Prepared for:
Chevron Environmental Management Company
6001 Bollinger Canyon Road
San Ramon, California

Soil and Groundwater Investigation Work Plan

Chevron Site No. 1001152

State Route 274

Tekoa, Washington

ENSR Corporation
October 2007
Project No. 01231-341

ENSR | AECOM

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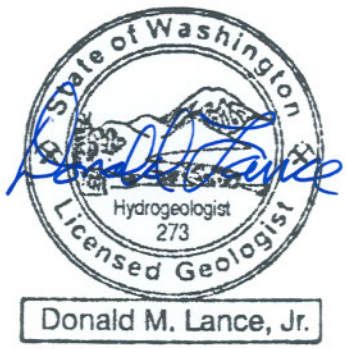

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Staff Specialist II

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Senior Geologist

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Contents

List of Figures

List of Attachments

1.0 INTRODUCTION

ENSR prepared this work plan to describe subsurface soil and groundwater investigation activities required to assess the potential presence of petroleum hydrocarbons (PHCs) from past operations at former Chevron Bulk Plant No.1001152, located in Tekoa, Washington (the Site) (Figure 1). The investigation objective is to obtain site-specific soil and groundwater data to determine if residual PHCs are present from leaks and spills that occurred during Chevron's operations. ENSR's investigative approach is to drill soil borings to collect soil samples, and install temporary monitoring wells to collect groundwater samples from areas where PHC spills or releases were most likely to have occurred. The proposed boring locations are shown in Figure 2. This work plan will be submitted to Chevron Environmental Management Company (EMC) for review before work starts on October 15, 2007. ENSR will prepare and submit to Chevron EMC a report of findings after the field and laboratory results have been compiled and interpreted.

2.0 SITE BACKGROUND

The subject property is located immediately east of the town of Tekoa, in Whitman County, Washington. Tekoa is located approximately 35 miles southeast of Spokane and 2 miles west of the Idaho border and the Coeur d'Alene Indian Reservation. The Site comprises a portion of the southwest quadrant of Section 18, Township 20 North, Range 46 East. According to the Whitman County Tax Assessor, the subject property is identified by the Parcel Number 2-0000-46-20-18-3901 and consists of approximately 1.14 acres of land.

The subject property is bordered to the north by Little Hangman Creek, agricultural land, and State Highway 274; to the south by Union Pacific Railroad tracks and agricultural land; and to the east and west by agricultural land. The subject property is accessible via a short roadway (part of the subject property) leading south from State Route 274.

ENSR performed a review for sources and receptors in September 2007 (Phase I of the Baseline Abandonment process, as outlined by the Chevron EMC, Retail and Terminal Business Unit *Guidelines to Evaluate Potential Environmental Risks for Property Transactions: Abandonment Process*, dated October 10, 2005; and according to ENSR's proposal to conduct the *First Phase: Review for Sources and Receptors*). The results of the sources and receptors review may be summarized as follows:

> The assessment included a review of documentation available from Chevron EMC and Chevron Business Real Estate Services (CBRES); a review of local governmental records; an analysis of historical aerial photographs, records, and maps; a review of prior environmental reports; an evaluation of federal and state governmental incident files (using Environmental Data Resources [EDR]); a review for potable and non-potable water well details; and interviews with selected local governmental officials.
>
> The subject property is not currently in active use. The only known structures remaining on the subject property are fencing, one or more utility poles, and a concrete bridge over Little Hangman Creek. State Highway 274 runs immediately north of the subject property and a Union Pacific Railroad right-of-way borders the property to the south. All other surrounding properties are agricultural land. The nearest sensitive receptor is Little Hangman Creek, which runs adjacent to the north of the property. There are no other sensitive receptors within 1/4 mile of the property.
>
> The subject property was purchased by the Standard Oil Company (now Chevron Corporation) in 1917. It was the site of a petroleum-based fuels bulk storage plant until the plant's closure in 1975. No information, other than (1) tax assessment records describing the facility, (2) a 1970 aerial photograph, and (3) a 1964 topographic map, is available on the use or conditions of the subject property during its operational lifetime as a bulk plant. The tax assessment records, from the 1960s and 1970s, provide a list of buildings and storage tanks on the property at that time. The records indicate that three 19,995-gallon tanks, of unknown

contents, were formerly located on the subject property. These tanks were located above ground and their long dimensions were horizontal, based on a site location map associated with this tax document. The tax assessment record also identifies the presence of an 18,137-gallon tank; however, the number preceding the text line appears to be a three, while the calculation of the value of the improvement indicates that there is one tank. No additional documents were found to clarify the number of 18,137 gallon tanks that were located on the subject property. The location of the 18,137-gallon tank(s) is unknown.

The storage tanks appear to have been removed from the subject property upon closure of the plant, based on a tax assessor document dated 1977, which states "tanks all gone." However, a CBRES e-mail dated October 1999, with the subject line "Tekoa/San Diego," states that "once the buildings are flatlotted and the tanks are pulled, etc. we may require environmental work," but it is unclear whether this refers to the Tekoa property or a San Diego property. There is, therefore, some ambiguity pertaining to the removal of all tanks located at the subject property. Buildings associated with the plant remained until 2005, including a garage, warehouse, office, and pump house. The approximate locations of former structures and tanks at the subject property are depicted in Figure 2. From the late 1970s to 2004 the subject property was leased to Cash Hardware Company, who used the Site to store John Deere farm equipment. Cash Hardware ceased using the property in 2004 and all buildings at the subject property were demolished in 2005, under Chevron direction.

A review of federal and state databases did not identify records for the subject property, any adjacent properties, or any properties within 1/4 mile of the subject property. No local governmental agencies had records on file related to the subject property. No prior environmental reports are known to have been prepared for the property.

In June 2004, based on an email dated June 15, 2004, a CBRES representative visited the property and made the observation of smoke rising from a pile of burning of pallets and other material, an open gasoline can (used to start the fire), locked buildings, buildings in dangerous conditions, and John Deere equipment stored throughout the Site. ENSR believes that areas where Cash Hardware stored equipment and burned debris at the subject property have the potential to present sources of groundwater and/or soil impacts at the subject property.

The long-term historic operations at the bulk plant have the potential for groundwater and/or soil impacts at the subject property. ENSR believes the historical operations associated with the garage, tanks, warehouse, pump house, and docks (wherever PHCs were stored, conveyed, or otherwise handled) are potential sources for adverse impacts. No other potential onsite or offsite sources were identified during this assessment.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

The subject property is located in a shallow valley formed by Little Hangman Creek. The elevation at the subject property is approximately 2,490 feet above mean sea level (msl). The major local topographic features are composed of (1) rolling hills to the east and south, rising to approximately 2,600 feet above msl; (2) Tekoa Mountain to the northwest, which rises to an elevation of approximately 4,000 feet above msl; and (3) the shallow valley formed by the main branch of Hangman Creek to the southwest.

Based on elevation profiles and topographic maps, surface runoff from the main portion of the property and from the access road flows toward Little Hangman Creek. Little Hangman Creek flows southwesterly and joins the main branch of Hangman Creek, which flows northwesterly, approximately 1/2 mile from the subject property.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (Flood Map Panel 5302050085B), the subject property is located in a 100-year flood plain. The area around Tekoa received

an average of 19.27 inches of annual precipitation from 1971 through 2000, according to Western Regional Climate Center data[1].

Based on topographic features, the groundwater flow direction beneath the subject property area is inferred to be toward Little Hangman Creek, that is, toward the northwest on the main portion of the property. No springs or wells are known to be present on the subject property. Depth to groundwater at the subject property is unknown. Well logs indicate that known wells within one mile of the property were drilled at depths greater than 120 feet below ground surface (bgs) with static groundwater encountered between 15 and 32 feet bgs (Attachment 1). Based on the close proximity of Little Hangman Creek, ENSR estimates that groundwater will be generally shallow, within about 10 to 15 feet below ground surface.

The subject property is located in the Columbia River Basin, a large flood basalt plateau between the Cascade and Rocky Mountains drained by the Columbia River. Geological information provided in the Environmental Data Resources database report for the Site (included in ENSR's 2007 Review for Sources and Receptors) indicates that the subject property is located in an area where the rock stratigraphic unit is identified as Cenozoic era, Tertiary system, and Miocene volcanic rocks series. The predominant soil types in the area of the subject property are:

- Thatuna, a moderately well drained silt loam with slow infiltration rates; typical depth to water table is 3 to 6 feet;
- Caldwell, a somewhat poorly drained silt loam with slow infiltration rates; typical depth to water table is 3 to 6 feet; and,
- Palouse, a well-drained silt loam with moderate infiltration rates; typical depth to water table is more than 6 feet.

These silt loam soils are underlain by basalt bedrock.

4.0 ACCESS AND UTILITY CLEARANCE

Because the subject property is owned by Chevron, ENSR has unrestricted access to conduct environmental investigations. Prior to the start of work, subsurface utilities will be marked. During the weeks preceding the field work, ENSR will use the services of the Washington Underground Utilities Notification Center to coordinate with local utility companies to mark the locations of utility lines in the areas of interest. Then ULS Services, a private utility locating contractor, will perform a detailed onsite subsurface survey using various location technologies.

As an additional safety measure, to avoid damaging underground lines that may be missed during the location survey, each borehole location will be cleared to a depth of eight feet below ground surface (bgs) using air knife and vacuum extraction techniques. If refusal is encountered before reaching eight feet bgs, then hand augering will be attempted to attain the desired depth. Within the interval from ground surface to eight feet bgs, hand auguring will be used to obtain soil samples at about three and six feet bgs for classifying soils and field screening.

A Borehole Clearance Review form (Attachment 2), representing all onsite boreholes, will be completed by ENSR prior to the start of soil boring activities. This is intended to ensure that all reasonable field precautions have been taken to locate subsurface lines or structures. The form asks a series of Yes/No questions to determine if clearance activities are complete and sufficient to allow the subsurface work to continue.

[1] Western Regional Climate Center. http://www.wrcc.dri.edu/

5.0 FIELD ACTIVITIES

As currently planned, a total of 13 soil borings will be advanced to depths between about 10 to 15 feet bgs, depending on the depth to groundwater (and depth to bedrock), at the approximate locations shown on Figure 2. A hollow-stem auger will be used for drilling. If refusal is encountered before reaching the anticipated depth, additional borings will be advanced, based on observed onsite conditions, including possible evidence of former subsurface product lines and railroad unloading areas. Potential alternate/additional boring locations also are presented on Figure 2. Cascade Drilling, a Washington-licensed drilling contractor from Woodinville, Washington, will serve as the drilling contractor. The total number of borings and locations and depths may be modified in the field for safety reasons, or based on interpretations from additional field observations, with the approval of the ENSR senior geologist and project manager.

Explanation of Soil Boring Locations

Based on historical Site use as a bulk plant, review of historical air photographs and tax assessment documents, and other considerations, ENSR has identified four onsite areas of concern: (1) the warehouse building and associated docks and loading rack, (2) the pump house, (3) the aboveground storage tank (AST) area, and (4) the garage and area along the north property line. Rationale for the boring locations is summarized as follows (refer to the boring locations shown on Figure 2):

Proposed Number of Boreholes	Area of Concern and Rationale for Selection of Location
6	Warehouse Building/Docks/Fuel Pumps. Assess potential releases from drum filling and/or drum handling, storage, and loading/unloading activities common to bulk plant facilities and potential spills/releases associated with former loading rack.
1	Pump house. Assess potential releases from pumps, valves, and conveyance lines related to transferring fuel throughout the Site.
3	ASTs. Assess potential releases from the former ASTs (at least three were present) and related appurtenances.
4	Garage, and North and West Property Lines. Assess potential releases from former garage and potential migration of PHCs in groundwater from the Site toward Little Hangman Creek.

Soil Sampling

Soil samples will be collected at each soil boring location using a split-barrel or split-spoon sampler. For details, please refer to ENSR Standard Operating Procedure (SOP) 7115, Subsurface Soil Sampling by Split Spoon (Attachment 3). The soils will be examined and logged by ENSR personnel under the responsible charge of a Washington-registered geologist. A written soil log will be recorded for each borehole, to include descriptions of: soil color, grain size, moisture content, texture, odor, staining, sheen, and soil classification according to the Unified Soil Classification System. As noted above, in the interval between ground surface and eight feet bgs (the interval removed during air knifing), ENSR will use a hand auger to collect samples at depths of about three and six feet bgs for soil logging.

Soil samples will be screened using a photoionization detector (PID) to assess the presence of volatile organic compounds from PHCs in the soil. For details, please refer to ENSR SOP 7315, Operation/Calibration of a Photoionization Detector (Attachment 3). PID screening will involve sealing a sample portion in a re-closable (Zip-Loc) bag and measuring the total ionizable gases in the bag headspace.

Based on soil observations and PID screening, the ENSR geologist will select at least one sample from each borehole for analysis. If there is no evidence of PHCs, then a sample for analysis will be collected from the zone of seasonal groundwater fluctuation. Groundwater may be near seasonal low levels (in October), depending upon cumulative rainfall following the summer dry season. Therefore, no soil samples for analysis will be collected below first encountered groundwater. However, additional samples for PID screening may be collected in the saturated zone, if screening suggests the presence of substantive contamination.

Samples for VOC analysis will be collected and preserved in the field using EPA Method 5035A procedures. This limits potential loss of VOCs through volatilization and biodegradation. Methanol preservative for the high-concentration method will be used. The soil VOC sampling procedure generally will follow the sampling instructions suggested by the Department of Ecology.[2]

All soil samples for analysis will be analyzed for the following analytes, as a minimum:

- BETX (benzene, ethylbenzene, toluene, and total xylenes) by EPA Method 8021B;
- Total petroleum hydrocarbons as gasoline (TPH-G) by Northwest Method NWTPH-Gx; and
- Total petroleum hydrocarbons as diesel (TPH-D) and heavy oil (TPH-O) by Northwest Method NWTPH-Dx, with acid/silica gel cleanup.

At least one soil sample from each of the four areas of interest (warehouse building/docks/loading rack, pump house, ASTs, and garage and north property), preferably a sample that most strongly indicates the presence of PHCs by field-screening criteria, will be analyzed for the following additional analytes:

- Volatile organic compounds (VOCs) by EPA Method 8260B;
- Polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270 SIM;
- Total lead by EPA 6000/7000 Series Methods.

A summary of the estimated number of soil samples to be collected and the analyses to be performed are as follows:

Soil Samples	BETX (EPA 8021B)	Gasoline (NWTPH-Gx)	Diesel and Heavy Oil (NWTPH-Dx)	VOCs (EPA 8260B)	PAHs (EPA 8270)	Total Lead (EPA 7420)
One or two samples from each boring	14 to 28	14 to 28	14 to 28	--	--	--
Up to 4 additional locations, based on field screening	--	--	--	4 to 8	4 to 8	4 to 8

[2] *Collecting and Preparing Soil Samples for VOC Analysis*, Washington Department of Ecology, Implementation Memorandum #5, Appendix A: Soil VOC Sampling Instructions, June 2004.

Soil sample containers will be marked using the following identification labeling:

1001152-SBX-ZZ-MMDDYY, where:

1001152 is the Chevron site number
X is the soil boring number (1 through 13)
ZZ is the sample depth in feet bgs
MMDDYY are the month, day, and year of sample collection

Groundwater Sampling

A minimum of 7 groundwater samples will be collected, from the locations shown on Figure 2. Additional samples may be collected for analysis, based on field observations, and following approval by the Project Geologist or Project Manager. Groundwater will be collected at each designated borehole location by installing a temporary well in the borehole. The temporary well will consist of one-inch-inside-diameter PVC well casing, the lower five feet perforated with 0.010-inch slots, extending from ground surface to the bottom of the open borehole. Groundwater samples will be obtained using a peristaltic pump and clean tubing at each sample location. Samples will be analyzed for the following analytes:

- TPH-G by NWTPH-Gx;
- TPH-D and TPH-O by NWTPH-Dx, with acid/silica gel cleanup;
- VOCs by EPA Method 8260B;
- Ethylene dibromide by EPA Method 8011:
- PAHs by EPA Method 8270 SIM; and
- Total and dissolved lead by EPA Method 6020.

Groundwater samples submitted for dissolved lead analyses will be filtered in the field.

In the event that light non-aqueous phase liquid hydrocarbons (LNAPL) are encountered on groundwater, samples of the LNAPL will be collected in one or more 40 mL vials. These samples will be submitted to the Chevron laboratory in Richmond, California, for fuel fingerprint analysis. A separate chain-of-custody form will be used for these samples (Attachment 4).

Groundwater sample containers will be marked using the following identification labeling:

1001152-SBX-MMDDYY, where:

1001152 is the Chevron site number
X is the soil boring number (1 through 13)
MMDDYY are the month, day, and year of sample collection

Each temporary well casing will be removed following sample collection.

Each borehole will be backfilled with hydrated bentonite.

Chain-Of-Custody

All sample containers will be supplied by the project analytical laboratory (Lancaster Laboratories) and will be labeled with the following information (as a minimum):

- Sample identification number (and depth of collection for soil samples);
- Date and time of collection;
- Project name and number;

- Type of preservative used (if any);
- Sample collector's name; and
- Types of analyses required.

Samples will be logged onto chain-of-custody forms and placed in iced coolers during field storage and transport to the laboratory. At the conclusion of field sampling, all samples will be securely packed and transported by express mail to Lancaster Laboratories in Lancaster, Pennsylvania, according to standard chain-of-custody procedures. Packing and shipping protocols are presented in Attachment 5.

6.0 EQUIPMENT DECONTAMINATION

The augers and boring tools, and all sampling tools with potential for contacting soil samples will be decontaminated between sample collection points by pressure washing or washing with a phosphate-free biodegradable detergent, such as Liquinox or Alconox, followed by rinsing with clean tap water and/or deionized water. Refer to ENSR SOP No. 7600, Decontamination of Field Equipment (Attachment 3).

7.0 INVESTIGATION-DERIVED WASTES

Waste soil (drill cuttings), decontamination wash water, and purge water generated during the soil and groundwater investigation will be stored in appropriately-labeled 55-gallon drums. Following the characterization of the wastes and completion of onsite work, all wastes will be transported by a Chevron-approved vendor, under a bill of lading, to an approved disposal facility.

8.0 HEALTH AND SAFETY

ENSR prepared a Site-specific health and safety plan (HASP), based upon the requirements of the Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120), and specific Chevron requirements. This HASP will be reviewed by all contractors and field personnel prior to beginning field work. The drilling contractors will use their own HASP and job safety analyses documents (JSAs) specific to the types of work or work tasks being performed. ENSR also prepared JSAs for each major field task. Copies of the ENSR and drilling contractor's HASP and JSA documents will be kept onsite for the duration of the field activities.

All ENSR and subcontractor personnel will be trained and qualified in the Loss Prevention System® prior to beginning work, according to Chevron requirements.

9.0 REPORTING AND SCHEDULING

ENSR will prepare a report of findings to document the soil and groundwater sampling activities and results.

