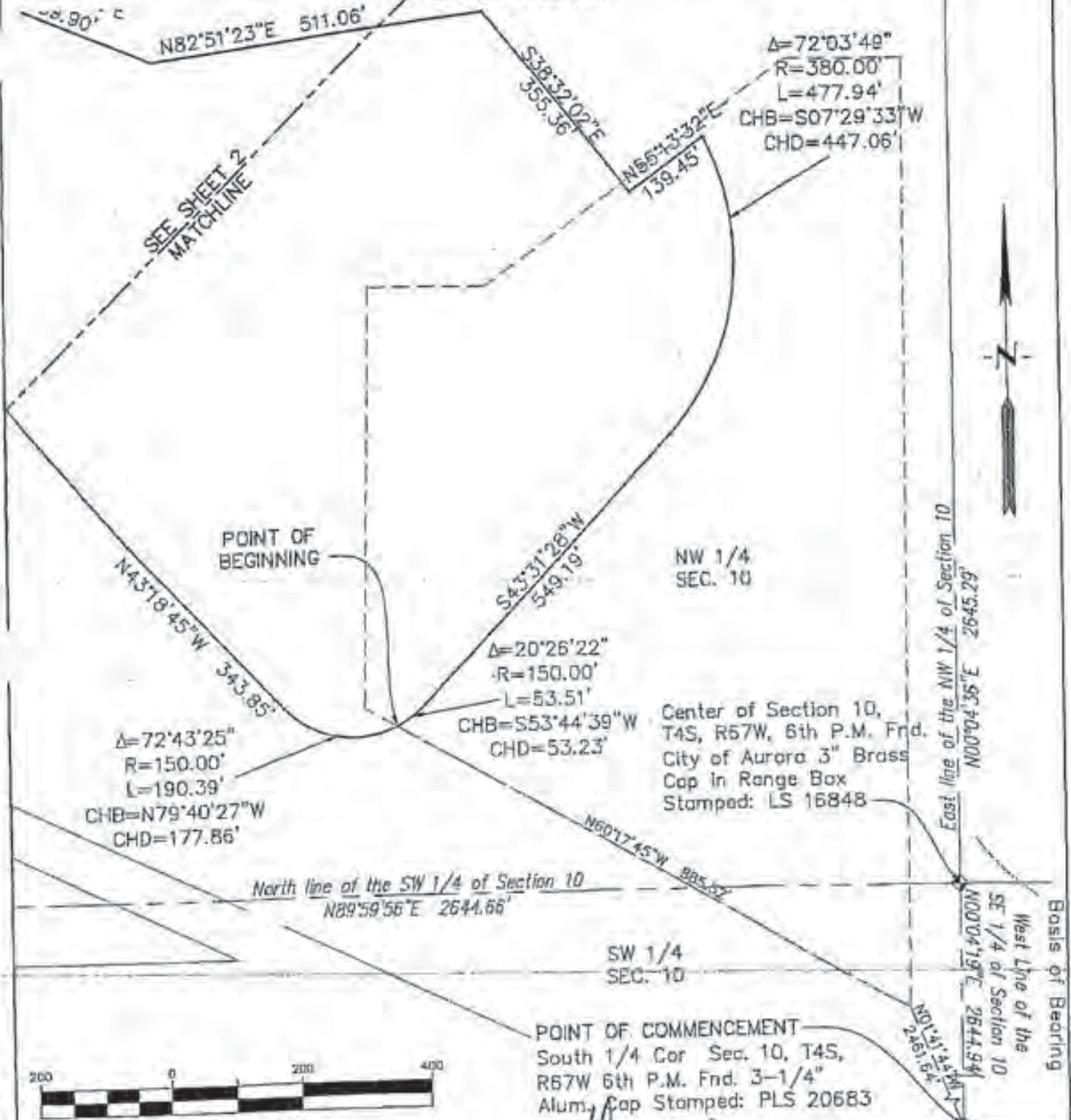
thence South 64°33'43" East a distance of 156.02 feet to a point on the southwesterly line of Tract B, Lowry Filing No. 14 of said City and County of Denver;  
thence South 53°27'42" West, along said southwesterly line, a distance of 58.01 feet;  
thence South 36°17'24" East a distance of 381.43 feet;  
thence South 17°56'49" East a distance of 238.64 feet;  
thence South 32°44'51" East a distance of 356.26 feet;  
thence South 67°06'32" East a distance of 309.90 feet;  
thence North 82°51'23" East a distance of 511.06 feet;  
thence South 38°32'02" East a distance of 355.36 feet;  
thence North 55°13'32" East a distance of 139.45 feet;  
thence along the arc of a curve to the right having a central angle of 72°03'49", a radius of 380.00 feet, an arc length of 477.94 feet and whose chord bears South 07°29'33" West a distance of 447.06 feet;  
thence South 43°31'28" West a distance of 549.19 feet to a point of curvature;  
thence along the arc of a curve to the right having a central angle of 20°26'22", a radius of 150.00 feet, an arc length of 53.51 feet and whose chord bears South 53°44'39" West a distance of 53.23 feet to the **POINT OF BEGINNING**;

Containing 2,111,340 square feet or 48.470 acres, more or less.

**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°04'19" East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter corner of Section 10 is a found 3-1/4" Aluminum cap Stamped URS CORP PLS 20683 and the Center Quarter corner of Section 10 is a found 3" brass cap stamped PLS 16848 in a range box.

  
A. David Johnson, P.L.S. No. 20683  
For and on behalf of URS CORP  
8181 E. North Ave.  
Denver, CO 80237  
Ph. 303.740.2800 Fax 303.694.2770  
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# EXHIBIT



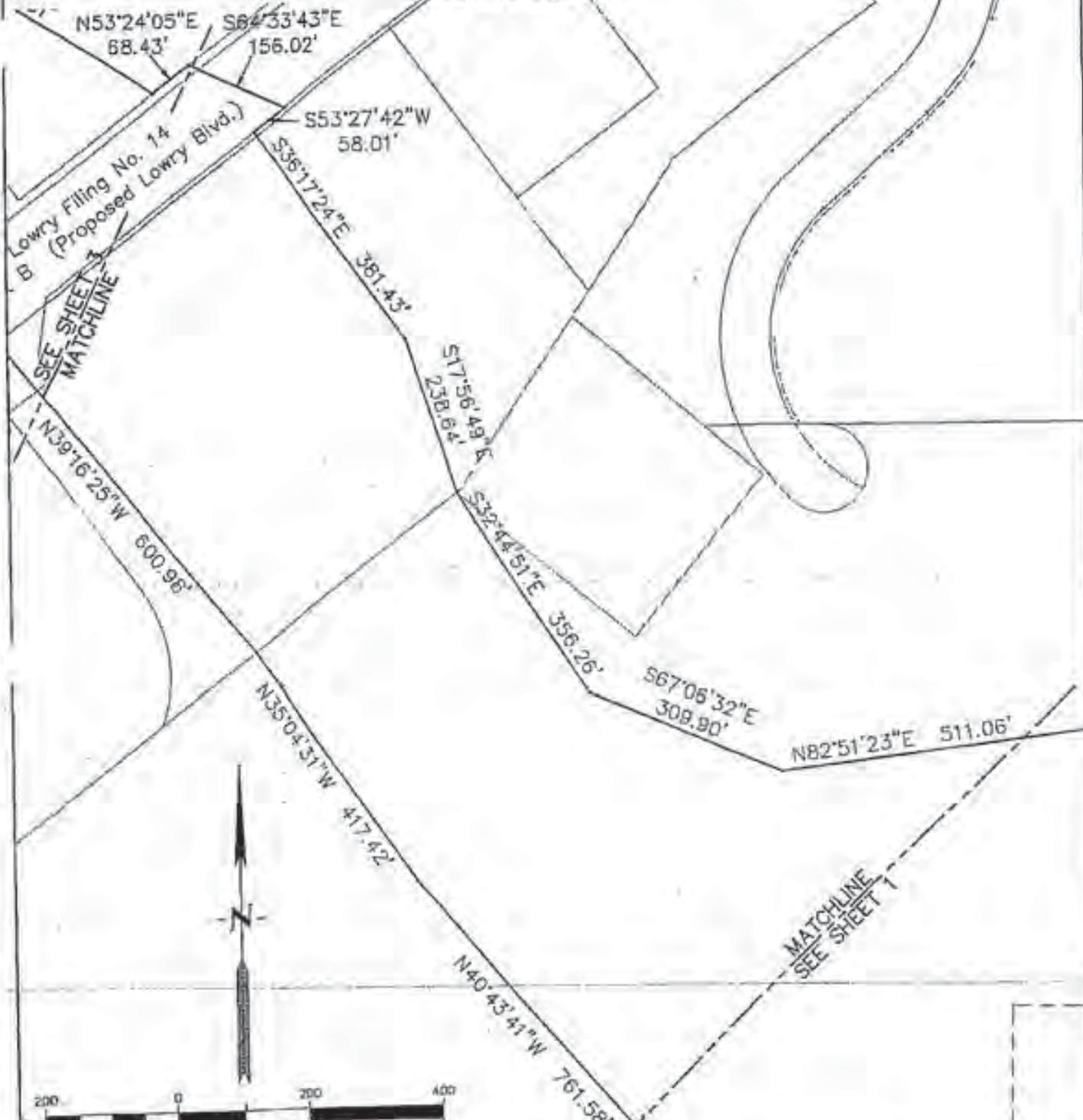
**URS**  
 8181 E. TIFTS AVENUE  
 DENVER, CO 80237  
 PH: 303-740-2600  
 FAX: 303-694-3946

