TERRANEXT
A Woman Owned Business Enterprise
4050 E. Cotton Center Blvd., Suite 73, Phoenix, AZ 85040

First Quarter 2013
Water-Quality Report
West Van Buren Area (WVBA)
Water Quality Assurance Revolving Fund (WQARF) Registry Site
Phoenix, Arizona

Terranext Project No. 03103154

July 2013

Telephone: (480) 496-4100 Fax: (480) 496-4399 www.terranext.net

FIRST QUARTER 2013
WATER-QUALITY REPORT
WEST VAN BUREN AREA (WVBA)
WATER QUALITY ASSURANCE REVOLVING FUND (WQARF) REGISTRY SITE
PHOENIX, ARIZONA

Prepared For:

Arizona Department of Environmental Quality
Remedial Projects Unit
1110 West Washington
Phoenix, Arizona 85007

Prepared By:

REGISTERED GEOLOGIST
CERTIFICATE NO.
13937
ARTHUR J.
GORDON
7-29-13
Date Signed
ARIZONA, U.S.A.
Expires 12-31-14

Arthur J. Gordon, R.G.
Project Manager

July 2013

TERRANEXT

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

The following appendices are presented in the attached CD:

Appendix A	Historic WVBA Hydrographs
Appendix B	Field Sampling Records: First Quarter 2013
Appendix C	Investigative Derived Waste Documentation: First Quarter 2013
Appendix D	Historic WVBA Concentration Trends For 1,1-DCE, PCE, TCE
Appendix E	Laboratory Data Reports: First Quarter 2013
Appendix F	Level III Data Package: First Quarter 2013
Appendix G	RID Laboratory Data Reports: First Quarter 2013
Appendix H	Data Verification Documentation

LIST OF ABBREVIATIONS AND ACRONYMS

1,1-DCE	1,1-dichloroethene
1,1-DCA	1,1-dichloroethane
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ALSCo	American Linen Supply Company
ASRAC	Arizona Superfund Response Action Contract
CAS	Columbia Analytical Services
CERCLA	Comprehensive Environmental Response Compensation Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COC	Contaminants of Concern
COP	City of Phoenix
DO	Dissolved Oxygen
EC	Electrical Conductivity
FSAP	Field Sampling and Analysis Plan
GPM	Gallons per Minute
GC/MS	Gas Chromatography/Mass Spectrometry (Analysis)
HASP	Health and Safety Plan
IDW	Investigative Derived Waste
LAU	Lower Alluvial Unit
MAU	Middle Alluvial Unit
MCL	Maximum Contaminant Level
mg/L	Milligram per Liter
mL	Milliliter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTBE	Methyl-tertiary-butyl ether
ORP	Oxygen Reduction Potential
PCE	Tetrachloroethene
PDB	Passive Diffusion Bag
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RID	Roosevelt Irrigation District
RPD	Relative Percent Difference
Synergy	Synergy Environmental
TASOW	Task Assignment Scope of Work
TCA	1,1,1- trichloroethane
TCE	Trichloroethene

UAU	Upper Alluvial Unit
UAU1	Upper Portion of UAU
UAU2	Lower Portion of UAU
µg/L	Microgram per Liter
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WQARF	Water Quality Assurance Revolving Fund
WVBA	West Van Buren Area

SECTION 1.0 INTRODUCTION

1.1 BACKGROUND

Terranext was retained by the Arizona Department of Environmental Quality (ADEQ) to perform an extended task assignment scope of work (TASOW) for the West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Registry Site. The project is being performed in accordance with Arizona Superfund Response Action Contract (ASRAC) No. EV09-000AB and TASOW Procurement Reference No. 10-0047. The TASOW calls for the sampling and analysis of wells within and around the WVBA to assist in evaluating the nature and extent of contamination.

The WVBA is the areal projection of the western portion of a large commingled plume of contaminated groundwater in both the upper alluvial unit (UAU) and middle alluvial unit (MAU) in central Phoenix. These units are underlain by the lower alluvial unit (LAU), which does not appear to have been contaminated at this time. Multiple sources contribute to the plume. The primary contaminants of concern (COC) for the WVBA include the following volatile organic compounds (VOCs): tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (TCA), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), 1,1-dichloroethane (1,1-DCA) and 1,1-dichloroethene (1,1-DCE). Chromium is also a COC to a limited extent. Contaminated groundwater also enters the WVBA from the east; regional groundwater flow is in a general westerly direction.

