GEOMATRIX

FAX

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Date: March 29, 2000

Number of pages Including cover sheet: 8

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Project No.: 6262.000.0
Project Name: Canterbury Residential Development

REMARKS:

☐ Hard copy to follow ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment

Enclosed is the work plan for soil and groundwater sampling and analysis in the existing streets at the Canterbury Residential Development. (Geomatrix protocols (Attachment 1) will be included with the hard copy of this work plan, which will be sent at the end of the day.)

Please provide any comments as soon as possible.

Thanks.

3 wells
8 soil borings

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ENVIRONMENTAL PROTECTION

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March 29, 2000
Project 6262.000.0

Mr. Hugh J. Murphy
City of Hayward Fire Department
777 B Street
Hayward, California 94541-5007

Subject: Work Plan for Subsurface Investigation: Holyoke Street, Branaugh Court, Mediterranean Avenue, and Chesterfield Court
Canterbury Residential Development
Hayward, California

Dear Mr. Murphy:

As requested by the City of Hayward, Geomatrix Consultants, Inc. (Geomatrix) has prepared this work plan to characterize soil and groundwater conditions beneath several streets in the Canterbury Residential Development located in Hayward, California. Based on a report by ACC Consultants[1] and information from third parties, affected soil from other properties in the development appears to have been placed below several streets in the development. Geomatrix has prepared this work plan to address related issues that were raised during meeting with the City of Hayward, Department of Public Works (DPW) and the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB).

- At a meeting on March 24, 2000, DPW requested information regarding the quality of soil likely to be contacted during street maintenance, from ground surface to the deepest utility buried beneath the streets. To date, only limited data have been collected to evaluate this soil interval.

- At a March 27, 2000 meeting, the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) requested the installation of three groundwater monitoring wells to provide additional information regarding water quality beneath the streets.

SCOPE OF WORK

The scope of work has been divided into three sections. The first section describes a soil-sampling program to further evaluate soil quality beneath the streets of interest in the development. The second section describes a well installation program to further evaluate water quality beneath the streets of interest. The third section discusses the analytical laboratory programs for collected soil and groundwater samples.

[1] ACC Environmental Consultants, 2000, Subsurface Investigation Report, Holyoke Street and Olympic Avenue, Hayward, California, March 22.

Prior to performing the field investigation, Geomatrix will complete the following: update the Health and Safety Plan as necessary; obtain necessary boring and well installation permits from the Alameda County Public Works Department; and clear boring locations for underground utilities by notifying appropriate utilities through Underground Service Alert (USA).

SOIL SAMPLING

As shown in Figure 1, soil sampling will be performed in Holyoke Street and Branaugh Court. Geomatrix will collect soil samples from boreholes advanced adjacent to the eight borings drilled and sampled by ACC[1].

Two samples will be collected at each boring location. One sample will be collected in the upper fill material identified by ACC as a sand/silt/gravel mixture that occurs from approximately 0.5 to 3.0 feet below ground surface (bgs). The second sample will be collected beneath the upper fill unit at a depth of approximately 4 to 5 feet bgs.

The sample depths were selected based on our review of the improvement plans for the Canterbury Residential Development, which indicate that utilities extend to approximately 5 feet bgs.

Soil borings will be advanced using a direct push technology rig. The borings will be continuously cored using a dual tube sampling system, and the recovered soil will be logged by a Geomatrix field geologist or engineer in accordance with the Unified Soil Classification System visual-manual procedure (ASTM D2488-90). The recovered soil will be screened with an organic vapor monitor equipped with a photoionization detector (PID). The inner sample barrel of the dual tube sampling system will be lined with polybutyrate tubing. The interval of recovered soil selected for chemical analysis will be cut from the polybutyrate tubing. The ends of the sample will be covered with teflon sheets and plastic caps. The caps will be secured with silicon tape. The soil samples will be labeled, and placed in cooler with ice pending delivery to an analytical laboratory under Geomatrix chain of custody. Soil sampling will be performed in accordance with Geomatrix protocols for Soil Sampling for Chemical Analysis, and Direct-Push Sampling and Destruction of Soil Borings presented in Geomatrix' March 17, 2000 work plan[2].

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[2] Geomatrix Consultants, Inc., 2000, Soil Sampling Plan, Canterbury Residential Development, Hayward, California, March 17.

Soil cuttings from soil sampling activities and water from equipment cleaning will be temporarily stored on site in 55-gallon drums pending characterization for disposal. SummerHill Homes will be responsible for final disposal.

MONITORING WELL INSTALLATION, DEVELOPMENT, AND SAMPLING

Geomatrix anticipates installing three monitoring wells at the locations shown in Figure 1. The borings will be drilled using hollow-stem auger techniques by a California-licensed drilling firm. The borings will be continuously cored, and the recovered soil will be logged by a Geomatrix field geologist or engineer in accordance with the Unified Soil Classification System visual-manual procedure (ASTM D2488-90). The recovered soil will be screened with a PID. The monitoring wells will be installed through the hollow stem augers and constructed of 2-inch-diameter, flush-thread, schedule 40 PVC casing and well screen. Each well will be constructed with approximately 10 feet of 0.02-inch factory slotted screen; approximately 2 of screen will be placed above the water table. Annular space will be filled with Lonestar Lapis Luster 2/16 sand (or equivalent) from the bottom of the borehole to approximately 2 feet above the top of the well screen. Approximately 2 feet of bentonite pellets will be placed on top of the filter sand, and the remaining annular space will be filled with Portland Type I/II cement grout using tremie pipe. The wells will be completed at the surface with traffic-rated manhole covers set in concrete.

The wells will be developed at least 24 hours after installation by a combination of bailing, surging, and pumping until the produced water is sufficiently clear and field water quality parameters (pH, specific electrical conductance, and temperature) have stabilized.

The wells will be sampled approximately 24 hours after development. The wells will be purged using a diaphragm pump and new disposable PVC tubing. Field water quality parameters (pH, specific electrical conductance, and temperature) will be monitored during purging; purging will be complete when the water quality parameters have stabilized to within 10 percent and at least three well casing volumes of groundwater have been removed. The wells will be sampled with new disposable polyethylene bailers. The groundwater will be transferred to laboratory-supplied bottles, labeled, and placed in a cooler with ice pending delivery to the analytical laboratory under Geomatrix chain of custody. Samples designated for metals analysis will be filtered in the field prior to placement in sample containers.

After installation and development, the wells will be surveyed by a California-licensed surveyor for horizontal position and elevation. Installation and development of wells will follow Geomatrix protocols. Three Geomatrix protocols entitled (1) Installation and Destruction of Wells, (2) Water Level, Well Depth, and Floating Product Measurements, and (3) Sampling of Groundwater Monitoring Wells and Water Supply Wells are attached.

Soil cuttings from drilling activities and water from well development and equipment cleaning will be temporarily stored on site in 55-gallon drums pending characterization for disposal.

