RD - 2473

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August 25, 2003

Ms. Eva Chu
Alameda County Health Care Services, Department of Environmental Health
Hazardous Materials Division
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: Deep Aquifer Site Assessment Workplan for Petroleum Hydrocarbon Contaminated Groundwater, Schropp Ranch No. 1 Site, 3880 Mountain House Road Byron, Alameda County, California

Dear Ms. Chu:

Enclosed is a copy of the requested Deep Aquifer Site Assessment Workplan for Petroleum Hydrocarbon Contaminated Groundwater for the Schropp Ranch No 1 Site located at 3880 Mountain House Road, Byron, Alameda County, California. This workplan is submitted in response to your letter from Alameda County Health Care Services Department of Environmental Health, Hazardous Materials Division (ACEHD) dated July 11, 2003 directing this investigation to be conducted. As we understand, this workplan directive was to determine if the deeper or second water bearing zone of the Schropp Ranch has been impacted by a unauthorized petroleum hydrocarbon release. This unauthorized petroleum hydrocarbon release has been documented in the previously submitted Final Problem Assessment Report (PAR) submitted to ACEHD in April, 2003.

This work plan is being submitted to ACEHD and the California Regional Water Quality Control Board-Central Valley Region (Region 5) (RWQCB) for review and approval.

1. **PURPOSE AND SCOPE:** The purpose of this work plan is to outline the methodology to be followed for the expanded petroleum hydrocarbon groundwater site assessment at the Schropp Ranch property located at 3880 Mountain House Road, Byron, Alameda County, California. The proposed scope of work for this project includes the following major tasks

- Develop a technical work plan and worker health and safety plan for the expanded groundwater site assessment;

- Advance two soil borings to an approximate depth of 75 feet below ground surface (bgs) to test the second water bearing zone at two locations in the area of the former underground storage tank and former domestic water well. Soil samples will be collected at five foot intervals for lithologic logging of the borings. Groundwater grab samples will be collected from the bottom of the soil borings at a depth of 75 feet bgs or as directed by ACEHD using a Hydropunch II sampling system.

- Analyze ten of the soil samples collected from below the former identified base of soil petroleum hydrocarbon contamination (about 30 feet bgs) and two of the groundwater grab samples from the soil borings (including a travel blank) for TPH as gasoline, BTEX, five oxygenates, and lead scavengers using USEPA Test Method 8260B;

- Conduct a Sensitive Receptor Survey within a 2,000 foot radius of the site to develop a better understanding of the deeper portion of the local hydrogeological environment immediately around the site between 50 and 150 feet bgs to determine if local groundwater supplies are threatened from the former petroleum release on site. It is anticipated that any domestic wells within 2,000 feet of the site will be sampled and tested for the analytes as outlined above;

- Revise the initial Site Conceptual Model of the site that was part of the Problem Assessment Report (PAR) to include the new deeper geological, hydrological, and chemical data from the new subsurface investigation results and Sensitive Receptor Survey. This revised model will assist in determining if impact to deeper aquifer zones has occurred from petroleum hydrocarbons;

- Prepare and submit a Revised Preliminary Problem Assessment Report (PAR) that will document all historical site assessment activities and data and incorporate the new data from soil borings and groundwater monitoring and testing. The PAR will present all drilling activities, monitoring well construction, soil and water sample analytical results, data analysis, conclusions, and recommendations for any further assessment action that may be necessary or if feasible, present a closure rationale for the site.

2. **SITE DESCRIPTION:** The site is located at 3880 Mountain House Road, within the unincorporated portion of Alameda County, California (Exhibits 1 and 2). The site is identified as Alameda County Assessors Parcel Number APN: 99B-7200-24 and 99B-7200-23 and covers approximately 488 acres (Exhibit 3).

Historical Site Summary

According to the current and previous property owners, until 1991, a 550-gallon gasoline underground storage tank was located at the residence where the former owner/operator, Mr. Bob J. Wing used the tank as a residential fuel supply. A previous tank was located at this same location and was in service from an unknown time in the early 1950's until approximately 1970 when it was replaced, reportedly because it could not maintain fuel levels and was believed to be leaking. This information was provided to WZI by Mr. Don Holck in 1992. No documentation or records then or subsequent to then have been found regarding the date of origin of service or operational history for this tank. Mr. Wing was contacted in 1992 and confirmed that the tank was used only for residential use by himself. The tank was specifically not used to fuel agricultural equipment at the farm. Mr. Wing could not remember the dates of operation of the tank. According to Mr. Holck, a replacement tank was put into service in 1971 and operated until 1979 when Mr. Wing sold the property to the current owners in 1980.