1.2 OBJECTIVES

The objectives of the sampling were to evaluate the nature and extent of contamination within the WVBA, monitor contaminant levels and trends in areas of known contamination, evaluate groundwater elevations and flow directions, and to identify potential contaminant sources.

1.3 SCOPE OF WORK

In March and early April 2013, Terranext performed WVBA groundwater sampling. ADEQ identified 118 groundwater monitor wells within the WVBA to be sampled (Table 1.1 and Figure 1.1); of these, 102 wells were sampled. Access could not be obtained to one well, 86-01; 14 wells were dry (AVB37-04, 47-01, 53-01, 65-01, 87-01, 100-01, 101-01, 118-01, 138-01, and PS-1 through -5), and one private well had been abandoned (AVB111-01). Terranext also was provided samples from 25 Roosevelt Irrigation District (RID) wells and four RID surface water locations.

Field activities were conducted in accordance with the project Health and Safety Plan (BE&K/ Terranext, Sept. 2000), Quality Assurance Project Plan (BE&K/Terranext, April 2000), and Field Sampling and Analysis Plan (BE&K/Terranext, Dec. 2000). Water quality data collected as part of this task assignment will also be submitted to ADEQ in accordance with the Groundwater Data Submittal Guidance Document Version 3.4 (ADEQ, 2000) for inclusion in the ADEQ Groundwater Quality Database.

SECTION 2.0 FIELD ACTIVITIES

2.1 *FIRST QUARTER 2013 WATER LEVEL MEASUREMENTS*

The static depth to groundwater was measured to the nearest 0.01 foot with an electronic sounder. Water levels in most wells were measured from March 5 through 8, 2012. The water levels were measured from a known surveyed measuring point at each well; either the north side of the top of casing or another identifiable measuring point, such as a notch in the casing. Groundwater elevations were then calculated from the surveyed measuring point.

Following each water level measurement, dirt and rust were removed with a clean paper towel while the sounder was withdrawn from the well. The electric sounder was then decontaminated with a solution of Alconox® and water, followed by a rinse with tap water and a final rinse of deionized water.

First Quarter 2013 depth to groundwater measurements and groundwater elevations are presented in Table 2.1. Locations of wells completed within UAU1, UAU2, and the MAU, along with groundwater elevations and SURFER-generated contours, are depicted on Figures 2.1, 2.2, and 2.3 respectively. Historical hydrographs for WVBA wells are included in Appendix A.

Groundwater contours for the upper portion of the UAU (UAU1) are shown on Figure 2.1. In the eastern portion of the WVBA, groundwater flow is westerly at a gradient of about 12.5 feet per mile (between wells AVB57-01 and 120-01). In the western portion of the WVBA, two apparent depressions of the water table surface are present, one in the vicinity of Buckeye Road west of 59th Avenue, and the second in the vicinity of 75th Avenue and Interstate 10.

Groundwater contours for the lower portion of the UAU (UAU2) are shown on Figure 2.2. East of about 43rd Avenue, the UAU2 gradient in the eastern portion of the WVBA is westerly at about 11 feet per mile (between wells AVB106-03 and 120-02). West of about 43rd Avenue, the gradient flattens to about 4.5 feet per mile (between wells AVB120-02 and 139-01).

Groundwater contours for the MAU are shown on Figure 2.3. The MAU gradient in the eastern portion of the WVBA is westerly at about 14 feet per mile (between wells AVB68-04 and 120-03). West of about 43rd Avenue, the gradient flattens to about five feet per mile (between wells AVB120-03 and 60-01).

Hydrograph data presented in Appendix A documents an overall increase in UAU1 water levels since Third Quarter 2012; on average, UAU1 water levels increased about 9.2 feet in the WVBA. The greatest measured water level increase was about 25 feet in AVB88-01. Three UAU1 wells exhibited a water level decrease; about one foot in AVB74-01, two feet in AVB130-01, and ten feet in AVB135-01.

In UAU2 wells, an increase in water levels since Third Quarter 2012 was observed; exclusive of AVB69-01, on average, UAU2 water levels increased approximately 12 feet in the WVBA. The greatest measured water level increase was about 42 feet in AVB69-01; this is likely due to the shut-off of adjacent production well RID-104 since Third Quarter 2012.

In MAU wells, an increase in water levels since Third Quarter 2012 was observed; MAU water levels increased an average of about 15 feet in the WVBA. The greatest measured water level increase was about 42 feet in AVB69-01. One MAU well exhibited a water level decrease; three feet in AVB60-01.