**EXHIBIT ACCOMPANYING DESCRIPTION  
 MAIN TCE PLUME -  
 GROUNDWATER  
 WITHIN PARCEL 4(B)**

DENVER EXHIBIT COLORADO  
 Drawn by: JED | Checked by: ADJ | Sheet No. 1 of 3 (Sheet(s))

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

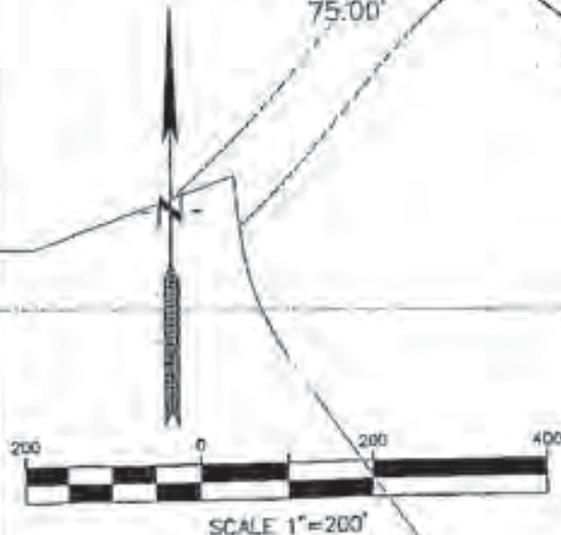
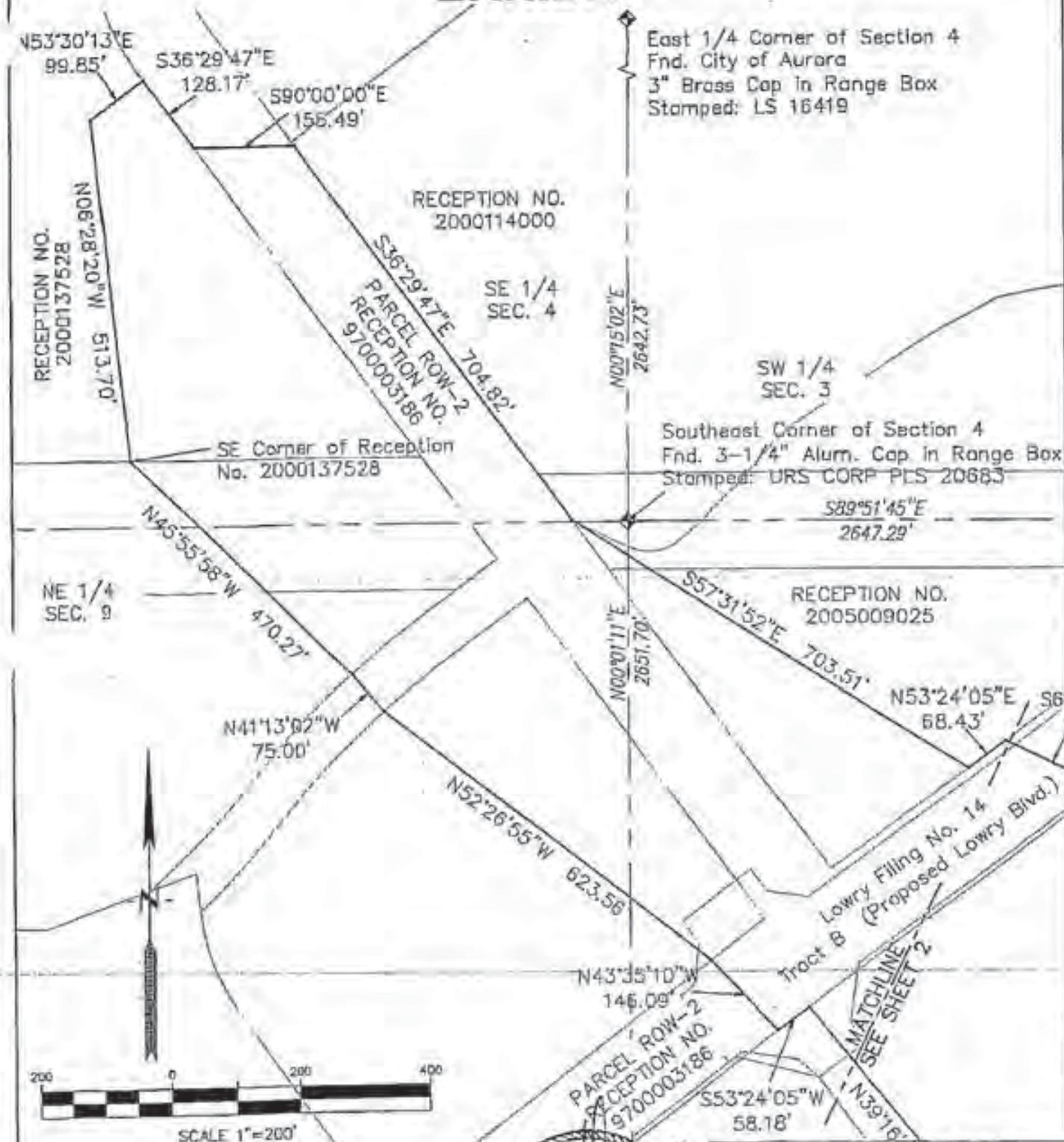
# EXHIBIT



<b>URS</b>		
6181 E. TUFTS AVENUE DENVER, CO 80237 Ph: 303-740-2600 Fax: 303-894-3940		
<b>EXHIBIT ACCOMPANYING DESCRIPTION          MAIN TCE PLUME -          GROUNDWATER          WITHIN PARCEL 4(B)</b>		
DENVER	<b>EXHIBIT</b>	COLORADO
Drawn by: JMB	Checked by: ADJ	Sheet No. 2 of 3 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