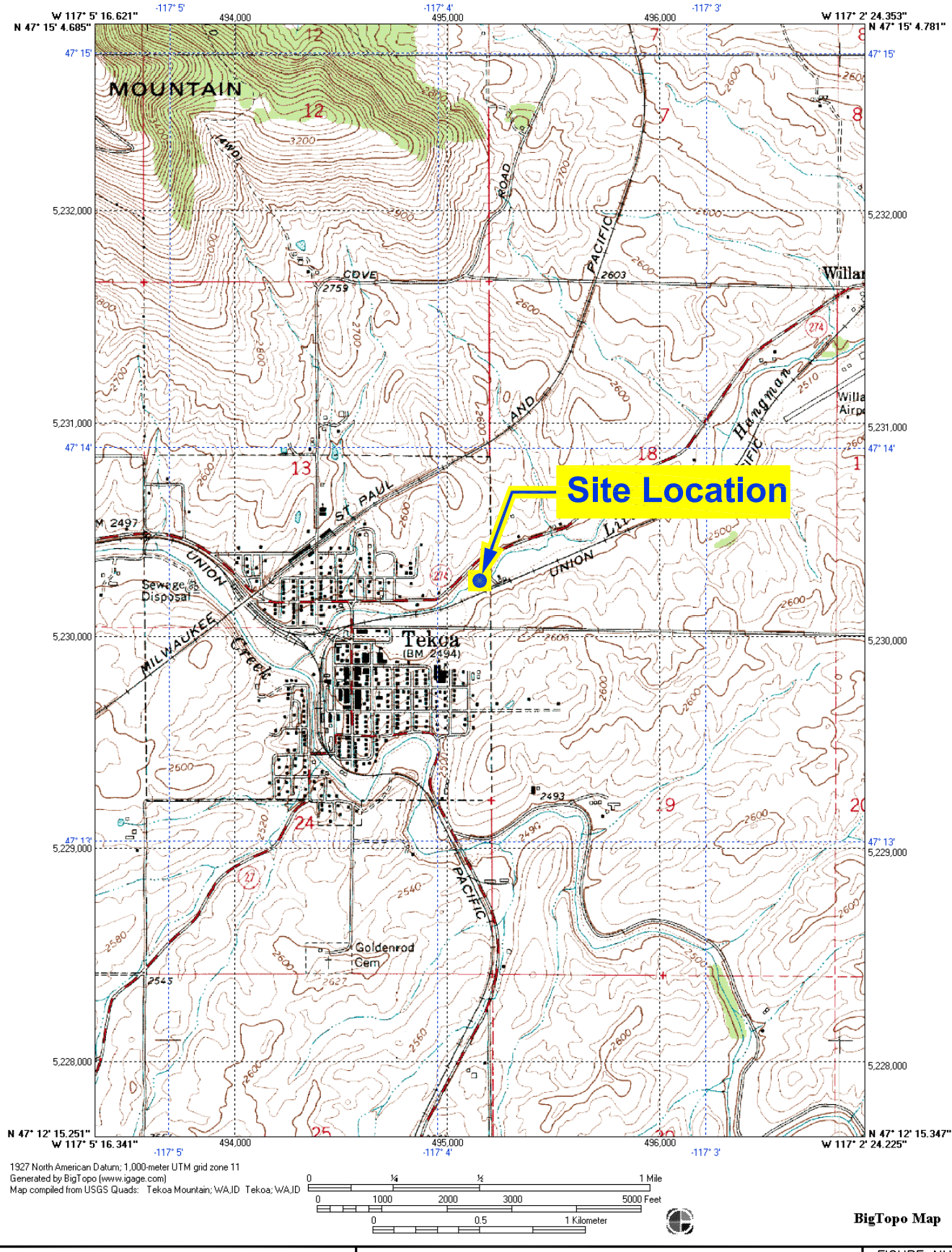
The estimated work schedule will proceed approximately as follows:

- One Call utility clearance activities will be conducted during the week of October 8, 2007;
- The detailed private utility location survey will be conducted on October 15, 2007;
- The air knifing, drilling, and sampling will start on October 17 and conclude on October 19, 2007.

- The report of findings will be prepared and submitted for Chevron's review within three weeks following receipt of the laboratory analytical results.

Figures

Tekoa-07



BigTopo Map

FILENAME: 0123134101A

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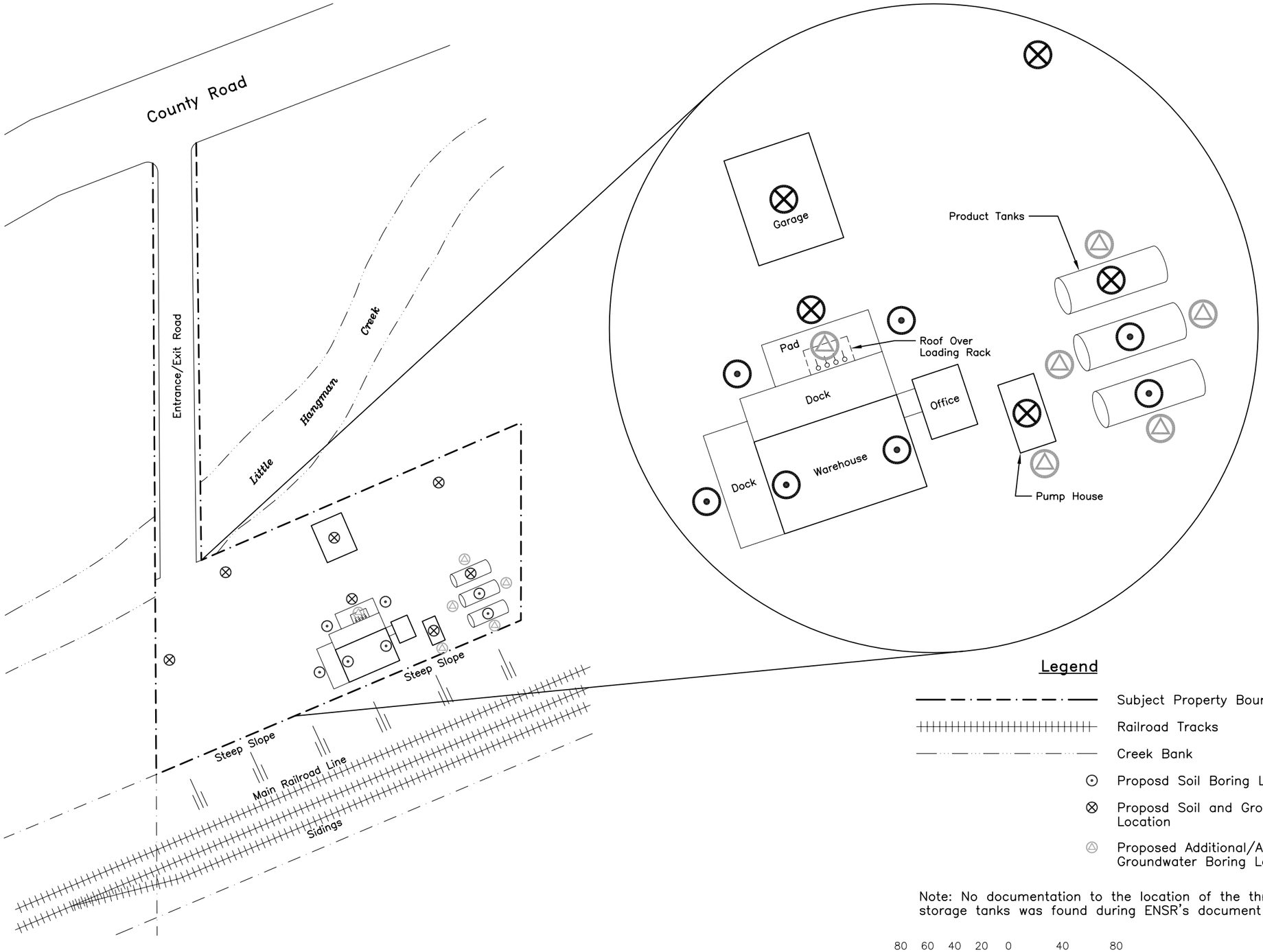
REDMOND, WASHINGTON 98052
PHONE: (425) 881-7700
FAX: (425) 883-4473
WEB: HTTP://WWW.ENSR.AECOM.COM

SITE LOCATION MAP

Chevron Facility No. 1001152
State Route 274
Tekoa, Washington

FIGURE NUMBER: 1

DRAWN BY:	DATE:	PROJECT NUMBER:	CHECKED BY:
KM	10/03/07	01231-341	JW



Legend

- Subject Property Boundary
- Railroad Tracks
- Creek Bank
- Proposd Soil Boring Location
- Proposd Soil and Groundwater Boring Location
- Proposed Additional/Alternative Soil and/or Groundwater Boring Location

Note: No documentation to the location of the three remaining storage tanks was found during ENSR's document review.

80 60 40 20 0 40 80
Approximate Scale in Feet

REVISIONS			
NO:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AL	KM	MM	JW

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PROPOSED SOIL AND GROUNDWATER BORING LOCATIONS

Chevron Facility No. 1001152
State Route 274
Tekoa, Washington

SCALE:	DATE:	PROJECT NUMBER:
1" = 80'	10/10/07	01231-341-0001

FIGURE NUMBER:
2

FILENAME:
0123134101D

Attachment 1

Washington Well Reports for Local Wells

WASHINGTON STATE DEPARTMENT OF ECOLOGY

WATER WELL REPORT
FOR AN EXISTING WELL

INSTRUCTIONS:
Use this form only if an original water well report was NEVER filed or is MISSING from Ecology records. Your well must be properly tagged prior to submitting this form. Please fill in all blanks as completely as possible. If information is not known, leave blank. After completing, mail the original form to: Wa State Dept of Ecology, PO Box 47600, Olympia, WA, 98504-7600, ATTN: Marian Bruner.

CURRENT USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

DIMENSIONS: Diameter of well 6 inches. Depth of completed well 115 ft. if known.

CONSTRUCTION DETAILS
Liner Installed ☒ Yes ☐ No ☐ Unknown
TYPE: ☐ PVC ☒ Steel ☐ Concrete Liner ☐ Other ☐ Unknown

Perforations: ☐ Yes ☐ No ☒ Unknown
SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☒ Yes ☐ No ☐ Unknown Mfr's Name _____
TYPE: ☒ Stainless Steel ☐ PVC ☐ Other
Diam. 6" Slot Size _____ from 110 ft. to 115 ft.

Gravel/Filter packed: ☐ Yes ☐ No ☒ Unknown
Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No ☐ Unknown If known, to what depth _____ ft
Materials used if known: ☐ Bentonite ☒ Cement

PUMP: ☒ Yes ☐ No Mfr's Name Westinghouse
Type: TURBINE H.P. 30

WATER LEVELS: Land-surface elevation above mean sea level 2,492 ft.
Static level 21 ft. below top of casing Date measured 9-15-06
Artesian pressure 0 lbs. per square inch Date measured 9-15-06
Well head has cap? ☐ Yes ☐ No (pump) Shut off valve? ☒ Yes ☐ No

WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? ☒ Yes ☐ No If yes, attach copy ☐ Unknown
Yield: 200 gal./min. with 10 ft. drawdown after 1 hrs.

Unique Ecology Well ID Tag No. AGG 172
Water Right? If yes, attach copy ☒ Yes ○ No
Property Owner Name City of Tekoa
Well Street Address 400 N. Washington St.
City Tekoa County: Whitman
Tax Parcel No. _____

LOCATION
An accurate location of your well is very important. The Township, Range, Section and 1/4, 1/4 can be found on your legal description or through your county asessor's office.

Sec 24 Twn 20 R 45 (EWM) or WWM — circle one

D	C	B	A
E	F	(G)	H
M	L	K	J
N	P	Q	R

This square represents one section of land, which is approx 640 acres. Within this section, circle the letter that best represents the location of the well within this section.

N / E

Lattitude/Longitude NOTE: Section, Township, Range still REQUIRED
Lat Deg N 47° Lat Min/Sec 13.543
Long Deg W 117° Long Min/Sec 04.512
☒ GPS ☐ Survey ☐ Topographic Map ☐ Computer Generated

Additional Information, if available:
☐ Location marked on topographic map (please attach)
☐ Location marked on air photo (please attach)

RECEIVED
MAR - 5 2007
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

CERTIFICATION: The information reported above is true to the best of my knowledge and belief.

☐ Driller ☐ Engineer ☐ Property Owner ☒ Other

Name James Thompson
Signature James Thompson
Driller License No. _____
Date Signed 3-1-07

Drilling Company _____
Address of person completing this form: PO Box 927
City, State, Zip Tekoa WA 99033

Original - Ecology

AGRI-SERVICE, INC.

WELL TEST LOG

Test No. _____ Date April 19 1978

Place Town of Tekoa Well Size _____ Static Level 32 ft.

Pump Setting 600 ft. Air Line 580 ft. Well Depth _____

Start Time	RPM Check	GPM Reading	Electric Sounder Read	Orifice Reading	Comments
9:35	/	/	32 ft.	/	mirky H_2O
9:45	/	1950	1850	89 ft. 57'	325 mirky H_2O
9:50	/	1950	2148	130 ft. 78'	27.5 mirky H_2O
10:00	/	1950	2400	130 ft. 98'	24.5 white clay like
10:15	/	1600	2565	146 ft. 114'	22.5 white
10:35	/	1600	2592	150 ft. 118'	21.4 white H_2O
10:40	/	1600	2625	180 ft. 148'	19.8 white H_2O
11:15	/	1800	2625	185 ft. 153'	19.1 white (clearing)
12:00	1800	2902	189 ft. 157'	20	18.5 white (clearing)
12:15	1950	3205	208 ft. 176'	83	18.3 white (clearing)
12:45	1950	3196	210 ft. 178'	82	18.0 milky to cloudy clearing
1:45	1950	3196	215 ft. 183'	82	17.5 milky to cloudy clearing
4:30	1950	3196	215 ft. 183'	82	17.5 milky to cloudy clearing
4:31	Reduced to 1600	2549	—	58	

AGRI-SERVICE, INC.

WELL TEST LOG

Test No. ________ Date April 10, 1978

Place Town of Tekoa Well Size ________ Static Level 32 ft.

Pump Setting 600 ft. Air Line 580 ft. Well Depth ________

Start Time	RPM Check	GPM Reading	Electric sound reading	Orfice Reading		Comments
1:35	1600	2545	476 ft. 149	54	17 2	Still cloudy but clearer
2:00	1600	2545	174 ft. 142	54	17 2	clearer
2:30	1600	2545	174 ft. 142	54	17 2	clearer
2:34	Reduced to 1325	2005	144 ft. 112	38	17 2	clearer
3:00	1325	2040	140 ft. 108	39	18 2	clear completely
3:19	1325	2040	139 ft. 107	39	19 1	clear completely
3:30	1325	2040	139 ft. 107	35	19 1	clear completely
3:31	Reduced to 1025	1500	114 ft. 82	17.5	18 3	clear completely
3:40 1025	1025	1500	112 ft. 80	17.5	18 8	clear completely
3:50	1025	1500	111 ft. 79	17.5	19 2	clear completely
4:00	1025	1500	110 ft. 78	17.5	19 3	clear completely
4:15	1025	1520	109 ft. 77	18	19 7	clear completely
5:00	1025	1520	107 ft. 75	18	20 3	clear completely
5:30	1025	1520	107 ft. 75	18	20 3	clear completely
5:31	shut down					Electricsounder reading: recovered in 1 min. 73 3 min. 69 ft. 10 min. 65 f. 45 min. 45 ft.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

RECEIVED
SEP 10 1979
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL

State of Washington
DEPARTMENT OF ECOLOGY
East 103 Indiana
SPOKANE, WA. 99207

PROOF OF APPROPRIATION OF WATER

APPLICATION NUMBER

PERMIT NUMBER: G3-25643P

NAME OF PERMITTEE: City of Tekoa

POST OFFICE ADDRESS: P. O. Box 220 | (CITY) Tekoa | (STATE) Washington | (ZIP CODE) 99033

ACTUAL SOURCE OF APPROPRIATION: three wells

PURPOSE OR PURPOSES WATER IS USED FOR: Municipal Supply

DATE WATER WAS COMPLETELY APPLIED TO PERMITTED USE: May 16, 1979

IF USED FOR IRRIGATION: NUMBER OF ACRES ACTUALLY IRRIGATED:

IF SOURCE IS A WELL, IS AN ACCESS PORT NOW INSTALLED: [XX] YES [ ] NO

MONTHS DURING WHICH WATER IS USED: Continuously

PUMP SIZE: New Pump (Well #4) is 100 Hp; others are 20 Hp and 25 Hp

ACTUAL AMOUNT WITHDRAWN OR DIVERTED FROM PERMANENT SYSTEM:
New Well (#4) = 1,000
Wells #1 and #2 = 550
[XX] GPM [ ] CFS Total = 1,550

HAVE ALL PROVISIONS AS REQUIRED BY PERMIT BEEN ACCOMPLISHED: [XX] YES [ ] NO

IF NO, EXPLAIN:

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS USED (USE ADDITIONAL SHEET IF NECESSARY)

Area served by the City of Tekoa, within Sections 13 and 24 T. 20N., R. 45 E.W.M., and Sections 18 and 19, T. 20N., R. 46 E.W.M.

OK FOR PA
MAILED PROOF 9/12.

STATE OF WASHINGTON,
County of Spokane } ss.

I, James C. Baker, being first duly sworn, depose and say that I have read the above and foregoing proof of appropriation; that I know the contents thereof; and that the facts therein stated are true.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of September, 19 79.

James C. Baker

Subscribed and sworn to before me this 7th day of September, 1979.

Notary Public

ECY 070-25

WASHINGTON STATE DEPARTMENT OF ECOLOGY

WATER WELL REPORT
FOR AN EXISTING WELL

INSTRUCTIONS:
Use this form only if an original water well report was NEVER filed or is MISSING from Ecology records. Your well must be properly tagged prior to submitting this form. Please fill in all blanks as completely as possible. If information is not known, leave blank. After completing, mail the original form to: Wa State Dept of Ecology, PO Box 47600, Olympia, WA, 98504-7600, ATTN: Marian Bruner.

CURRENT USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other

DIMENSIONS: Diameter of well 4 inches. Depth of completed well 180 ft. if known.

CONSTRUCTION DETAILS
Liner Installed ☒ Yes ☐ No ☐ Unknown
TYPE: ☐ PVC ☒ Steel ☐ Concrete Liner ☐ Other ☐ Unknown
Perforations: ☐ Yes ☐ No ☒ Unknown
SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☒ Yes ☐ No ☐ Unknown Mfr's Name ____
TYPE: ☒ Stainless Steel ☐ PVC ☐ Other
Diam. 4" Slot Size ? from ? ft. to ? ft.

Gravel/Filter packed: ☐ Yes ☐ No ☒ Unknown
Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No ☐ Unknown If known, to what depth ? ft
Materials used if known: ☐ Bentonite ☒ Cement

PUMP: ☒ Yes ☐ No Mfr's Name US MOTORS
Type: TURBINE H.P. 20

WATER LEVELS: Land-surface elevation above mean sea level 2,492 ft.
Static level 21 ft. below top of casing Date measured 9-15-06
Artesian pressure 0 lbs. per square inch Date measured 9-15-06
Well head has cap? ☐ Yes ☐ No (Pump) Shut off valve? ☒ Yes ☐ No

WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? ☐ Yes ☐ No If yes, attach copy ☒ Unknown
Yield: 75 gal./min. with 10 ft. drawdown after 1 hrs.

Unique Ecology Well ID Tag No. AGG 173
Water Right? If yes, attach copy ☒ Yes ○ No
Property Owner Name City of Tekoa
Well Street Address 400 N. Washington St.
City Tekoa County: Whitman
Tax Parcel No. ____

LOCATION
An accurate location of your well is very important. The Township, Range, Section and 1/4, 1/4 can be found on your legal description or through your county asessor's office.

Sec 24 Twn 20 R 45 (EWM) WWM *circle one*

D	C	B	A
E	F	(G)	H
M	L	K	J
N	P	Q	R

This square represents one section of land, which is approx 640 acres. Within this section, circle the letter that best represents the location of the well within this section.

N E S

Latitude/Longitude NOTE: Section, Township, Range still REQUIRED
Lat Deg N 47° Lat Min/Sec 13.543
Long Deg W 117° Long Min/Sec 04.512
☒ GPS ☐ Survey ☐ Topographic Map ☐ Computer Generated

Additional Information, if available:
☐ Location marked on topographic map (please attach)
☐ Location marked on air photo (please attach)

RECEIVED
MAR - 5 2007
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

CERTIFICATION: The information reported above is true to the best of my knowledge and belief.