2.2 *First Quarter 2013 Sampling Locations and Requested Analyses*

ADEQ generated a list of 118 monitor wells in the WVBA to be sampled during the First Quarter 2013 groundwater quality sampling event. Table 2.1 lists the wells and includes the following information for each well:

- ADEQ well ID,
- Facility and owner names and facility well number,
- Date and time of well visit (if applicable),
- ADWR registration number,
- Well construction information,
- Depth to water measured prior to well sampling,
- Groundwater elevation calculated from available data, and
- Additional comments or observations.

For this round of monitoring, sampling was performed as follows (identification of wells sampled by these different methods is included in Table 2.2):

- through the use of passive diffusion bags (PDBs) at wells selected by ADEQ personnel,
- purging prior to sampling, and
- collection of a grab sample with a bailer at wells where purging was not possible either due to insufficient water in the well for purging or no access for the three-inch diameter purge pump.

Groundwater samples collected from the WVBA were analyzed by XENCO Laboratories for purgeable volatile organic compounds (including 1,4-dioxane) by gas chromatography/mass spectrometry (GC/MS) analysis in accordance with U.S. Environmental Protection Agency (EPA) Method 8260B. Samples collected from PDBs were not analyzed for ethers, ketones, or alcohols because PDBs do not generally recover these compounds adequately due to their hydrophilic properties. In addition, monitor wells not sampled utilizing PDBs were analyzed for total and dissolved chromium by EPA Method 6010B.

2.3 *Groundwater Sampling Procedures*

Groundwater sampling activities were performed in accordance with the project health and safety, quality assurance, and field sampling and analysis plans. First Quarter 2013 sampling, including the RID wells, took place from March 8 through April 2, 2013.

2.3.1 *MONITOR WELL PURGING PROCEDURES*

Purging procedures followed during sampling are described herein. A clean three-inch diameter submersible pump was utilized for purging the four-inch diameter shallow wells. The pump was lowered into the middle of the water column. Purge rates ranged from between 2.5 to 12.0 gallons per minute (gpm). Field parameters (pH, temperature, and specific electrical conductance) were measured during purging and recorded onto Terranext field sampling forms. A summary of purge and parameter information is included in Table 2.2. Field sampling forms for the First Quarter 2013 are included in Appendix B.

Purging continued until three casing volumes were removed from the wells and the field parameters stabilized to within ten percent of the previous reading. If the field parameters did not appear to have stabilized, additional well volumes were removed, to a maximum of five well volumes to avoid producing large quantities of investigative derived waste.

Terranext retained a subcontractor to purge the deeper monitor wells. A three-inch diameter submersible pump was used for the deeper wells. The pump was lowered into the well and set at the middle of the water column. The deeper wells were purged at a rate of between 8.4 and 27.1 gpm. Purging continued until three casing volumes were removed from the wells and the field parameters stabilized to within ten percent of the previous reading. If the field parameters did not appear to have stabilized, additional well volumes were removed, to a maximum of five well volumes to avoid producing large quantities of investigative derived waste.

2.3.2 *MONITOR WELL SAMPLE COLLECTION*

Upon completion of the purge procedures described in Section 2.3.1, the pump was removed and the sample was collected with a two-inch diameter stainless steel Timco point source bailer. The sampling device was lowered to the desired collection interval via a steel cable. The Timco bailer has two ball-check valves, which allow water to flow through the device while lowering, and then trap the water inside the bailer during retrieval. A Teflon® sampling port specifically designed for VOC sampling using a flow-regulating valve to reduce aeration during the filling of sample vials was utilized to transfer the groundwater sample from the bailer into the laboratory supplied sample containers. After the sample was collected, the pump was removed from the well. Grab samples were collected from four wells (AVB38-04, 40-08, 68-02, and 97-01) that either did not have enough water in the well to sample through purging or there was insufficient access for the three-inch diameter purge pump. Analytical data from these wells are considered estimates as purging was not performed.

A sample label was affixed to each sample container at the time of collection. The label included the sample ID number, date and time sampled, analyses requested, preservatives used, and sampler's initials.