The UST along with the rest of the property was purchased by the current property owner, Mr. and Mrs. Werner Schropp in 1980. At the time of purchase the UST was no longer used on a regular basis. Approximately three loads of gasoline fuel (1,200 gallons) were placed in the UST between 1979 and 1986 by the resident property lessor, Mr. Don Holck This fuel was used by the lessor as fuel for his personal vehicle. During this time (1980 to 1991) all agriculture equipment used at the property used operated exclusively on diesel fuel, obtained from offsite fuel supply sources.

The UST was never registered with the California State Water Resources Control Board Underground Storage Tank Program and also never registered with the California State Board of Equalization. During the fall of 1991, the underground tank and associated piping was removed by the property lessor, Mr. Don Holck. Mr. Holck reported to the property owners that a significant volume of hydrocarbon stained soil was present around the former tank location. Mr. Holck reportedly removed the tank without an ACEHD Underground Storage Tank removal permit. The tank, piping, and surface dispenser were all stockpiled within the main yard area after removal. Mr. Holck reported to the property owner that a significant volume of petroleum hydrocarbon contaminated soil was present beneath the tank pit.

Because the domestic water supply well was located immediately adjacent to the former UST location the property owners decided to conduct a site assessment investigation. WZI Inc. (WZI) was retained by the land owners property management agent Agriculture Industries Inc., West Sacramento, to conduct a site assessment and recommend any necessary corrective action regarding the hydrocarbon contaminated soil and ground water. A Preliminary Site Assessment investigation was conducted by WZI in 1992 to assist in determining the necessary background information on the property.

Leakage from the previous or initial tank location and surface spillage of fuel is considered to be the only source of gasoline contamination in the soil on the Schropp property based on results of the WZI investigation. No other potential sources of gasoline were found. It is unclear if the first tank had contributed gasoline into the subsurface from leakage. No information was obtained regarding the location or configuration of the underground storage tanks' piping and surface dispenser. No information was available regarding the condition of any of the piping or either of the former underground storage tank. Surface soil staining from gasoline was present immediately around the former dispenser location during a WZI inspection that occurred in April, 1992. The length of underground piping that connected the dispenser to the underground tank was not determined.

According to Mr. Don Holck, only gasoline fuel was stored in the two underground storage tanks. Mr. Holck did not recall who was responsible for maintaining the tank, fuel dispensing system, or where fuel was obtained during the period that Mr. Wing maintained the property.

Subsequent investigation by WZI indicated that soil and ground water hydrocarbon contamination were confirmed to be present on the Schropp property. A site assessment and remediation workplan for petroleum hydrocarbon contaminated soil and groundwater was submitted to ACEHD for approval. The subsequent work and findings from this effort were incorporated into a Final Problem Assessment Report prepared and submitted to ACEHD by Stephen G. Muir Consulting Geologist & Geophysicist in April, 2003.

ACEHD reviewed the PAR and determined that additional site assessment work was warranted in the area of the former domestic water supply well. ACEHD expressed concerns that the deeper water bearing zones had been contaminated by contaminated shallow groundwaters being pulled into the domestic water supply well and possibly contaminating deeper zones. This work plan is designed to evaluate if the deeper water bearing zones have been impacted by petroleum hydrocarbons or if sufficient information exists to close the site.

<u>Contact Information</u>

The Primary Responsible Party is Mr. and Mrs. Werner R. Schropp, c/o Agriculture Industries Inc., PO Box 1076, West Sacramento, California 95691. (916) 372-5595 FAX (916) 374-6888.

Consultant contact is Mr. Stephen G. Muir, Consulting Geologist & Geophysicist, PO Box 152, Woodbridge, California 95258-0152, (209) 369-9421 FAX (209) 369-9358,
e-mail: sgmuir@earthlink.net.

The Lead Regulatory Agency is Ms. Eva Chu, Alameda County Health Care Services Department of Environmental Health Hazardous Materials Division, 1131 Harbor Bay Parkway, Suite 250, Alameda, California 94502-6755 (510) 567-6762 e-mail: ***echu@co.alameda.ca.us***

The California Regional Water Quality Control Board-Central Valley Region (Region 5) contact is Mr. James Barton, 3443 Routier Road, Suite A, Sacramento, California, 95827-3003, (916) 255-3115, FAX (916) 255-3439 ***e-mail: bartonj@rb5s.swrcb.ca.gov***

3. **SITE MAPS:** Site maps are included as Exhibits 1 to 7.