☐ Driller ☐ Engineer ☐ Property Owner ☒ Other

Name James Thompson
Signature James Thompson
Driller License No. ____
Date Signed 3-1-07

Drilling Company ____
Address of person completing this form. PO Box 927
City, State, Zip TEKOA WA 99033

Original - Ecology

Ecology is an Equal Opportunity Employer.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

RECEIVED
SEP 10 1979
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL

State of Washington
DEPARTMENT OF ECOLOGY
East 103 Indiana
SPOKANE, WA. 99207

PROOF OF APPROPRIATION OF WATER

APPLICATION NUMBER	PERMIT NUMBER
	63-25643P

NAME OF PERMITTEE
City of Tekoa

POST OFFICE ADDRESS	(CITY)	(STATE)	(ZIP CODE)
P. O. Box 220	Tekoa	Washington	99033

ACTUAL SOURCE OF APPROPRIATION
three wells

PURPOSE OR PURPOSES WATER IS USED FOR
Municipal Supply

DATE WATER WAS COMPLETELY APPLIED TO PERMITTED USE	IF USED FOR IRRIGATION: NUMBER OF ACRES ACTUALLY IRRIGATED
May 16, 1979	
IF SOURCE IS A WELL, IS AN ACCESS PORT NOW INSTALLED [XX] YES [ ] NO	MONTHS DURING WHICH WATER IS USED: Continuously

PUMP SIZE
New Pump (Well #4) is 100 Hp ; others are 20 Hp and 25 Hp

ACTUAL AMOUNT WITHDRAWN OR DIVERTED FROM PERMANENT SYSTEM
New Well (#4) = 1,000
Wells #1 and #2 = 550
[XX] GPM [ ] CFS Total = 1,550

HAVE ALL PROVISIONS AS REQUIRED BY PERMIT BEEN ACCOMPLISHED	IF NO, EXPLAIN
[XX] YES [ ] NO	

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS USED (USE ADDITIONAL SHEET IF NECESSARY)

Area served by the City of Tekoa, within Sections 13 and 24 T. 20N., R. 46 E.W.M., and Sections 18 and 19, T. 20N., R. 46 E.W.M.

OK FOR PA
MAKE PROOF DATE.

STATE OF WASHINGTON,
County of Spokane } ss.

I, James C. Baker, being first duly sworn, depose and say that I have read the above and foregoing proof of appropriation; that I know the contents thereof; and that the facts therein stated are true.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of September, 19 79

James C Baker

Subscribed and sworn to before me this 7th day of September, 1979.

Notary Public

ECY 070-25

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. .....
Permit No. G3-25644

(1) OWNER: Name CITY OF TEKOA Address TEKOA WASHINGTON

(2) LOCATION OF WELL: County WHITMAN NE ¼ SW ¼ Sec. 24 T. 20 N., R. 45 W.M.

Give distance from section or subdivision corner 340' W - 70' S of Center

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 16" inches.
Drilled 1400 ft. Depth of completed well 1400 ft.

(6) CONSTRUCTION DETAILS: 0 — 25 FT 20

Casing installed: 16" Diam. from +2 ft. to 636 ft.
Threaded ☐ 12" Diam. from 901 ft. to 1025 ft.
Welded ☒ 10" Diam. from 971 ft. to 1281 ft.

Perforations: Yes ☒ No ☐
Type of perforator used TORCH CUT
SIZE of perforations ¼ in. by 4 in.
360 perforations from 965 ft. to 995 ft.
540 perforations from 1100 ft. to 1145 ft.
480 perforations from 1200 ft. to 1240 ft.
360 1250 1280

Screens: Yes ☐ No ☒
Manufacturer's Name .....
Type ..... Model No .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 45 ft.
Material used in seal CEMENT GROUT
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

(7) PUMP: Manufacturer's Name .....
Type: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level ≈2529 ft.
Static level 32 ft. below top of well Date 3-24-78
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? CONTRACTOR
Yield 3196 gal./min. with 189 ft. drawdown after 2 hrs.
" 2545 " " 142 " " 3 "
" 1520 " " 75 " " 8 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	107	10 min	65		
5 min	73	45 min	45		
60					

Date test 4-10-78
Bailer test ..... gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water 65° Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
TOP SOIL	0	5
BASALT HARD	5	104
GREEN CLAY & SAND ★	104	140
BASALT BLACK MED	140	306
GREY SAND ★	306	332
CLAY BROWN	332	363
BASALT BLACK MED	363	455
SANDY CLAY SOME WOOD	455	473
BROWN SANDY CLAY	473	614
BASALT BLACK HARD	614	908
SAND STONE BROWN MED	908	971
QUARTZITE GREY FRAC ★	971	1015
QUARTZITE GRAVEL + CLAY	1015	1056
CLAY RED	1056	1091
QUARTZITE ★	1091	1218
QUARTZITE FRAC. ★	1218	1289
QUARTZITE + CLAY ★	1289	1239
ANDESITE GRAVEL ★	1239	[illegible]
WELL ROUNDED		1297
[illegible]		
QUARTZITE GRAY	1297	1375
QUARTZITE FRAC. ★	1375	1400

9/141
3000 gal
2000
MUD
★ WATER
Tekoa 7½

Work started 2-15 19 78 Completed 3-24 19 78

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME HOLMAN DRILLING CORP
(Person, firm, or corporation) (Type or print)

Address E 3410 9TH AVE SPOKANE WN

[Signed] Arnold E Holmen PRES.
(Well Driller)

License No. 0189 Date 4-24 19 78

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No _____
Permit No _____

(1) OWNER Name Palouse Seed Co. Address P.O.Box 291, Fairfield, Wa. 99012

LOCATION OF WELL County Whitman NE ¼ SE ¼ Sec 18 T 20 N R 46E W.M.
Bearing and distance from section or subdivision corner Parcel "B"

(3) PROPOSED USE Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK Owner's number of well (if more than one)
New well ☒ Method Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS Diameter of well 6 inches
Drilled 145 ft Depth of completed well 145 ft

(6) CONSTRUCTION DETAILS
Casing installed 6 Diam from +1 ft to 145 ft
Threaded ☐ 8 Diam from +1 ft to 29 ft
Welded ☒ Diam from ____ ft to ____ ft

Perforations Yes ☐ No ☒
Type of perforator used
SIZE of perforations ____ in by ____ in
perforations from ____ ft to ____ ft
perforations from ____ ft to ____ ft
perforations from ____ ft to ____ ft

Screens Yes ☐ No ☒
Manufacturer's Name
Type Model No
Diam Slot size from ft to ft
Diam Slot size from ft to ft

Gravel packed Yes ☐ No ☒ Size of gravel
Gravel placed from ft to ft

Surface seal Yes ☒ No ☐ To what depth? 18 ft
Material used in seal Bentinite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H.P

(8) WATER LEVELS Land surface elevation above mean sea level 2600 ft
Static level ft below top of well Date
Artesian pressure flowing lbs per square inch Date
Artesian water is controlled by (Cap valve etc)

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes by whom? driller
Yield 100 gal/min with 0 ft drawdown after 1 hrs

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
1					

Date of test
Bailer test gal/min with ft drawdown after hrs
Artesian flow g p m Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG

Formation *Describe by color character size of material and structure and show thickness of aquifers and the kind and nature of the material in each stratum penetrated with at least one entry for each change of formation*

MATERIAL	FROM	TO
Brn silty top soil	0'	1'
Clay,brn,dry,hrd	1'	8'
Clay,tan,moist,firm	8'	12'
Basalt,heav fract,blk,tan sed,med hrd	12'	15'
Basalt,occas fract,drk gray,med hrd	15'	26'
Basalt,drk gray,hrd	26'	79'
Basalt,occas fract,drk gray,med hrd,water 1 GPM	79'	112'
Basalt,drk gray,hrd	112'	132'
Basalt,heav fract,blk,hon comb,brn sed,med hrd,water 20 GPM Artesian	132'	135'
Basalt,drk gray,med hrd	135'	137'
Basalt,heav fract,blk,hon comb,heav brn sed,m hrd,water 100 + Artesian	137'	139'
Basalt,occas fract,drk gray,med hrd	139'	145'

Work started Nov. 30n 1981 Completed Dec. 4 1981

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

NAME ZINKGRAF'S WELL DRILLING COMPANY
(Person firm or corporation) (Type or print)

Address P.O.Box 4341,Spokane Wa,99202

[Signed] James J. Zinkgraf (Well Driller)

License No 0544 Date Dec. 8 1981

(USE ADDITIONAL SHEETS IF NECESSARY)

12/15/81 TeTaa

ECY 050-1 20

WATER WELL REPORT
STATE OF WASHINGTON

WRC 751

Application No 12276
Permit No G3-20167P

Copy with ... Copy

Name Howard E Wise Address Tekoa, Wash ...

LOCATION OF WELL. County Whitman 650 ft S & 1050 ft E W ¼ W ¼ Sec. 18 T. 20 N., R. 46 E W.M.

Distance from section or subdivision corner ?613

PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☒ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS Diameter of well 6 inches
Drilled ... ft Depth of completed well 120 ft.

(6) CONSTRUCTION DETAILS
Casing installed: 6" Diam from 0 ft to 21 ft
Threaded ☐ " Diam from ft to ft.
Welded ☐ ✓ Diam from ft to ft.

Perforations Yes ☐ No ☒
Type of perforator used
SIZE of perforations in by in.
perforations from ft to ft
perforations from ft to ft
perforations from ft to ft

Screens Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam Slot size from ft to ft
Diam Slot size from ft. to ft.

Gravel packed Yes ☐ No ☒ Size of gravel
Gravel placed from ft to ft

Surface seal Yes ☒ No ☐ To what depth? 21 ft.
Material used in seal Cement & bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H.P.

(8) WATER LEVELS Land-surface elevation above mean sea level 2540 ft
Static level ft below top of well Date
Artesian pressure 10 lbs per square inch Date
Artesian water is controlled by Valve (Cap valve etc)

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes by whom?
Yield gal/min with ft drawdown after hrs

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
constant flow of approx. 50 gals. per minute					

Date of test
Bailer test gal/min with ft drawdown after hrs
Artesian flow 150 g.p.m Date Feb 71
Temperature of water 51° Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation

MATERIAL	FROM	TO
Clay	0	12
broken basalt	12	20
solid black basalt	20	120
water	120	121

Confined
150 gpm
36.5 af/yr
30 af
10

Tekoa

Work started 19 Completed 19

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

NAME Findlay Well Drilling (Person firm or corporation) (Type or print)

Address 285 Parsons Clarkston ...

[Signed] Bill E. Findlay (Well Driller)

License No 62 Date Feb , 1971

OK Two 7-73

(USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

WBC 751 | Application No. 12296
Permit No. G-7001671P

(1) OWNER: Name Howard E Stead Address Pateros Wash

(2) LOCATION OF WELL: County Okanogan 650 ft S & 1850 ft E of NW ¼ Sec 18 T 20 N, R 24E W.M.
Bearing and distance from section or subdivision corner ?

RECEIVED
FEB 6 1973
DEPARTMENT OF CONSERVATION
WATER RESOURCES DIVISION

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled ____ ft. Depth of completed well 120 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 21 ft.
Threaded ☐ ____" Diam. from ____ ft. to ____ ft.
Welded ☐ ____" Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 21 ft.
Material used in seal Cement + bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: HP

(8) WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level ____ ft. below top of well Date
Artesian pressure 10 lbs. per square inch Date
Artesian water is controlled by Valve (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: ____ gal/min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Constant flow 7 approx. 30 gals. per minute
Date of test
Bailer test ____ gal/min. with ____ ft. drawdown after ____ hrs.
Artesian flow 130 g.p.m. Date Feb 71
Temperature of water 51° Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Clay	0	12
Lapilli tuff	12	20
and light basalt	20	120
Water	120	121

COPY (EXEMPT) FROM WR FILE

Work started ____ 19__ Completed ____ 19__

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ferd Day Well drilling (Person, firm, or corporation) (Type or print)
Address 285 Pearson Blackfoot Ida
[Signed] Bill E Findley (Well Driller)
License No. 62 Date Feb, 19 71

OK Tmd 2-15-71

S. P. No. 1158—OS—(Rev. 6-71) (USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

206588

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction

○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

CURRENT

Notice of Intent No. W248802

Unique Ecology Well ID Tag No. AAU 279

Water Right Permit No. G3-25643

Property Owner Name City Of Tekoa

Well Street Address Tekoa Golf Course

City Tekoa **County** Whitman

Location SW 1/4-1/4 NW 1/4 Sec 19 Twn 20 R 46 (EWM or WWM) circle one

Lat/Long (s, t, r Still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☒ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned ☐ Deepened *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 8 inches, drilled 180 ft. Depth of completed well 180 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 8" Diam. from +2 ft. to 45 ft. ☒ Liner installed 6" Diam. from 10 ft. to 180 ft. ☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☒ Yes ☐ No

Type of perforator used Drilled

SIZE of perfs 1 in. by 1 in. and no. of perfs 60 from 110 ft. to 160 ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 45 ft. 45

Material used in seal Bentonite

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Surface Depth of strata 26

Method of sealing strata off Bentonite Seal 8/25/06

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 21 ft. below top of well Date 8/25/06

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by Cap (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 300+ gal./min. with stem set at 160 ft. for 4 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water 48° Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
12" Brown Dirt	0 ft	8 ft
12" BrownClay	8 ft	18 ft
12" Dark Brown Clay	18 ft	26 ft
12" Broken Black basalt	26 ft	33 ft
12" Hard black basalt	33 ft	45 ft
8" Hard basalt	45 ft	105 ft
8" Medium hard fractured basalt	105 ft	140 ft
8" Broken basalt	140 ft	158 ft
8" Hard basalt	158 ft	172 ft
8" White course sand	172 ft	180 ft

RECEIVED SEP 25 2006 DEPARTMENT OF ECOLOGY WELL DRILLING UNIT

RECEIVED SEP 27 2006 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

Start Date August 21, 2006 Completed Date Aug. 23, 2006

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Stanley K. Wolfe

Driller/Engineer/Trainee Signature Stanley K Wolfe

Driller or trainee License No. 2108

IF TRAINEE,

Driller's Licensed No. _____

Driller's Signature _____

Drilling Company All-Ways Drilling, Inc.

Address 100 Endova Lane

City, State, Zip St. Maries, Idaho 83861

Contractor's Registration No. ALLWAD1077 JG Date 9/16/06

Ecology is an Equal Opportunity Employer.

REPORT OF FINDINGS ON GROUND WATER Declaration No. 299

NAME Chicago, Milwaukee, St. Paul and Pacific Railway Company

TYPE OF WORKS: Pump well Date of Examination

Dimensions: 432' by 10" Progress of Works: Completed 1918

LOCATION: SW¼ of SE¼ of Sec. 13, Twp. 20 N., Rge. 46 E.W.M.

QUANTITY Claimed or
~~Awarded~~ 50 g.p.m. 22.59 acre feet per year

USE: Locomotive supply.

Irrigation-acreage; Present Planned Feasible

Municipal: Population as of

Industrial:

Time Pump Will Be Operated: Continuously

Other Water Rights of Applicant: None

Proximity to existing works, springs or streams: City of Tekoa South about 1/4 mile.

Estimated effect of withdrawal of water on existing water rights:

Water Bearing Zone:

RECOMMENDATIONS

Approved for 50 g.p.m. 22.59 acre feet per year, subject to existing water rights.

The amount of water used from this well is calculated at 22.59 acre feet a year by the Chicago, Milwaukee, St. Paul and Pacific R. R. Co.

Signed this 6th day of November, 1946. Fred B Roberts

FRED B. ROBERTS
Ground Water Geologist
Division of Hydraulics

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

WELL LOG

No. Dacla. #364
Cent. #334-D

Date 1912, 19__
Record by L. A. Collins
Source G. W. Dacla. Claim

Location: State of WASHINGTON
County Whitman
Area
Map
NE ¼ NW ¼ sec. 24 T 20 N., R 45 E.

DIAGRAM OF SECTION

Drilling Co.
Address
Method of Drilling drilled Date Dec. 1939
Owner Oregon Wash. R. R. Nav. Co.
Address Portland, Oregon
Land surface, datum ft. above / below

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	no record		
Pump Test:			
	Dim: 300' x 13"		
	SWL: 15'		
	Dd: 15'		
	Yield: 100 g.p.m.		
	Pump: 4" deep well turbine		
	Motor: 3 hp, AC, 5 hp, Fairbanks-Morse		

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Turn up

Sheet ____ of ____ sheets

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. S 28723

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*
- ☐ Construction
- ☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* 210687

Type of Well *(select one)*
- ☐ Resource Protection
- ☑ Geotech Soil Boring

Consulting Firm LFR Inc.

Unique Ecology Well ID Tag No. B1 B2 B3 B4 B5

Property Owner Gardner Oil Company

Site Address PO Box 107 Oakesdale, WA 9

City Oakesdale WA County Whitman

Location SW 1/4-1/4 SE 1/4 Sec 13 Twn 20N R 45E (Select One) ☐ RWM ☐ WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

☒ Driller ☐ Engineer ☐ Trainee Name (Print) _____

Driller/Engineer/Trainee Signature Marc Shill

Driller or Trainee License No. 2845

Cased or Uncased Diameter 2" Static Level _____

(Work) Decommission Start Date 10-9-06

Work (Decommission) Completed Date 10-9-06

If trainee, licensed driller's Signature and License No. _____

Construction/Design	Well Data	Formation Description
5ft 10ft 12ft 2" macrocore	Drilled 12' w/macrocore GeoProbe Backfilled w/betonite chips	0-12' silty fines to sandy course gravels

RECEIVED
NOV 16 2006
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. S 28723

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)* 210688

☐ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Type of Well *(select one)*

☐ Resource Protection

☒ Geotech Soil Boring

Consulting Firm LFR Inc.

Property Owner Gardner Oil Company

Site Address PO Box 107 Oakesdale, WA 9

Unique Ecology Well ID

Tag No. B1 B2 B3 B4 B5

City Oakesdale WA County Whitman

Location SW 1/4-1/4 SE 1/4 Sec 13 Twn 20N R 45E (Select One) ☐ EWM ☐ WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

☒ Driller ☐ Engineer ☐ Trainee Name (Print) _____

Driller/Engineer /Trainee Signature Mark Shill

Driller or Trainee License No. 2845

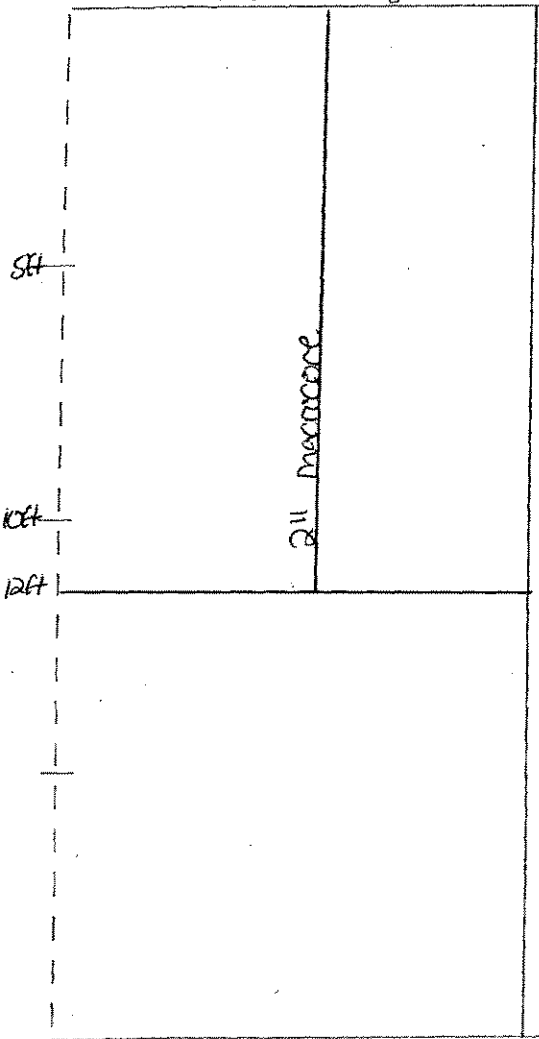
Tax Parcel No. _____

Cased or Uncased Diameter 2" Static Level _____

(Work) Decommission Start Date 10-9-06

If trainee, licensed driller's Signature and License No. _____

Work (Decommission) Completed Date 10-9-06

Construction/Design	Well Data	Formation Description
	Drilled 12' w/macrocore Geoprobe Backfilled w/bentonite chips	0-12" silty fines to sandy course gravels

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

CURRENT Notice of Intent No. S 28723

Construction/Decommission *(select one)*
☐ Construction
☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____
710689

Type of Well *(select one)*
☐ Resource Protection
☑ Geotech Soil Boring

Consulting Firm LFR Inc.