VOC samples (including 1,4-dioxane) were contained in four 40-milliliter (mL) volatile organic analysis (VOA) vials preserved with hydrochloric acid. Total chromium samples were contained in 500-mL plastic bottles preserved with nitric acid. Dissolved chromium samples were contained in separate unpreserved 500-mL plastic bottles; dissolved chromium samples then underwent laboratory filtering and subsequent preservation. Sample bottles were obtained daily from XENCO Laboratories and were prepared by the laboratory with the appropriate preservative. Samples were placed in a cooler with ice immediately after collection, and were delivered to the laboratory on the day of sample collection. Samples remained within the control of Terranext personnel until delivery to the laboratory and were not left unattended at any time.

2.3.3 Decontamination Procedures

Sampling equipment, pumps, bailers, discharge piping, etc. were decontaminated prior to each day's sampling and between sampling locations. Decontamination procedures consisted of scrubbing the equipment with coarse bristle brushes using a solution of Alconox® and tap water. A rinse with clean tap water followed with a final rinse with deionized water. A high-pressure steam cleaner was used to decontaminate subcontractor equipment between wells after saturating the equipment with an Alconox® solution.

The field procedures deviated from the QAPP with regards to the decontamination of some field equipment. The QAPP states in Section 2.2.6 that "Purging equipment such as submersible pumps will be steam cleaned in the field using deionized water and Alconox". A steam cleaner was not used for the decontamination of any equipment except as mentioned in the preceding paragraph. The effectiveness of Terranext's decontamination procedures has been verified by the collection of a daily field equipment blank, as explained in Section 2.4.2.

2.3.4 Passive Diffusion Bag Sampling

There were 56 wells that were sampled by retrieving PDBs previously placed in the wells; these wells are identified in Table 2.2. PDBs allow for the equilibration of VOCs within and outside the PDB; however, PDB samples are not recommended for the analysis of acetone, 2-butanone, 4-methyl-2-pentanone, 2-hexanone, and MTBE. Most PDBs were installed during Third Quarter 2012 sampling and collected between March 13 and 26, 2013. Upon retrieval of the PDB from each well, the PDB was immediately cut open and VOA vials were filled and handled as described in Section 2.3.2.

2.3.5 RID Well Sample Collection

Sampling of the RID wells was performed on April 2, 2013. Samples were collected by Synergy Environmental (Synergy), RID's consultant, by replacing a plug on the discharge pipe with a valved hose bib. Water was allowed to discharge from the hose bib for several minutes prior to sample collection. During this time, the field parameters of pH, conductivity, and temperature were measured and recorded (Table 2.3). Samples were collected by the filling of sample containers directly from the hose bib discharge. Sample containers were labeled and handled as described in Section 2.3.2. After collection by Synergy, the samples were then transferred to Terranext personnel following chain-of-custody procedures. Synergy collected seven split samples.

2.3.6 RID SURFACE WATER SAMPLING PROCEDURES

Sampling of RID surface water was performed on April 2, 2013. Surface water sampling procedures consisted of a measurement of each location's physical structure followed by a measurement of surface water field parameters. Physical measurements collected by Terranext included the following:

- Canal/lateral bottom width (feet)
- Water depth (feet)
- Canal/lateral width at water surface (feet)
- Water velocity (counts per second converted to centimeters per second)

Surface water field parameters were measured by Terranext using a YSI multiple meter sensor. The following parameters were measured at each sample location:

- Temperature
- pH
- electrical conductivity (EC)
- dissolved oxygen (DO)
- oxidation reduction potential (ORP)

Field measurements for each of the surface water sampling locations are summarized in Table 2.4. Additionally, using the channel and velocity measurements, surface water flow in cubic feet per second was estimated by Terranext for each location.

Sample containers provided by XENCO were filled by Synergy using a peristaltic pump. The samples were then transferred to Terranext personnel following chain-of-custody procedures. Synergy collected four split samples.

A sample label was affixed to each sample container at the time of collection. The label included the sample ID number, date and time sampled, analysis requested, and preservative used. VOC samples were contained in three 40 mL VOA vials preserved with hydrochloric acid. Sample containers were obtained from XENCO and were prepared by the laboratory with the appropriate preservative. Samples were placed in a cooler with ice immediately after collection, and were delivered to the laboratory on the day of sample collection. Samples remained within the control of Terranext personnel until delivery to the laboratory and were not left unattended at any time.

2.4 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field quality assurance/quality control (QA/QC) samples were employed for quality assurance. The QA/QC samples are used to verify that field sample collection, handling, transportation, and laboratory processes have not adversely affected sample integrity. These samples consisted of trip blanks, equipment blanks, and field duplicate samples. Field QA/QC samples are described herein.