4. **TOPOGRAPHY, GEOLOGY, AND HYDROGEOLOGY:**

Topography: The property is located on the U. S. Geological Survey Clifton Court Forebay 1:24,000 scale topographic map (Exhibit 2), near the base of the foothills of the eastern flank of the Diablo Range on a gentle northeast-sloping surface which has been dissected by small northeast flowing streams. The elevations of the property range from approximately 160 feet above mean sea level in the southwest corner of the property to 80 feet above mean sea level in the northeast corner of the property.

Geology and Hydrogeology The site is located near the base of the foothills of the eastern flank of the Diablo Range on a gentle southeast sloping surface which has been dissected by a series of northeast-flowing streams. The regional geology of the site and surrounding vicinity is shown on Exhibit 5. Regional geologic mapping conducted by Reiche (1950), Clark (1955), Atwater (1982), and Page (1986) indicates that the project site is underlain by the Great Valley Sequence, consisting of sedimentary rocks of Late Jurassic to Cretaceous age (140 to 65 million years old). These older sediments are overlain by Tertiary to Holocene (less than 65 million years old) non-marine sediments. The thickness of the Tertiary and younger deposits is approximately 4,000 thick (Bartow, 1985).

Site Geology

The Schropp Ranch No. 1 site is situated in the northwestern section of San Joaquin Valley and is underlain by clay, silts, sands, and gravel's of Recent, Pleistocene, and Pliocene Age (Hotchkiss and Balding, 1971). The shallow deposits of the site consists of alluvial deposits, comprised of silts and clays with occasional lenses of sand and gravel. These shallow deposits are underlain by the upper portion of the Tulare Formation. The Tulare Formation consists of alluvial clays, silts, sands and gravel to a depth of approximately 1,000 feet (Hotchkiss and Balding, 1971). Within the Tulare Formation, a laterally extensive clay layer, known as the Corcoran Clay Member, is present at approximately 100 feet below ground surface. The Tulare Formation is underlain by sedimentary and crystalline rocks of Tertiary and pre- Tertiary age.

Site geology is depicted on Exhibit 5. The Schropp Ranch No. 1 is underlain by Pleistocene to Recent (less than two million years old) non-marine sediments. The majority of these sediments were deposited by streams as alluvial deposits draining the uplands are west of the project site (Atwater, 1982; Page, 1986).

Regional Hydrogeologic Setting

The northwestern San Joaquin Valley is bounded to the east by the Sierra Nevada Range and to the west by the Diablo Range. The Diablo Range forms a rain shadow and average annual precipitation decreases markedly east of the rest of the mountains. The majority of the annual precipitation falls as rain during the winter rainy season from November through April. The mean annual precipitation at the project site is between 10 and 12 inches per year (Rantz, 1971). The depth of precipitation at the project site during a 100-year frequency, 24-hour duration storm event is estimated to be approximately three inches (Rantz, 1971).

Surface Water

The project site is located on a gentle, northeastward sloping alluvial surface at the base of the eastern flank of the Altamont Hills. The Altamont Hills are a foothill region within a group of northwest-trending low mountain ranges, which are collectively referred to as the Diablo Range. The Altamont Hills rise to a drainage divide located approximately six miles west of the project site. Streams draining the western side of the divide flow westward toward the Livermore and Las Positas valleys. The eastern flank is drained by northeastward flowing streams that discharge to the San Joaquin River system.

The San Joaquin River joins the Mokelumne, Calaveras, and Sacramento rivers to form the Sacramento-San Joaquin Delta (Delta), which discharges to San Francisco Bay. The Delta covers an area of over 700,000 acres and contains over 700 miles of interconnected channels and canals, many of which are controlled by a system of flood protection levees. The Delta is one of the largest protected waterways in the western United States and one of the most valuable freshwater resources in California.

Export of water from the Delta to other areas of California has been occurring since the completion of the Contra Costa Canal in 1940. The two major water export projects, the Central Valley Project and the State Water Project, control operations of the Delta-Mendota Canal and the California Aqueduct. The California aqueduct drains water from the Clifton Court Forebay facility in the southwest portion of the Delta. The Delta-Mendota Canal receives water pumped from intakes located north of the Schropp Ranch No. 1

Groundwater

In the area of the project site, the most important water-bearing stratum ("aquifer") is the Tulare Formation. The Tulare Formation consists of interbedded Pleistocene (less than two million years old) gravel, sand, silt, and clay (Bartow, 1985). The coarser-grained deposits are the most significant source of groundwater supply in the Tracy area of western San Joaquin County. The aquifer yield to wells in this area is typically greater than 1,000 gallons per minute (Page, 1986).