Property Owner Gardner Oil Company

Site Address PO Box 107 Oaksdale, WA 9

Unique Ecology Well ID
Tag No. B1 B2 B3 B4 B5

City Oaksdale WA County Whitman

Location SW 1/4-1/4 SE 1/4 Sec 13 Twn 20N R 45E Select One ☐ EWM ☐ WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

☒ Driller ☐ Engineer ☐ Trainee Name (Print) _____

Driller/Engineer /Trainee Signature Marc Shill

Driller or Trainee License No. 2845

Tax Parcel No. _____

Cased or Uncased Diameter 2" Static Level _____

(Work) Decommission Start Date 10-9-06

Work (Decommission) Completed Date 10-9-06

If trainee, licensed driller's Signature and License No. _____

Construction/Design	Well Data	Formation Description
5ft 2" macrocore 10ft 12ft	Drilled 12' w/macrocore GeoProbe Backfilled w/betonite chips	0-12' Silty fines to sandy course gravels

RECEIVED
NOV 16 2006
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. S 28723

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)* 210690

- ☐ Construction
- ☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Type of Well *(select one)*

- ☐ Resource Protection
- ☒ Geotech Soil Boring

Consulting Firm LFR Inc.

Property Owner Gardner Oil Company

Site Address PO Box 107 Oakesdale, WA 9

Unique Ecology Well ID
Tag No. B1 B2 B3 B4 B5

City Oakesdale WA County Whitman

Location SW 1/4-1/4 SE 1/4 Sec 13 Twn 20N R 45E (Select One ☐ EWM ☐ WWM)

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

☒ Driller ☐ Engineer ☐ Trainee Name (Print) _____

Driller/Engineer/Trainee Signature Marc Shill

Driller or Trainee License No. 2845

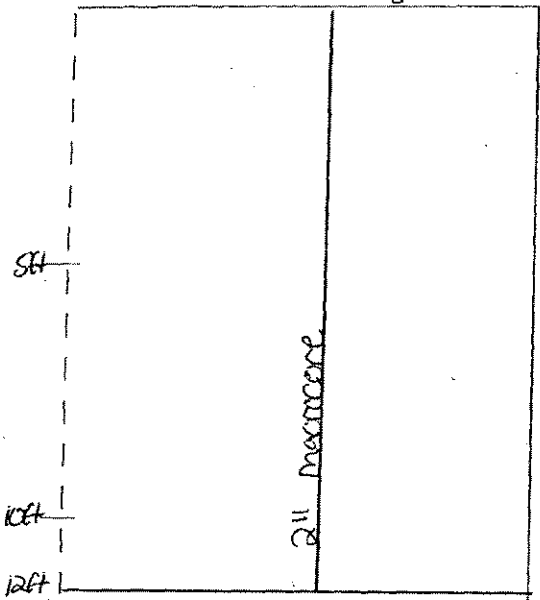
Tax Parcel No. _____

Cased or Uncased Diameter 2" Static Level _____

(Work) Decommission Start Date 10-9-06

Work (Decommission) Completed Date 10-9-06

If trainee, licensed driller's Signature and License No. _____

Construction/Design	Well Data	Formation Description
	Drilled 12' w/macrocore Geoprobe Backfilled w/betonite chips	0-12' Silty fines to sandy course gravels

210691

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. S 28723

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*

☐ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Consulting Firm LFR Inc.

Unique Ecology Well ID

Tag No. B1 B2 B3 B4 B5

Type of Well *(select one)*

☐ Resource Protection

☒ Geotech Soil Boring

Property Owner Gardner Oil Company

Site Address PO Box 107 Oakesdale, WA 9

City Oakesdale WA County Whitman

Location SW 1/4-1/4 SE 1/4 Sec 13 Twn 20N R 45E (Select One) ☐ SWM ☐ WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

☒ Driller ☐ Engineer ☐ Trainee Name (Print) _____

Driller/Engineer/Trainee Signature Marc Shill

Driller or Trainee License No. 2645

Tax Parcel No. _____

Cased or Uncased Diameter 2" Static Level _____

(Work) Decommission Start Date 10-9-06

Work (Decommission) Completed Date 10-9-06

If trainee, licensed driller's Signature and License No. _____

Construction/Design	Well Data	Formation Description
5ft 2" macrocore 10ft 12ft	Drilled 12' w/macrocore Geoprobe Backfilled w/betonite chips	0-12" Sity fines to Sandy course gravels

RECEIVED
NOV 16 2006
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

Attachment 2

Borehole Clearance Form

ENSR | AECOM

BOREHOLE CLEARANCE REVIEW

Chevron Site #: _____ Project #: _____

Borehole #s Reviewed: _____ Date: _____

Clearance Inspected by: _____ Reviewed by: _____
(Consultant Rep) (Consultant PM Initial) (Chevron PM Initial)

Yes No

1. Is a scaled site plan showing the proposed borehole locations attached to this form?

2. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities shown on Chevrons building plans?

3. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities shown on public right-of-way street improvement plans?
   PM to check here if applicable to this job.

4. Does the station manager have any knowledge of any subsurface utilities within 3 feet of the proposed borehole locations? (Review locations with the station manager).

5. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities identified during a geophysical survey?
   PM to check here if applicable to this job.

6. Has a utility locate service been contacted, the Dig Alert Notification document been completed? Have all utilities been marked out in the vicinity of the borehole locations? Have all affected utilities notified ENSR whether or not they have any facilities near the proposed borehole locations?

7. Do any of the proposed borehole locations lie on a line connecting two similar looking manhole covers?

8. Do any of the proposed borehole locations lie on a line perpendicular to the street from the water, gas, and electrical meter?

9. Has the pavement in the vicinity of any of the proposed borehole locations subsided or does it give the appearance it may be covering a former trench?

10. Have you hand augured or post-hole dug, or air knifed a hole to 8 feet below grade before using the drill rig?

11. Is the diameter of the hand augured, post-holed, or air knifed hole greater than the outer diameter of the drilling auger you will be using?

12. Is the soil you encountered in the hand augured, post-holed or air knifed clearance hole clean gravel, clean sand, aggregate base (gravelly sand with ~10% fines), or non-native looking material?

Questions 1 thru 9 must be answered prior to mobilizing a drilling rig to the site. Questions 10 thru 12 must be answered prior to drilling by the field staff.

DO NOT DRILL, if you answered NO to questions 1, 2, 3, 5, 6, 10, or 11 or answered YES to questions 4, 7, 8, 9, or 12. Contact your supervisor for instructions and describe the conflict on the back of this form.

Revised 5/8/07

Attachment 3

ENSR Standard Operating Procedures

SOP NUMBER: 7115

Subsurface Soil Sampling by Split Spoon

Date:	3rd Qtr. 1994
Revision Number:	3
Author:	Charles Martin
Discipline:	Geosciencies

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This Standard Operating Procedure (SOP) describes the methods used in obtaining subsurface soil samples for physical and/or chemical analysis. Subsurface soil samples are obtained in conjunction with soil boring programs and provide information as to the physical and/or chemical makeup of the subsurface environment.

The purpose of this SOP is to provide a description of a specific method or procedure to be used in the collection of subsurface soil samples. Subsurface soil is defined as unconsolidated material which may consist of one or a mixture of the following materials: sand, gravel, silt, clay, peat (or other organic soils), and fill material. Subsurface soil sampling, conducted in accordance with this SOP will promote consistency in sampling and provide a basis for sample representativeness.

This SOP covers subsurface soil sampling by split-spoon only, as this is the means most often used for obtained samples of unconsolidated deposits. Other types of equipment are available for use in subsurface soil sampling, including thin-wall tube samplers (Shelby tubes), piston samplers, and continuous core barrel samplers. Information on the use of these other sampling devices may be found in several available drilling handbooks and respective state and/or federal agency technical guidance documents. The American Society for Testing and Materials (ASTM) also provides procedures for use of split-spoon and other sampling devices.

Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Split-spoon subsurface soil sampling generally requires use of a drilling rig and typically the hollow-stem auger or other common drilling method to generate a borehole in which to use the split-spoon sampler. The split-spoon sampler is

inserted through the augers (or other type of drill casing) then is driven into the subsurface soil with a weighted hammer. The sampler is then retrieved and opened to reveal the recovered soil sample. Soil samples may be collected at a continuous interval or at pre-selected vertically spaced intervals within the borehole.

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the QAPP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

1.4 Health and Safety Considerations

Subsurface soil sampling may involve chemical hazards associated with the types of contaminants potentially encountered and will always involve potential physical hazards associated with use of drilling equipment. When sampling is performed in materials which may contain hazardous constituents, or when the quality assurance objectives of the project require the use of hazardous solvents, adequate Health and Safety measures must be taken to protect sampling personnel. These measures must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Drilling Subcontractor

It will be the responsibility of the drilling subcontractor to provide the necessary materials for obtaining subsurface soil samples. This generally includes one or more split-spoon samplers in good operating condition and sample containers used for stratigraphic characterization samples (sample containers for environmental samples should be provided by the designated analytical laboratory). It is the drilling subcontractor's responsibility to provide and maintain their own boring logs if desired. Equipment decontamination materials should also be supplied by the subcontractor and should meet project specifications.

2.2 Project Geologist/Sampling Engineer

It will be the responsibility of the project geologist/sampling engineer to conduct subsurface soil sampling in a manner which is consistent with this SOP. The project geologist/sampling engineer will observe all activities pertaining to subsurface soil sampling to ensure that the SOP is followed, and to record all pertinent data onto a boring log. It is also the project geologist/sampling engineer's responsibility to indicate the specific targeted sampling depth or sampling interval to the drilling subcontractor. The project geologist/sampling engineer is also responsible for the collection of representative environmental or stratigraphic characterization samples once the sampling device has been retrieved and opened. Additional sample collection responsibilities include labeling, handling, and storage of samples until further chain-of-custody procedures are implemented.

3.0 REQUIRED MATERIALS

In addition to those materials provided by the subcontractor, the project geologist/sampling engineer will require:

- Project Sampling Plan, QAPP, and HASP
- Boring logs
- Teaspoon or spatula (stainless steel is recommended)
- Sample kit (bottles, labels, custody records and tape, cooler)
- Sample collection pen
- Folding rule or tape measure
- Equipment decontamination materials
- Health and safety equipment (as required by HASP)
- Field project notebook/pen

4.0 METHOD

4.1 General Method Description

Split-spoon sampling devices are typically constructed of steel and are most commonly available in lengths of 18 and 24 inches and diameters of 1.5 to 3 inches. The split-spoon consists of a tubular body with two halves that split apart lengthwise, a drive head on the upper end with a ball-check valve for venting, and a hardened steel cutting shoe at the bottom. The soil sample enters the split-spoon through the cutting shoe as the device is driven into the ground. A replaceable plastic or metal basket is often inserted into the shoe to assist with retaining samples. Once the

sampler is retrieved, the drive head and cutting shoes are removed and the split-spoon halves are then separated, revealing the sample.

Sample depth intervals are usually defined on a project-specific basis with these requirements specified in the project sampling plan. Sampling intervals typically range from one (1) sample per five (5) feet of drilling to continuous sampling where the entire drilled interval is sampled.

Subsurface soil sampling is usually accomplished as part of a drilling program where a soil boring is advanced with drilling equipment to the designated depth prior to collection of a representative sample. The general procedures outlined briefly in the following section provide requirements for advancing drill casing/augers in preparation for sampling.

4.2 General Procedures - Borehole Preparation

4.2.1 Advancing Casing/Augers

Soil borings that are completed for soil sampling purposes are typically advanced using hollow-stem augers and sometimes drive-and-wash or other casing methods. The casing/augers must be of sufficient diameter to allow for soil sampling at a minimum. The casing/augers will be advanced according to project requirements to the required depth for sampling. If hollow-stem augers are used, a temporary plug shall be used in the lead auger to prevent the auger from becoming filled with drill cuttings while drilling is in progress.

4.2.2 Obstructions

For those borings which encounter obstructions, the casing/augers will be advanced past or through the obstruction if possible. Caution should be exercised when obstructions are encountered and an effort made to identify the obstruction before drilling is continued. If the obstruction is not easily drilled through or removed, the boring should be relocated to an adjacent location.

4.2.3 Use of Added Water

The use of added or recirculated water during drilling is permitted when necessary. Use of extraneous water should be minimized or avoided if possible as it may impact sample quality. Water usage should be documented in the field notebook. Sampling and analysis of added or

recirculated water may be required for quality assurance purposes (refer to QAPP). If a well is installed within the completed borehole, removal of the added water may be required.

4.3 Sampling Procedure

4.3.1 Equipment Decontamination

Each split-spoon must be decontaminated prior to its initial use and following collection of each soil sample. Site-specific requirements for equipment decontamination should be outlined within the Project Sampling Plan. Equipment decontamination procedures are also outlined within SOP 7600 - Decontamination of Equipment.

4.3.2 Standard Penetration Test

The drilling subcontractor will lower the split-spoon into the borehole. Samples are generally obtained using the Standard Penetration Test (SPT) in accordance with ASTM standards (ASTM D 1586-84). Following this method, the sampler will be driven using the 140-pound hammer with a vertical free drop of 30 inches using two turns of the rope on the cathead. The number of hammer blows required for every 6 inches of penetration will be recorded on the boring log. Blowcount information is used as an indicator of soil density for geotechnical as well as stratigraphic logging purposes. Once the split-spoon has been driven to its fullest extent, or to refusal, it will be removed from the borehole.

4.3.3 Sample Recovery

The split-spoon will be immediately opened upon removal from the casing/auger. The open sampler shall then be screened for volatile organics with a photoionization device (PID) if required by the Project Sampling Plan. If the Sampling Plan also requires individual soil sample headspace screening for volatile organic compounds, then a small portion of the split-spoon sample shall be removed and properly contained for that purpose.

Sample recovery will be determined by the project geologist/sampling engineer who will examine the soil core once the sampler is opened. The length of sample shall then be measured with a folding rule or tape measure. Any portion of the split-spoon contents which are not considered part of the true sample (i.e., heaved soils) will be discarded. If the sample recovery is considered inadequate for sample characterization or analytical testing

purposes, another sample should be collected from the next vertical interval if possible before drilling is reinitiated.

Adequate sample recovery for stratigraphic logging purposes and/or headspace organic vapor testing purposes should be approximately 6 inches. Adequate sample recovery for analytical testing purposes should be a minimum of 12 inches and is somewhat dependent on the type of analytical testing required. In some cases, continuous sampling over a short interval, and compositing of the sample, may be required to satisfy analytical testing requirements. Larger diameter samplers may be used if large volumes of soil are required for analytical testing.

4.3.4 Sample Containment - General

Once retrieved, the sample will be removed from the split-spoon with a teaspoon or spatula and placed into the appropriate sample container. The sample will be split if necessary to meet sampling program requirements. Sample splitting may be necessary to provide individual samples for headspace testing, visual characterization, physical testing, analytical testing, or simply for archiving purposes. In general, most sampling programs are structured around environmental characterization needs; therefore, sample portions required for analytical testing should be collected first. The Project Sampling Plan and QAPP provides specific sample container requirements for each type of sample and should be referred to for guidance.

Once filled, the sample containers should be properly capped, cleaned, and labeled, and chain-of-custody and sample preservation procedures initiated. Sampling equipment should then be properly decontaminated.

4.3.5 Sample Containment - Volatile Organic Analyses

Collection of subsurface soil samples for volatile organic analysis (VOA) is slightly more complex than collection of samples for other routine chemical or physical testing primarily because of the concern for the potential loss of volatiles during the sample collection procedure. To limit the potential for loss of volatiles, the soil sample needs to be obtained as quickly and as directly as possible from the split-spoon. This generally means that the VOA sample is to be collected and placed into the appropriate sample container first. The VOA sample should also be obtained from a discrete portion of the entire sample interval and not composited or homogenized. The remainder of the recovered sample can then be composited, homogenized or split to meet the other testing requirements. The boring log and/or sample logbook should be

filled out to indicate actual sample collection depths for both VOA samples and other portions of the sample which may have been composited over a larger vertical interval.

5.0 QUALITY CONTROL

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

6.0 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms include:

- Boring logs
- Field log books
- Sample collection records
- Chain-of-custody records
- Shipping labels

Boring logs (Figure 1) will provide visual and descriptive information for each sample collected and are often the most critical form of documentation generated during a sampling program. The field log book is kept as a general log of activities. Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original copies of these records should be maintained in the appropriate project files.

7.0 REFERENCES

ASTM D 1586-84

Figure 1

Sheet 1 of __

BORING LOG

Project No. _____ Date – Start _____ Finish _____ Boring _____

Project Name _____ Drilling Co. _____

Location _____ Drilling Method _____

Total Depth _____ Inspector _____ Reviewer _____

Remarks _____

Depth Feet	Sample				Graphic Log	Lithologic Description	Equipment Installed
	Type & No.	Blows per 6 in.	Depth Range	Rec.			

R:\pubs\mw97\SOPs\7115\fig-1.doc

SOP NUMBER: 7315

Operation/Calibration of a Photoionization Detector (PID)

Date:	1st Qtr. 2005
Revision Number:	3
Author:	Debra McGrath
Discipline:	Quality Assurance

1.0 INTRODUCTION

1.1 Purpose and Applicability

This document describes the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID). The PID is primarily used by ENSR personnel for safety and survey monitoring of ambient air, determining the presence of volatiles in soil and water, and detecting leakage of volatiles.

PIDs routinely used by ENSR personnel include the Photovac Microtip, Thermoelectron 580EZ, and MiniRAE 2000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

1.2 Principle of Operation

The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV.

The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energies ranging from 9.5 eV to 11.7 eV. All organic and inorganic vapor/gas compounds having ionization potentials lower than the energy output of the UV lamp are ionized and the resulting potentiometric change is seen as a positive reading on the unit. The reading is proportional to the concentration of organics and/or inorganics in the vapor.

Sample gases enter the probe through the inlet tube and enter the ion chamber where they are exposed to the photons emanating from the UV lamp. Ionization occurs for those molecules having ionization potentials near to or less than that of the lamp. A positive-

biased polarizing electrode causes these positive ions to travel to a collector electrode in the chamber. Thus the ions create an electrical current which is amplified and displayed on the meter. This current is proportional to the concentration of trace gas present in the ion chamber and to the sensitivity of that gas to photoionization.

In service, the analyzer is first calibrated with a gas of known composition equal to, close to, or representative of that to be measured. Gases with ionization potentials near to or less than the energy of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials greater than the energy of the lamp will not be detected. The ionization potentials of the major components of air, i.e., oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to 15.6 eV and are not ionized by any of the lamps available. Gases with ionization potentials near to or slightly higher than the lamp are partially ionized, with low sensitivity.

1.3 Specifications

Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent.

1.4 Quality Assurance Planning Considerations

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Quality Assurance Project Plan (QAPP), hereafter referred to as the project plan.

1.5 Health and Safety Considerations

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). In the absence of a site-specific HASP, work will be conducted according to the ENSR Health and Safety Policy and Procedures Manual and/or direction from the Regional Health and Safety Manager.

Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project HASP for instructions pertaining to instrument use in explosive atmospheres.

2.0 RESPONSIBILITIES

2.1 The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the measurements in accordance with this SOP and the project plan.

2.2 The field operator is responsible for verifying that the PID is in proper operating condition prior to use and for implementing the calibration and measurement procedures in accordance with this SOP and the project plan.

