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Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

RECEIVED
By Alameda County Environmental Health at 10:39 am, Aug 29, 2014

RE: **Light Non-Aqueous Phase Liquid (LNAPL) Recovery Work Plan**
Former Chevron Service Station 97127
Grant Line Road and Interstate 580
Tracy, California
RWQCB # RO0000185

Dear Mr. Detterman:

ARCADIS U.S., Inc. (ARCADIS), at the request of Chevron Environmental Management Company (Chevron), has prepared the enclosed Light Non-Aqueous Phase Liquid (LNAPL) Recovery Work Plan for Former Chevron Service Station 97127, located at Grant Line Road and Interstate 580 in Tracy, California.

I declare to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached document are true and correct. The enclosed report is submitted pursuant to the requirements of California Water Code Section 13267 (b)(1).

Sincerely,

Carryl MacLeod

Carryl MacLeod
Project Manager

ARCADIS
Infrastructure · Water · Environment · Buildings

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Roseville
California 95678
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www.arcadis-us.com

Mr. Mark Detterman, P.G., C.E.G.
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

ENVIRONMENT

Subject:
Light Non-Aqueous Phase Liquid (LNAPL) Recovery Work Plan
Former Chevron Service Station No. 97127
Grant Line Road and Interstate 580
Tracy, California
RWQCB # RO0000185

Date:
August 28, 2014

Contact:
Tonya R. Russi

Phone:
916.865.3168

Email:
Tonya.Russi@
arcadis-us.com

Our ref:
B0047959.0007

Dear Mr. Detterman:

On behalf of Chevron Environmental Management Company (Chevron), ARCADIS U.S. Inc. (ARCADIS) has prepared this *Light Non-Aqueous Phase Liquid* (*LNAPL) Recovery Work Plan* for the former Chevron service station 97127, located at the east side of Grant Line Road, just south of Interstate-580 in a rural area of Tracy, California (the site; Figure 1).

ARCADIS prepared this work plan as requested by Alameda County Environmental Health (ACEH), as indicated in their letter dated July 10, 2014. ACEH requested that interim LNAPL recovery be implemented at the site. During February 2014, ARCADIS submitted the *Additional Site Assessment Report* which included results of LNAPL baildown testing and LNAPL mobility analysis. The results of the analysis indicated that LNAPL recovery in the vicinity of monitoring well MW-1 could reduce the overall LNAPL mass in the area near the former underground storage tanks (UST). Additionally, LNAPL at the site is not migrating and the plume is stable. The purpose of this work plan is to implement interim LNAPL recovery activities at four onsite monitoring wells (MW-1, MW-3, MW-10 and MW-11) which contain measurable thicknesses of LNAPL. The details of the investigation are discussed below.

Site Description and Features

The site is a vacant lot located on the east side of Grant Line Road, just south of Interstate-580 in a rural area of Tracy, California (Figure 1). Former service station facilities at the site included fuel underground storage tanks (USTs) (two 10,000-gallon capacity and one 1,000-gallon capacity), one steel used oil UST (1,000-gallon capacity), one heating oil UST (750-gallon capacity), product line piping and pump islands, and station building (Figure 2). The USTs and associated piping were removed during April 1991. The site is currently a vacant lot.

Proposed Scope of Work

ARCADIS proposes the following scope of work to recover LNAPL via manual bailing at the four onsite monitoring wells, MW-1, MW-3, MW-10 and MW-11 as requested by ACEH. Figure 2 illustrates the well locations.

Site Specific Health and Safety Plan

As required by the Occupational Health and Safety Administration (OSHA) Standard "Hazardous Waste Operations and Emergency Response" guidelines (29 Code of Federal Regulations Section 1910.120), and by California Occupational Health and Safety Administration (Cal-OSHA) "Hazardous Waste Operations and Emergency Response" guidelines (California Code of Regulations Title 8, Section 5192), ARCADIS will prepare a site-specific health and safety plan (HASP) prior to commencement of fieldwork. Field staff and contractors will review the HASP before beginning field operations at the site.

LNAPL Removal via Bailing

Manual LNAPL recovery methods are used when there is no evidence of a migrating LNAPL body and risks appear low as observed at the site. Manual methods will result in limited immediate hydraulic capture and removal of LNAPL exceeding residual saturation from the formation outside the well bore.