LABORATORY ANALYSES

Soil and water samples will be submitted to Friedman & Bruya in Seattle, Washington for petroleum-related analyses. These analyses will include total petroleum hydrocarbons as motor oil (TPHmo; U.S. EPA 8015M), volatile organic compounds (U.S. EPA Method 8260), and polycyclic aromatic hydrocarbons (PAHs; U.S. EPA Method 8270 SIMS).

Metals analyses will be conducted on groundwater samples only. These samples will be submitted to Chromalab, Inc. of Pleasanton, California and analyzed in accordance with EPA 6000/7000 series methods for Title 22 metals.

As presented in the schedule section below, it is anticipated that, based on subcontractor availability, the soil samples will be collected approximately one week prior to the collection of the groundwater samples. Therefore, the soil samples will be run on a standard turn-around, and the groundwater samples will be analyzed on 48-hour turnaround time.

For Quality Assurance/Quality Control purposes, the laboratory will analyze a method blank and lab control samples in accordance with its quality assurance plan. Geomatrix will specify one site soil sample and one site groundwater sample to be used by the laboratory for matrix spike/matrix spike duplicates. In addition, one blind duplicate groundwater sample will be tested for VOCs and PAHs and one trip blank sample of deionized water provided by the lab will be tested for VOCs.

REPORTING

A report presenting the data obtained during this investigation will be prepared and will include:

- details of installation and development of the monitoring wells, including boring and well construction logs;
- potentiometric surface map based on water levels from the three wells;
- A summary of the soil and groundwater sampling results; and
- An evaluation of potential exposure by maintenance workers that may contact the shallow soil beneath the streets.

SCHEDULE

The tentative schedule for the project is:

- Thursday, March 30, perform soil sampling
- Friday, March 31, install monitoring wells
- Monday, April 3, develop monitoring wells
- Tuesday, April 4, sample and survey monitoring wells
- Tuesday, April 11, present initial sample results and evaluation

Geomatrix appreciates this opportunity to provide services to City of Hayward Fire Department. If you have any questions, please contact either of the undersigned.

Sincerely yours,
GEOMATRIX CONSULTANTS, INC.

Thomas H. Gavigan, R.G., C.HG.
Project Hydrogeologist

Ann M. Holbrow
Senior Scientist

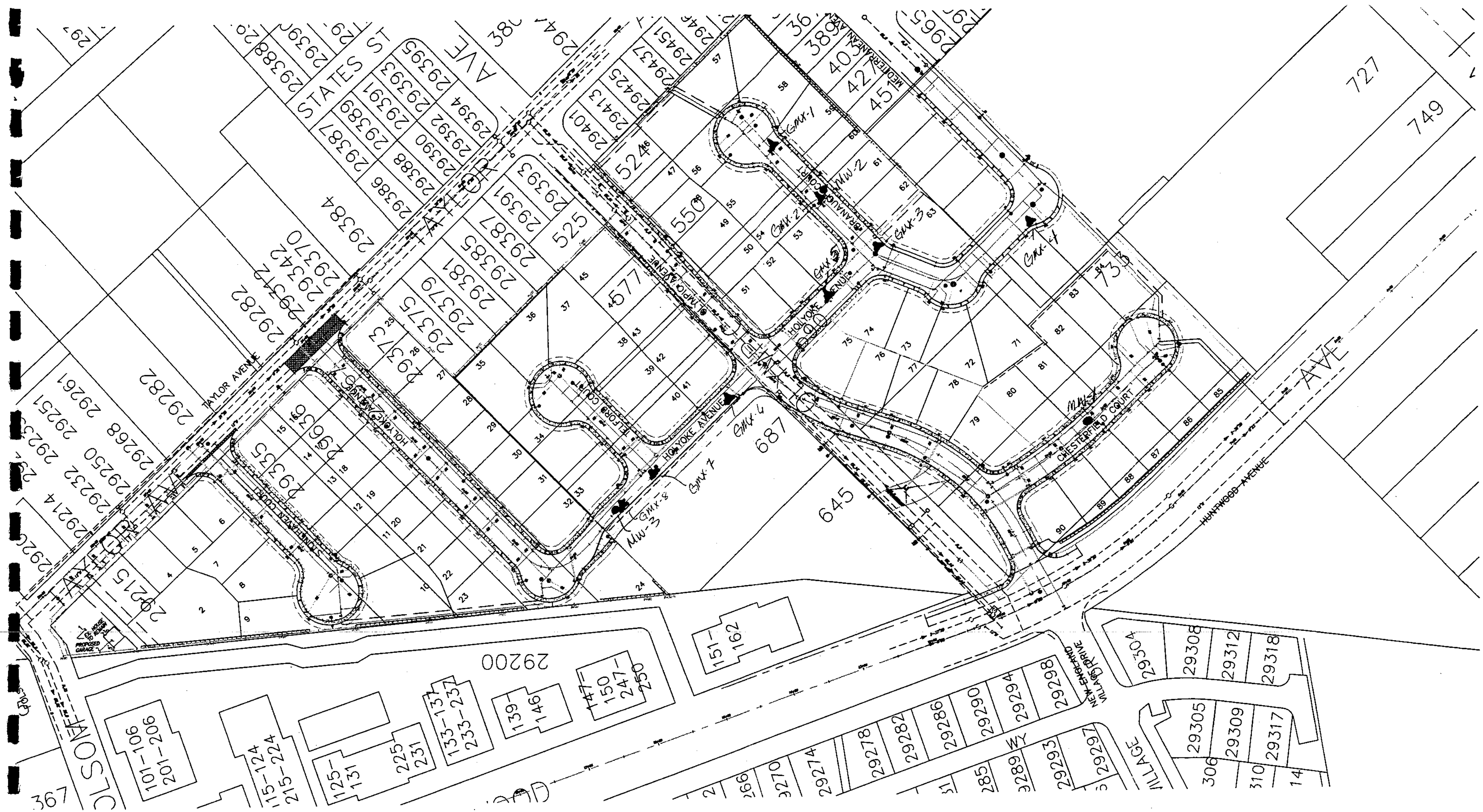
Attachments: Figure 1 Proposed Sampling Locations
Geomatrix Protocols

- Installation and Destruction of Wells
- Water Level, Well Depth, and Floating Product Measurements
- Sampling of Groundwater Monitoring Wells and Water Supply Wells

cc: Susan Hugo – Alameda County Health Care Services
Roger Brewer – California Regional Water Quality Control Board, S.F. Bay Region
Kim Brandt – LFR Levine*Fricke
Mark Beskind – SummerHill Homes

FIGURE 1

Proposed Sampling Locations



▲ - Geomatrix Shallow soil sample location (approximate)

● Groundwater Monitoring Well location (approximate

Figure 1
Proposed Sampling Locations for Streets
Canterbury Residential Development

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GEOMATRIX PROTOCOLS

- **Installation and Destruction of Wells**
- **Water Level, Well Depth, and Floating Product Measurements**
- **Sampling of Groundwater Monitoring Wells and Water Supply Wells**

PROTOCOL
INSTALLATION AND DESTRUCTION OF WELLS

1.0 INTRODUCTION

This protocol describes the procedures to be followed during the installation or destruction of monitoring, groundwater extraction, and vapor extraction wells. Drilling and logging of soil borings for the well installation will be in conformance with the protocol DRILLING OF SOIL BORINGS. The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2.0 WELL INSTALLATION

A DAILY FIELD RECORD will be completed for each day of fieldwork, and the original will be kept in the project files. If required, permits will be acquired from the appropriate agency(s), and an underground utility check will be performed before drilling begins. An underground utility check will, at a minimum, consist of contacting a local utility alert service, if available.