3.0 REQUIRED MATERIALS

- Calibration Gas: Compressed gas cylinder of isobutylene in air or similar stable gas mixture of known concentration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50-75% of the range in which the instrument is to be calibrated.
- Regulator for calibration gas cylinder
- Approximately 6 inches of Teflon® tubing
- Tedlar bag (optional)
- Commercially-supplied zero grade air (optional)
- "Magic Marker" or “Sharpie” or other waterproof marker
- Battery charger
- Moisture traps
- Spare lamps
- Manufacturer’s instructions
- Field data sheets or logbook/pen

4.0 METHOD

4.1 Preliminary Steps

4.1.1 Preliminary steps (battery charging, check-out, calibration, maintenance) should be conducted in a controlled or non-hazardous environment.

4.2 Calibration

4.2.1 The PID must be calibrated in order to display concentrations in units equivalent to ppm. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionizable gas or vapor, is then used to set the sensitivity.

4.2.2 Calibrate the instrument according to the manufacturer's instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records.

4.2.3 If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned (Section 4.4).

4.3 Operation

4.3.1 Turn on the unit and allow it to warm up (minimum of 5 minutes). Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit.

4.3.2 Calibrate the instrument as described in Section 4.2, following the manufacturer's instructions. Record the calibration information in the field records.

4.3.3 The instrument is now operational. Readings should be recorded in the field records.

4.3.4 When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a "bump" test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated.

4.3.5 At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration (Section 4.2) except that no

adjustment will be made to the instrument. Record the information in the field records.

4.3.6 Recharge the battery after each use (Section 4.4).

4.3.7 When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

4.4 Routine Maintenance

4.4.1 Routine maintenance associated with the use of the PID includes charging the battery, cleaning the lamp window, replacing the detector UV lamp, replacing the inlet filter, and replacing the sample pump. Refer to the manufacturer's instructions for procedures and frequency.

4.4.2 All routine maintenance should be performed in a non-hazardous environment.

4.5 Troubleshooting Tips

4.5.1 One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a magic marker. A significant reading should readily be observed.

4.5.2 Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings.

4.5.3 A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place.

4.5.4 Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings.

4.5.5 A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used.

4.5.6 Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure.

4.5.7 When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

5.0 QUALITY CONTROL

Calibration of the PID will be conducted at the frequency specified in the project plan. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day or whenever instrument operation is suspect. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated.

Checks of the instrument response (Section 4.5.1) should be conducted periodically and documented in the field records.

6.0 DOCUMENTATION

Safety and survey monitoring with the PID will be documented in a bound field logbook, or on standardized forms, and retained in the project files. The following information is to be recorded:

- Project name and number.
- Instrument manufacturer, model, and identification number.
- Operator's signature.
- Date and time of operation.
- Calibration gas used.
- Calibration check at beginning and end of day (meter readings before adjustment).
- Span setting after calibration adjustment.
- Meter readings (monitoring data obtained).
- Instances of erratic or questionable meter readings and corrective actions taken.
- Instrument checks and response verifications – e.g., battery check, magic marker response (Section 4.5.1) or similar test.

7.0 REFERENCES

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

SOP NUMBER: 7600

Decontamination of Field Equipment

Date:	4th Qtr. 1994
Revision Number:	4
Author:	Charles Martin
Discipline:	Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This SOP describes the methods to be used for the decontamination of field equipment used in the collection of environmental samples. The list of field equipment may include a variety of items used in the collection of soil and/or water samples, such as split-spoon samplers, trowels, scoops, spoons, bailers and pumps. Heavy equipment such as drill rigs and backhoes also require decontamination, usually in a specially constructed temporary decontamination area.

Decontamination is performed as a quality assurance measure and a safety precaution. Improperly decontaminated sampling equipment can lead to misinterpretation of environmental data due to interference caused by cross-contamination. Decontamination protects field personnel from potential exposure to hazardous materials. Decontamination also protects the community by preventing transportation of contaminants from a site.

This SOP emphasizes decontamination procedures to be used for decontamination of reusable field equipment. Occasionally, dedicated field equipment such as well construction materials (well screen and riser pipe) or disposable field equipment (bailers or other general sampling implements) may also require decontamination prior to use. The project-specific work plan should indicate the specific decontamination requirements for a particular project.

Respective state or federal agency (regional offices) regulations may require specific types of equipment or procedures for use in decontamination of field equipment. The project manager should review the applicable regulatory requirements, if any, prior to the start of the field investigation program.

1.2 General Principles

Decontamination is accomplished by manually scrubbing, washing, or spraying equipment with detergent solutions, tap water, distilled/deionized water, steam and/or high pressure water, or solvents. The decontamination method and agents

are generally determined on a project-specific basis and must be stated in the Quality Assurance Project Plan (QAPP).

Generally, decontamination of equipment is accomplished at each sampling site between collection points. Waste decontamination materials such as spent liquids and solids will be collected and managed as investigation-derived waste for later disposal. All decontamination materials, including wastes, should be stored in a central location so as to maintain control over the quantity of materials used or produced throughout the investigation program.

1.3 Quality Assurance Planning Considerations

1.3.1 General Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific QAPP. The QAPP guidelines typically require collection of equipment blank samples in order to determine the effectiveness of the decontamination procedure.

The decontamination method, solvent, frequency, location on site and the method of containment and disposal of decontamination wash solids and solutions are dependent on site logistics, site-specific chemistry, and nature of the contaminated media to be studied and the objectives of the study. Each topic must be considered and addressed during development of a decontamination strategy and should be outlined in the Quality Assurance Project Plan (QAPP).

1.3.2 Solvent Selection

There are several factors which need to be considered when deciding upon a decontamination solvent. The solvent should not be an analyte of interest. The sampling equipment must be resistant to the solvent. The solvent must be evaporative or water soluble or preferably both. The applicable regulatory agency may have specific requirements regarding decontamination solvents. The QAPP should specify the type of solvent to be used for a particular project.

The analytical objectives of the study must also be considered when deciding upon a decontamination solvent. Pesticide-grade methanol is the solvent of choice for general organic analyses. It is relatively safe and effective. Hexane, acetone, and isopropanol are sometimes used as well. A 10% nitric acid in deionized water solution is the solvent of choice for general metals

analyses. Nitric acid can be used only on Teflon, plastics and glass. If used on metal equipment, nitric acid will eventually corrode the metal and lead to the introduction of metals to the collected samples. Dilute hydrochloric acid is usually preferred over nitric acid when cleaning metal sampling equipment.

Equipment decontamination should be performed a safe distance away from the sampling area so as not to interfere with sampling activities but close enough to the sampling area to maintain an efficient working environment. If heavy equipment such as drill rigs or backhoes are to be decontaminated, then a central decontamination station should be constructed with access to a power source and water supply.

1.4 Health and Safety Considerations

Decontamination procedures may involve chemical exposure hazards associated with the type of contaminants encountered or solvents employed and may involve physical hazards associated with decontamination equipment. When decontamination is performed on equipment which has been in contact with hazardous materials or when the quality assurance objectives of the project require decontamination with chemical solvents, the measures necessary to protect personnel must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing equipment decontamination, and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Sampling Technician

It is the responsibility of the sampling technician to be familiar with the decontamination procedures outlined within this SOP and with specific quality assurance, and health and safety requirements outlined within project-specific work plans (HASP, QAPP). The sampling technician is responsible for decontamination of field equipment and for proper documentation of decontamination activities. The sampling technician is also responsible for ensuring that decontamination procedures are followed by subcontractors when heavy equipment requires decontamination.

2.2 Field Project Manager

The field project manager is responsible for ensuring that the required decontamination procedures are followed at all times. The project manager is also responsible for ensuring that subcontractors construct and operate their decontamination facilities according to project specifications. The project manager is responsible for collection and control of IDW in accordance with project specifications.

3.0 REQUIRED MATERIALS

- Decontamination agents (per work plan requirements):
    - LIQUI-NOX, ALCONOX, or other phosphate-free biodegradable detergent,
    - Tap water,
    - Distilled/deionized water,
    - Nitric acid and/or hydrochloric acid,
    - Methanol and/or hexane, acetone, isopropanol.
- Health and Safety equipment
- Chemical-free paper towels
- Waste storage containers: drums, 5-gallon pails w/covers, plastic bags
- Cleaning containers: plastic buckets or tubs, galvanized steel pans, pump cleaning cylinder
- Cleaning brushes
- Pressure sprayers
- Squeeze bottles
- Plastic sheeting
- Aluminum foil
- Field project notebook/pen

4.0 METHODS

4.1 General Preparation

4.1.1 It should be assumed that all sampling equipment, even new items, are contaminated until the proper decontamination procedures have been performed on them or unless a certificate of analysis is available which demonstrates the items cleanliness.

Field equipment that is not frequently used should be wrapped in aluminum foil, shiny side out, and stored in a designated "clean" area. Small field equipment can also be stored in plastic bags to eliminate the potential for contamination. Field equipment should be inspected and decontaminated prior to use if the equipment appears contaminated and/or has been stored for long periods of time. Unless customized procedures are stated in the QAPP for decontamination of equipment, the standard procedures specified in this SOP shall be followed.

4.1.2 Establish the decontamination station within an area that is convenient to the sampling location. If single samples will be collected from multiple locations, then a centralized decontamination station, or a portable decontamination station should be established.

4.1.3 An investigation-derived waste (IDW) containment station should be established at this time also. The project-specific work plan should specify the requirements for IDW containment. In general, decontamination solutions are discarded as IDW between sampling locations. Solid waste is disposed of as it is generated.

4.2 Decontamination for Organic Analyses

4.2.1 This procedure applies to soil sampling and groundwater sampling equipment used in the collection of environmental samples submitted for organic constituents analysis. Examples of relevant items of equipment include split-spoons, trowels, scoops/spoons, bailers, and other small items. Submersible pump decontamination procedures are outlined in Section 4.4.

4.2.2 Decontamination is to be performed before sampling events and between sampling points.

4.2.3 After a sample has been collected, remove all gross contamination from the equipment or material by brushing and then rinsing with available tap water.

This initial step may be completed using a 5-gallon pail filled with tap water. Steam or a high-pressure water rinse may also be conducted to remove solids and/or other contamination.

4.2.4 Wash the equipment with a phosphate-free detergent and tap water solution. This solution should be kept in a 5-gallon pail with its own brush.

4.2.5 Rinse with tap water or distilled/deionized water until all detergent and other residue is washed away. This step can be performed over an empty bucket using a squeeze bottle or pressure sprayer.

4.2.6 Rinse with methanol or other appropriate solvent using a squeeze bottle or pressure sprayer. Rinsate should be collected in a waste bucket.

4.2.7 Rerinse with deionized water to remove any residual solvent. Rinsate should be collected in the solvent waste bucket.

4.2.8 Allow the equipment to air-dry in a clean area or blot with chemical-free paper towels before reuse. Wrap the equipment in tin foil and/or seal it in a plastic bag if it will not be reused for a while.

4.2.9 Dispose of soiled materials and spent solutions in the designated IDW disposal containers.

4.3 Decontamination for Inorganic (Metals) Analyses

4.3.1 This procedure applies to soil sampling equipment used primarily in the collection of environmental samples submitted for inorganic constituents analysis. Examples of relevant items of equipment include split-spoons, trowels, scoops/spoons, bailers, and other small items.

4.3.2 For plastic and glass sampling equipment, follow the steps outlined in 4.2 above, however, use a 10% nitric acid solution (acid in water) in place of the solvent rinse in Section 4.2.6.

4.3.3 For metal sampling equipment, follow the steps outlined in 4.2 above, however, use a 10% hydrochloric acid solution (acid in water) in place of the solvent rinse in Section 4.2.6.

4.4 Decontamination of Submersible Pumps

4.4.1 This procedure will be used to decontaminate submersible pumps before and between ground-water sample collection points. This procedure applies to both electric submersible and bladder pumps. This procedure also applies to discharge tubing if it will be reused between sampling points.

4.4.2 Prepare the decontamination area if pump decontamination will be conducted next to the sampling point. If decontamination will occur at another location, the pump and tubing may be removed from the well and placed into a clean trash bag for transport to the decontamination area. Pump decontamination is easier with the use of 3-foot tall pump cleaning cylinders (i.e., Nalgene cylinder) for the various cleaning solutions, although the standard bucket rinse equipment may be used.

4.4.3 Once the decontamination station is established, the pump should be removed from the well and the discharge tubing and power cord coiled by hand as the equipment is removed. If any of the equipment needs to be put down temporarily, place it on a plastic sheet (around well) or in a clean trash bag. If a disposable discharge line is used it should be removed and discarded at this time.

4.4.4 As a first step in the decontamination procedure, use a pressure sprayer with tap water to rinse the exterior of the pump, discharge line, and power cord as necessary. Collect the rinsate and handle as IDW.

4.4.5 Place the pump into a pump cleaning cylinder or bucket containing a detergent solution (detergent in tap water). Holding the tubing/power cord, pump solution through the pump system. A minimum of one gallon of detergent solution should be pumped through the system. Collect the rinsate and handle as IDW.

4.4.6 Place the pump into another cylinder/bucket containing a 10% solution of solvent (methanol, or other designated solvent) in distilled/deionized water. Pump until the detergent solution is removed. Collect the rinsate and handle as IDW.

4.4.7 Place the pump into another cylinder/bucket containing distilled/deionized water. Pump a minimum of 3 to 5 pump system volumes (pump and tubing) of water through the system. Collect the rinsate and handle as IDW.

4.4.8 Remove the pump from the cylinder/bucket and if the pump is reversible, place the pump in the reverse mode to discharge all removable water from the system. If the pump is not reversible the pump and discharge line should be drained by hand as much as possible. Collect the rinsate and handle as IDW.

4.4.9 Using a pressure sprayer with distilled/deionized water, rinse the exterior of the pump, discharge line, and power cord thoroughly, shake all excess water, then place the pump system into a clean trash bag for storage. If the pump system will not be used again right away, the pump itself should also be wrapped with aluminum foil before placing it into the bag.

4.5 Decontamination of Large Equipment

4.5.1 Consult the QAPP for instruction on the location of the decontamination station and the method of containment of the wash solutions. On large projects usually a temporary decontamination facility (decontamination pad) is required which may include a membrane-lined and bermed area large enough to drive heavy equipment (drill rig, backhoe) onto with enough space to spread other equipment and to contain overspray. Usually a small sump with pump is necessary to collect and contain rinsate. A water supply and power source is also necessary to run steam cleaning and/or pressure washing equipment.

4.5.2 Upon arrival and prior to leaving a sampling site, all heavy equipment such as drill rigs, trucks, and backhoes should be thoroughly cleaned and then the parts of the equipment which come in contact or in close proximity to sampling activity should be decontaminated. This can be accomplished in two ways, steam cleaning or high pressure water wash and manual scrubbing. Following this initial cleaning, only those parts of the equipment which come in close proximity to the sampling activities (i.e., auger stems, rods, backhoe bucket) must be decontaminated in between sampling events.

Occasionally, well construction materials such as well screen and riser pipe may require decontamination before the well materials are used. These materials may be washed in the decontamination pad, preferably on a raised surface above the pad (i.e., on sawhorses), with clean plastic draped over the work surfaces. Well materials usually do not require a multistep cleaning process as they generally arrive clean from the manufacturer. Usually, a thorough steam-cleaning of the interior/exterior of the well materials will be sufficient. The QAPP should provide specific guidance regarding decontamination of well materials.

5.0 QUALITY CONTROL

5.1 Field Blank Sample Collection

General guidelines for quality control check of field equipment decontamination usually require the collection of one field blank from the decontaminated equipment per day. The QAPP should specify the type and frequency of collection of each type of quality assurance sample.

Field blanks are generally made by pouring laboratory-supplied deionized water into, over, or through the freshly decontaminated sampling equipment and then transferring this water into a sample container. Field blanks should then be labeled as a sample and submitted to the laboratory to be analyzed for the same parameters as the associated sample. Field blank sample numbers, as well as collection method, time and location should be recorded in the field notebook.

6.0 DOCUMENTATION

Specific information regarding decontamination procedures should be documented in the project-specific field notebook. Documentation within the notebook should thoroughly describe the construction of each decontamination facility and the decontamination steps implemented in order to show compliance with the project work plan. Decontamination events should be logged when they occur with the following information documented:

- Date, time and location of each decontamination event
- Equipment decontaminated
- Method
- Solvents
- Noteable circumstances
- Identification of field blanks and decontamination rinsates
- Method of blank and rinsate collection
- Date, time and location of blank and rinsate collection
- Disposition of IDW

Repetitive decontamination of small items of equipment does not need to be logged each time the item is cleaned.

7.0 TRAINING/QUALIFICATIONS

All sampling technicians performing decontamination must be properly trained in the decontamination procedures employed, the project data quality objectives, health and safety

procedures and the project QA procedures. Specific training or orientation will be provided for each project to ensure that personnel understand the special circumstances and requirements of that project. Field personnel should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous materials may be present.

8.0 REFERENCES

Not applicable.

SOP NUMBER: 7220

Monitoring Well Construction and Installation

Date:	3rd Qtr., 1995
Revision Number:	4
Author:	Charles Martin
Discipline:	Geosciences

1.0 PURPOSE AND APPLICABILITY

1.1 Purpose and Applicability

This SOP provides guidance for installing groundwater monitoring wells. Monitoring wells are installed to monitor the depth to groundwater, to measure aquifer properties, and to obtain samples of groundwater for chemical analysis.

This SOP is applicable to installation of single monitoring wells within a borehole. The construction and installation of nested, multilevel or other special well designs is not covered within this SOP as these type of wells are not frequently constructed. This SOP applies to both overburden and bedrock monitoring wells.

Some states and EPA Regions have promulgated comprehensive guidelines for monitoring well construction and for subsurface investigation procedures. Deviations from this SOP to accommodate other regulatory requirements should be reviewed in advance of the field program, should be explained in the project work plan, and must be documented in the field project notebook when they occur.

1.2 General Principles

Monitoring well construction and installation generally involves drilling a borehole using conventional drilling equipment, installing commercially available well construction and filter/sealing materials, and development of the well prior to sampling. This SOP covers well construction and installation methods only. Borehole drilling and well development methods are covered under SOP-7115 (Subsurface Soil Sampling) and SOP-7221 (Monitoring Well Development), respectively.

1.3 Quality Assurance Planning Considerations

Field personnel should follow specific quality assurance guidelines as outlined in the site-specific QAPP.

The following aspects of monitoring well design and installation procedures depend on project-specific objectives which should be addressed in the QAPP and in the project work plan:

- Borehole drilling method and diameter,
- Type of construction materials for well screen, riser, filter pack and seals,
- Diameter of well materials,
- Length of well screen,
- Location, thickness, and composition of annular seals, and
- Well completion and surface protection requirements.

1.4 Health and Safety Considerations

Monitoring well installation may involve chemical hazards associated with materials in the soil or groundwater being investigated; and always involves physical hazards associated with drilling equipment and well construction methods. When wells are to be installed in locations where the aquifer and/or overlying materials may contain chemical hazards, a Health and Safety Plan (HASP) must be prepared and approved by the Health and Safety Officer before field work commences. This plan must be distributed to all field personnel and must be adhered to as field activities are performed.

2.0 RESPONSIBILITIES

2.1 Drilling Subcontractor

It is the responsibility of the drilling subcontractor to provide the necessary equipment for well construction and installation. Well construction materials should be consistent with project requirements.

2.2 Surveying Subcontractor

It is the responsibility of the surveying subcontractor to provide one or more of the following well measurements as specified in the project work plan: ground surface elevation, horizontal well coordinates, top of well casing elevation (i.e., top-of-casing, or measuring point elevation), and/or top of protective casing elevation.

2.3 Project Geologist/Engineer

It is the responsibility of the Project Geologist/Engineer to directly oversee the construction and installation of the monitoring well by the drilling subcontractor to ensure that the well-installation specifications defined in the project work plan are adhered to, and that all pertinent data are recorded on the appropriate forms.

2.4 Project Manager

It is the responsibility of the Project Manager to ensure that each project involving monitoring well installation is properly planned and executed.