Prior to LNAPL removal, LNAPL thickness will be gauged using an oil water interface probe at each monitoring well. The thickness of the LNAPL will be measured periodically for 5 to 10 minutes to ensure LNAPL levels equilibrate. LNAPL will be removed from each well using the Superbailer™ manufactured by EON Products, Inc. (EON). The Superbailer™ has an inverted conical tip which provides for a wide opening and allows easier retrieval of LNAPL. The Superbailer^{TM} has a diameter of 1.6-inch. MW-1 is a 4-inch diameter well therefore three Superbailers^{TM} will be taped together with electrical tape to recover as much LNAPL as feasibly possible from the 4-inch diameter well.

LNAPL will be removed from each well by using the Superbailer^{TM} for approximately 1 hour or when LNAPL has been removed to the extent practical, at each well location. The procedures outlined in the attached ARCADIS *SOP for LNAPL Baildown Test* (Appendix A) will be followed with the exception of removing LNAPL instantaneously. After one hour of LNAPL removal, or when LNAPL has been removed to the extent practical, LNAPL thickness will be measured in one minute intervals for fifteen minutes to monitor changes in hydraulic head for approximately one hour or until LNAPL thickness stabilizes. The frequency of measurements after the first 15 minutes can be adjusted based on site conditions. If LNAPL recovery rates are high, then measurements should be taken more frequently, however, if LNAPL recovery rates are lower, then the interval of time between measurements can be increased. Field staff will collect and record measurements of LNAPL and depth to water. Once the rate of recovery is slow enough, LNAPL recovery can be conducted at another location while returning periodically to collect measurements. The LNAPL and groundwater collected during LNAPL recovery events will be placed in proper waste management containers.

LNAPL recovery will be completed on a monthly basis through the end of 2014. The program will be evaluated on an ongoing basis to determine appropriate recovery event frequency and adoption of alternative recovery methods, if necessary, or until active LNAPL remediation is employed at the site, if deemed appropriate. After 2014, ARCADIS will evaluate the effectiveness of the interim LNAPL recovery activities and assess the onsite LNAPL plume.

The LNAPL, purged groundwater and personal protective equipment (PPE) generated during field activities will be containerized in Department of Transportation (DOT) – approved 55-gallon drums and temporarily stored on the subject property pending disposal. A Chevron disposal contractor will transport waste to an appropriate disposal or treatment facility.

Report

ARCADIS will include a detail of results and findings in the quarterly groundwater monitoring reports including LNAPL removal and recovery rates.

Schedule

ARCADIS is prepared to initiate field work upon the approval of this work plan by the ACEH.

If you have any questions or comments regarding the content of this work plan, please contact Tonya Russi by telephone at 916.865.3168 or by e-mail at Tonya.Russi@arcadis-us.com

Sincerely,

ARCADIS U.S., Inc.