2.4.1 *Trip Blanks*

Trip blanks provide a check on possible VOC contamination occurring during sample transport and storage. A laboratory prepared trip blank was supplied by XENCO to accompany each sample cooler on a daily basis. The samples and trip blank remained together on ice until delivery to the laboratory.

2.4.2 *Equipment Blanks*

Equipment blanks provide information on the effectiveness of decontamination procedures on non-dedicated sampling equipment. One equipment blank was collected on each day of purged sampling. Equipment blanks were collected after the sampling of at least one well.

Equipment blanks were collected after the final deionized water rinse of the decontamination process. Water deionized by reverse osmosis was poured into the sampling device and then collected into 40 mL VOA vials using the same process to collect groundwater samples. Equipment blanks were also collected in 500-mL bottles for total and dissolved chromium analysis. Equipment blanks were labeled and placed in the cooler immediately after collection.

2.4.3 *Duplicate Samples*

Field duplicate samples allow for an evaluation of analytical precision. Precision is the ability to reproduce a sample result. Field duplicate samples were collected at an approximate 1 in 10 frequency and submitted to XENCO. Results from these samples are presented and explained in Section 3.3.2.

2.5 *Investigative-Derived Waste Management*

For First Quarter 2013 sampling, most monitor well purge water was collected in a mobile 550-gallon tank transported between wells as they were sampled. A manhole entry permit was obtained from the City of Phoenix (COP) through the Water Services Department to dispose of the purge water into COP sewer system manholes identified by Terranext at various locations in the project area. A copy of the manhole entry permit (no permit number) is included in Appendix C; the permit expiration date was March 29, 2013. COP prohibited the discharge of purge water from one well: AVB20-03. Purge water from this well was drummed and then profiled/disposed as non-hazardous liquid waste; disposal documentation is also included in Appendix C.

SECTION 3.0 ANALYTICAL RESULTS

3.1 MONITOR WELL ANALYTICAL RESULTS

3.1.1 VOLATILE ORGANIC COMPOUNDS

During the First Quarter 2013, 102 existing monitor wells were sampled, and a total of 136 samples were submitted to the laboratory for analysis. Of these, 13 were trip blanks, 102 were groundwater samples, nine were equipment blanks, and 11 were duplicate samples.

A table of analytical results for groundwater is presented as Table 3.1.a.; QA/QC data is included as Table 3.1.b. Existing Aquifer Water Quality Standards (AWQSs) are also included in Table 3.1.a. Historic WVBA concentration trends for 1,1-DCE, PCE, and TCE are included as Appendix D. Level II data reports for the analyses, with the laboratory QA/QC data, are included in Appendix E. At the request of ADEQ, approximately ten percent of the data packages were also obtained as Level III data packages; these Level III data packages are included as Appendix F.

The contaminants of concern are PCE, TCE, 1,1-DCE, *cis*-1,2-DCE, 1,1-DCA, and TCA. These constituents are displayed below with their highest detected concentration in micrograms per liter (ug/L) and corresponding well for the last three rounds of sampling.

	March 2013			September 2012			March 2012		
Contaminant	Well	Unit	Conc	Well	Unit	Conc	Well	Unit	Conc
PCE	AVB119-01	UAU1	87.5	AVB119-01	UAU1	77.7	AVB47-01	UAU1	93.9
TCE	AVB132-01	UAU2	177	AVB134-02	UAU2	161	AVB132-01	UAU2	209
1,1-DCE	AVB82-01	MAU	29.4	AVB82-01	MAU	24.8	AVB132-01	UAU2	24.3
cis-1,2-DCE	AVB132-01	UAU2	31.7	AVB134-02	UAU2	23.8	AVB132-01	UAU2	38.4
1,1-DCA	AVB132-01	UAU2	10.4	AVB134-01	UAU1	8.54	AVB132-01	UAU2	11.9
TCA	AVB85-01	UAU1	0.600			ND	PS-2	UAU1	1.80

Of the listed contaminants, PCE, TCE, and 1,1-DCE exceed their respective AWQSs. Figures 3.1 through 3.7 depict concentrations of 1,1-DCE, PCE, and TCE from the First Quarter 2013 sampling event.

For this sampling round, collected samples were also analyzed for 1,4-dioxane. With a detection limit of 4.00 ug/L, 1,4-dioxane was not detected in any of the analyzed samples.