3.0 REQUIRED MATERIAL

3.1 Well Construction Materials

Well construction materials are usually provided by the drilling subcontractor and most often consist of commercially available flush-threaded well screen and riser pipe constructed of PVC or stainless steel with a minimum 2-inch inside diameter. The length of the screen and the size of the screen slots should be specified in the project work plan.

3.2 Well Completion Materials

Well completion materials include silica sand, bentonite, cement, protective casings and locks. Completion materials are generally provided by the drilling subcontractor.

3.3 Other required materials include the following:

- Potable water supply
- Fiberglass or steel measuring tape
- Water level indicator
- Well construction diagrams (Figure 1)
- Waterproof marker or paint (to label wells)
- Health and Safety supplies

- Equipment decontamination materials
- Field project notebook/pen

4.0 METHOD

4.1 General Preparation

4.1.1 Borehole Preparation

Standard drilling methods should be used to achieve the desired drilling/well installation depths specified in the project work plan. Soil sampling, if conducted, should be conducted in accordance with ENSR SOP-7115 (Subsurface Soil Sampling).

The diameter of the borehole must be a minimum of 2 inches greater than the outside diameter of the well screen or riser pipe used to construct the well. This is necessary so that sufficient annular space is available to install filter packs, bentonite seals, and grout seals. Bedrock wells may require reaming after coring in order to provide a large enough borehole diameter for well installation.

Rotary drilling methods requiring bentonite-based drilling fluids, if selected, should be used with caution to drill boreholes that will be used for monitoring well installation. The bentonite mud builds up on the borehole walls as a filter cake and permeates the adjacent formation, potentially reducing the permeability of the material adjacent to the well screen.

If water or other drilling fluids have been introduced into the boring during drilling or well installation, samples of these fluids should be obtained and analyzed for chemical constituents that may be of interest at the site. In addition, an attempt should be made to recover the quantity of fluid or water that was introduced, either by flushing the borehole prior to well installation and/or by overpumping the well during development.

4.1.2 Well Material Decontamination

Although new well materials (well screen and riser pipe) generally arrive at the site boxed and sealed within plastic bags, it is sometimes necessary to decontaminate the materials prior to their use. Well materials should be inspected by the project geologist/engineer upon delivery to check

cleanliness. If the well materials appear dirty, or if local or regional regulatory guidance requires decontamination, then well material decontamination should be performed by the drilling subcontractor in accordance with ENSR SOP-7600 (Decontamination of Equipment).

4.2 Well Construction Procedure

4.2.1 Depth Measurement

Once the target drilling depth has been reached, the drilling subcontractor will measure the total open depth of the borehole with a weighted, calibrated tape measure. Adjustments of borehole depth can be made at this time by drilling further or installing a small amount of sand filter material to achieve the desired depth. If drilling fluids were used during the drilling process, the borehole should be flushed at this time using potable water. The water table depth may also be checked with a water level indicator if this measurement cannot be obtained with the calibrated tape.

4.2.2 Centralizers

In order to install a well which is centered within the borehole, it is recommended that centralizers be used. Centralizers are especially helpful for deep well installations where it may be difficult to position the well by hand. Centralizers may not be necessary on shallow water table well installations where the well completion depth is within 25 feet of the ground surface.

4.2.3 Well Construction

The well screen and riser pipe generally are assembled by hand as they are lowered into the borehole. Before the well screen is inserted into the borehole, the full length of the slotted portion of the well screen as well as the unslotted portion of the bottom of the screen should be measured with the measuring tape. These measurements should be recorded on the well construction diagram.

After the above measurement has been taken, the drilling subcontractor may begin assembling the well. As the assembled well is lowered, care should be taken to ensure that it is centered in the hole if centralizers are not used. The well should be temporarily capped before filter sand and other annular materials are installed.

4.2.4 Filter Sand Installation

The drilling subcontractor should fill the annular space surrounding the screened section of the monitoring well to at least 1 foot above the top of the screen with an appropriately graded, clean sand or fine gravel. In general, the filter pack should not extend more than 3 feet above the top of the screen to limit the thickness of the monitoring zone. If coarse filter materials are used, an additional 1-foot thick layer of fine sand should be placed immediately above the filter pack to prevent the infiltration of sealing components (bentonite or grout) into the filter pack. As the filter pack is placed, a weighted tape should be lowered in the annular space to verify the depth to the top of the layer. Depending upon depth, some time may be required for these materials to settle. If necessary, to eliminate possible bridging or creation of voids, placement of the sand pack may require the use of a tremie pipe. Tremie pipe sandpack installations are generally suggested for deep water table wells and for wells which are screened some distance beneath the water table.

4.2.5 Bentonite Seal Installation

A minimum 2-foot thick layer of bentonite pellets or slurry seal will be installed by the drilling subcontractor immediately above the well screen filter pack in all monitoring wells. The purpose of the seal is to provide a barrier to vertical flow of water in the annular space between the borehole and the well casing. Bentonite is used because it swells significantly upon contact with water. Pellets generally can be installed in shallow boreholes by pouring them very slowly from the surface. If they are poured too quickly, they may bridge at some shallow, undesired depth. As an option, powdered bentonite may be mixed with water into a very thick slurry and a tremie pipe used to inject the seal to the desired depth.

4.2.6 Annular Grout Seal Installation

This grout seal should consist of a bentonite/cement mix with a ratio of bentonite to cement of between 1:5 and 1:20. The grout ratio should be chosen based on site conditions with a higher percentage of bentonite generally used for formations with higher porosity. A mud balance should be used if a specific mud density is required at a particular site. Grout slurry should be pumped into the annular space using a side-discharging tremie pipe located about 2 feet above the sand pack. Side discharge will help preserve the integrity of the sand pack.

In situations where the monitoring well screen straddles the water table, the seal will be in the unsaturated zone and pure bentonites (pellets or powder) will not work effectively as seals without hydration. Dry bentonite may be used if sufficient time to hydrate the seal is allowed. Seal hydration requires the periodic addition of clean water. Optionally, seals in this situation may be a cement/bentonite mixture containing up to 10 percent bentonite by weight. This type of mixture shall be tremied to the desired depth in the borehole.

The borehole annulus will be grouted with seal materials to within 3 feet of the ground surface. Drill cuttings, even those known not to be contaminated, will not be used as backfill material.

4.2.7 Well Completion

The drilling subcontractor will cut the top of the well to the desired height and install a vented (if possible), locking cap. The upper portion of the well casing can optionally be drilled to allow venting. Well casings are usually cut to be a certain height above ground surface (typically 2.5 to 3 feet) or are cut to be flush with the ground surface.

4.2.8 Protective Casing/Concrete Pad Installation

The drilling subcontractor will install a steel guard pipe on the well as a protective casing. The borehole around the guard pipe will be dug out to an approximate 2 to 3-foot radius to a minimum depth of 1 foot at the center and 6 inches at the edges. After installing the protective casing, the excavation will be filled with a concrete/sand mix. The surface of the concrete pad will be sloped so that drainage occurs away from the well. Flush-mount protective casings may not require an extensive concrete pad and should be completed such that they are slightly mounded above the surrounding surface to prevent surface water from running over or ponding on top of the casing. It should be noted, however, that in areas subject to snowfall, flush-mount casings may have to be installed so that they are entirely flush with the ground surface as they may be damaged by snow plows.

Above-ground protective casings should also be vented or should have non-air tight caps. Road box installations should not be vented. Installation of additional guard pipes may be necessary around above-ground well completions in traffic areas. Protective casings should be lockable to prevent unauthorized access.

4.2.9 Well Numbering

The project geologist/engineer will number each well casing with an indelible marker or paint to identify the well. This is particularly important with nested or paired wells to distinguish between shallow and deep wells. The well should be labeled on both the outside of the protective casing and inside beneath the protective casing lid.

4.2.10 Measuring Point Identification

The project geologist/engineer will mark the measuring point from which water level measurements will be made at a specific location along the upper edge of the well casing. PVC wells can easily be notched with a pocket knife or saw. Stainless steel wells (or PVC wells) can be marked with a waterproof marker on the outside of the well casing with an arrow pointing to the measuring point location. The measuring point is the point which will require surveying during the well elevation survey task.

4.2.11 Well Measurements

Upon completion, the following well measurements should be taken by the project geologist/engineer and recorded on the well construction diagram (Figure 1):

- Depth to static water level if water level has stabilized,
- Total length of well measured from top-of-well casing,
- Height of well casing above ground surface,
- Height of protective casing above ground surface,
- Depth of bottom of protective casing below ground surface (may be estimated).

Well screen filter pack, bentonite seal and annular seal thicknesses and depths should also be recorded on the well construction diagram.

4.2.12 Disposal of Drilling Wastes

Drill cuttings and other investigation-derived wastes such as drilling mud or well development/purge water must be properly contained and disposed of. Site-specific requirements for collection and removal of these waste materials should be outlined within the project work plan. Containment of these materials should be performed by the drilling subcontractor.

4.2.13 Well Development

At some point after installation of a well and prior to use of the well for water-level measurements or collection of water quality samples, development of the well shall be undertaken in accordance with ENSR SOP-7221 (Monitoring Well Development). Well development may be performed by the drilling subcontractor if contracted to do so, or by the project geologist/engineer or other project staff.

4.2.14 Well Elevation Survey

At the completion of the well installation program, all monitoring wells are usually surveyed to provide, at a minimum, the top-of-casing measuring point elevation for water level monitoring purposes. Other surveyed points which may be required by the project work plan include: ground surface elevation, top of protective casing elevation, and well coordinate position. Well elevation surveys are usually conducted by a surveying subcontractor.

5.0 QUALITY CONTROL

Certain quality control measures should be taken to ensure proper well completion.

5.1 The borehole will be checked for total open depth, and extended by further drilling or shortened by backfilling, if necessary, before any well construction materials are placed.

5.2 Water level and non-aqueous phase liquid (NAPL) presence will be checked during well installation to ensure that the positions of well screen, sand pack, and seal, relative to water level, conform to project requirements.

5.3 The depth to the top of each layer of packing (i.e., sand, bentonite, grout, etc.) will be verified and adjusted if necessary to conform to project requirements before the next layer is placed.

5.4 If water or other drilling fluids have been introduced into the boring during drilling or well installation, samples of these fluids may be required for analysis of chemical constituents of interest at the site.

6.0 DOCUMENTATION

All well construction data will be recorded on the Monitoring Well Construction Detail form (Figure 1). All wells will be referenced onto the appropriate site map. A field notebook and/or boring log will be used as additional means of recording data. In no case will the notebook or boring log take the place of the well construction diagram.

7.0 TRAINING/QUALIFICATIONS

Well construction and installation requires a moderate degree of training and experience as numerous drilling situations may occur which will require field decisions to be made. It is recommended that inexperienced personnel be supervised for several well installations before working on their own. Experienced drillers are also of great assistance with problem resolution in the field. Field personnel should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

8.0 REFERENCES

1. Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, WSC-310-91, 1991.

APPENDIX: DEFINITIONS

Annulus: The measured width between the borehole wall and the outside of the well screen or riser pipe.

Bentonite Seal: A granular, chip, or pellet-size bentonite material that is often used to provide an annular seal above the well screen filter pack. This seal is typically installed dry followed by in-place hydration with or without the addition of water. Hydrated bentonite is sometimes used as a grout seal.

Bottom Cap/Plug: Threaded or slip-on cap placed at the bottom of the well prior to installation. Often serves as a sump for accumulation of silt which settles within the well. The measured length from the lowermost well screen slot to the bottom of the bottom cap is known as the sump or tail pipe portion of the well.

Centralizers: Stainless steel expansion clamps which, when fitted to well screens or riser pipe, expand to contact the borehole walls positioning the well centrally within the open borehole. Centralizers assist with even positioning and distribution of filter pack and sealant materials and assist with maintaining well plumbness.

Expansion Cap/Well Cap: Cap used to cover the opening at the top of the well riser pipe. Expansion caps are equipped with a rubber gasket and threaded wing nut which, when turned, provides a watertight seal. Expansion caps may also be locked, and generally are recommended for use with flush-constructed wells where road box protective casings are also used. Other well caps may include slip-on or threaded caps made of the same material as the well casing.

Filter Pack: A well-graded, clean sand or gravel placed around the well screen to act as a filter in preventing the entry of very fine soil particles into the well.

Grout Seal: A cement/bentonite mixture used to seal a borehole that has been drilled to a depth greater than the final well installation depth or to seal the remaining borehole annulus once the well has been installed. Occasionally, pure cement or pure bentonite is used as a grout seal.

Measuring Point: A selected point at the top of the well casing (riser pipe) used for obtaining periodic water-level measurements. The measuring point should consist of either a notch or indelibly marked point on the upper surface of the casing. Typically, the highest point on the casing (if not level) is used as the measuring point. The measuring point is also the point that is surveyed when well elevation data is obtained.

Protective Casing: A locking metal casing, placed around that portion of the well riser pipe that extends above the ground surface. The protective casing is generally cemented in place when the concrete pad is constructed around the well.

Riser Pipe: The section of unperforated well casing material used to connect the well screen with the ground surface. Frequently, it is made of the same material and has the same diameter as the well screen. Riser pipe is typically available pre-cleaned and pre-threaded for immediate use.

Road Box: A protective casing that is flush-mounted with the ground around a well installation. Road boxes are used in areas where the monitoring well cannot extend above the ground surface for traffic or security reasons. Road boxes usually require a special key to open.

Tremie Pipe: A small diameter pipe which fits in the open borehole annulus and is used to inject filter sands or hydrated seal materials under pressure.

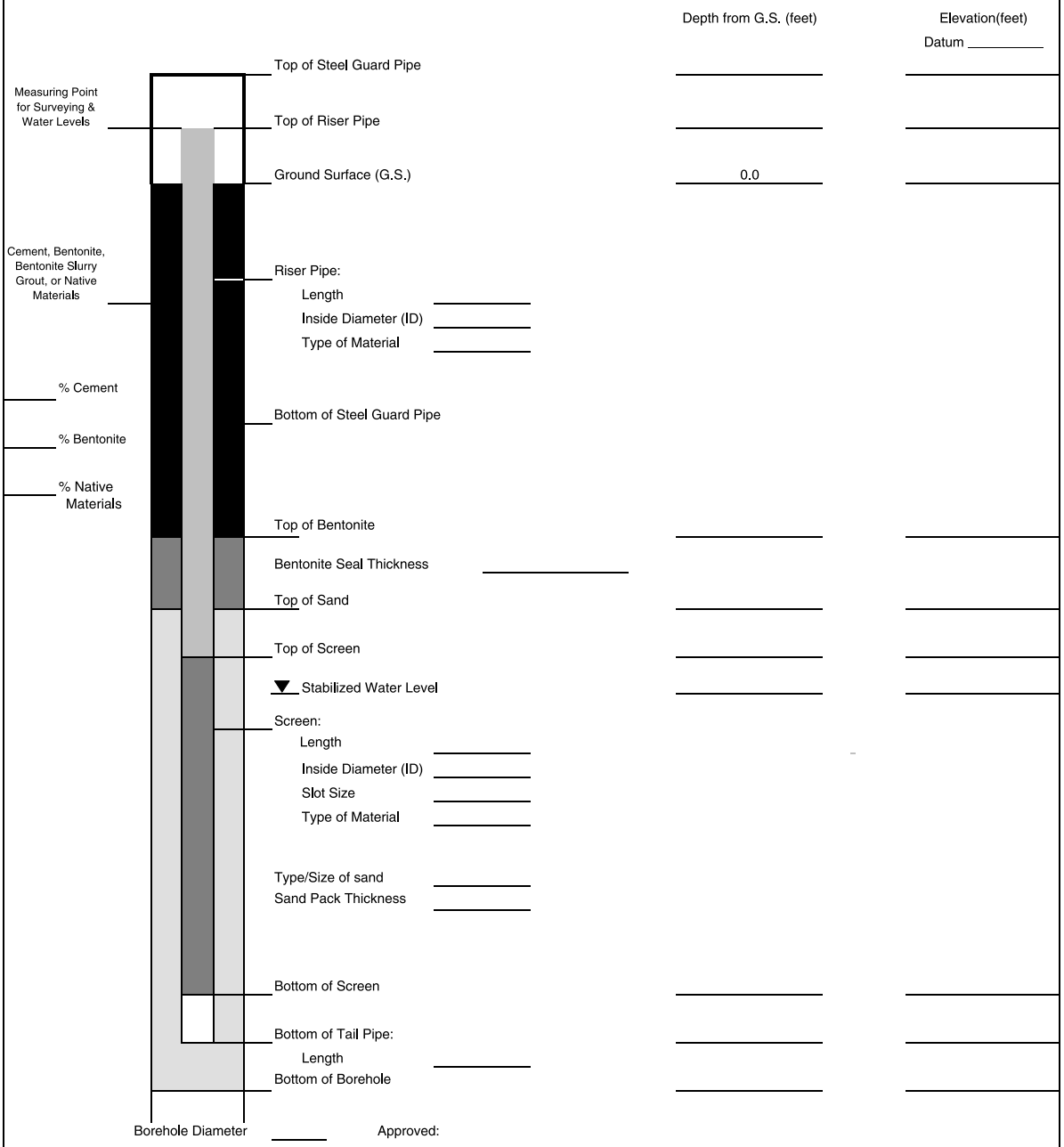
Well Screen: That portion of the well casing material that is perforated in some manner so as to provide a hydraulic connection to the aquifer. Typically a well screen is purchased pre-slotted, pre-cleaned, and pre-threaded for immediate use.

Vent Hole: Small diameter hole drilled in the upper portion of the well riser pipe which provides atmospheric venting of the well. Allows for constant equilibration of the water level with changing atmospheric conditions. In flood-prone areas, or with flush-mount wells, vent holes should not be used.

Figure 1 Monitoring Well Construction Detail

ENSR	*Client:*	WELL ID:
	Project Number:	
	Site Location:	*Date installed:*
	Well Location: *Coords:*	*Inspector:*
	Method:	*Contractor:*

MONITORING WELL CONSTRUCTION DETAIL



Attachment 4

Chevron Energy Technology Company
Request for Environmental Analysis and Chain of Custody Form

Request for Environmental Analysis and Chain of Custody

To: Environmental Analysis Lab, Room 51-1151, Chevron Energy Technology Co., 100 Chevron Way, Richmond, CA 94802 Contact: Grace Chen 510-242-5918 or Michael Moir 510-242-1634		Date
Chevron PM		Phone
Company, Department	EMC Bus. Unit, if applicable	Charge Code
Address		
Contract PM	E-mail	Phone
Company, Address		

Sampling Location (Address)	Facility Number
( ) Service Station ( ) Fuel Terminal ( ) Marine Terminal ( ) Pipeline ( ) Refinery ( ) Other_____	
( ) Chevron ( ) Texaco ( ) Gulf ( ) BP ( ) Cumberland Farms ( ) Other_____	

Type of Analysis Desired
( ) Identify Product ( ) Compare Spill with Potential Sources (Send Source Samples)
( ) Compare Samples with Previous Analyses. Log Numbers and/or Dates:_____
( ) Other_____ (Call 510-242-5918 or 510-242-1634 for Approval)

Reason for Request (Clearly State Problem, Site History, Draw or Enclose a Map, Indicate Whether Leak or Spill)

Normal turn-around time is 4 weeks. Call 510-242-1634 to negotiate alternate arrangements.

Number of Containers Per Sample	Sample Name/Description	Date Sampled	Sampled By
Transporter		Date Received	Initials
Laboratory **Chevron Energy Technology Company**		Date Received	Initials

It is the shipper's responsibility to ensure Federal DOT regulations and UN performance standards are complied with. When in doubt, assume the sample is flammable
6/07/04

Guidelines for shipping samples to ETC for Environmental Analysis

Sample containers and desired volumes:

- **Hydrocarbons:** 120 ml per gasoline sample, preferably in three 40 ml clear glass vials with **solid** teflon-coated caps (septum caps leak). 40 ml per distillate or oil sample. If 40 ml vials are unavailable, a pint or 4 oz. glass jar with teflon lined cap is acceptable. Leave approximately 1/8" headspace in the vials to allow for fuel expansion. If necessary, include produced water to minimize headspace.