A prominent clay layer, the Corcoran Clay Member, separates an upper and lower water-bearing strata within the Tulare Formation. This clay layer, which is also called the "modified E clay", is encountered at a depth of approximately 200 feet and is about 80 feet thick in the area of the site (Page, 1986). Groundwater flow in the lower Tulare

Formation is directed to the north-northwest (California Department of Water Resources, 1967), possibly influenced by recharge in the Sierra Nevada. The upper water-bearing zone is recharged by surface water infiltration in the foothills of the Diablo Range and groundwater flow is generally toward the north-northeast in the Tracy area (California Department of Water Resources, 1967; San Joaquin County Flood Control and Water Conservation District, 1999).

The depth to significant water-bearing zones, the direction of groundwater flow, and the potential aquifer yields in the area of the Schropp No. 1 Ranch are not well known. Available subsurface information suggests that the hydrogeologic conditions are complex in this areas (Iwonima, 1991).

Water for irrigation is supplied by surface water sources rather than wells (Kaufman, 1991). The surface water for the Schropp No 1 Ranch is provided by the Byron Bethany Irrigation District (BBID). Water supply for farms within the vicinity of the site is provided by domestic wells. The wells probably draw water from the Tulare Formation as well as from overlying alluvial deposits.

Groundwater has been encountered at shallow depths (15 feet below ground surface at the site). The shallow groundwater is drained from the agricultural fields by farm drains to lower the groundwater level.

The quality of the groundwater resources in the area of the project site is at best, marginal. Water from wells in the area typically have relatively high total dissolved solids (TDS) concentrations (Miller, 1991). The high TDS is possibly related to salt water intrusion from the Delta or saline formation water. Relatively high concentrations of nitrates and sulfides have also been reported from wells in the area (Kaufman, 1991). High nitrate concentrations may be caused by livestock management at dairies or releases from household septic systems.

5. **IDENTIFICATION AND ESTIMATED QUANTITY OF MATERIAL RELEASED:** Gasoline fuel, the quantity of which is unknown but has impacted over 19,000 cubic yards at a depth of up to thirty feet below ground surface.

6. **PREVIOUS WORK:** WZI was retained by Agriculture Industries, Inc., (AII) in 1992 to conduct a site assessment and recommend any necessary corrective action regarding the unpermitted tank removal. The former UST had been kept on site and an inspection of the UST indicated numerous holes in the bottom of the tank. The former UST was determined to be a 550 gallon tank without any identification numbers.

   The initial WZI review of the property indicated a water supply well immediately adjacent to the former UST location to be potentially contaminated by petroleum hydrocarbons from the former UST. The resident living at the house was interviewed and reported a "gasoline" like odor from the tap water. A water sample was collected from the water supply well and analyzed using United States Environmental Protection Agency (USEPA) Test Method 8015(modified) for total petroleum hydrocarbons as gasoline. Analytical results reported the water supply well contained 20 μg/l of total petroleum hydrocarbons as gasoline (TPH-g). It was determined that the residents using the water supply well had not used this water for domestic use for over five years because of poor water quality from the well. Further investigation revealed that the residents had been using bottled water all along because of the poor quality and taste of the water from the well. No information regarding the depth, seal, water bearing zones was found to be on file with the California Department of Water Resources regarding the domestic water supply well.

The initial WZI soil investigation was started in April, 1992 with two exploratory trenches placed immediately adjacent to the former UST location. These trenches allowed investigation of the subsurface to a depth of approximately 25 feet below ground surface in order to determine if significant soil hydrocarbon contamination had occurred. These trenches revealed that the soil immediately underneath and adjacent to the former underground tank location was contaminated with hydrocarbons. Maximum concentrations of constituents were reported as follows: total petroleum hydrocarbon as gasoline, 1,140 mg/kg; benzene, 22.8 mg/kg; toluene, 44.4 mg/kg; ethylbenzene 7.1 mg/kg; and xylene, 46 mg/kg. The physical aspects of the soil contamination and analytical laboratory evaluation of soil samples obtained indicated that the petroleum hydrocarbon contamination was exclusively gasoline in character around the former UST location.

A grab sample from the ground water underneath the tank at a depth of 27 feet below ground surface confirmed that the local ground water was contaminated with benzene and total petroleum hydrocarbon as gasoline at concentrations above established Maximum Contaminant Levels (MCL's). Maximum concentrations were reported as follow: TPH-g, 27,500 μg/l; benzene, 11,800 μg/l; toluene, 16,500 μg/l; ethylbenzene, 265 μg/l; and xylene, 725 μg/l.