After well installation, well completion report(s) will be completed and filed with the State Department of Water Resources or the appropriate agency.

Each groundwater monitoring well will be designed to enable measurement of the potentiometric surface and to permit water sampling of a specific water-bearing zone. Each vapor monitoring well will be designed to enable measurement of pressure conditions and permit sampling of a specific zone. The field geologist/engineer, in consultation with the project geologist or engineer, who will be licensed in the state in which the work is performed if required, will specify the screened interval using the lithologic log and geophysical log (if be used immediately above and below the well screen and approximately every 30 to 50 feet along the length of the casing. Centralizers need not be placed on well assemblies installed within augers or drill casings because the auger or drill casing will adequately center the well casing and screen in the borehole.

For borings drilled by the mud rotary method, potable water may be added to the drill mud and circulated in the borehole after completion of the boring. Circulation will continue until the suspended sediment in the return fluid has been decreased. If borehole conditions are relatively stable, the mud will be thinned before the casing assembly is lowered to the specified depth. This is preferred because it reduces the potential for clogging the well screen with thick mud. Conversely, if borehole conditions are relatively unstable, the mud will be thinned after the casing is placed at the specified depth but prior to installation of annular fill materials. After installation of the well assembly, a slurry of filter sand and potable water will then be tremied into the annular space.

For borings drilled using the hollow stem auger method, the filter sand will be placed after the well assembly has been lowered to the specific depth through the augers. The augers will be incrementally raised as the filter sand is placed by free fall through the augers. The depth to the top of the filter pack will be measured after each increment to detect possible bridging. If bridging occurs, it will be broken by washing the filter materials into proper place with potable water or by repeatedly raising and lowering the augers slightly. The amount of water, if any, added to the borehole should be noted on the BORING LOG or DAILY FIELD RECORD.

For monitoring wells, the filter sand will be placed in a calculated quantity sufficient to fill the annular space to a level of about 1 to 2 feet above the top of the well screen. For extraction wells, the level of filter sand above the well screen will be based on site conditions. The depth to the top of the filter pack will be verified by measuring, using a tremie pipe or a weighted tape. Groundwater extraction wells or monitoring wells may be surged before placement of the transition seal to promote filter material settlement, as specified by the project manager.

Once the depth to the top of the filter material has been verified, bentonite or fine sand may be placed in the annular space as a transition seal between the filter material and the grout. A sufficient quantity of bentonite or fine sand will be poured to fill the annular space to a level of about 2 feet above the top of the filter pack. If bentonite is to be placed below standing water, a high-solids bentonite grout will be pumped through a tremie pipe, or pellets may be poured through the annulus. If bentonite is to be placed above standing water, a high-solids bentonite grout should be used or pellets may be placed in 6-inch lifts. Unless prohibited by well conditions, each lift should be hydrated using approximately 1 gallon of potable water per lift of pellets. The completed bentonite transition seal will be allowed to hydrate for at least 30 minutes prior to placing the grout. If a layer of fine sand is placed as the transition seal, the fine sand will be mixed with potable water and placed as a slurry through the tremie pipe or poured dry through the annulus. The depth to the top of the transition seal will be verified by measuring, using the tremie pipe or a weighted tape.

A neat cement grout, cement/sand grout, cement/bentonite grout, or high-solids bentonite grout will be placed from the top of the transition seal to the ground surface. The grout seal will be placed by pumping through a tremie pipe lowered to within 5 feet of the top of the transition seal in mud rotary borings. The grout seal will be placed in hollow stem auger borings by free fall through the augers as they are incrementally raised or by pumping through flexible hose or tremie pipe lowered to near the bottom of the zone to be grouted. The grout must be tremied if there is standing water in the augers above the transition seal. Grout/additive/water mixtures will be determined on a site-specific basis. Typical specifications of grout mixtures include: (a) neat cement/bentonite grout, consisting of a mixture of one sack (94 pounds) of Portland Type I/II cement, approximately 2 to 5 percent by weight (of cement) powdered bentonite, and approximately 6 to 8 gallons of water; (b) neat cement grout, consisting of one sack of Portland cement and approximately 5 to 6 gallons of water; and (c) cement/sand grout, consisting of no more than two parts sand to one part cement and approximately 7 gallons of water. Only potable water will be used to prepare the grout. No work will be done on the monitoring well until after the grout has set approximately 24 hours.

2.4 SURFACE COMPLETION

Upon completion of the well, a suitable slip-on cap, threaded end cap, or waterproof cap will be fitted on the top of the riser casing to reduce the potential for entry of surface runoff or foreign matter. Either a steel protective well cover (e.g., stovepipe) or a vault which may have a traffic-rated cover will be completed at the ground surface. All wells will be locked for security and will be designed to limit surface water infiltration.

2.5 DEVELOPMENT OF GROUNDWATER MONITORING OR EXTRACTION WELLS

When the well installation is complete and the grout has cured a minimum of 24 hours, the well will be developed by surging, bailing, and/or pumping, or other appropriate method as specified by the project manager. The objectives of well development are to remove sediment that may have accumulated during well installation, to consolidate the filter pack around the well screen, and to enhance the hydraulic connection between the target zone and the well. In most instances, a bailer will be used to remove sediment and turbid water from the bottom of the well. A surge block may then be used within the entire screened interval to flush the filter pack of fine sediment. Surging will be conducted slowly to reduce disruption to the filter pack and screen. The well will be bailed again to remove sediment drawn in by the surging process until suspended sediment is reduced.

Following bailing and surging, the well may be further developed using air-lift or pumping methods. A bailer may be used for low-yield wells. If possible, the well will be developed at a higher pumping rate than the anticipated rate of future purging. During development, the turbidity of the water will be monitored, and the pH, specific conductance, and temperature of the return water will be measured. Drawdown and recovery will be measured during and at the end of the development process, respectively, using an electric sounder. Well development will proceed until, in the judgment of the Geomatrix field personnel, the return water is of sufficient clarity. If the screened interval is too long to be developed adequately in one stage, multiple stages will be employed, in which the end of the pump intake will be raised or lowered to various depths, as required.

2.6 DOCUMENTATION

A well construction diagram for each well will be completed in the field on the WELL LOG by the field geologist/engineer and submitted to the reviewing geologist or engineer upon completion of each well. Well installation and construction data will be summarized on the DAILY FIELD RECORD or on a specialized form produced for this purpose. Well development notes and field measurements of water quality parameters will be summarized on a WELL SAMPLING AND/OR DEVELOPMENT RECORD. Following review by the project manager, the original records will be kept in the project file.