Tonya Russi

Tonya R. Russi
Senior Scientist

David W. Lay, P.G., C.P.G.
Principal Geologist

PROFESSIONAL GEOLOGIST
DAVID LAY
No.8545
STATE OF CALIFORNIA

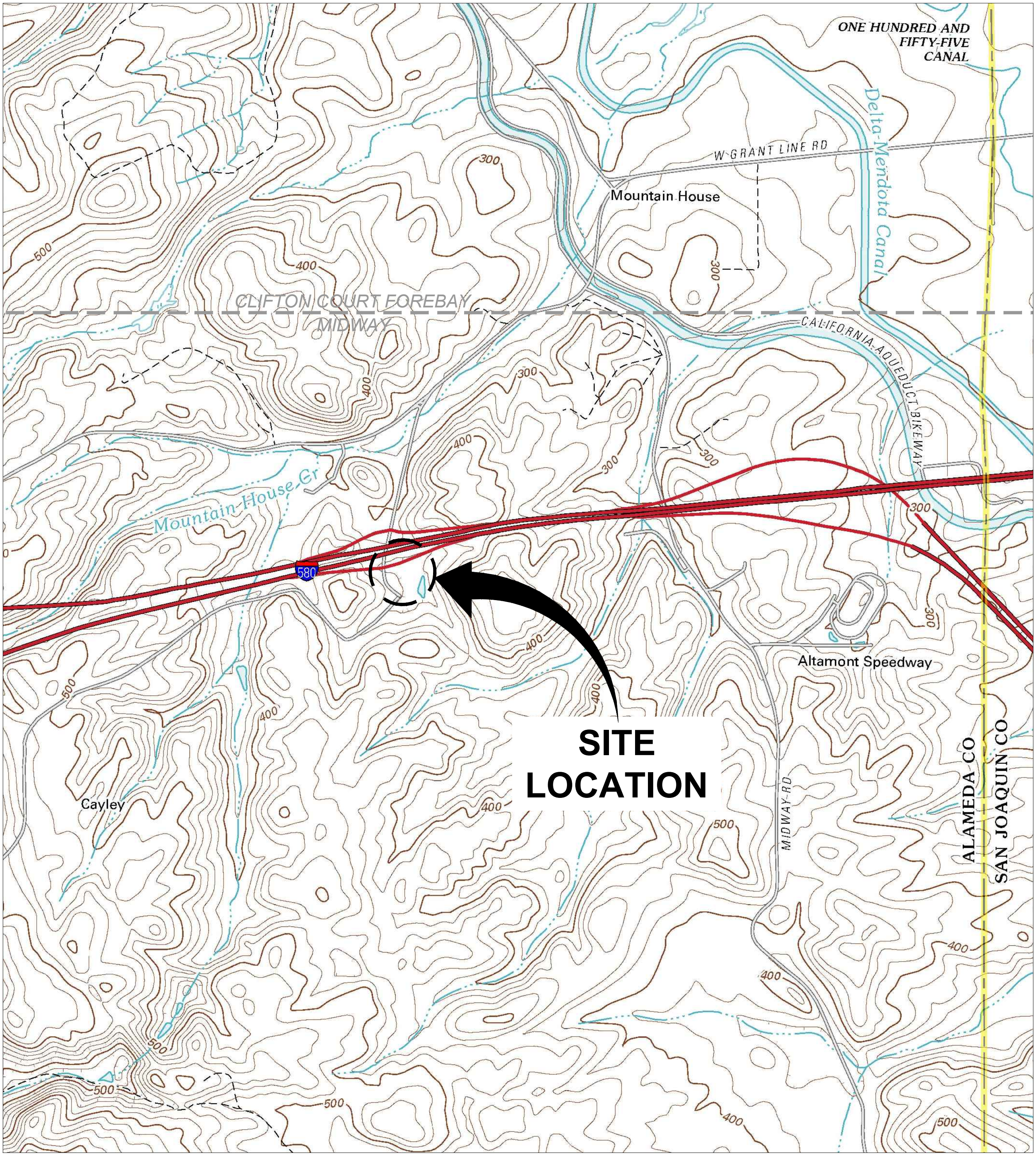
Enclosures:

Figure 1	Site Location Map
Figure 2	Site Plan
Appendix A	ARCADIS SOP for LNAPL Baildown Test

Copies:

Ms. Carryl MacLeod, Chevron Environmental Management Company
Mr. Ardavan Onsori, DM Livermore, Inc.
Mr. Wyman Hong, Zone 7 Water Agency

Figures



REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., MIDWAY AND CLIFTON COURT FOREBAY, CALIFORNIA, 2012.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.