# EXHIBIT



**URS** 8181 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2600  
Fax: 303-694-3946

**EXHIBIT ACCOMPANYING DESCRIPTION  
MAIN TCE PLUME -  
GROUNDWATER  
WITHIN PARCEL 4(B)**

DENVER **EXHIBIT** COLORADO

Drawn by: JDB | Checked by: JDB | Sheet No. 2 of 3 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

8:\Projects\25\Lowry Filling\Area\Groundwater\GV-PARCEL4(B).dwg 9/27/2005 10:58 AM KCT

**DESCRIPTION**  
**TCE 1 - Groundwater**  
**within Parcel 5(A)**

A part of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver and County of Arapahoe, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North  $21^{\circ}56'56''$  East a distance of 2734.35 feet to the **POINT OF BEGINNING**;  
thence South  $89^{\circ}58'34''$  East a distance of 650.94 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of  $193^{\circ}34'14''$ , a radius of 327.76 feet, an arc length of 1107.34 feet and whose chord bears North  $89^{\circ}58'34''$  West, a distance of 650.94 feet to the **POINT OF BEGINNING**;

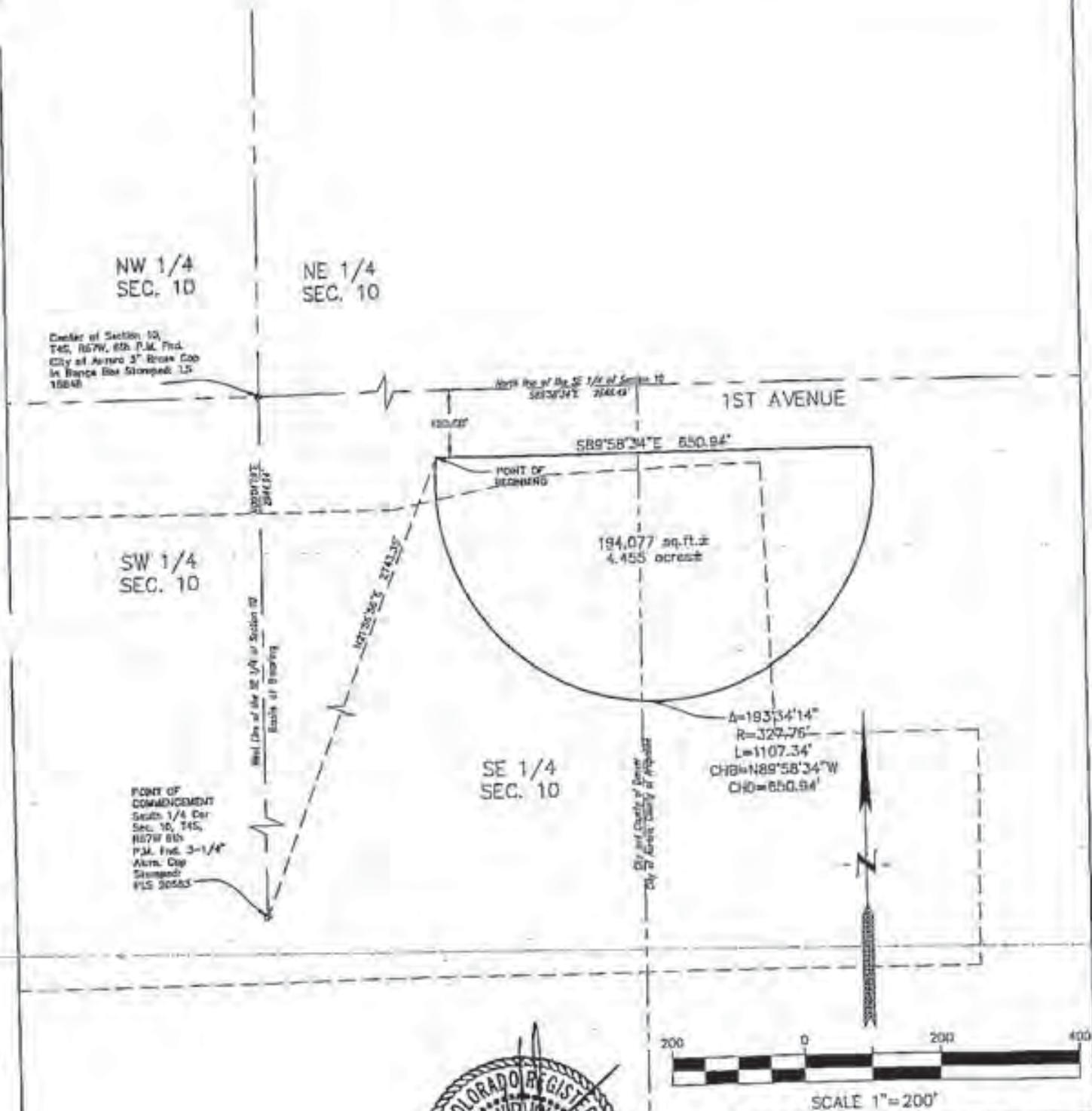
Containing 194,077 square feet or 4.455 acres, more or less.

**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North  $00^{\circ}04'19''$  East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter corner of Section 10 is a found 3-1/4" Aluminum cap Stamped: PLS 20683 and the Center Quarter corner of Section 10 is a found 3" brass cap stamped: PLS 20683 range box.

A. David Johnson  
For and on behalf of  
8181 E. Tuff  
Denver, CO 80231  
Ph. 303.740.2600 Fax 303.694.2770  
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# EXHIBIT



POINT OF COMMENCEMENT  
South 1/4 Cor  
Sec. 10, T4S,  
R57W 8th  
P.M. Pnd. 3-1/4"  
Alum. Cap  
Stamped:  
FLS 30563



*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

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8181 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2600  
Fax: 303-694-3848

**URS**

EXHIBIT ACCOMPANYING DESCRIPTION  
**TCE 1 - GROUNDWATER**  
**WITHIN PARCEL 5(A)**  
**EXHIBIT**

DENVER COLORADO

Drawn by: JKB Checked by: ADJ Sheet No. 1 of 1 Sheet(s)

**DESCRIPTION**  
**TCE 2 - Groundwater**  
**within Parcel 5(A)**

A part of the South Half of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North 03°28'49" East a distance of 1529.38 feet to the **POINT OF BEGINNING**;  
thence North 07°27'06" West a distance of 209.15 feet;  
thence North 73°06'50" West a distance of 314.13 feet;  
thence North 01°16'53" West a distance of 157.04 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of 89°07'05", a radius of 686.75 feet, an arc length of 1068.17 feet and whose chord bears North 84°37'41" East, a distance of 963.71 feet to a point of non-tangency;  
thence South 01°06'53" East a distance of 205.03 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of 67°52'09", a radius of 430.70 feet, an arc length of 510.19 feet and whose chord bears South 45°32'39" West, a distance of 480.88 feet to a point of non-tangency;  
thence South 89°11'29" West a distance of 289.02 feet to the **POINT OF BEGINNING**;

Containing 497,192 square feet or 11.414 acres, more or less.

**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°04'19" East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter corner of Section 10 is a found 3-1/4" Aluminum cap Stamped: PLS 20683 and the Center Quarter corner of Section 10 is a found 3" brass cap stamped: PLS 16848 in a range box.