3.0 CLEANING OF DRILLING EQUIPMENT

Cleaning of the drill rig and associated drilling equipment will follow the procedures discussed in Section 2.0 of the protocol DRILLING AND DESTRUCTION OF SOIL BORINGS.

All well casing materials will be cleaned before they are installed. Well development equipment will be cleaned before use. The following cleaning procedure has been found to be effective and will be used or adapted as appropriate for general conditions of materials or equipment to be cleaned.

1. Steam-rinse with potable water or rinse in deionized or organic-free water.
2. Cover with clean plastic to protect materials and equipment from contact with chemical products, dust, or other contaminants.

Alternatively, well casing materials that have been steam-cleaned and sealed in individual airtight plastic bags by the factory can be used.

Decontamination rinsate will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

4.0 WELL DESTRUCTION

Destruction of wells will be completed in accordance with applicable state and local requirements. If required, permits for destruction will be obtained from the appropriate regulatory agency. As part of destruction design and implementation, care will be taken to seal groundwater pathways between multiple aquifers and to limit surface water infiltration through the destroyed borehole.

If practical, the well casing will be removed from the borehole. If the well casing cannot be removed, the casing should be cut and/or pressure-grouted in accordance with regulating agency requirements. For shallow wells and if the well has been completed in the uppermost aquifer, the casing may be pulled from the borehole before auger entry. Alternatively, and if the well has been completed below the uppermost aquifer, the annular fill may be drilled out with hollow stem augers and the casing removed from the borehole through the augers. If the well casing is PVC or other similar material and cannot be removed as described above, it may be removed by drilling out the casing and annular fill using a tricone or drag bit and a rotary drilling method. The borehole will be redrilled to the same or a slightly larger diameter than the original borehole. The redrilled borehole will be plumb and adequately centered, and all of the well casing will be removed.

The borehole will be filled with a neat cement, cement/sand, cement/bentonite grout, or a high-solids bentonite grout. Before its initial set, the grout will be placed in one continuous pour from the bottom of the boring to the ground surface. The grout will be emplaced by pumping through a tremie pipe or flexible hose which is initially lowered to the bottom of the borehole. The augers should be raised incrementally as emplacement proceeds, but not exceed increments of 20 feet or increments greater than allowed by borehole stability. Boreholes that are terminated above the water table and are not greater than 20 feet deep may be grouted by a continuous pour originating at the ground surface. If the aquifer is confined and the head pressure is great, the grout may need to be placed under pressure.

The volume of sealing material used will be calculated and compared to the casing or borehole volume to ensure that bridging has not occurred during well destruction. If the well is in an urban area and if the casing remains in the borehole, a hole will be excavated around the well to a depth of 5 feet, and the casing will be removed to the bottom of the excavation. The sealing material will be allowed to spill over into the excavation to form a cap. The remainder of the excavation will be backfilled with either native material, grout, or concrete.

Attachments: Daily Field Record
Typical Monitoring Well Construction Diagram
Well Log
Well Sampling and/or Development Record

DAILY FIELD RECORD

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Page 1 of ____

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	**Company**	**Time In**	**Time Out**

PERSONAL SAFETY CHECKLIST					
	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	**DESCRIPTION OF CONTENTS AND QUANTITY**	**LOCATION**

TIME	**DESCRIPTION OF WORK PERFORMED**

Forms(PF).004 (Revised 12/95)

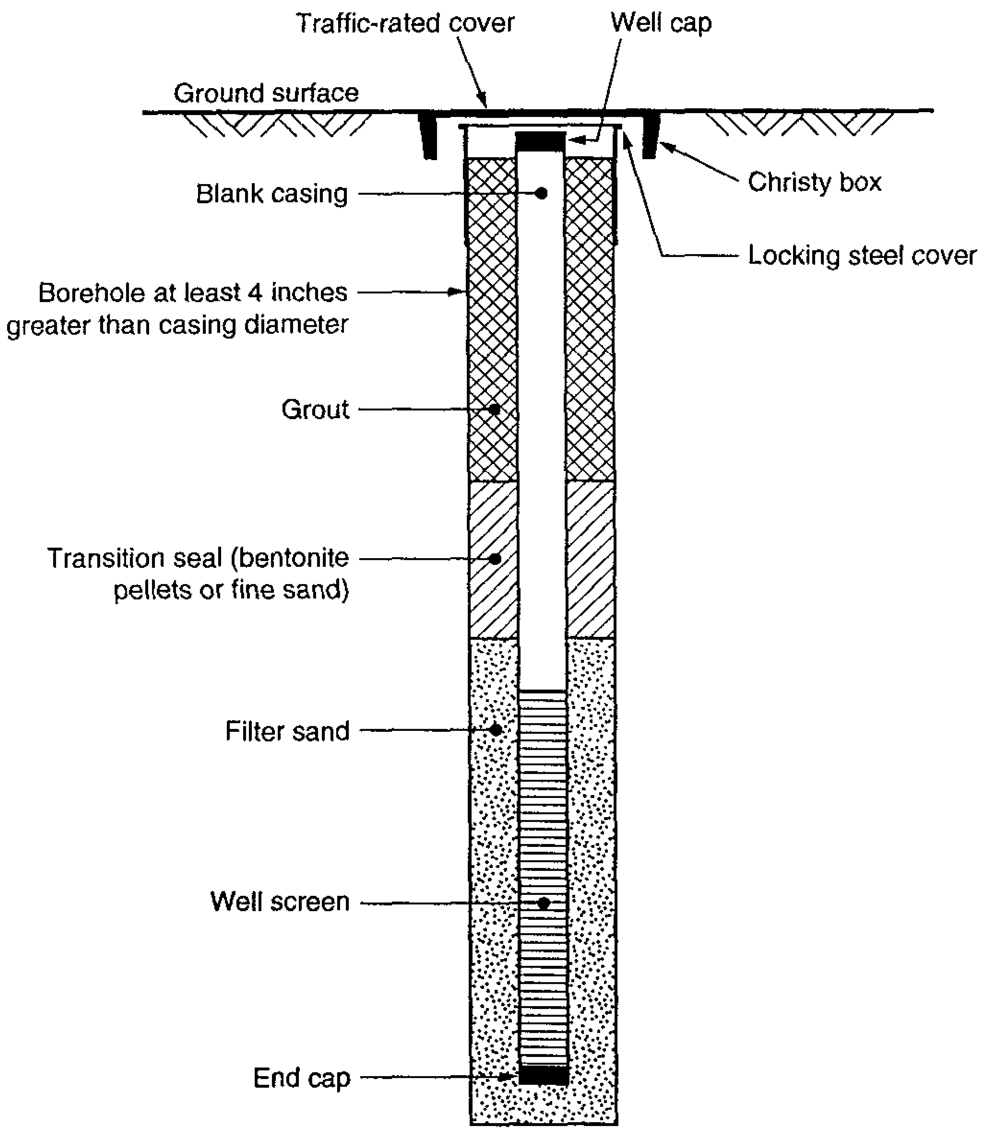
DAILY FIELD RECORD (continued)

GEOMATRIX

Project and Task Number: ____________________ Date: ____________________

Time	Description of Work Performed

TYPICAL MONITORING WELL CONSTRUCTION DIAGRAM



Not to scale

PROJECT:		Log of Well No.	
BORING LOCATION:		ELEVATION AND DATUM:	
DRILLING CONTRACTOR:		DATE STARTED:	DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST / COMPL.	CASING:
SAMPLING METHOD:		LOGGED BY:	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol) color, moist, % by weight , plast , consistency, structure, cementation, react. w/HCl, geo inter — Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-1 (12/95)

Project No.	Geomatrix Consultants	Figure

W-1 (Blank)

PROJECT:	Log of Well No.