CHEVRON SITE ID 97127
GRANT LINE ROAD AND INTERSTATE 580
TRACY, CALIFORNIA

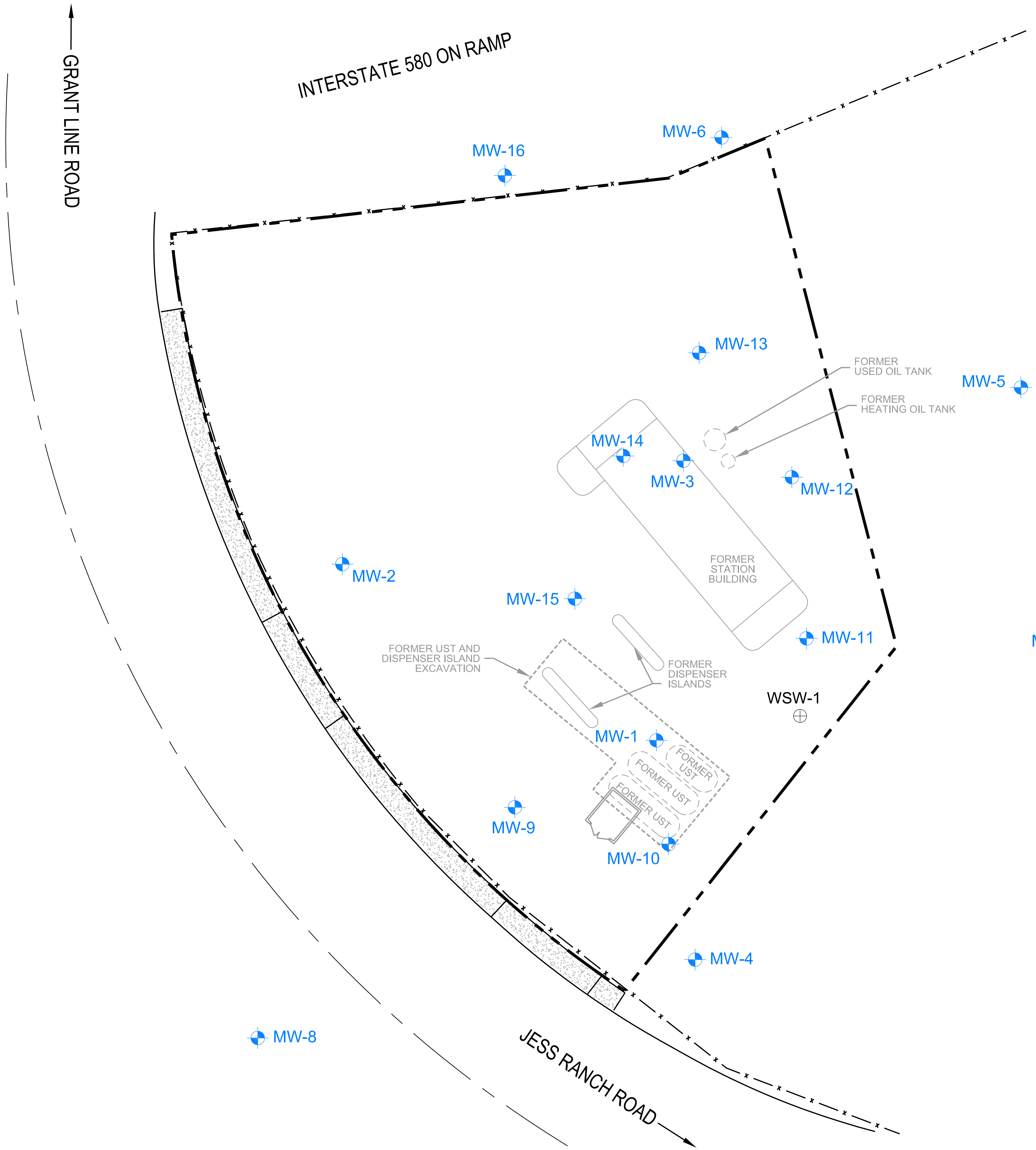
SITE LOCATION MAP

ARCADIS

FIGURE
1

CITY: SAN RAFAEL, CA (PETALUMA) DIV/GROUP: ENVCAD DB: J. HARRIS
C:\Users\jharris\Desktop\ENVCAD\B0047959\0004\00021\Q14\DWG\47959N01.dwg LAYOUT: 1 SAVED: 1/10/2014 1:51 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: SETUP1 PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 3/26/2014 11:01 AM BY: HARRIS, JESSICA

XREFS: IMAGES: Clifton Court Forebay 2012.jpg Midway 2012.jpg PROJECTNAME: ----



LEGEND

- PROPERTY BOUNDARY
- FENCE
- MW-1 MONITORING WELL LOCATION
- WSW-1 WATER SUPPLY WELL (LIVESTOCK)

NOTES:

1. MONITORING WELL LOCATIONS BASED ON SURVEY DATA PROVIDED BY MUIR CONSULTING, INC. EXCEL FILE 4285-02 GEO_XY.XLS.
2. MAP MODIFIED FROM CONESTOGA-ROVERS & ASSOCIATES (CRA) FIGURE ENTITLED "FIGURE 2 CONCENTRATION MAP" DATED FEBRUARY 21, 2012, DRAWING FILE xsite.dwg. ALL SITE FEATURES AND LOCATIONS ARE APPROXIMATE.
3. MONITORING WELL MW-8 DISCONTINUED FROM MONITORING AND SAMPLING PROGRAM.