A. David Johnson  
For and on behalf of  
8181 E. Tufts  
Denver, CO 80231

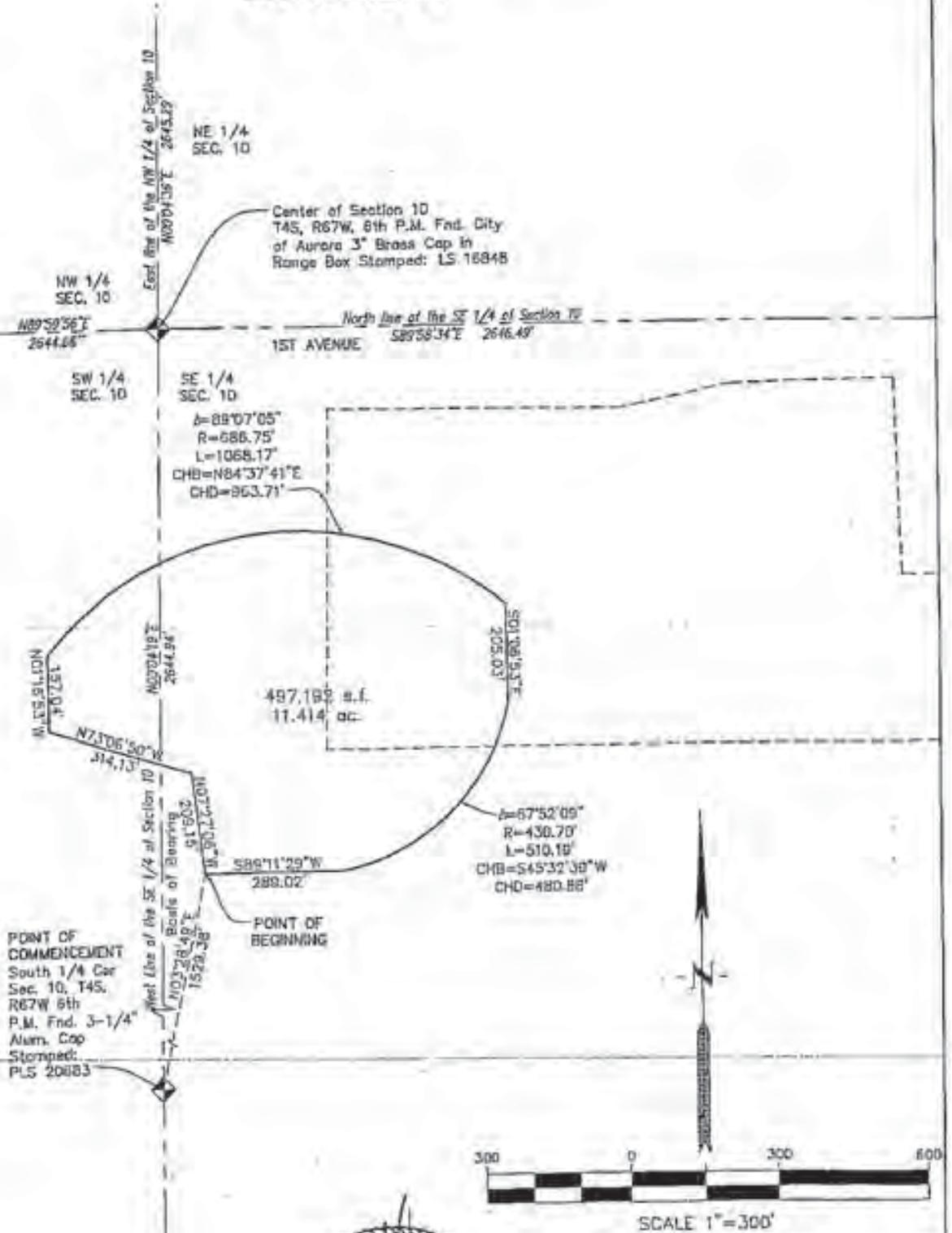
Ph. 303.740.2600 Fax 303.694.2770

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9/27/05

# EXHIBIT



**URS**

8181 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2600  
Fax: 303-694-3946

EXHIBIT ACCOMPANYING DESCRIPTION  
TCE 2 - GROUNDWATER  
WITHIN PARCEL 5(A)  
EXHIBIT

DENVER COLORADO  
Drawn by JKB Checked by ADJ Sheet No. 1 of 1 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

**DESCRIPTION**  
**TCE - Groundwater**  
**Parcel 5(B)**

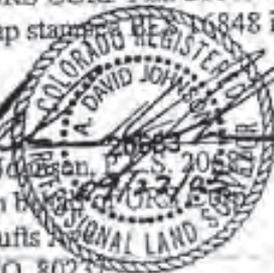
A part of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver and County of Arapahos, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North 47°09'29" East a distance of 1480.30 feet to the **POINT OF BEGINNING**;  
thence North 40°57'19" West a distance of 267.82 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of 145°32'17", a radius of 304.97 feet, an arc length of 774.66 feet and whose chord bears North 57°35'42" East a distance of 582.56 feet to a point of non-tangency;  
thence South 16°39'31" East a distance of 270.37 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of 101°22'37", a radius of 303.34 feet, an arc length of 536.72 feet and whose chord bears South 57°01'53" West a distance of 469.40 feet to the **POINT OF BEGINNING**;

Containing 266,156 square feet or 6.110 acres, more or less.

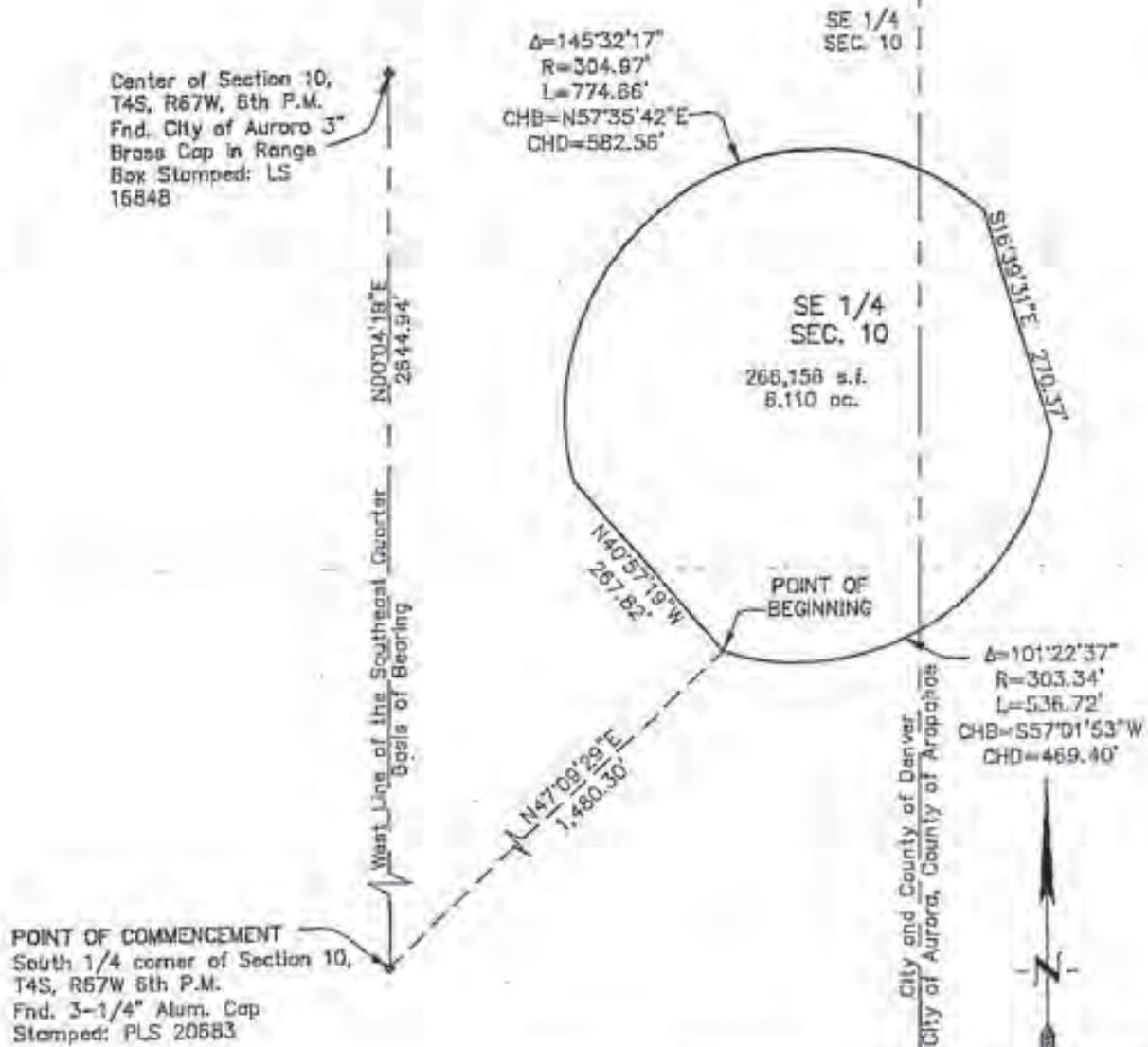
**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°04'19" East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter Corner of Section 10 is a found 3-1/4" aluminum cap stamped URS CORP PLS 20683 and the Center Quarter Corner of Section 10 is a found 3" brass cap stamped URS CORP PLS 206848 in a City of Aurora range box.