DEPTH (feet)	SAMPLES			OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react w/HCl geo. inter	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot			

W-2 (12/95)

Project No.	Geomatrix Consultants	Figure

W-2 (Blank)

GEOMATRIX

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: ______________________

Sample ID: __________ Duplicate ID: __________

Sample Depth: ______________________

Project and Task No.: ______________________

Project Name: ______________________

Date: ______________________

Sampled By: ______________________

Method of Purging: ______________________

Method of Sampling: ______________________

Initial Depth to Water: ______________________

Depth to Water after Sampling: ______________________

Total Depth of Well: ______________________

Well Diameter: ______________________

1 Casing/Borehole Volume = ______________________
(Circle one)

4 Casing/Borehole Volumes = ______________________
(Circle one)

Total Casing/Borehole Volumes Removed: ______________________

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm = µmhos/cm)			
Temperature °C			
Instrument Reading			

Model or Unit No.:

Notes: ______________________

Forms(PF).003 (Revised 12/95)

PROTOCOL

WATER LEVEL, WELL DEPTH, AND FLOATING PRODUCT MEASUREMENTS

1.0 INTRODUCTION

This protocol describes the procedures to be followed during water level, well depth, and free product measurements. The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2.0 WATER LEVEL AND WELL DEPTH MEASUREMENTS

A DAILY FIELD RECORD will be completed for each day of fieldwork. Water levels will be recorded on a WATER LEVEL MONITORING RECORD. Following review by the project manager, the original records will be kept in the project files.

Water level measurements at a site will be taken as quickly as practical, to best represent the potentiometric surface across the site at a single time. If pressure is suspected or has developed inside the well casing, the well will be allowed to stand without a cap for a few minutes or until the water level stabilizes before taking the water level measurement. Water level measurements will be recorded to the nearest hundredth (0.01) foot, and well depth measurements will be noted to at least the nearest half (0.5) foot. Equipment placed in the wells for water level and well depth measurements will be cleaned prior to reuse, as discussed in Section 4.0. Care will be taken not to drop foreign objects into the wells and not to allow the tape or sounding device to touch the ground around the well during monitoring.

2.1 WATER LEVEL MEASUREMENTS

Water level measurements will be performed by one of the following methods:

A. Wetted-Tape Method

A steel surveyor's tape will be prepared by coating several feet of the lower end of the tape with chalk or water-finding paste. A weight is attached to the lower end of the steel tape to keep it taut. The tape is lowered into the well until a foot or two of the chalked portion is submerged.

A tape without weight can be used if the well opening or pump casing clearance is too small and restricts the passage of the weight. The proper length to lower the tape may have to be determined experimentally. Measurement will be done as follows:

1. Lower and hold the tape at an even foot mark at the measuring point (MP) and note this tape reading.

2. Remove the steel tape from the well. Add or subtract the wetted length from the even foot mark noted in Step 1, as appropriate for your tape, and record this as water level below MP on the WATER LEVEL MONITORING RECORD.

B. Electric Sounder Method

An electric sounder consists of a contact electrode suspended by an insulated electric cable from a reel that has an ammeter, a buzzer, a light, or other closed circuit indicator attached. The indicator shows a closed circuit and flow of current when the electrode touches the water surface. Electric sounders will be calibrated periodically by measuring each interval and remarking them where necessary.

The procedure for measuring water levels with an electric sounder is as follows:

1. Turn sounder on, and check that it is working.

2. Lower the electric sounder cable into the well until the ammeter or buzzer indicates a closed circuit. Raise and lower the electric cable slightly until the shortest length of cable that gives the maximum response on the indicator is found.

3. With the cable in this fixed position, note the length of cable at the MP.

4. If the electric cable is not graduated between foot markings, use a pocket steel tape measure (graduated in hundredths of a foot) to interpolate between consecutive marks. Care must be taken to ensure that the tape measurements are subtracted from the graduated mark footage value when the water level hold point (determined in Step 3) is below the graduated mark and added when it is above the mark. Record the resulting value as water level below MP on the WATER LEVEL MONITORING RECORD.

2.2 WELL DEPTH MEASUREMENTS

The depth of a well will be measured by sounding with a weighted steel surveying tape or an electric sounding line, weighted when possible. Procedures to be followed are described below.

1. Measure the distance between the zero mark on the end of the measuring line and the bottom of the weight.

2. Lower the weighted measuring line into the well until the line becomes slack or there is a noticeable decrease in weight, which indicates the line is touching the bottom of the well. Raise the line slowly until it becomes taut (this may have to be done several times to determine the taut point) and, with the line in this fixed position, note the reading at the MP. Add the distance described in Step A to this reading, and record the resulting value as well depth. This procedure will be performed before and after initial well development or as necessary to determine well casing depth.

3. Record the well depth value on a WATER LEVEL MONITORING RECORD.

3.0 FLOATING PRODUCT MEASUREMENTS

Floating product level/thickness will be measured using an interface probe or steel tape and paste. The electric sounder and bailer method is limited to checking the wells for the presence or absence of floating product. Procedural details are provided below.

All floating product level measurements shall be recorded to the nearest hundredth foot (0.01 foot). All equipment placed in the wells for floating product level measurement will be cleaned prior to reuse, as discussed in Section 4.0. Care will be taken not to drop foreign objects into the wells and not to allow the measuring device to touch the ground around the well during monitoring.

3.1 INTERFACE PROBE METHOD

The floating product-water interface probe consists of a electrode suspended by a graduated tape from a reel that has a light and two-toned audible signals. Audible and visual signals occur when the electrode touches the floating product surface and then the water surface.

The procedure for measuring floating product levels using the interface probe is as follows:

1. Turn interface meter on, and check that it is working.
2. Lower the interface meter into the well slowly until the meter signals an interface. Note if the interface is oil or water.
3. Raise and lower the meter slightly until the shortest length of cable that gives the maximum response on the meter is found.
4. With the cable in this fixed position, note the length of cable at the measuring point.
5. If the interface recorded above was oil, slowly lower the meter until a water interface signal is given.
6. Repeat steps 3 and 4 above.
7. Turn the probe off and store in a case after cleaning.