0 40' 80'
GRAPHIC SCALE

CHEVRON SITE ID 97127
GRANT LINE ROAD AND INTERSTATE 580
TRACY, CALIFORNIA

SITE PLAN

ARCADIS

FIGURE
2

CITY: PETALUMA, CA DIV/GROUP: ENV DB: J. HARRIS/BAR PM: DAVID EVANS LAYOUT: 2 (2) SAVED: 8/5/2014 9:44 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: SETUP1 PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 8/5/2014 9:44 AM BY: ROBITAILLE, BEVERLY
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Appendix A

ARCADIS SOP for LNAPL Baildown Test

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Standard Operating Procedure for LNAPL Baildown Test

Rev. # 2

Rev. Date: January 14, 2010

Approval Signatures

Prepared by: ______________________________ Date: January 14, 2010
Jonathon J. Smith

Reviewed by: ______________________________ Date: January 14, 2010
Brad W. Koons, P.E.

I. Scope and Application

The objective of this Standard Operating Procedure (SOP) is to establish uniform procedures for conducting rising-head light non-aqueous-phase liquid (LNAPL) baildown tests to evaluate LNAPL conductivity (K_n) in the subsurface at a specific well location. The data generated from the LNAPL baildown test can be used, along with other site data, to evaluate LNAPL mobility and recoverability at a site. This SOP describes the equipment, field procedures, materials and documentation procedures necessary to determine LNAPL conductivity. The details within this SOP should be used in conjunction with project work plans.

This SOP applies to task orders and projects associated with ARCADIS. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plans or reports. If changes to the testing procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and documented in the project report.

II. Personnel Qualifications

Only qualified ARCADIS-related personnel will conduct LNAPL baildown tests. ARCADIS field sampling personnel will have sufficient “hands-on” experience necessary to successfully complete the LNAPL baildown test field work. Training requirements for conducting LNAPL baildown tests include reviewing this SOP and other applicable SOPs and/or guidance documents, instrument calibration training, and health and safety training.

ARCADIS field sampling personnel will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, first aid and cardiopulmonary resuscitation (CPR) training), as needed.

III. Equipment List

Equipment and materials used for conducting the LNAPL baildown tests may include, but are not limited to, the following:

- appropriate personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP)
- equipment decontamination supplies
- photoionization detector (PID) (see ARCADIS SOP: Photoionization Detector Air Monitoring and Field Screening)
- plastic sheeting
- oil absorbent pads
- stopwatch
- polypropylene rope
- clean disposable bailers
- oil-specific skimmer pump
- vacuum truck
- plastic bucket with lid
- plastic beakers or graduated cylinders (appropriately sized for anticipated NAPL/water recovery volume)
- Calculator
- appropriate field logs/forms
- oil-water interface probe (see ARCADIS SOP: Water Level Measurement)
- data logger and transducer
- white masking tape

- measuring tape with gradation in hundredths of a foot
- indelible ink pen
- monitoring well keys
- bolt cutters
- monitoring well locks
- field log book or PDA or field (computer) notebook

IV. Cautions and Procedure Considerations

Wells containing LNAPL for baildown testing should be selected based on project-specific objectives and a review of historical site data. It is good practice to select several baildown test wells to bracket the range of observed historical apparent LNAPL thickness measurements and LNAPL mobility/recoverability conditions across a given area. As a rule of thumb, apparent LNAPL thicknesses in wells used for baildown tests should be greater than or equal to the borehole diameter (Lundy and Parcher, 2007). Additional guidelines for selecting appropriate wells for LNAPL baildown testing include:

- Select wells located near the interior and exterior portions of the LNAPL plume(s)
- Select wells located in a variety of geologic materials, as feasible
- Consider the position of wells relative to groundwater and LNAPL flow direction
- Consider the potential of wells to exhibit different equilibrated apparent LNAPL thicknesses
- Select wells which contain different types of LNAPL, if present

In addition, understanding the areas affected by recent remediation efforts should be considered because these areas may not be representative of static subsurface conditions. Also, ARCADIS field sampling personnel must be aware of historical fluid levels as they compare to the conditions at the time of testing (i.e., the smear zone).