A. David Johnson, P.S. 20582  
For and on behalf of URS  
8181 E. Tufts  
Denver, CO 80231  
Ph. 303.740.2600  
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09/27/05

# EXHIBIT



SCALE 1"=200'

**URS**

8181 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2600  
Fax: 303-684-3946

EXHIBIT ACCOMPANYING DESCRIPTION  
TCE - GROUNDWATER  
PARCEL 5(B)  
EXHIBIT

DENVER

COLORADO

Drawn by JMS | Checked by ADJ | Sheet No. 1 of 3 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

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**DESCRIPTION**  
**PCE - Groundwater**  
**Parcel 5(C)**

A part of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian, County of Arapahoe, State of Colorado, being more particularly described as follows:

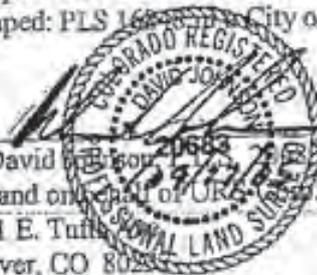
**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North 52°38'44" East a distance of 3207.33 feet to a point on the westerly line of Havana Street and the **POINT OF BEGINNING**;  
thence South 59°05'51" West a distance of 189.00 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of 172°13'15", a radius of 180.05 feet, an arc length of 541.20 feet and whose chord bears North 20°19'25" West, a distance of 359.27 feet to a point of non-tangency;  
thence North 60°40'32" East a distance of 330.66 feet to a point on said westerly line of Havana Street ;  
thence South 00°11'25" West, along said westerly line, a distance of 401.78 feet to the **POINT OF BEGINNING**;

Containing 137,708 square feet or 3.161 acres, more or less.

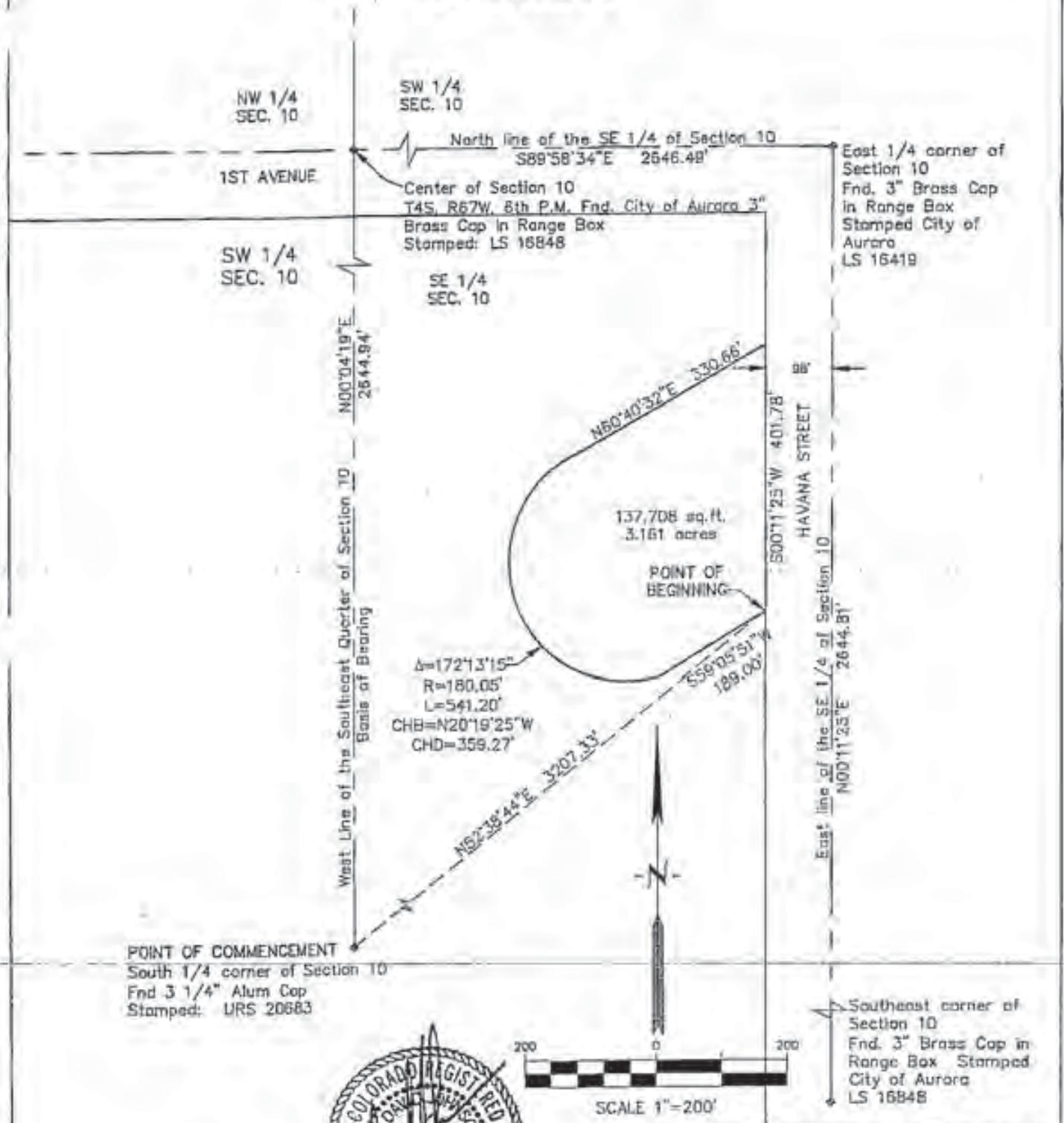
**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°04'19" East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter Corner of Section 10 is a found 3-1/4" aluminum cap stamped: PLS 20683 and the Center Quarter Corner of Section 10 is a found 3" brass cap stamped: PLS 168 City of Aurora range box.