Contaminants of interest associated with petroleum products are benzene, toluene, ethylbenzene, xylenes and MTBE. These constituents are displayed below with their highest detected concentration (ug/L) and corresponding well for the last three rounds of sampling.

	March 2013 2012		September 2012		March 2012	
Contaminant	Well	Concentration	Well	Concentration	Well	Concentration
Benzene		Not Detected		Not Detected	AVB10-02	11.8
Toluene	AVB61-01	179	AVB82-02	7.66		Not Detected
Ethylbenzene		Not Detected		Not Detected		Not Detected
Xylenes		Not Detected		Not Detected		Not Detected
MTBE		Not Detected		Not Detected		Not Detected

It should be noted that 13 of the wells sampled using the subcontractor's pump rig (including AVB61-01) exhibited detectable concentrations of toluene. Historically, toluene has not been detected in these wells and toluene was not detected in the associated trip and equipment blanks. Accordingly, it appears that the detected toluene is a result of pump rig contamination, the subcontractor has been notified of this situation, and the toluene data has been flagged in Table 3.1.a.

3.1.2 CHROMIUM

Monitor wells purged for sampling during this round were also analyzed for total and dissolved chromium by EPA Method 6010B. The analytical results for the chromium sampling are summarized in Table 3.1.a and laboratory data sheets are included in Appendix E.

During this round of sampling, 11 wells exhibited chromium concentrations at or greater than the AWQS of 0.1 mg/L. A list of these wells is displayed below with their corresponding total and dissolved chromium concentrations in mg/L, along with concentrations observed during the previous two rounds of sampling. It should be noted that most of the dissolved chromium concentrations of these wells were less than the AWQS, suggesting the total chromium concentrations are likely the result of unfiltered sediment contained within the groundwater samples.

Well ID	Contaminant	Concentration (mg/L)		
		March 2013	September 2012	March 2012
AVB57-01 [1]	Total Cr	0.465	4.45	2.97
	Dissolved Cr	<0.0100	<0.0100	<0.0100
AVB61-01 [1]	Total Cr	0.109	0.252	NS
	Dissolved Cr	<0.0100	<0.0100	
AVB70-01 [1]	Total Cr	3.19	9.16	3.38
	Dissolved Cr	<0.0100	<0.0100	<0.0100
AVB71-01	Total Cr	1.21	0.0844	0.0735
	Dissolved Cr	<0.0100	<0.0100	<0.0100
AVB72-01	Total Cr	1.19	NS	2.70
	Dissolved Cr	<0.0100		0.0735
AVB73-01 [1]	Total Cr	2.32	4.12	0.690
	Dissolved Cr	<0.0100	<0.0100	<0.0100

AVB74-01 [1]	Total Cr	5.74	10.2	0.109
	Dissolved Cr	0.0322	0.0207	0.0318
AVB75-01 [1]	Total Cr	3.84	0.341	0.0630
	Dissolved Cr	<0.0100	0.0102	<0.0100
AVB76-01 [1]	Total Cr	0.361	0.760	0.213
	Dissolved Cr	0.0115	<0.0100	0.0157
AVB91-01	Total Cr	0.141	0.0394	0.0241
	Dissolved Cr	0.0208	0.0191	0.0198
AVB125-01	Total Cr	0.155	NA	NA
	Dissolved Cr	0.135		

NS – Not Sampled NA – Not Analyzed [1] Well developed early Feb/late March

To evaluate whether sediment in select wells may have been the reason for historical elevated total chromium concentrations, in late February and early March 2013, Terranext redeveloped 12 wells, including 7 of 11 wells identified in the above table. Of the 12 redeveloped wells, total chromium concentrations decreased in all but one: AVB75-01. Total chromium concentrations decreased to below the AWQS of 0.01 mg/L in five of the redeveloped wells but remained above the AWQS in seven of the redeveloped wells.

3.2 RID ANALYTICAL RESULTS

On April 2, 2013, 25 RID wells and four RID surface water locations were sampled with 34 samples submitted to the laboratory for analysis; sample locations are shown on Figure 3.8. Of the samples submitted, one was a trip blank, one was an equipment blank, and three were duplicate samples.

A comprehensive table of analytical results is presented as Table 3.2.a; QA/QC data is included as Table 3.1.b. For comparison purposes only, existing AWQSs are also included in Table 3.2. The Level II data reports for the analyses, with the laboratory QA/QC data, are included in Appendix G.