If higher LNAPL recovery rates are expected, larger diameter wells (4- to 6-inch-diameter casings) are generally preferred. The increased area of the wellbore seepage face for larger diameter wells will provide information that is applicable to a larger, more representative volume of aquifer material. However, if the expected recovery rate is low, smaller diameter wells are often preferred because the volume of the borehole is smaller relative to the formation recovery capacity. Further discussion on accounting for the well filter pack is presented in *A Protocol for Performing Field Tasks and Follow-up Analytical Evaluation for LNAPL Transmissivity using Well Baildown Procedures* (Beckett and Lyverse, 2002).

ARCADIS project personnel must confirm that the test wells have been properly developed. This cannot be overemphasized, as incomplete well development results in underestimates of LNAPL transmissivity (T_n) and LNAPL conductivity (K_n). See the ARCADIS SOP titled *Monitoring Well Development* for additional details.

ARCADIS field sampling personnel must verify that the air/LNAPL and LNAPL/groundwater interfaces occur within the screen interval. At a minimum, the piezometric head elevation in the well should occur below the top of the screen.

ARCADIS field sampling personnel will choose the most appropriate technique to evacuate the LNAPL from the well. These techniques include:

- **Manual bailer** — A 1¾-inch-diameter bailer will be used for 2-inch-diameter wells. For 4-inch-diameter wells, a 3-inch-diameter bailer will be used for LNAPL recovery. ARCADIS highly recommends using product recovery cups, which attach to the bottom of the bailer and maximize the surface area for LNAPL recovery (For example, the Superbailer™, manufactured by EON Products, Inc. has this feature built-in). This will allow for more complete LNAPL removal and more accurate recovery measurements.

- **Pumping** — LNAPL removal can be accomplished by using an oil-specific skimmer pump that operates at a pumping rate which exceeds the LNAPL recharge capacity. For shallow wells (< 25 feet below ground surface), a peristaltic pump may also be a useful, effective and appropriate mode of LNAPL removal.

- **Vacuum Truck** — If large LNAPL volumes are to be removed or extremely rapid recovery rates are anticipated, LNAPL removal can be accomplished using a vacuum truck. The vacuum extraction line is to be outfitted with a small-diameter stinger attachment that will be extended down the well and an in-line site glass to observe extracted fluid color for determination of whether LNAPL or groundwater is being extracted. Begin pumping at the LNAPL/air interface and slowly move the stinger tube downward to extract LNAPL. When groundwater recovery is observed indicating that the LNAPL has been evacuated withdraw the stinger tube and begin fluid level measurements.

Follow the sequential steps below for each baildown test well. Data collection is generally manual using an interface probe, although a data logger can also be used as long as it can sense either the fluid interfaces or the head change only with respect to LNAPL. Before performing an LNAPL baildown test, allow monitoring well water and LNAPL levels to equilibrate with atmospheric pressure. Gauge fluid levels periodically for 5 to 10 minutes to monitor changes in head. Monitoring wells without vents (flush mounts) may require more time to equilibrate with atmospheric pressure following well cap removal.

ARCADIS recommends taking LNAPL measurements initially in one-minute intervals and then adjusting the frequency of measurements thereafter, based on site-specific conditions. The rate of LNAPL recovery will usually slow over time unless the zone of interest is highly conductive. Once the rate of recovery is slow enough, a new baildown test can be initiated at another location, returning to take periodic measurements at the initial test well. Continue this process as long as it is viable based on soil characteristics, field logistics, well locations and data collection needs. Real-time examination of the data curves is the best indicator of data sufficiency. A plot of the change in LNAPL thickness over time may exhibit up to three theoretical segments:

1) initial steep segment that could reflect filter pack drainage

2) main production segment where the formation LNAPL gradient to the wells controls recovery

3) third segment where the diminishing formation LNAPL gradient produces a flatter recovery curve

Repeatedly introducing the oil-water interface indicator may alter the fluid-level measurements. Avoid splashing the probe into the water table or lowering the probe too far beyond the LNAPL-water interface depth. To avoid introducing surface soil or other material into the monitoring well, stage downhole equipment on a clean and dry working surface.