- **Water samples:** Two 1000 mL clear glass bottles with teflon-lined caps. Make sure there is no headspace in the bottle. Do not send VOA vials of water - the volume is insufficient for fingerprint analysis. Water samples must be preserved with HCl at pH <2 and kept at 4°C.

- **Soil samples:** Two 8 ounce wide mouth clear glass jars with teflon-lined caps, or a capped brass sleeve from a split spoon sampler. Minimize headspace. Keep the samples at 4°C.

Shipping Instructions: All samples must be accompanied by a Request for Environmental Analysis and Chain of Custody form, obtained by calling 510-242-1634 (Michael Moir) or 510-242-5918 (Grace Chen). Please obtain the appropriate charge code for the site and note it on the form. Seal the form in a plastic bag and enclose it in the container with the samples.

Please ship all soil and water samples in an ice chest at 4^{O}C. Seal each sample in a plastic bag to keep the labels from getting wet. A mixture of foam blocks and plastic bags containing ice works well to chill the samples and protect them from breakage. Hydrocarbon samples need not be iced. They should be wrapped in plastic, enclosed in a metal can filled with vermiculite or other protective packing, and packed in a box that meets D.O.T. and U.N. requirements.

It is advisable to send the samples by overnight air. **No weekend deliveries**, please. It is the shipper's responsibility to ensure federal D.O.T. regulations and UN performance standards are complied with.

Local samplers must also comply with all Hazmat regulations. Call 510-242-5918 to obtain a shipping form that **must** accompany the samples. **Samples that arrive without a shipping form will not be accepted.** Properly packed and chilled samples should be delivered to Chevron's Richmond Technology Center shipping and receiving dock. The address is 100 Chevron Way in Richmond, CA, but the property entrance is located on the Richmond Parkway at the Castro Street offramp from Interstate 580. Drive up to the guard kiosk and ask for directions to shipping and receiving.

Fuel Product Hazard Warnings (See Chevron MSDS for Additional Information)		
Gasoline (All Grades) Jet Fuel B Jet Fuel Gasoline Grade Aviation B Gasoline (All Grades)	**Danger**	Extremely flammable. Harmful or fatal if swallowed. Prolonged or repeated contact may cause skin/eye and respiratory irritation or other injury.
Diesel (All Grades) Heating Fuel/Oil (All Grades) Jet Fuel (Grades A, A-1, A-50, JP-4, JP-5) Aviation Turbine Fuel, JP-5	**Danger**	Combustible. Harmful or fatal if swallowed. Prolonged or repeated contact may cause skin/respiratory irritation or other injury.
Water samples with ppm or less hydrocarbon Soil samples with ppm or less hydrocarbon		Not hazardous.
For Health and Safety Information Call or Write Chevron Emergency Information Center: P.O. Box 4054, Richmond, Ca 94804-0054, 800-457-2022 **In case of leak, spill or fire, call CHEMTREC Toll Free 800-424-9300**		

6/07/04

Request for Environmental Analysis and Chain of Custody

To: Environmental Analysis Lab, Room 51-1151 **Chevron Energy Technology Company** **100 Chevron Way, Richmond, CA 94802** **Contact: Grace Chen 510-242-5918 or Michael Moir 510-242-1634**		Date
Chevron PM		Phone
Company, Department	EMC Bus. Unit, if applicable	Charge Code
Address		
Contract PM	E-mail	Phone
Company, Address		
Sampling Location (Address)		Facility Number

( ) Service Station ( ) Fuel Terminal ( ) Marine Terminal ( ) Pipeline ( ) Refinery
( ) Other_____

( ) Chevron ( ) Texaco ( ) Gulf ( ) BP ( ) Cumberland Farms
( ) Other_____

Type of Analysis Desired
( ) Identify Product ( ) Compare Spill with Potential Sources (Send Source Samples)
( ) Compare Samples with Previous Analyses. Log Numbers and/or Dates:_____
( ) Other_____ (Call 510-242-5918 or 510-242-1634 for Approval)

Reason for Request (Clearly State Problem, Site History, Draw or Enclose a Map, Indicate Whether Leak or Spill)

Normal turn-around time is 4 weeks. Call 510-242-1634 to negotiate alternate arrangements.

Number of Containers Per Sample	Sample Name/Description	Date Sampled	Sampled By
Transporter		Date Received	Initials
Laboratory **Chevron Energy Technology Company**		Date Received	Initials

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6/07/04

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Sample containers and desired volumes:

- **Hydrocarbons:** 120 ml per gasoline sample, preferably in three 40 ml clear glass vials with **solid** teflon-coated caps (septum caps leak). 40 ml per distillate or oil sample. If 40 ml vials are unavailable, a pint or 4 oz. glass jar with teflon lined cap is acceptable. Leave approximately 1/8" headspace in the vials to allow for fuel expansion. If necessary, include produced water to minimize headspace.

- **Water samples:** Two 1000 mL clear glass bottles with teflon-lined caps. Make sure there is no headspace in the bottle. Do not send VOA vials of water - the volume is insufficient for fingerprint analysis. Water samples must be preserved with HCl at pH <2 and kept at 4°C.

- **Soil samples:** Two 8 ounce wide mouth clear glass jars with teflon-lined caps, or a capped brass sleeve from a split spoon sampler. Minimize headspace. Keep the samples at 4°C.

Shipping Instructions: All samples must be accompanied by a Request for Environmental Analysis and Chain of Custody form, obtained by calling 510-242-1634 (Michael Moir) or 510-242-5918 (Grace Chen). Please obtain the appropriate charge code for the site and note it on the form. Seal the form in a plastic bag and enclose it in the container with the samples.

Please ship all soil and water samples in an ice chest at 4^{o}C. Seal each sample in a plastic bag to keep the labels from getting wet. A mixture of foam blocks and plastic bags containing ice works well to chill the samples and protect them from breakage. Hydrocarbon samples need not be iced. They should be wrapped in plastic, enclosed in a metal can filled with vermiculite or other protective packing, and packed in a box that meets D.O.T. and U.N. requirements.

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Fuel Product Hazard Warnings (See Chevron MSDS for Additional Information)		
Gasoline (All Grades) Jet Fuel B Jet Fuel Gasoline Grade Aviation B Gasoline (All Grades)	**Danger**	Extremely flammable. Harmful or fatal if swallowed. Prolonged or repeated contact may cause skin/eye and respiratory irritation or other injury.
Diesel (All Grades) Heating Fuel/Oil (All Grades) Jet Fuel (Grades A, A-1, A-50, JP-4, JP-5) Aviation Turbine Fuel, JP-5	**Danger**	Combustible. Harmful or fatal if swallowed. Prolonged or repeated contact may cause skin/respiratory irritation or other injury.
Water samples with ppm or less hydrocarbon Soil samples with ppm or less hydrocarbon		Not hazardous.
For Health and Safety Information Call or Write Chevron Emergency Information Center: P.O. Box 4054, Richmond, Ca 94804-0054, 800-457-2022. **In case of leak, spill or fire, call CHEMTREC Toll Free 800-424-9300**		

6/07/04

Attachment 5

Lancaster Laboratories Packing and Shipping Protocols

Packing and Shipping Coolers to Lancaster Laboratories

This guide will explain the step-by-step process of packing samples for shipment to Lancaster Laboratories.

Section 1 – items you may receive in a cooler.

Section 2 – how to properly pack the cooler for shipment.

It is very important to follow the directions in Section 2 exactly to ensure the samples properly arrive at Lancaster Laboratories. **Any changes in these steps may cause the samples to be rejected and significant additional costs to Lancaster Laboratories for resampling.**

Critical issues when packing and shipping samples to Lancaster Laboratories
1. Chain of Custody (COC) - proper completion of the Received and Relinquished Fields
2. Temperature blank - samples must be $4^{o}C \pm 2$
3. No breakage (no glass touching glass)
4. Holding times must be met so the samples must be shipped via Overnight Priority Delivery
5. All documents must be placed in a ziploc bag - two copies are sent to the laboratory - the client will keep the pink copy of the COC
6. Prechill temperature blanks in a refrigerator

If you run into problems or have questions about the packing process please contact:

Steve Davies: 717-656-2300, Ext. 1260 Cell phone: 717-587-5131

Backup Contacts:

Rachel Kreamer: 717-656-2300, Ext. 1350

Lynn Dodd: 717-656-2300, Ext. 1582

Jeff Moyer: 717-656-2300, Ext. 1884

Lancaster Laboratories

Section 1

This section describes what you may receive in your coolers. Depending on the type of samples you'll be packing, you may receive all of these items or only some of the items.

- Cooler custody seal
- Return shipping label with Lancaster Labs address for the outside of the cooler
- FedEx Air bill
- Labels for small bottles (40mL vials)
- Labels for large bottles
- Foam disks and bubble wrap packing materials
- Chain-of-Custody
- Sample container record (bottle inventory list)
- Water and/or soil containers
- Ziplocs - two sizes:
    - Large Ziploc bags are provided for ice
    - Small Ziploc bags are provided for both documents (COC) and 40mL vials packaged in foam
- Large plastic bag
- Absorbant Pad
- Cable tie

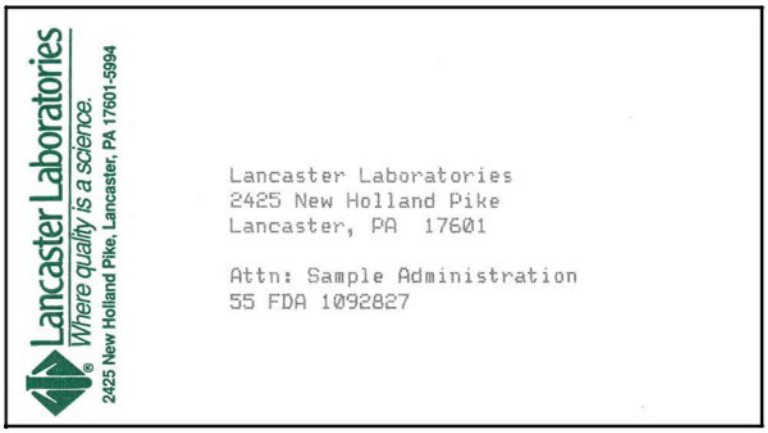
Description of items you may receive in your cooler.

This photo shows the items you may receive in your cooler.

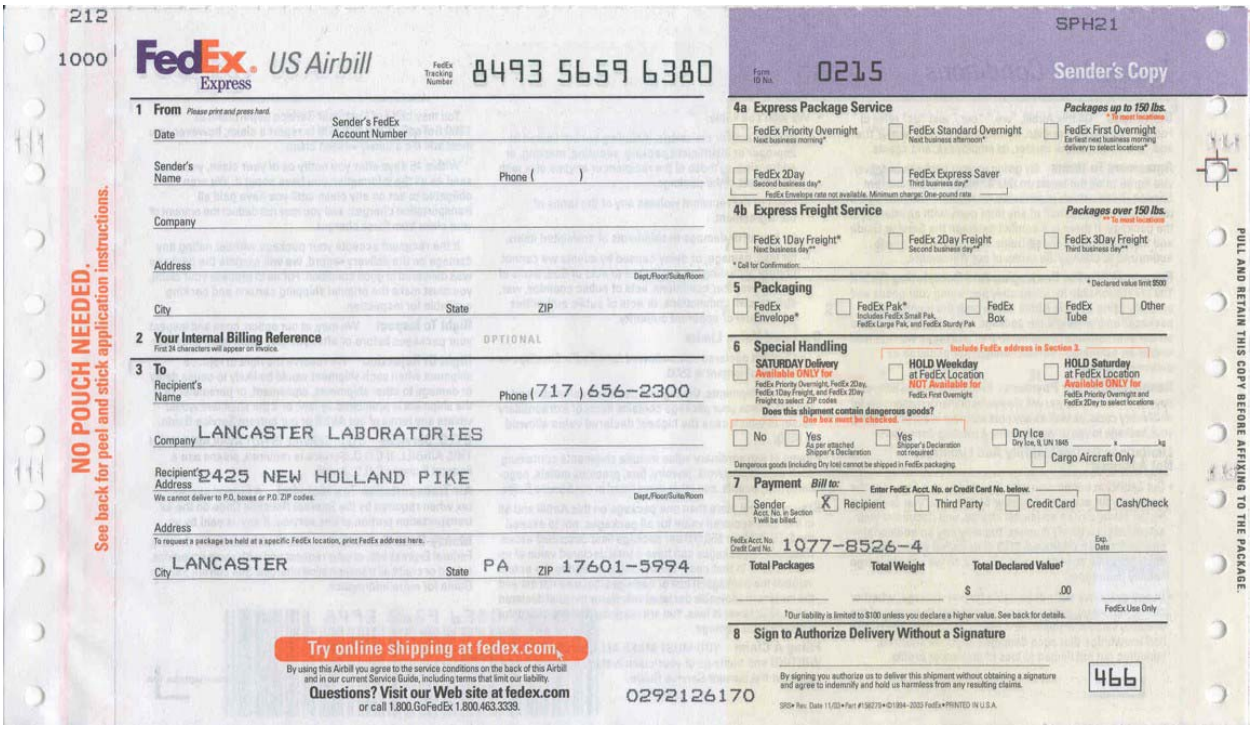
Description of items you may receive in your cooler.

Cooler custody seal

Return shipping label with Lancaster Labs address for the outside of the cooler

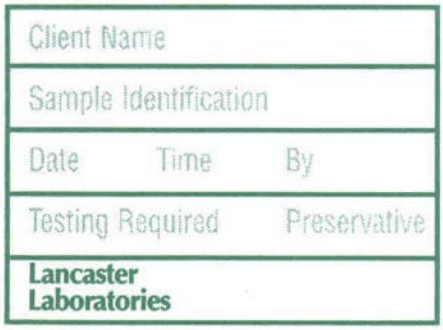


FedEx Air bill

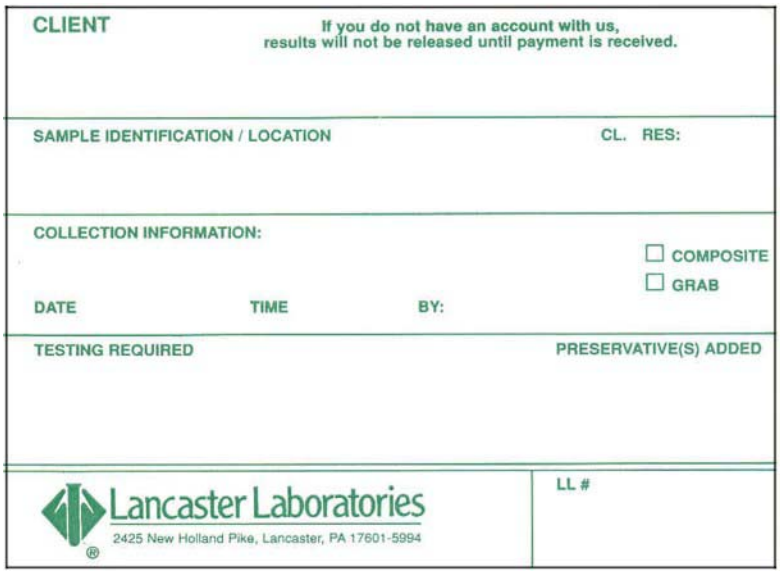


Description of items you may receive in your cooler.

Labels for small bottles (40 mL vials)



Labels for large bottles



Foam disks and bubble wrap packing materials

Analysis Request / Environmental Services Chain of Custody

Lancaster Laboratories
Where quality is a science.

For Lancaster Laboratories use only

Acct. #_____ Group#_____ Sample # _____

COC # 0071069

Please print. Instructions on reverse side correspond with circled numbers.

(1)

Client: _____ Acct. #: _____

Project Name/#: _____ PWSID #: _____

Project Manager: _____ P.O.#: _____

Sampler: _____ Quote #: _____

Name of state where samples were collected: _____

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4): Soil	Water (Check if Applicable: ☐ Potable ☐ NPDES)	Other	Total # of Containers	(5) Analyses Requested	Remarks	(6) Temperature of samples upon receipt (if requested)

For Lab Use Only
FSC: _____
SCR #: _____

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: _____
Rush results requested by (please circle): Phone Fax E-mail
Phone #: _____ Fax #: _____
E-mail address: _____

(8) **Data Package Options** (please circle if required)
QC Summary — Type VI (Raw Data)
Type I (Tier I) — GLP
Type II (Tier II) — Other
Type III (NJ Red. Del.)
Type IV (CLP)

SDG Complete? Yes No

Site-specific QC required? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal Chain of Custody required? Yes No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

(Bottle inventory list for soil sampling)

Sample Container Record

Lancaster Laboratories
Where quality is a science.

Order Number 1196610
Order Date 10/29/04
Page 1

Client: 0011
XYZ Corp.
2222 Lab Road
Lancaster, PA 17603
717-849-6995

Ship To:
XYZ Corp.
2222 Lab Road
Lancaster, PA 17603
717-849-6995

Group: 1 – Soils w/ EnCores

Lancaster Laboratories is giving you bottles for 1 sampling point.
Please fill the following bottles per sampling point.

Qty	Code	Bottle Type	Preservative	Analyses		Holding Time
3	094	En Core Sampler	None	8389	Encore	48 hours
1	094	En Core Sampler	None	8390	Encore	48 hours
1	020	500 ml wide mouth glass	None	1155	Pb GF	6 months
				6935	As-ICP	6 Months
				6961	Ni-ICP	6 Months
				6951	Cr-ICP	6 Months
				425	Cr6+	96 Hours
				111	Moist	N/A
				2858	SIM	14 Days
				4688	8270	14 Days
				4689	SW846	14 Days
1	059	125 ml glass	None	2729	TPH	14 Days

If you have any questions, please contact your Client Service Representative.

Date Needed	Shipping Method	This order is:
10/29/04	Federal Express Next Day (AM)-39	Per Your Request

Lancaster Laboratories • 2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681

2104 Rev. 8/4/99

Description of items you may receive in your cooler.

(Bottle inventory list for water sampling)

Sample Container Record

Lancaster Laboratories
Where quality is a science.

Order Number 1196610
Order Date 10/29/04
Page 4

Client: 0011
XYZ Corp.
2222 Lab Road
Lancaster, PA 17603
717-849-6995

Ship To:
XYZ Corp.
2222 Lab Road
Lancaster, PA 17603
717-849-6995

Group: 2 XYZ Corp. - Waters

Lancaster Laboratories is giving you bottles for 1 sampling point.
Please fill the following bottles per sampling point.

Qty	Code	Bottle Type	Preservative	Analyses		Holding Time
3	026	40 ml glass vial	HCl	1728	8015	14 Days
1	029	1000 ml round amber glass	HCl	2740	TPH	7 days
3	038	40 ml glass vial (GC/MS)	HCl	2300	UST-UN	14 Days
1	008	500 ml round plastic	HNO3	7044	Sb-ICP	6 Months
				7035	As-ICP	6 Months
				7046	Ba-ICP	6 Months
				7049	Cd-ICP	6 Months
				7051	Cr-ICP	6 Months
				7052	Co-ICP	6 Months
				7053	Cu-ICP	6 Months
				1055	Pb GF	6 Months
				259	Hg	28 Days
				7061	Ni-ICP	6 Months
				7036	Se-ICP	6 Months
				7066	Ag-ICP	6 Months
				1073	Tl GF	6 Months
				7072	Zn-ICP	6 Months
2	045	1000 ml round amber glass	Na2S2O3	4678	8270	7 Days
				4679	SW846	7 Days
1	004	500 ml round plastic	None	276	Cr6+	24 Hours

If you have any questions, please contact your Client Service Representative.

Date Needed	Shipping Method	This order is:
10/29/04	Federal Express Next Day (AM)-39	Per Your Request

Description of items you may receive in your cooler.

Example of Empty Bottles for Water Samples
Bottle types shown are:

1 Liter plastic

1 Liter Amber glass

1 Liter Clear glass

40 mL vials (front of photo)

Description of items you may receive in your cooler.