A. David  
For and on behalf of  
8181 E. Tull  
Denver, CO 80231  
Ph. 303.740.2600

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# EXHIBIT



**URS**  
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**EXHIBIT ACCOMPANYING DESCRIPTION  
 PCE - GROUNDWATER  
 PARCEL 5(C)  
 EXHIBIT**

DENVER COLORADO  
 Drawn by JCS | Checked by ASJ | Sheet No. 1 of 1 (Rev. 0)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

**DESCRIPTION**  
**BTEX - Groundwater**  
**Parcel 5(D)**

A part of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver and County of Arapahoe, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;  
thence North  $62^{\circ}57'16''$  East a distance of 2077.79 feet to the **POINT OF BEGINNING**;  
thence North  $62^{\circ}59'15''$  East a distance of 782.10 feet to a point on the westerly line of Havana Street;  
thence South  $00^{\circ}11'25''$  West, along said westerly line, a distance of 334.39 feet;  
thence South  $65^{\circ}47'23''$  West a distance of 677.83 feet to a point of non-tangent curvature;  
thence along the arc of a curve to the right having a central angle of  $131^{\circ}54'47''$ , a radius of 147.04 feet, an arc length of 338.52 feet and whose chord bears North  $16^{\circ}45'43''$  West a distance of 268.56 feet to the **POINT OF BEGINNING**;

Containing 223,394 square feet or 5.128 acres, more or less.

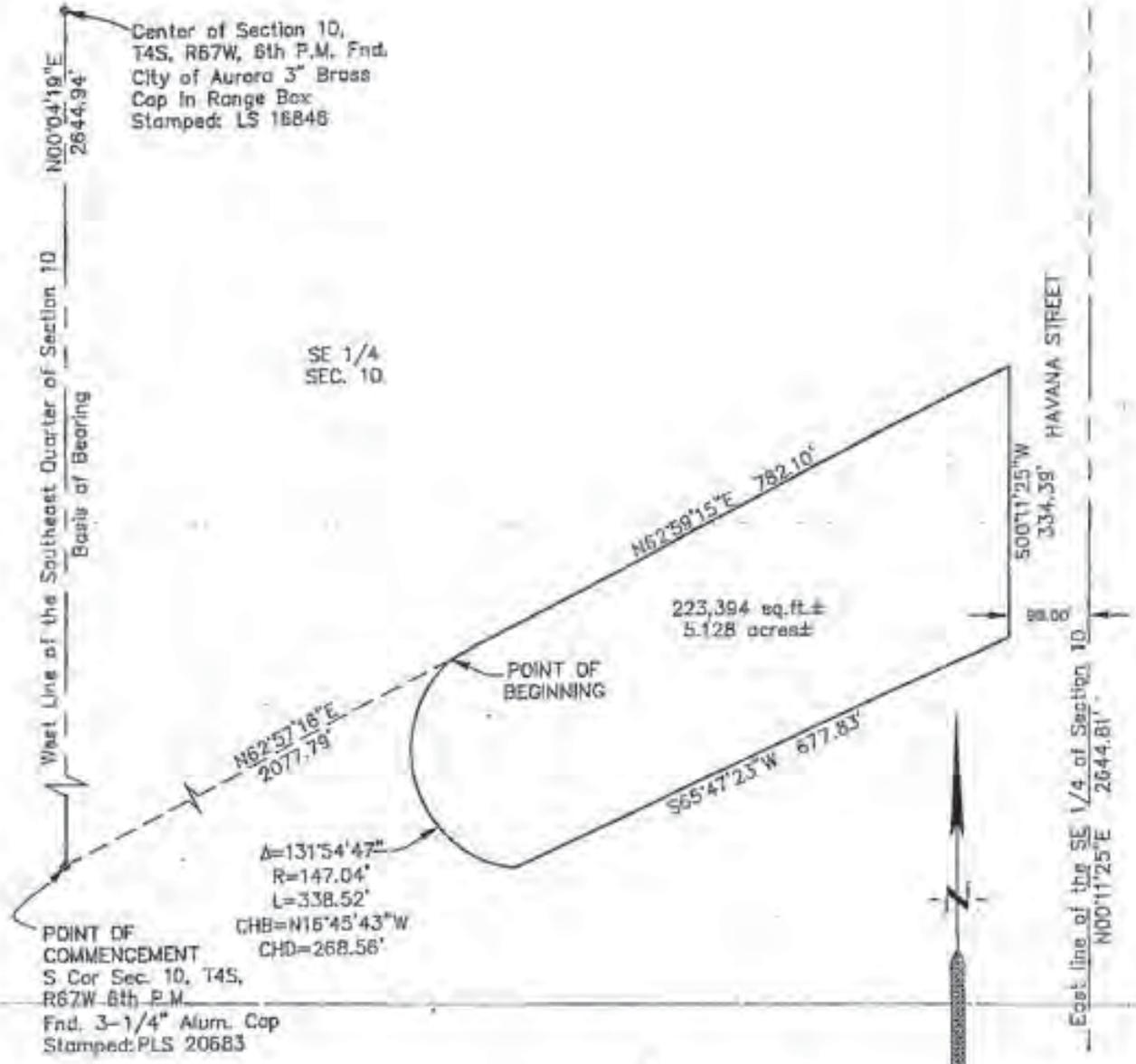
**Basis of Bearings:** Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North  $00^{\circ}04'19''$  East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter Corner of Section 10 is a found 3-1/4" aluminum cap stamped URS CORP PLS 20683 and the Center Quarter Corner of Section 10 is a found 3" brass cap stamped RES 9 8948 in a City of Aurora range box.

A. David Johnson  
For and on behalf of  
8181 E. Tufts Avenue  
Denver, CO 80237  
Ph. 303.740.2600

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# EXHIBIT



**URS** 8181 E. TUFTS AVENUE  
DENVER, CO 80237  
Ph: 303-740-2800  
Fax: 303-594-3946

EXHIBIT ACCOMPANYING DESCRIPTION  
**BTEX - GROUNDWATER**  
**PARCEL 5(D)**  
**EXHIBIT**

DENVER COLORADO

Drawn by: JKB Checked by: ADJ Sheet No. 1 of 1 Sheet(s)

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

**APPENDIX G**  
**RESPONSE TO WRITTEN COMMENTS**

**Response to Comments  
Second Five Year Review  
Former Lowry Air Force Base**

The Draft Second Five Year Review for the Former Lowry Air Force Base was issued to the members of the Lowry Cleanup Team (LCT) for review and comment on July 23, 2013. Two on-board reviews were held to interactively incorporate written and verbal comments received from the LCT members in order to streamline the document review process. The on-board reviews were held on August 28, 2013 and September 16, 2013 and were attended by representatives of the Air Force Civil Engineer Center (AFCEC), the Colorado Department of Public Health and Environment (CDPHE), U.S. Environmental Protection Agency Region 8 (EPA), and Lowry Assumption, LLC (LAC). Written comments were received from the EPA and the Lowry Economic Redevelopment Authority (LRA). In lieu of formal written comments, the CDPHE provided comprehensive verbal comments and suggested revisions during the two on-board reviews.

The written comments provided by the EPA and the LRA with the AFCEC responses are presented in the following pages. The AFCEC responses are included in *italics* following each comment.

**EPA Comments on the Former Lowry AFB Second Five Year Review**

Received August 21, 2013

1) Exec. Summary:

- period of review is from the date of notification to the public to the sign date

*Text modified*

- 1<sup>st</sup> paragraph, last sentence—the AF is the lead because of executive Order 12580. I think the RCRA agreement between CDPHE and the AF specifies the AF agreed to do 5YRs. DOD in general is committed to performing 5YRs at places where they retain CERCLA 120 liability and where waste has been left in place.

*Text modified*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- Paragraph 2, 26 sites---the 5YR should be written in terms of OUs wherever possible. This would be x # of OUs, plus y # of locations outside of OUs.

*Comment noted – content modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- Every recommendation should be connected to an issue. OU2 had no issues. OU5 will have some.

*Comment noted – content modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- OU2 is protective, OU5 is protective in the short term

*Comment noted – content modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 2) General: Since there is another famous Superfund site in metro Denver (Lowry Landfill) I recommend you use the name Lowry Air Force Base when referring to your BRAC site. Especially at the landfill.