3.2 ELECTRIC SOUNDER AND BAILER METHOD

The procedure for checking present of floating product using an electric sounder and an acrylic bailer is as follows:

1. Measure the water level with the electric sounder as described in Section 2.1.
2. Suspend a clean acrylic bailer on a line and slowly lower the bailer into the well until it partially intersects the groundwater surface.

3. Slowly pull the bailer to the surface.

4. Let the bailer stand for several minutes.

5. Observe the surface of the water within the bailer. Measure the thickness of the product in the bailer to the nearest 0.01 foot and record the value on the sampling record. If the product is less than 0.01 foot thick, the amount should be recorded as less than 0.01 foot. If only a sheen is observed or no floating product is seen, these observations should be recorded.

3.3 STEEL TAPE AND PASTE METHOD

1. Measure the water level with an electric sounder as described in Section 2.1.

2. Spread a thin layer of gasoline or oil-finding paste on one side of a steel surveyor's tape, beginning at the zero-foot mark and extending up the tape about 1-foot more than the anticipated thickness of the floating product.

3. Spread a thin film of water-finding paste on the opposite side of the tape, beginning at the zero-foot mark and extending up the tape about 1 foot.

4. Slowly lower the tape into the well until the zero-foot mark is located, about 6 inches below the water level (the tape reading at the measuring point should be 6 inches greater than the actual depth to water). Take care not to touch the sides of the well with the tape.

5. Slowly remove the tape from the well. The pastes will have changed color upon contact with the water or the floating product. The product thickness is the difference between the tape reading at the point where water-finding paste indicates the water level and the point where the gasoline or oil-finding paste indicates the top of the floating product.

4.0 EQUIPMENT CLEANING

Steel tapes, electric well sounders, and acrylic bailers will be cleaned after measurements in each well. Cleaning procedures will be as follows:

1. Wipe floating product off with disposable towels. Rinse probe or portion of instrument that was immersed in well water with a solution of laboratory-grade detergent and potable water.

2. Rinse with potable water.

3. Dry with a clean paper towel.

4. The interface probe may also be cleaned with acetone at this stage.

Solutions resulting from cleaning procedures will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

Attachments: Daily Field Record
Water Level Monitoring Record

DAILY FIELD RECORD

GEOMATRIX

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST					
	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD (continued)

GEOMATRIX

Page _____ of _____

Project and Task Number: ______________________ Date: ______________________

Time	Description of Work Performed

WATER LEVEL MONITORING RECORD

GEOMATRIX

Project Name: ______________________ Project and Task Number: ______________

Date: __________ Measured by: ____________________ Instrument Used: __________

Note: For your convenience, the following abbreviations may be used.

P = Pumping   I = Inaccessible   D = Dedicated Pump
ST = Steel Tape   ES = Electric Sounder   MP = Measuring Point   WL = Water Level

Well No.	Time	MP Elevation (feet)	Water Level Below MP (feet)	Water Level Elevation (feet)	Previous Water Level Below MP	Remarks

Forms(PF).007 (Revised 12/95)

PROTOCOL

SAMPLING OF GROUNDWATER MONITORING WELLS AND WATER SUPPLY WELLS

1.0 INTRODUCTION

This protocol describes the procedures to be followed during sampling of groundwater monitoring wells and water supply wells for laboratory chemical analysis. The laboratory must be certified by the appropriate regulating agency for the analyses to be performed.

The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2.0 SAMPLING

2.1 SAMPLE COLLECTION

A. Monitoring Wells

Methods for purging and sampling monitoring wells with dedicated and non-dedicated equipment are described in this Section. When practical, the purging and sampling technique adopted for a given site will remain consistent from one sampling event to the next.

A.1 Purging Monitoring Wells

A submersible pump, diaphragm pump, positive displacement pump, which may contain a bladder, or a bailer will be used for evacuating (purging) the monitoring well casing. If the well is to be sampled using equipment that must be separately introduced into the well, the purge intake will be located near the top of the water column for removal of at least one casing volume to remove stagnant water above the screened interval in the well casing; the pump may then be moved to the midscreen interval to complete the purging progress, if required. If a bailer is used to purge the monitoring well, it will be gently lowered into the well to reduce the potential for aeration of water. Purging will progress at a rate intended to minimize differential drawdown between the interior of the well screen and the filter material to limit cascading water along the inside of the well casing. Procedures for purging slowly recharging wells are discussed in Section A.3.

A minimum of four well casing volumes or one saturated borehole volume, whichever is greater, will be removed to purge the well prior to collection of groundwater samples if the well will be purged with non-dedicated equipment. If a low-flow capacity pump is dedicated in the well, the micropurge method described in Section A.4 may be used to reduce the purge volume. If the well goes dry before four casing volumes are removed, the procedure discussed in Section A.3 will be followed. The saturated borehole volume is the volume of water in the well casing plus the volume of water in the filter pack. For a well with a dedicated pump and packer, a casing volume is defined as the volume of water in the well casing below the inflated packer.

Periodic observations of turbidity and measurements of temperature, pH, and specific electrical conductance (SEC) will be made with field equipment during purging to evaluate whether the water samples are representative of the target zone. Samples will be collected when: (1) a minimum of four sets of parameter readings have been taken; and (2) the temperature, pH, and SEC reach relatively constant values, and the turbidity has stabilized.

A.2 <u>Sampling Monitoring Wells</u>

The sampler will wear clean gloves appropriate for the chemicals of concern while collecting the sample. Samples will be collected directly in laboratory-prepared bottles from the sampling device.

Each sampling episode or day should generally begin with the well having the least suspected concentrations of target compounds. Successive wells should generally be sampled in sequence of increasing suspected concentration.

A Teflon® bailer, new disposable bailer, stainless steel positive displacement Teflon® bladder pump with Teflon® tubing, or a clean electric submersible pump with low-flow sampling capacity will be used to collect the water samples for laboratory chemical analysis.

If a bailer is being used to collect the sample, it will be gently lowered into the well below the point where the purge device was located. Samples will collected in the following order: (1) volatile organic compounds; (2) semi-volatile organic compounds; (3) metals; (4) other analytes.

If a bladder pump or electric submersible pump is being used to sample the well for volatile compounds, the flow rate will be adjusted to either 1) approximately 100 milliliters per minute; 2) a rate specifically selected for the well based on groundwater flow rates and well hydraulic conditions; or 3) as low as possible. This rate will be maintained until the discharge line has been purged and the sample collected.

A.3 Purging and Sampling Wells With Slow Recharge

Wells that recharge very slowly may be purged dry once, allowed to recharge, and then sampled as soon as sufficient water is available. In this case, at least two sets of parameter readings of field water quality should be taken, one initially and one after recharge.

A.4 Purging and Sampling Wells Using "Micropurge" Sampling Method

Based on current research, a low-flow-rate, reduced purge method may be used to purge and sample a well with a dedicated pump (Barcelona et al., 1994; Kearl et al., 1994). This method may be used if acceptable to applicable agencies. This method assumes the water within the screened interval is not stagnant, and a small change to the natural flow rate in the screened interval will result in samples with particulates and colloidal material representative of groundwater. The pump should be preset in the screen interval at least 24 hours before the sampling event. A minimum of two pump plus riser pipe volumes should be purged at a flow rate of approximately 100 milliliters per minute or as low as possible based on groundwater flow and well hydraulic conditions. Purging should progress until water quality parameters (pH, SEC, temperature) have reached relatively constant values. Dissolved oxygen readings are recommended, if practical.