Example Bottles for Soil Samples
Bottles and samplers shown in this photo are:

1 liter glass

500 mL bottle

125 mL bottle (shown in middle of photo)

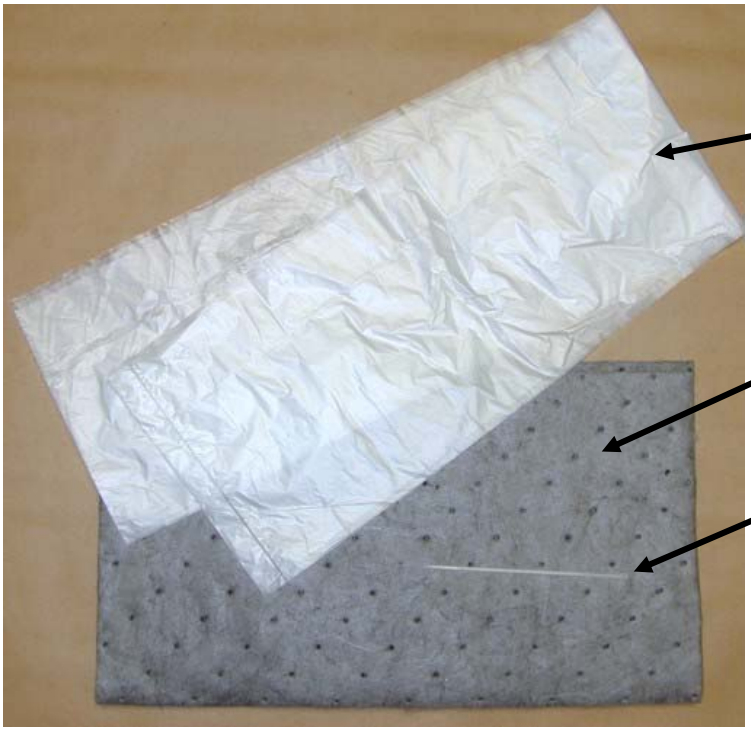
EnCore 5g (foil packs)

Description of items you may receive in your cooler.

Large Ziploc bags are provided for ice.

Small Ziploc bags are provided for both documents (COC) and 40mL vials packaged in foam.

Ziploc bags - two sizes will be included in the cooler



Large plastic bag to line the cooler with.

Absorbant pad to go inside the large plastic.

Cable tie for securing the large plastic bag.

Section 2

This section describes how to properly pack the cooler for shipment to Lancaster Laboratories.

Items you need to provide

- Tape - clear packing tape
- Ice – approximately 20 lbs per cooler

Items provided by Lancaster Laboratories

- Cooler custody seal - one per cooler
- Return shipping label with Lancaster Labs address for the outside of the cooler
- FedEx Air bill
- Ziploc bags for ice, documents and 40mL vials in foam holder
- Empty coolers

Critical issues when packing and shipping samples to Lancaster Laboratories
1. Chain of Custody (COC) - proper completion of the Received and Relinquished Fields
2. 20 lbs of ice for each cooler - prepared in two Ziploc bags of 10 lbs of ice each (see photo above)
3. Temperature blank - samples must be 4^{o}C $\pm$ 2
4. No breakage (no glass touching glass)
5. Holding times must be met so the samples must be shipped via Overnight Priority Delivery
6. All documents must be placed in a Ziploc bag - all originals are sent to the laboratory - the client will keep the pink bottom copy of the COC
7. Prechill temperature blanks in a refrigerator

After you've properly packed and sealed the coolers, deliver them to a Federal Express Service Center. To find a location near you, visit:

www.fedex.com

Step 1

1. Start with an empty cooler.

2. Place the large plastic bag into the cooler and pull excess down the outer edge of cooler. Then place cardboard insert into the bag.

3. Fill one large Ziploc bag with 10 lbs. ice and place on top of the cardboard insert in the bottom of the cooler.

4. Place the cardboard divider insert on top of the Ziploc bag filled with ice.

Step 2a
This step describes packing water samples.

Example of Water Samples

Make sure that the ID labels on the samples are matched with the correct Chain of Custody form.

Analysis Request / Environmental Services Chain of Custody

Lancaster Laboratories — Where quality is a science.

For Lancaster Laboratories use only — Acct. # _____ Group# _____ Sample # _____

COC # 0071071

Please print. Instructions on reverse side correspond with circled numbers.

1 Client: Company LLI Acct. #: _____
Project Name/#: Groundwater Only PWSID #: _____
Project Manager: Wilson Hershey P.O.#: AB-8322
Sampler: Donald E. Wyand Quote #: _____
Name of state where samples were collected: PA

2 Sample Identification	Date Collected	Time Collected	3 Grab	3 Composite	Matrix 4: Soil	Water	Other	Total # of Containers	5 Analyses Requested: TCL VOC 8260	TCL SVOC 8270	TAL Metals 6010	pH, TDS	Remarks	6 Temperature of samples upon receipt (if requested)
MW-1	11/4/04	0900				X		6	X	X	X	X		
MW-2	11/4/04	0930				X		6	X	X	X	X		
MW-3	11/4/04	2100				X		2	X					

Matrix 4: Potable / NPDES (Check if Applicable)

For Lab Use Only: FSC: _____ SCR #: _____

7 **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: _____
Rush results requested by (please circle): Phone Fax E-mail
Phone #: 717-656-2300 Fax #: 717-656-0450
E-mail address: dwyand@lancasterlabs.com

8 **Data Package Options** (please circle if required)
QC Summary — Type VI (Raw Data) — SDG Complete? Yes No
Type I (Tier I) — GLP — Site-specific QC required? Yes No
Type II (Tier II) — Other — (If yes, indicate QC sample and submit triplicate volume.)
Type III (NJ Red. Del.)
Type IV (CLP) — Internal Chain of Custody required? Yes No

9 Relinquished by:	Date	Time	Received by:	Date	Time
Donald E. Wyand	11/4/04	2130			
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

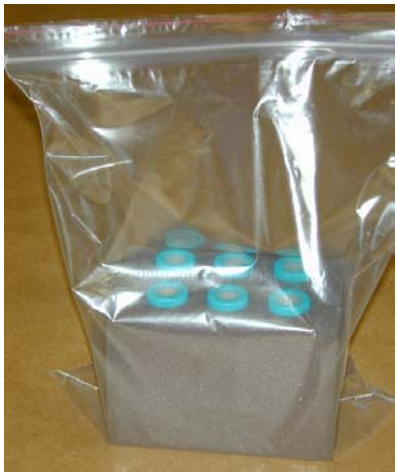
Lancaster Laboratories, Inc., 2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 (717) 656-2300
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

2102 Rev. 10/27/02

The Chain of Custody form that matches the samples must be sent with the samples in the cooler.

Step 2b
This step describes packing water samples.

1. If you have water samples in 40 mL vials, place the vials in the foam holders as shown above, so that only the tops of the vials will be showing.



2. Place the foam holder containing the vials, in the smaller size Ziploc bag and seal.

Foam holders must be packed with vial tops facing upward. You must place bubble wrap between foam holders if you stack them on top.

Plastic bottles can touch, but should not be able to move about during shipping.

3. Pack the sample bottles into the cooler using the cardboard divider insert. You may bend the cardboard inserts to meet your needs but **no glass bottles can touch** each other.

Step 3a
This step describes packing soil samples.

Example of Soil Samples.
Make sure that the ID labels on the samples are matched with the correct Chain of Custody form.

Analysis Request / Environmental Services Chain of Custody

Lancaster Laboratories
Where quality is a science.

For Lancaster Laboratories use only
Acct. # _____ Group# _____ Sample # _____

COC # 0071070

Please print. Instructions on reverse side correspond with circled numbers.

(1) Client: Company LLI Acct. #:
Project Name/#: Soil Investigation PWSID #:
Project Manager: Wilson Hershey P.O.#: AB-7463
Sampler: Donald E. Wyand Quote #: 201878
Name of state where samples were collected: PA

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water	Other	Total # of Containers	(5) Analyses Requested: SVOC TCL	Pest/PCB TCL	Metals TAL	Herbicide Appl.	TCL VOCs	Remarks	(6) Temperature of samples upon receipt (if requested)
SB-1 (0-2')	11/5/04	2100		✓	✓			1	X	X	X				
SB-1 (2-4')	11/5/04	2110		✓	✓			1	X	X	X				
SB-2 (0-2')	11/5/04	2120		✓	✓			1	X	X	X				
SB-2 (2-4')	11/5/04	2120		✓	✓			1	X	X	X				
SB-22 (0-10')	11/5/04	1200		✓	✓			1	X	X	X	X			
SB-35 (0-10')	11/5/04	1200		✓	✓			1	X	X	X	X			
SB-10 (0-2')	11/5/04	2200	✓		✓								X		
SB-20 (0-2')	11/5/04	2215	✓		✓								X		
SB-8 (0-2')	11/5/04	2000	✓		✓								X		

For Lab Use Only: FSC: SCR #:

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax (E-mail)
Phone #: 717-656-2300 Fax #: 717-656-0450
E-mail address: dwyand@lancasterlabs.com

(8) **Data Package Options** (please circle if required)
QC Summary, Type I (Tier I), Type II (Tier II), Type III (NJ Red. Del.), Type IV (CLP), Type VI (Raw Data), GLP, Other
SDG Complete? Yes No
Site-specific QC required? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal Chain of Custody required? Yes (No)

(9) Relinquished by:	Date	Time	Received by:	Date	Time
Donald E. Wyand	11/5/04	2400			
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

Lancaster Laboratories, Inc., 2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 (717) 656-2300
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

2102 Rev. 10/27/02

Step 3b
This step describes packing soil samples.

Pack the soil sample bottles into the cooler using the cardboard divider insert. You may bend the cardboard inserts to meet your needs but no glass bottles can touch.

Use bubble wrap and the foam disks to make sure that no samples are touching and to fill empty spaces.

Step 4
Final cooler packing

This step applies to packing either soil samples or water samples.

1. The temperature bottle **MUST** be returned with the samples in the cooler.

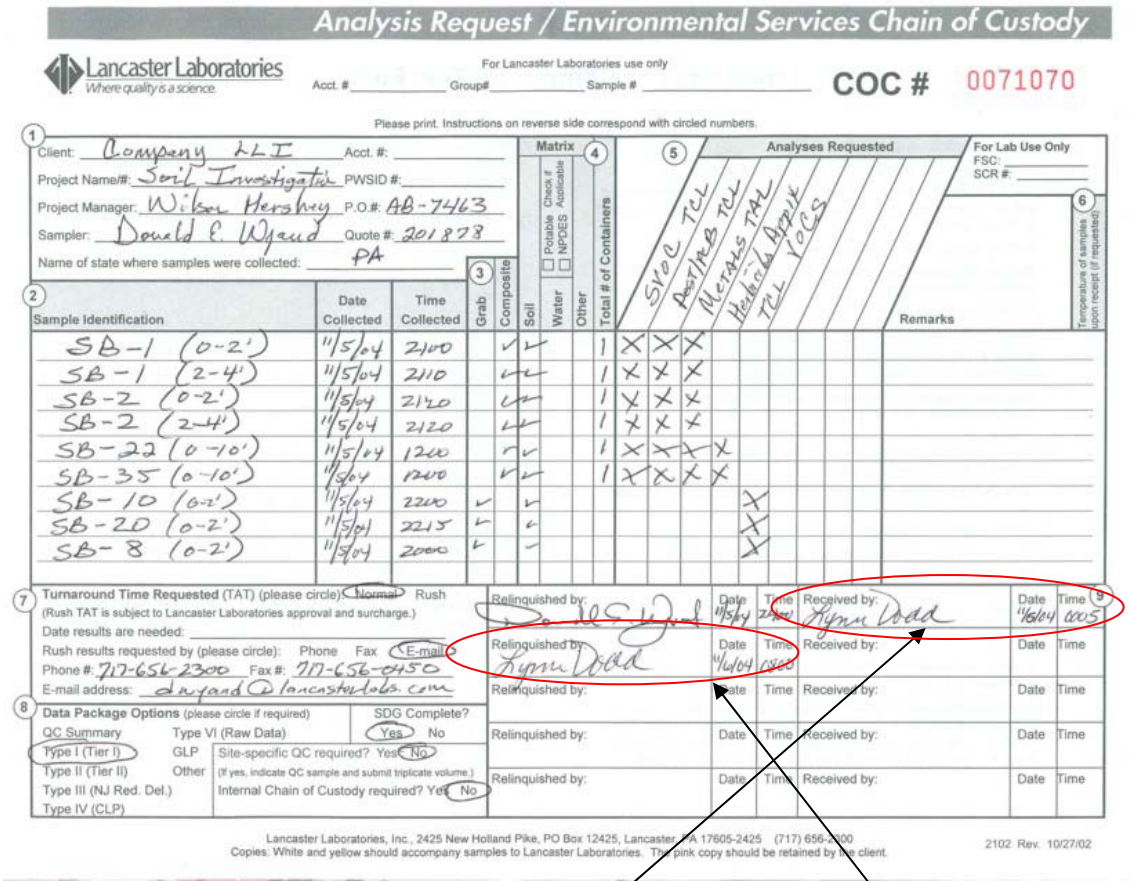
2. Place this bottle on top of the samples in the cooler.

3. After the samples and temperature bottle are packed, fill the large Ziploc bag with 10 lbs. of ice and place on top of the cardboard divider and temperature bottle.

4. Pull up edges of large bag and cinch together and secure the bag closed with the cable tie.

Step 4b
Final cooler packing

The last item to place in the cooler will be the Chain of Custody. Sign off on this form (as shown below), then **place in a Ziploc bag** on top of the closed bag.



Analysis Request / Environmental Services Chain of Custody

Lancaster Laboratories — Where quality is a science.

For Lancaster Laboratories use only — Acct. # ____ Group# ____ Sample # ____

COC # 0071070

Please print. Instructions on reverse side correspond with circled numbers.

1 Client: Company LLI — Acct. #: ____
Project Name/#: Soil Investigation — PWSID #: ____
Project Manager: Wilson Hershey — P.O.#: AB-7463
Sampler: Donald E. Wyand — Quote #: 201878
Name of state where samples were collected: PA

2 Sample Identification	Date Collected	Time Collected	3 Grab	3 Composite	4 Matrix: Soil	Water	Other	Potable / NPDES (Check if Applicable)	4 Total # of Containers	5 Analyses Requested: Sieve TCL	Perform TAL	Metals TAL	Herbicides TCL	Pesticides TCL	Volatiles	Remarks	6 Temperature of samples upon receipt (if requested)
SB-1 (0-2')	11/5/04	2100		✓	✓				1	X	X	X					
SB-1 (2-4')	11/5/04	2110		✓	✓				1	X	X	X					
SB-2 (0-2')	11/5/04	2120		✓	✓				1	X	X	X					
SB-2 (2-4')	11/5/04	2120		✓	✓				1	X	X	X					
SB-22 (0-10')	11/5/04	1240		✓	✓				1	X	X	X	X				
SB-35 (0-10')	11/5/04	1240		✓	✓				1	X	X	X	X				
SB-10 (0-2')	11/5/04	2200	✓		✓									X	X		
SB-20 (0-2')	11/5/04	2215	✓		✓									X	X		
SB-8 (0-2')	11/5/04	2000	✓		✓									X	X		

For Lab Use Only — FSC: ____ SCR #: ____

7 Turnaround Time Requested (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: ____
Rush results requested by (please circle): Phone Fax E-mail
Phone #: 717-656-2300 Fax #: 717-656-0450
E-mail address: dwyand@lancasterlabs.com

8 Data Package Options (please circle if required)
QC Summary — Type VI (Raw Data) — SDG Complete? Yes No
Type I (Tier I) — GLP — Site-specific QC required? Yes No
Type II (Tier II) — Other — (If yes, indicate QC sample and submit triplicate volume.)
Type III (NJ Red. Del.) — Internal Chain of Custody required? Yes No
Type IV (CLP)

Relinquished by:	Date	Time	Received by:	Date	Time
Donald E. Wyand	11/5/04	2100	Lynn Dodd	11/6/04	0005
Lynn Dodd	11/6/04	0800			

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Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

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You must sign your name in the **Received by** area and write the time and date you received the samples.

You must sign your name in the **Relinquished by** area and write in the time and date when you will be sending the cooler for shipping.

Step 5
Sealing the cooler

1. Place clear shipping tape around the lid of the cooler so that the lid is sealed to the bottom of the cooler.

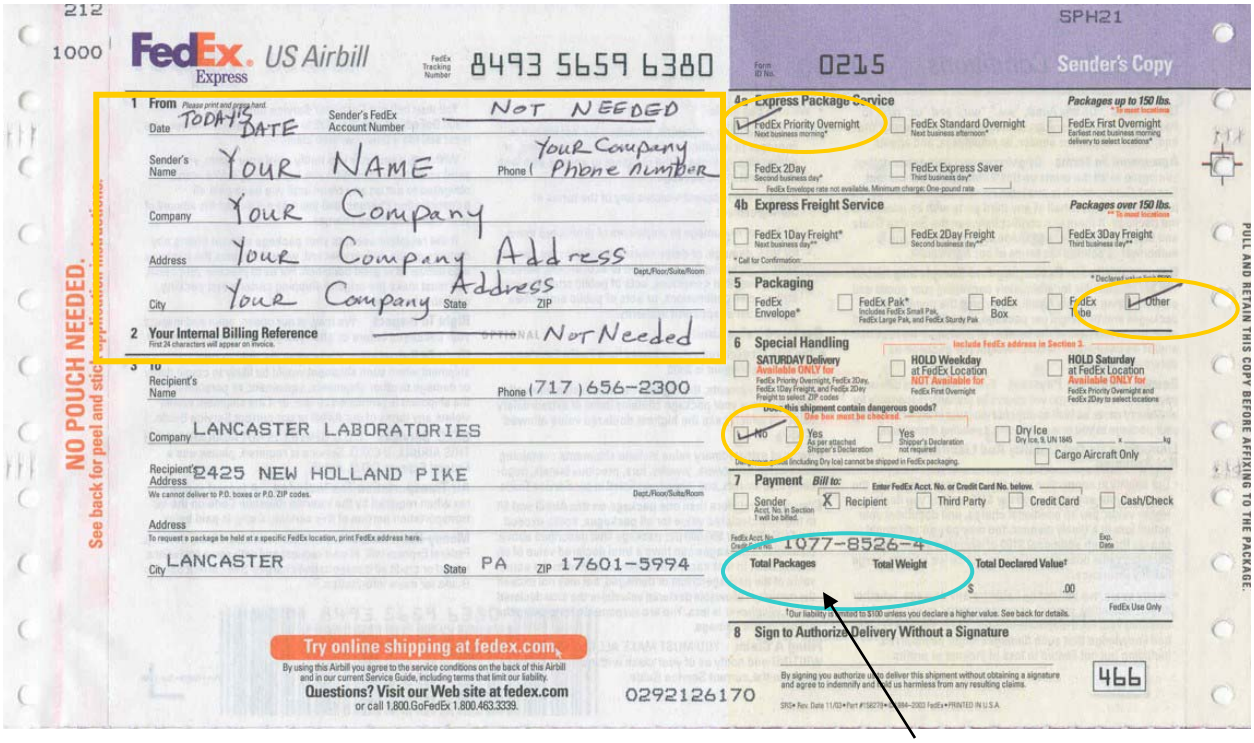
2. Place clear shipping tape around the body of the cooler. Place one strip on either side of the latch that opens the lid.

3. Sign and date the custody seals for each cooler.

4. Place the custody seal on the cooler as shown, so that the lid of the cooler is sealed to the bottom of the cooler.

5. Place the shipping label with Lancaster Laboratories' address, on the top of the cooler. Place clear packing tape over the label to keep it secure.

Step 6
Completing the Fed Ex shipping forms



Samples must be dropped off at a staffed Federal Express Service Center. To find a staffed location near you, visit: **www.fedex.com**

Federal Express can weigh the coolers.