Two field personnel are recommended to adequately perform this test, one person to collect the data and one person to record the data.

V. Health and Safety Considerations

Overall, the Loss Prevention System™ (LPS) tools and the site-specific HASP will be used to guide the performance of LNAPL baildown tests in a safe manner without incident. A Job Safety Analysis (JSA) will be prepared for LNAPL baildown tests. The following specific health and safety issues must be considered when conducting LNAPL baildown tests:

- Monitoring for volatile organic compounds (VOCs) in the monitoring well head space must be conducted with a PID and recorded in the field logbook prior to initiating the LNAPL baildown test. PID readings will be compared to action levels established in the site HASP for appropriate action.

- Appropriate PPE must be worn to avoid contact with LNAPL during the baildown test.

- LNAPL removed from the test well must be managed with caution to avoid igniting the LNAPL material. LNAPL characteristics must be reviewed in the JSA, which will be prepared and reviewed by the project team prior to implementing the baildown test.

- LNAPL generated during the baildown test must be properly managed in accordance with facility and applicable regulatory requirements.

- Well covers must be carefully removed to avoid potential contact with insects or animals nesting in the well casings.

VI. Procedure

Specific procedures for conducting LNAPL baildown tests are presented below:

1. Identify site, well number, date and time on the LNAPL Baildown Test Log and field logbook or PDA, along with other appropriate LNAPL baildown testing information. An example LNAPL Baildown Test Log is provided in Attachment 1 to this SOP.

2. Place clean plastic sheeting and several oil absorbent pads on the ground next to the well.

3. Unlock and open the monitoring well cover while standing upwind from the well.

4. Measure the concentration of detectible organics present in the worker breathing zone immediately after opening the well using a PID. If the PID reading(s) exceed the thresholds provided in the HASP, take appropriate actions per the HASP. After monitoring the worker breathing zone, proceed to

monitor the well head space with the PID and record the PID reading in the field logbook.

5. Prepare a test log to record LNAPL recovery data. Initially, data should be collected very frequently. As time progresses and the LNAPL recovery rate slows, less frequent measurements will be required. In most cases, initial measurement increments of 1 minute are sufficient, with subsequent measurements farther apart as appropriate, based on observed rate of recovery during the first few readings. If LNAPL recovery rates are high, data should be collected more frequently. For lower LNAPL recovery rates, time intervals between measurements can be increased.

6. It is important to monitor rapid LNAPL recovery at a higher frequency, again as indicated by the observed recovery data.

7. Secure one end of the rope to the bailer and the other end to the well casing using a bowline knot.

8. Before beginning the baildown testing, measure and record static fluid levels using the oil/ water interface probe (i.e., depth to LNAPL and depth to groundwater) and document the well construction details. Using the conversion chart at the bottom of the test log, the measured LNAPL thickness and the well diameter, calculate and record the initial LNAPL volume in the well. Gauge fluid levels periodically for 5 to 10 minutes to monitor changes in head. Do not begin the test until the well has equilibrated. Ideally, one person will be responsible for lowering the bailer into the well and recording time intervals in the log, and another person will be responsible for lowering the water-level probe into the well and measuring and communicating water-level depths to the person recording information in the log.

9. To begin baildown testing, slowly lower the bailer or equivalent into the well until it is just below the LNAPL-water interface.

10. Set stopwatch. Wait to start the stopwatch until immediately after LNAPL removal is finished.

11. Evacuate LNAPL from the well by gently bailing, pumping, or vacuum recovery as described in Section IV above <u>while minimizing water production. One of the assumptions employed in the analysis of the baildown test data is that the LNAPL is removed from the well instantaneously. Thus, it is important to avoid spending excessive amounts of time (more than 5 minutes) removing LNAPL from the well.</u>

12. Record the time at which LNAPL removal is complete (or removed to the maximum practical extent) as the test start time. Begin measuring the elapsed time, starting with this point. Monitor depth to LNAPL and depth to water at the appropriate intervals, as discussed above (5). Measure fluid levels to the nearest hundredth of a foot with the oil-water interface probe and record, along with the corresponding time reading in minutes and seconds.