3.2.1 SURFACE WATER

The contaminants of concern in the WVBA are PCE, TCE, 1,1-DCE, *cis*-1,2-DCE, 1,1-DCA, and TCA. These constituents are displayed below with their highest detected concentration (ug/L) and corresponding surface water location.

PCE	Salt Canal west of RID-105	2.75
TCE	Salt Canal west of RID-105	2.97
1,1-DCE	Not Detected	-
cis-1,2-DCE	Salt Canal west of RID-105	1.02
1,1-DCA	Not Detected	-
TCA	Not Detected	-

AWQSs (for comparison only) were not exceeded in the four surface water samples. Contaminants associated with petroleum products were not detected.

3.2.2 GROUNDWATER

The contaminants of concern are displayed below with their highest detected concentration (ug/L) and corresponding well.

PCE	RID-92	14.7
TCE	RID-92	73.5
1,1-DCE	RID-95	9.23
cis-1,2-DCE	RID-95	9.62
1,1-DCA	RID-95	4.53
TCA	Not Detected	-

Of the previous contaminants, PCE and TCE were the most prevalent, one or both exceeding the AWQS of 5 ug/l in 14 of the 25 sampled wells. The AWQS of 7 ug/l for 1,1-DCE was exceeded in one well, RID-95. AWQSs were not exceeded in RID-86, -88, -90, -91, -93, -94, -101, -103, -104, -105, and –111R. Contaminants associated with petroleum products were not detected in any of the sampled RID wells.

3.3 FIRST QUARTER 2013 QA/QC SAMPLES

3.3.1 TRIP BLANKS

Fourteen trip blanks were submitted for First Quarter 2013 sampling; the trip blanks were analyzed by EPA Method 8260B. One VOC, carbon disulfide, was detected in the trip blank that accompanied the RID samples; results are included in Appendix G. Carbon disulfide was not detected in any of the samples analyzed that day; thus, the presence of carbon disulfide in the trip blank is likely a result of laboratory contamination. One VOC, 1,2,3-trichloropropane, was detected in the trip blank that accompanied groundwater samples collected on March 14, 2013; results are included in Appendix E. 1,2,3-trichloropropane was not detected in any of the samples analyzed that day; thus, the presence of 1,2,3-trichloropropane in the trip blank is likely a result of laboratory contamination.

3.3.2 DUPLICATE SAMPLES

Duplicate samples were collected on a frequency of approximately one for every ten groundwater samples. Purged monitor well duplicate sample containers were generally filled with water from the same bailer as the groundwater samples, minimizing the chance of obtaining water from a different depth interval. Fourteen duplicate samples were submitted to the laboratory for First Quarter 2013 sampling. The results of the duplicate samples are displayed and compared in Table 3.3. The duplicate samples generally compared favorably with the groundwater samples. Relative percent differences (RPD) exceeding 25 percent are as follows (it should be noted that concentrations were low, resulting in relatively larger RPDs even though absolute differences were small):

- AVB139-01 (total chromium 0.0190 vs. 0.0363 mg/l resulting in RPD of 62.57 percent)
- AVB125-01 (PCE 18.1 vs. 24.0 ug/l resulting in RPD of 28.03 percent)
- AVB132-01 (Chloroform 1.08 vs. 1.40 ug/l resulting in RPD of 25.81 percent)

As described in Section 3.4, this data was qualified by a third-party subcontractor.

3.3.3 Equipment Blanks

Equipment blanks were collected after the decontamination of sampling equipment. Ten equipment blanks, one for each day of purging/sampling, were collected and submitted for analysis for First Quarter 2013 sampling. Results are as follows:

- The equipment blank collected on March 13, 2013, exhibited a detectable concentration of dissolved chromium.
- The equipment blank collected on March 18, 2013, exhibited a detectable concentration of carbon disulfide; the presence of carbon disulfide in the equipment blank is likely a result of laboratory contamination.
- The equipment blank collected on March 19, 2013, exhibited detectable concentrations of total chromium, chloroform, PCE, and TCE.

As described in Section 3.4, this data was qualified by a third-party subcontractor. Based on the above results, field personnel were reminded of the importance of proper equipment decontamination.