*Text modified*

- 3) Table 1: not needed. This table is in the guidance to distinguish between policy and statutory reviews.

*Deleted*

- 4) Section 3.1, “achieved closure”: closure and UU/UE are not the same. To make the stronger statement you make elsewhere, UU/UE is the threshold.

*Text modified*

- 5) Section 3.2, 3<sup>rd</sup> paragraph: The CIP is getting pretty old. Contact names are out of date. You may want to mention when the next update will take place. They often happen concurrent with the 5YR.

*LAC plans to update the Community Involvement Plan (CIP) in the later part of 2013.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- 6) Section 3.2, 4<sup>th</sup> paragraph, community involvement as defined in the Consent Agreement: This is phrased as if you're trying to keep them at arm's length. Instead---The plan identifies where to find information to stay informed about the progress on the clean-ups, and who to contact with concerns.

*Text modified*

- 7) Section 3.2, 5<sup>th</sup> paragraph, interviews with community members: Refer to the appendix if this means the regulator and operator interviews. The community member interviews should be summarized. The names can be redacted, or the responses can be summarized. Otherwise, it gives the impression only officials were interviewed. Don't ignore information from the interviews in the body of the report. See comment 22.

*This paragraph refers to the public interviews conducted as part of the 2009 Revised Community Involvement Plan – the interview information is summarized in Paragraphs 5-7 of the Second Five Year Review and in the CIP which is included as Appendix B to the Second Five Year Review.*

- 8) End of section 3.3, "cycle": probably a typo.

*Text corrected*

- 9) Table 3, chronology: recommend this level of detail in a chronology be reserved for an appendix. A select chronology for the 5YR would be more applicable here. Significant 5YR dates: RODs/decisions, RA starts, sitewide, construction completion, LUCs in place, UU/UE's established, land transfers, decommissioning, deletion (for NPL sites).

*Comment noted – content modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews. The Operable Unit 5 (OU5) chronology table was formatted to be a stand-alone table (Table 4).*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

10) Section 4.2:

- somewhere before the delineation of the plumes, and definitely by the time you get to the basis for taking action, it would be good to see the crosswalk with the RAOs and the remedies listed.

*Comment noted – content modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews. A new Table 2 was created to address the comment.*

- There are some acronyms which should be defined the first time they are used: BAHCS, SARS. Show these and the other remedies described (PRB, sub-slab systems), on a map.

*Comment noted – content modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- Clarify whether the PRB was removed. Locate the BAHCS on 11<sup>th</sup> Ave better with cross-streets in the text.

*Text modified and Figure 1 modified to include location.*

- HQ plume: see notes for figures and OU5 Tech Eval question B. This area may need an additional sentence here.

*Text modified*

- Sub-slab systems: buildings overlie the plume north of the base.

*Text corrected*

11) Section 4.4.1: RAOs do not usually include preferred technologies and the bullet after it.

*The Remedial Action Objectives (RAOs) from the Phase 2 Corrective Action Plan for Groundwater were inserted into the text in their entirety per discussions at the on-board reviews. Table 2 was also created to include the complete listing of RAOs.*

12) Section 4.3 indicates there are no known direct exposure pathways to ground water. This describes drinking water use, but excludes vapor

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

intrusion. Add vapor intrusion info. VI was handled with “aggressive active remediation” and vapor mitigation systems.

*Text modified*

- 13) Section 4.5, Fire Training zone bedrock table: there should be a similar table for alluvial detections, and an alluvial graph similar to Figure 5. ID wells WEFT11 and FT-13 following the table as bedrock or alluvial or multi-completion wells.

*The Fire Training Zone (FTZ) TCE Plumes contamination is localized in ‘bedrock’ – there is no saturated alluvium in the identified plume areas*

- 14) Section 4.8, Tech Evaluation Question A:

- be aware addenda to the 5YR guidance have been issued for the following since the last 5YR: asbestos, VI and IC evaluations.

*Comment noted.*

- Text does not address the VI objective.

*Text modified*

- Refer to appropriate figures in the tech evaluation.

*Text modified*

- Text only discusses carbon tet and TCE results. Discuss detections of the breakdown products. Most detections are below MCLs. 1,1-DCE was detected above the MCL in the Jan ’13 samples. Detections of breakdown products should be on a map.

*The identified contaminants of concern (COCs) for OU5 are trichloroethene (TCE) and carbon tetrachloride (CT). As discussed during the on-board reviews, 1,1-dichloroethen (DCE) is a breakdown product of 1,1,1-trichloroethane (TCA) – one detection in January 2013 in excess of Colorado Basic Groundwater Standard (CBGWS) from well MWMF03D (26 microgram per liter [ug/l]) -a bedrock well in the Building 1432 source area.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- “functioning as intended” language: Figure 3 shows concentrations are asymptotic and above the MCL in the main plume, and Figure 4 shows rising concentrations in the HQ plume. The objective is to attain standards. If VI is not a factor, this makes the remedy protective in the short term. Revise text.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- ICs—the CDPHE reference doesn’t relate to remedy performance, and can be omitted. There should be a map somewhere which shows the LUC area relative to the plume boundary. Of the ICs listed, mitigation systems and sub-slab systems are engineering controls, not ICs. The instruments that provide for no use of water are the actual IC. Restate.

*Text modified – see Section 4.4.4 -the State Environmental Covenants set forth the requirements for mitigation systems and groundwater use restriction.*

*Figure 1 was modified to show the boundaries for the State Environmental Covenants at the Former Lowry Air Force Base. A copy of the State Environmental Covenant for OU5 is included in Appendix F.*

- Add to the bullets: Construction oversight. Indicate what was observed during the site inspections/visits regarding how well the ICs are working. What will happen when the construction oversight phase is over?

*Construction oversight is not part of OU5. Construction oversight is handled via a CDPHE-approved Soil Management Program that is exclusive of the identified OUs being evaluated in this Second Five Year Review*

- 2<sup>nd</sup> to last bullet indicates injections are at the end of their usefulness. Refer to appropriate figures.

*Text modified*

**Response to Comments  
Second Five Year Review  
Former Lowry Air Force Base**

- Asymptotic concentrations above the MCL would be an example of an early indicator. Rising concentrations in the HQ area are another.

*Text modified*

15) Section 4.8, question B:

- The MCL for 1,1-DCE is 7 ug/l and it is exceeded in some samples. Discuss in this section.

*See note above in #14 re: 1,1-DCE*

- The dioxin tox factors were finalized in the last year. I can't recall if they apply here.

*Not applicable*

- The indoor air logic was well done: the tox factor change was explained, then whether it affects protectiveness.

*Comment noted*

- Question C is not meant to repeat information from question B.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

16) Section 4.8 tech assessment summary:

- Make text change based on comments above.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- The “no changes in land use” statement will need more support in Question A, particularly with respect to vapor intrusion.

*Text modified*

17) Section 4.8.1, issues: new issue—continued treatment will not bring TCE below the GW standard. Possible additional issues with VI, extent of ICs, and breakdown products.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- 18) Section 4.8.2, recommendations: no issues would normally mean no recommendations, but since there is at least one issue, the recommendation(s) should relate to it.  
*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*
- 19) Section 4.9, protectiveness statement: follow the format in the guidance. You are not expected to be, but already protective. “The remedy at OU5 is protective of human health and the environment. Potential exposure pathways have been limited through institutional controls and aggressive remediation of the ground water plumes. To be protective in the long term, . . . Post remediation monitoring in OU5 continues to evaluate contaminant concentrations and the effectiveness of the remedy.”  
*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*
- 20) Section 5.2, paragraph 2: may want to bullet the items itemized in the final cover design.  
*Text modified*
- 21) Section 5.8, Question A:
- Look over the RAOs and add a sentence or two to appropriate bullets describing how the remedy is performing with respect to them. Or revise presentation so that performance with respect to RAOs is obvious.  
*Text modified*
  - ICs—a map showing the landfill boundary and the LUC boundary will be needed.  
*Figure 1 shows landfill boundary and has been modified to denote the boundary of the State Environmental Covenant for OU2. A copy of the State Environmental Covenant for OU2 is included in Appendix F.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- Opportunities for optimization: none  
*Text modified*
  
- Early indicators—the fence repairs are a good example. The burrowing example reads as if they take care of themselves. It would be better to say the O&M Plan provides for repairs to the cap and the drainage systems.  
*Text modified*
  
- You’ve introduced things in the issues and recommendations tables which are better put in the technical evaluation  
*Text modified and tables deleted per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 22) Section 5.8, Question C: The text here repeats the protectiveness statement, and ignores the many interviews that indicated concern with the landfill redevelopment. You have to deal with that, and this is a good place.