13. Transfer the LNAPL and groundwater evacuated from the well into an appropriately sized beaker or graduated cylinder. Record the volumes of LNAPL and groundwater on the Baildown Test Log (Attachment 1). If an LNAPL/water emulsion was formed during fluid recovery, allow time for LNAPL/water separation and make note of the observed emulsification.

14. Two to eight hours of data collection is usually sufficient. However, faster LNAPL recovery need not be monitored for extended periods, and slow recovering wells may benefit from follow-up readings the next day.

15. Place all LNAPL and groundwater collected during the test into an appropriate container for proper waste management.

16. Decontaminate the oil-water level indicator with a non-phosphate detergent and water scrub, a tap water rinse, a reagent grade methanol rinse, a second tap water rinse, a second methanol rinse, a third tap water rinse, and a triple rinse with distilled water (see SOP titled *Field Equipment Decontamination*).

17. Secure the monitoring well prior to leaving by replacing the well cap and/or cover and locking it.

VII. Waste Management

Rinse water, PPE and other waste materials generated during equipment decontamination must be placed in appropriate containers and labeled. Containerized waste will be disposed of in a manner consistent with appropriate waste management procedures for investigation-derived waste.

VIII. Data Recording and Management

ARCADIS field sampling personnel will record data using the LNAPL Baildown Test Log (Attachment 1). All information relevant to the test data beyond the items identified in the Baildown Test Log will be recorded using the field logbook, PDA or field computer. Field equipment decontamination activities and waste management activities will be recorded in the field logbook. Records generated as a result of implementing this SOP will be controlled and maintained in the project record files in accordance with client-specific requirements.

IX. Quality Assurance/Quality Control

ARCADIS project personnel will review the data set collected during the LNAPL baildown test in the field to determine whether or not the data are reasonable given site-specific conditions. For example, if the data indicates that LNAPL recovery is very rapid in a very low-permeability soil type, this may indicate that there are problems with the data set. If the data are questionable, the field equipment must be checked to confirm it is working properly and the test will be repeated, if possible. Depending on data quality objectives, a duplicate LNAPL baildown test may be conducted as a quality control check 48 hours after the initial test, assuming water levels and apparent LNAPL thicknesses have returned to static conditions.

Any issues that may affect the data must be recorded in the field log book so that analysts can consider those issues when processing the data.

X. References

Beckett, G.D. and Lyverse, M.A. 2002. *A Protocol for Performing Field Tasks and Follow-up Analytical Evaluation for LNAPL Transmissivity using Well Baildown Procedures, August 2002.*

Lundy, D. and Parcher, M. 2007. *Assessment of LNAPL Volume, Mobility and Recoverability for Recovery Systems: Design and Risk-Based Corrective Action. National Ground Water Association Short Course, November 2007.*

<u>ARCADIS SOPs Referenced Herein</u>:

Field Equipment Decontamination, Revision No.1, April, 2009.

Monitoring Well Development, Revision No.2, March, 2008.

Photoionization Detector Air Monitoring and Field Screening, Revision No. 0, July, 2003.

Water Level Measurement, Revision No. 1, March, 2004.

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Attachment 1: LNAPL BAILDOWN TEST LOG

LNAPL Baildown Test Standard Operating Procedure

Site Name		Test Well ID	
Date and Time In		Date and Time Out	
Personnel		Weather	

Well Construction Details

Top of Casing Elevation (ft amsl)		Screen Slot Size (in)	
Total Well Depth (ft)		Filter Pack Type	
Depth to Top of Screen (ft)		Depth to Bottom of Screen (ft)	
Well Casing Diameter (in)		Borehole Diameter (in)	

Initial Test Conditions

Static Depth to LNAPL (ft)		Test Date	
Static Depth to Water (ft)		Start Time	
LNAPL Thickness (ft)		Initial LNAPL Volume in Well (gal)	

LNAPL Removal Information

LNAPL Removal Method/Equipment		Time LNAPL Removal Begins	
Volume of LNAPL Removed (gal)		Time LNAPL Removal is Completed	
Volume of Groundwater Removed (gal)			

Baildown Test Data

Elapsed Time (min)	Depth to LNAPL (ft)	Depth to Water (ft)	Observations

(Modified after Beckett and Lyverse, 2002)

Well Casing Volumes	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
(Gal./Ft.)	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47