3.4 Data Verification

Data verification and validation was performed by Laboratory Data Consultants (LDC), a subcontractor (Appendix H). LDC's review resulted in the addition of several qualifiers to the original laboratory data sheets. A summary of the qualified data is presented in Table 3.4, and indicates that, except for dissolved chromium in well AVB82-02, the concentrations of the constituents identified in the table should be considered estimated. According to Ms. Erlinda Rauto, LDC operations manager, the estimated concentrations were determined by LDC to be usable. Regarding well AVB82-02, the dissolved chromium should be considered not detected due to field blank contamination exceeding 20 percent of the sample concentration.

SECTION 4 SUMMARY AND RECOMMENDATIONS

Based upon the data generated as contained in this report, the following summary and recommendations are presented:

- In the eastern portion of the WVBA, UAU1 groundwater flow is westerly at a gradient of about 12.5 feet per mile. In the western portion of the WVBA, two apparent depressions of the water table surface are present, one in the vicinity of 63rd Avenue and Buckeye Road, and the second in the vicinity of 75th Avenue and Roosevelt.

- East of about 47th Avenue, the UAU2 gradient in the eastern portion of the WVBA is westerly at about 11 feet per mile. West of about 47th Avenue, the gradient flattens to about 4.5 feet per mile.

- The MAU gradient in the eastern portion of the WVBA is westerly at about 14 feet per mile. West of about 43rd Avenue, the gradient flattens to about five feet per mile.

- Hydrograph data documents an overall increase in UAU1 water levels since Third Quarter 2012; on average, UAU1 water levels increased about 9.2 feet in the WVBA. The greatest measured water level increase was about 25 feet in AVB88-01. Three UAU1 wells exhibited a water level decrease; about one foot in AVB74-01, two feet in AVB130-01, and ten feet in AVB135-01.

- In UAU2 wells, an increase in water levels since Third Quarter 2012 was observed; exclusive of AVB69-01, on average, UAU2 water levels increased approximately 12 feet in the WVBA. The greatest measured water level increase was about 42 feet in AVB69-01; this is likely due to the shut-off of adjacent production well RID-104 since Third Quarter 2012.

- In the MAU wells an increase in water levels since Third Quarter 2012 occurred; MAU water levels increased an average of about 15 feet in the WVBA. The greatest measured water level increase was about 42 feet in AVB69-01. One MAU well exhibited a water level decrease; three feet in AVB60-01.

- Based upon approximate measurements of lateral/canal structure and surface water velocity, flow in the RID Main Canal was calculated to range from 176.9 to 281.2 cubic feet per second (cfs), and flow in the Salt Canal at the sample location was 75.5 cfs.

- Regarding UAU1, 1,1-DCE, PCE, and/or TCE exceed their AWQS at multiple locations. VOC-contaminated groundwater appears to be entering the WVBA from the east, southeast, and north-central portions of this WQARF registry site. These results are similar to those observed during previous rounds of groundwater sampling.

- Regarding UAU2, PCE and TCE exceed their AWQS from near the northeastern corner of the site to just west of 67th Avenue. 1,1-DCE exceeds the AWQS from the eastern boundary to just west of 35th Avenue, similar to the last few rounds of groundwater sampling. TCE and 1,1-DCE-contaminated groundwater appears to be entering the WVBA from the east.

- Regarding the MAU, PCE, 1,1-DCE, and TCE exceed their AWQS at AVB82-01, and PCE exceeds its AWQS at AVB82-02. The nearest upgradient MAU monitor well to this location is AVB120-03, about three miles to the east.

- AWQSs (for comparison only) were not exceeded in the four surface water samples. Contaminants of interest associated with petroleum products were not detected.

- PCE and TCE were the most prevalent detected VOCs in the RID wells; one or both exceeding the AWQS of 5 ug/l in 14 of the 25 sampled wells. The AWQS of 7 ug/l for 1,1-DCE was exceeded in one well, RID-95. AWQSs were not exceeded in RID-86, -88, -90, -91, -93, -94, -101, -103, -104, -105, and –111R. Contaminants associated with petroleum products were not detected in any of the sampled RID wells.

SECTION 5 REFERENCES

ADEQ, 2000, Groundwater Data Submittal Guidance Document (Version 2.1)

BE&K/Terranext, April 2000, Quality Assurance Project Plan (QAPP), West Van Buren WQARF Registry Site, prepared for ADEQ

BE&K/Terranext, Sept. 2000, Site Specific Health and Safety Plan (HASP), West Van Buren WQARF Registry Site, prepared for ADEQ

BE&K/Terranext, Dec. 2000, Field Sampling and Analysis Plan (FSAP), West Van Buren WQARF Registry Site, prepared for ADEQ