Replace this text with a discussion of the landfill redevelopment plans in progress, what stage they are in, and what programs at the State will be worked with so that protectiveness will not be anticipated to change.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 23) Section 5.8, tech assessment summary: a little more description would help. The cap is effective in preventing exposures to human health and the environment, the vent system is successful in eliminating gas build-up, the O&M plan is effective in reducing trespass and maintaining the cap, the monitoring system confirms releases to ground water are not taking place, etc.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

24) Section 5.8.1 and 2, issues and recommendations:

- the issues brought up here should be introduced in Question A or C. If they are covered under O&M, and they don't affect protectiveness, they should not be included here.

*Deleted tables – these are covered under O&M and do not affect the protectiveness of the remedy. Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- Clarify if the scheduled removal is expected to be completed before the 5YR is signed, or say when it is scheduled to take place.

*The issues raised during the construction of the new Denver Fire Station near Alameda and Xenia is not associated with OU2.*

- Locate the fire station on a map.

*See response above*

- For Westerly Creek Dam, discuss in question C and locate on a map. Clarify if the vegetative cover is required for the cap.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- Milestone dates need to be in mo/day/year format. This will apply to OU5.

*Table 7 created to summarize recommendations per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews. Date format consistent with comment.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- 25) Section 5.9, protectiveness statement: use language from the guidance, and the Sept 2012 memo for writing the protectiveness statement: The remedy at OU2 is protective. Exposure pathways that could result in unacceptable risk are controlled through the use of the O&M plan and existing ICs.

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 26) Section 6.0, sitewide protectiveness statement: replace with: Because the remedial actions at OU5 are protective in the short term, the sitewide protectiveness statement is protective in the short term. To be protective in the long term, . . .

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 27) Section 7, next review:

- Due October 7, 2018,
- Instead of five years from the date of this review, it's ten years from the initial review. (per 2011 EPA policy memo, due dates are now pegged from an earlier due date).
- Specify Lowry AFB

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 28) Table 2—

- OU identification is missing for the most part. Include. Parcel numbers may also be useful to some audiences. RAOs are missing, but can be handled in your table X.

*Table modified (now Table 1) per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews. A new Table 2 includes the RAOs.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- where is the northwest neighborhood in this?  
*Not applicable to the Five Year Review. The asbestos in soil issues were addressed under the Lowry Soil Management Program.*

29) Figures

- There should be a figure showing the locations from Table 2.  
*The figures were modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*
- Show BAHCS, SARS, fire house, and other features mentioned in the text on an appropriate map.  
*Figure 1 was modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*
- There should be figures showing LUCs relative to plumes and the landfill.  
*Figure 1 was modified to illustrate the boundaries of the State Environmental Covenants relative to the OU5 plumes and OU2.*
- Show flow direction on plume maps and the landfill GW monitoring map (figure 14). Add to legend.  
*The figures were modified to include an indication of alluvial groundwater flow direction.*
- There should be a map showing breakdown products.  
*There are no mappable breakdown products for TCE when using chemical oxidation.*
- Figure 4 begs attention for this area in the text.  
*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- Figure 7: The side by side maps are great, but there are 2 legends on this figure, confusing things. Stick to the original legend and scales. Showing colors with different scales is deceiving. Wells should be placed on these maps, indicating the degree of control. Dots without names are sufficient on this general a map.

*The map legend was corrected on Figure 7.*

- Figure 8 shows well locations inside the plume, but not the control points which allow you to establish the outside of the plume. The map should make it clear that there are co-located or nested wells and identify deep vs. shallow designations in the legend. Here or on another figure, show the data as Figures 6, 9, and 11 do. Refer to these figures as needed in the HQ plume text areas.

*The figure (now Figure 11) was modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

- 30) App B—community involvement plans are generally updated at the time of the 5YR or just before. At a minimum, the elected officials and other contacts need updating.

*LAC anticipates updating the CIP in the later part of 2013. The LAC website ([www.lowryafbcleanup.com](http://www.lowryafbcleanup.com)) has recently been updated and is current with appropriate contact information.*

- 31) App C—the last question in most of the interviews asks if anyone else should be interviewed. It doesn't look like the follow up interviews took place. The cities should also be asked if the ICs are working to their satisfaction. This can be outside the formal interviews.

*Follow-up interviews and discussion were conducted if a response merited such action. Per Mr. Pivonka's recommendation, an additional questionnaire was sent to Ms. Christine O'Connor with Lowry United Neighborhood.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

- 32) App E---the cover page should indicate the title and date of the report this is excerpted from. Even so, this is not the best way to demonstrate CURRENT risk conditions. Sample 5YR risk evaluation attached.

*The title page has been updated. The Assessment of Risk included in the FOSET is appropriate for the intended use in this Second Five Year Review.*

**LRA Comments on the Former Lowry AFB Second Five Year Review**

Received August 28, 2013

1. ES-1 – Says “and the program continues today with investigations of sites identified during the Resource Conservation and Recovery Act (RCRA) Facility Assessment.” - Should that say “was completed with investigations...” or similar (P. 3-1 says these investigations are all closed/NFA.)

*Text modified*

2. 2.0 - Site chronology – Suggest clarification as to whether Buckley Annex is included since it is mentioned in ES and 2<sup>nd</sup> paragraph (DFAS) .

*Text modified in the last paragraph on Page 2-1.*

3. P. 2-1 – Last paragraph – should “LAC’s obligations” under privatization include cleanup of AF legacy conditions?

*Text modified in the last paragraph on Page 2-1.*

4. Page 3-5 – (Editorial - consistency) 5 yr or Five yr Review?

*Text modified throughout document for consistency.*

**Response to Comments**  
**Second Five Year Review**  
**Former Lowry Air Force Base**

5. P 4-10 – last sentence –Should that read “reduce concentrations below levels of concern”?– as remediation doesn’t eliminate a pathway – it reduces exposure. (Same comment in the first ¶ of 4.4.1 – reduce/eliminate exposure, not pathway)

*Text modified per discussions with AFCEC, CDPHE, EPA, and LAC at the on-board reviews.*

6. Table 2 – Suggest rewording the red text. Does text mean that the ROD includes information on the “remedy minus the covenant” or LAC evaluated the “remedy” minus the covenant?

*Table 2 has been changed to Table 1. Text modified for clarity. Note that Table 3 was created to summarize CDPHE issues raised with respect to several completed and ongoing response actions, including OU4.*

7. Fig 11 – should it show KMnO<sub>4</sub> injection area also? Or is KMnO<sub>4</sub> in the borehole from injections elsewhere

*The KMnO<sub>4</sub> present in well MWCT04 was from injections associated with the treatment of TCE in OU5 and was not associated with the treatment for carbon tetrachloride. Note that Figure 11 is now Figure 14.*

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**ADMINISTRATIVE RECORD**

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