B. Water Supply Wells

Water supply wells will be sampled by purging the wells for a period of time adequate to purge the pump riser pipe. Alternatively, if the volume of the riser pipe is unknown, the pressure tank will be drained until the pump cycles on, or the well may be purged until three successive field measurements performed 5 to 10 minutes apart have stabilized. If the well is currently pumping, the sample can be taken without purging the well. Water samples will then be collected from the discharge point nearest the well head. Samples will be collected directly into laboratory-prepared bottles.

C. Extraction Wells

Extraction wells will be sampled while extraction is occurring. Samples will be collected from an in-line sampling port after purging the sampling line. Samples will be collected directly into laboratory-prepared bottles.

A WELL SAMPLING AND/OR DEVELOPMENT RECORD will be used to record the following information:

- Sample I.D.
- Duplicate I.D., if applicable
- Date and time sampled
- Name of sample collector
- Well designation (State well numbering system for water supply wells, and unique sequential number for other wells)
- Owner's name, or other common designation for water supply wells
- Well diameter
- Depth to water on day sampled
- Casing volume on day sampled
- Method of purging (bailing, pumping, etc.)
- Amount of water purged
- Extraordinary circumstances (if any)
- Results of instrument calibration/standardization and field measurements (temperature, pH, specific electrical conductance) and observed relative turbidity
- Depth from which sample was obtained
- Number and type of sample container(s)
- Purging pump intake depth
- Times and volumes corresponding to water quality measurement
- Purge rate

2.2 SAMPLE CONTAINERS AND PRESERVATION

Appropriate pre-cleaned sample containers and preservatives for the analyses to be performed will be obtained from the subcontracted analytical laboratory. Frequently requested analyses and sample handling requirements are listed in Table 1.

2.3 SAMPLE LABELING

Sample containers will be labeled before or immediately after sampling with self-adhesive tags having the following information written in waterproof ink:

- Geomatrix
- Project number
- Sample I.D. number
- Date and time sample was collected
- Initials of sample collector

2.4 QUALITY CONTROL SAMPLES

In order to evaluate the precision and accuracy of analytical data, quality control samples, such as duplicates and blanks, will be periodically prepared. These samples will be collected or prepared and analyzed by the laboratory, as specified in the project Quality Assurance Project Plan (QAPP) or by the project manager.

2.5 HANDLING, STORAGE, AND TRANSPORTATION

Efforts will be made to handle, store, and transport supplies and samples safely. Exposure to dust, direct sunlight, high temperature, adverse weather conditions, and possible contamination will be avoided. Immediately following collection, samples will be placed in a clean chest that contains ice or blue ice (if cooling is required), and will be transported to the subcontracted laboratory as soon as practical, or in accordance with the project QAPP.

3.0 FIELD MEASUREMENTS

Field measurements of temperature, pH, and SEC will be performed on aliquots of groundwater that will not be submitted for laboratory analysis. Field water quality measurements and instrument calibration details will be recorded on the WELL SAMPLING AND/OR DEVELOPMENT RECORD.

3.1 TEMPERATURE MEASUREMENTS

Temperature measurements will be made with a mercury-filled thermometer or an electronic thermistor, and all measurements will be recorded in degrees Celsius.

3.2 pH MEASUREMENT

The pH measurement will be made as soon as possible after collection of the sample, generally within a few minutes. The pH will be measured by immersing the pH probe into an aliquot of groundwater.

The pH meter will be calibrated at the beginning of and once during each sampling day and whenever appropriate, in accordance with the equipment manufacturer's specifications, as outlined in the instruction manual for the specific pH meter used. Two buffers (either pH-4 and pH-7, or pH-7 and pH-10, whichever most closely bracket the anticipated range of groundwater conditions) will be used for instrument calibration.

3.3 SPECIFIC ELECTRICAL CONDUCTANCE MEASUREMENT

SEC will be measured by immersing the conductivity probe into an aliquot of groundwater. The probes used should automatically compensate for the temperature of the sample. Measurements will be reported in units of micro-Siemens (μS) per square centimeter (equivalent to micromhos or μmhos) at 25 degrees Celsius.

The SEC meter will be calibrated at the beginning and once during each sampling day in accordance with the equipment manufacturer's specifications, as outlined in the instruction manual for the SEC meter used. The SEC meter will be calibrated with the available standardized potassium chloride (KCl) solution that is closest to the SEC expected in groundwater below the site.

4.0 DOCUMENTATION

4.1 FIELD DATA SHEETS

A DAILY FIELD RECORD will be completed for each day of fieldwork. A WELL SAMPLING AND/OR DEVELOPMENT RECORD will be used for each well to record the information collected during water quality sampling. Samples may also be recorded on a SAMPLE CONTROL LOG SHEET or in the DAILY FIELD RECORD as a means of identifying and tracking the samples. Following review by the project manager, the original records will be kept in the project file.

4.2 CHAIN-OF-CUSTODY PROCEDURES

After samples have been collected and labeled, they will be maintained under chain-of-custody procedures. These procedures document the transfer of custody of samples from the field to the laboratory. Each sample sent to the laboratory for analysis will be recorded on a CHAIN-OF-CUSTODY RECORD, which will include instructions to the laboratory for analytical services.

Information contained on the triplicate CHAIN-OF-CUSTODY RECORD will include:

- Project number
- Signature of sampler(s)
- Date and time sampled
- Sample I.D.
- Number of sample containers
- Sample matrix (water)
- Analyses required

- Remarks, including preservatives, special conditions, or specific quality control measures
- Turnaround time and person to receive laboratory report
- Method of shipment to the laboratory
- Release signature of sampler(s), and signatures of all people assuming custody.
- Condition of samples when received by laboratory

Blank spaces on the CHAIN-OF-CUSTODY RECORD will be crossed out between the last sample listed and the signatures at the bottom of the sheet.

The field sampler will sign the CHAIN-OF-CUSTODY RECORD and will record the time and date at the time of transfer to the laboratory or to an intermediate person. A set of signatures is required for each relinquished/reserved transfer, including transfer within Geomatrix. The original imprint of the chain-of-custody record will accompany the sample containers. A duplicate copy will be placed in the project file.

If the samples are to be shipped to the laboratory, the original CHAIN-OF-CUSTODY will be sealed inside a plastic bag within the ice chest, and the chest will be sealed with custody tape which has been signed and dated by the last person listed on the chain-of-custody. U.S. Department of Transportation shipping requirements will be followed and the sample shipping receipt will be retained in the project files as part of the permanent chain-of-custody document. The shipping company (e.g., Federal Express, UPS, DHL) will not sign the chain-of-custody forms as a receivor; instead the laboratory will sign as a receivor when the samples are received.

5.0 EQUIPMENT CLEANING

Bailers, sampling pumps, purge pumps, and other non-dedicated purging or sampling apparatus will be cleaned before and after sampling each well. Factory new and sealed disposable bailers may be used for sampling, but may not be reused. Thermometers, pH electrodes, and SEC probes that will be used repeatedly will be cleaned before and after sampling each well and at any time during sampling if the object comes in contact with foreign matter.

Purged waters and solutions resulting from cleaning of purging or sampling equipment will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

Cleaning of reusable equipment that is not dedicated to a particular well will consist of the following:

- Bailers - the inside and outside of bailers will be cleaned in a solution of laboratory-grade detergent and potable water, followed by a rinse with deionized (DI) water. They may also be steam-cleaned, followed by a DI water rinse. If samples are to be collected for metals analysis, the Teflon® bailer may be rinsed with a pH2 nitric acid solution followed by a double DI rinse.

- Purge Pumps - All downhole, reusable portions of purge pumps will be steam-cleaned on the outside. If the pump does not have a backflow check valve, the inside of the pump and tubing also should be steam-cleaned. For a purge pump with a backflow check valve, the interior of the pump and tubing may be cleaned by pumping a laboratory-grade detergent and potable water solution through the system followed by a potable water rinse, or by steam-cleaning.

- Water Quality Meters - All meters will be cleaned by rinsing the probe portions in DI water, and allowing to air dry.

- Bailer Tripod - The tripod cable will be steam-cleaned or rinsed with DI water.

Sample bottles and bottle caps will be cleaned by the subcontracted laboratory using standard EPA-approved protocols. Sample bottles and bottle caps will be protected from contact with solvents, dust, or other contamination. Sample bottles will not be reused.

6.0 REFERENCES

Barcelona, M.J., et al., 1994, Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground-Water Sampling: *Groundwater*, January-February.

Kearl, P.M., et al., 1994, Field Comparison of Micropurging vs. Traditional Ground Water Sampling: *Ground Water Monitoring Review*, Fall.

Attachments: Water and Soil Analytical Methods and Sample Handling
Well Sampling and/or Development Record
Daily Field Record
Chain-of-Custody Record
Sample Control Log Sheet

TABLE 1

WATER AND SOIL ANALYTICAL METHODS AND SAMPLE HANDLING

Parameter	Method	Water Containers[1]	Preservation[1]	Maximum Holding Time[1]
Total Petroleum Hydrocarbons: • as diesel • as gasoline	GCFID (3550)[2] GCFID (5030)[2]	2 - 1 liter amber glass 2 - 40 ml VOA glass	cool on ice HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days) 14 days (unacidified water, 7 days)
Benzene, Toluene, Xylene, and Ethylbenzene	EPA 8020	2 - 40 ml VOA glass	HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days)
Oil and Grease	5520 E & F (soil)[3] 5520 C & F (water)[3]	2 - 1 liter amber glass	H_2SO_4 to pH <2 in water samples: cool on ice	28 days
Volatile Organics	EPA 8010 EPA 8240[5]	2 - 40 ml VOA glass 2 - 40 ml VOA glass	cool on ice[4] HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days) 14 days (unacidified water, 7 days)
Semi-volatile Organics	EPA 8270	2 - 1 liter amber glass	cool on ice	7 days for extraction, water 14 days for extraction, soil 40 days for analysis
Polynuclear Aromatic Hydrocarbons	EPA 8310	2 - 40 ml VOA glass	cool on ice	7 days, water 14 days, soil
Metals (dissolved)	EPA 7000 series for specific metal	1 - 500 ml plastic	Water Samples: field filtration (0.45 micron filter) and field acidify to pH 2 with HNO_3 except: Cr^{+6} - cool on ice	6 months, except: Hg - 28 days Cr^{+6} - 24 hours, water; 24 hours after prep, soil

Notes:

1 All soil samples should be collected in full, clean brass liners, capped with aluminum foil or Teflon and plastic caps, and sealed with tape. If soil samples are to be analyzed for metals, they may be placed in laboratory-prepared clean glass jars. Soil should be cooled as indicated under "preservation" and maximum holding times apply to both soil and water unless otherwise noted.

2 For analysis in California, use California DHS recommended procedure as presented in LUFT manual using gas chromatography with a flame ionization detector. In other states, local requirements should be followed.

3 Method to be used in California Regional Water Quality Control Board North Coast and Central Valley Regions. In other areas, local requirements should be followed.

4 If EPA Methods 8010 and 8020 are to be run in sequence, HCL may be added. Check with the project manager before adding acid.

5 Chloroethylvinylether may be detected at concentrations below 50 parts per billion due to degradation of HCL.

References:

U.S. EPA, 1986, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods - SW-846, Third Edition, July, and final amendments.

California State Water Resources Control Board, 1989, Leaking Underground Fuel Tank (LUFT) Field Manual, Tables 3-3 and 3-4, October.

California Regional Water Quality Control Boards, North Coast, San Francisco Bay, and Central Valley Regions, 1990, Regional Board Staff Recommendations for Initial Evaluation and Investigation of Underground Tanks, 10 August.

GEOMATRIX

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: ______________________

Sample ID: __________ Duplicate ID: __________

Sample Depth: ______________________

Project and Task No.: ______________________

Project Name: ______________________

Date: ______________________

Sampled By: ______________________

Method of Purging: ______________________

Method of Sampling: ______________________

Initial Depth to Water: ______________________

Depth to Water after Sampling: ______________________

Total Depth of Well: ______________________

Well Diameter: ______________________

1 Casing/Borehole Volume = ______________________
(Circle one)

4 Casing/Borehole Volumes = ______________________
(Circle one)

Total Casing/Borehole Volumes Removed: ______________________

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm = µmhos/cm)			
Temperature °C			
Instrument Reading			

Model or Unit No.:

Notes: ______________________

Forms(PF).003 (Revised 12/95)

DAILY FIELD RECORD

GEOMATRIX

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD (continued)

GEOMATRIX

Page ______ of ______

Project and Task Number: ____________________ Date: ____________________

Time	Description of Work Performed

CHAIN-OF-CUSTODY RECORD

Nº

Date:

Page of

Project No.:

Samplers (Signatures):

Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel												Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers	Additional Comments

ANALYSES | REMARKS

Turnaround time:

Results to:

Total No. of containers:

Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Method of Shipment:
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:	Laboratory Comments and Log No.:
Company:		Company:		Company:		
Received by (signature):	Date:	Received by (signature):	Date:	Received by (signature):	Date:	
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:	
Company:		Company:		Company:		GEOMATRIX

Forms(PF).012b (Revised 12/95)

SAMPLE CONTROL LOG

GEOMATRIX

Project Name: ______________________ Laboratory: ______________________

Project and Task No.: ______________________ Page _____ of _____

Sampling Date	Sampling Time	Sample Number (ID)	C.O.C. Number	Analyses Requested	Turnaround Time, Sample Location, Handling Notes, Chain-of-Custody Remarks, et. (Duplicate, blank info, etc.)	Date Sent to Lab	Date Results Due