Because the identified hydrocarbon contamination of soil and ground water on Schropp Ranch was above State of California MCL's, ACEHD was notified and an Unauthorized Release Report of hydrocarbon fuel was made on April 24, 1992. ACEHD prepared an inspection report on April 22, 1994 that required the property owner to comply with a series of actions which included abandonment of the existing water supply well and the initiation of a soil and groundwater site assessment investigation. A subsequent workplan to conduct a soil and ground water site assessment for hydrocarbon contamination was submitted to and subsequently approved by ACEHD.

Prior to initiating additional excavation, WZI placed a series of hand auger borings and exploratory trenches in the main shop yard during July, 1992 to determine if any hydrocarbon soil was present on the property in the shallow subsurface to a depth of approximately 25 feet below ground surface. Soil samples obtained from these borings indicated a wide-spread extent of minor soil hydrocarbon contamination present in the shop yard. Information obtained from these borings assisted in the development of a final excavation plan.

The WZI investigation also included evaluation of the former domestic water well and its subsequent abandonment. WZI removed the pump and piping from the wellbore in October, 1992 in order to inspect the water supply wellbore. WZI conducted a televideo log of the water well in October, 1992 and determined that the upper 50 feet of the well had not been perforated. Ground water samples collected from this well bore were analyzed for benzene, toluene, ethylbenzene, and xylene by USEPA Test Method 602 in addition to total petroleum hydrocarbon as gasoline using USEPA Test Method 8015(m). Laboratory analytical results from these samples were reported to contain the following concentrations: TPH-g , 79,000 μg/l; benzene 7,050μg/l; toluene, 2,830 μg/l; ethylbenzene, 2,300 μg/l; and xylene as 2,160 μg/l. The domestic water well was then abandoned in accordance with the Alameda County Water District Zone 7 requirements and under ACEHD permit. During followup excavation at a later date the wellbore was observed in the upper 20 feet of the excavation. No evidence of a sanitary seal was visible around the wellbore.

A limited Sensitive Receptor Survey was conducted in October, 1992 by WZI to determine receptors that would be potentially impacted by the gasoline release at Schropp Ranch. Surface waters were found to be present approximately 1,500 feet north of the site as Mountain House Creek. A total of one water supply well off the Schropp property were found to be present within 2,000 feet.

The Mountain House School water supply was tested in November, 1992. Ground water samples collected from this well were analyzed for benzene, toluene, ethylbenzene, and xylene by USEPA Test Method 602 in addition to total petroleum hydrocarbon as gasoline using USEPA Test Method 8015(m). All water samples were reported to contain concentrations of analytes below analytical method detection limits.

Using the soil and groundwater information collected in 1992, WZI conducted a Remediation Feasibility Study that indicated overexcavation of contaminated soil was the only satisfactory way to remove the source from the groundwater and effect remediation of the site. The shallow groundwater depth and fine grained nature of the sediments makes other standard remediation methods such as soil vapor extraction (SVE), bioventing, and passive bioremedation to not be effective and hence, not warranted.

The WZI soil site assessment was continued in July, 1993 and completed by removal of all gasoline contaminated soil on the Schropp property by overexcavation. Approximately 19,000 cubic yards of low-level (50 to 100 mg/kg) gasoline hydrocarbon contaminated soil was removed from the subsurface to a depth of approximately 30 feet below ground surface during July to August, 1992. An annual fluctuation in the ground water level from 15 to 25 feet below ground surface resulting from agricultural irrigation operations allowed downward migrating gasoline contaminated ground water to contaminate soil as deep as 32 feet below ground surface.

The gasoline contaminated soil was found to extend from the former underground tank location northward through the shop yard beneath and along the Byron-Bethany Irrigation District water supply line to the north and northeast of the property line. No work was conducted on the property adjacent and north of the Schropp property. All of the gasoline contaminated soil was removed from the subsurface and stockpiled except for a small volume of hydrocarbon contaminated soil which was left in place for engineering safety below and immediately adjacent to the farm house. An estimated 700 to 750 gallons of gasoline was contained within this hydrocarbon contaminated soil that was excavated from the subsurface.

Ground water that collected in the excavation was pumped through a carbon filtration system into a series of 20,000 gallon holding tanks. Clean backfill was then placed in the excavation until the former grade was attained. The filtered water from the excavation was sampled for hydrocarbon constituents and if necessary, refiltered until non-detection limits were attained. The filtered water was then discharged into a local alfalfa field on the property in accordance with a waste discharge permit obtained from the California Regional Water Quality Control Board.

Remediation of the gasoline contaminated from the UST excavation was accomplished by aeration in accordance with Bay Area Air Quality Management District (BAAQMD) guidelines at rates prescribed for total petroleum hydrocarbon concentrations at or below 50 mg/kg. The soil was also sampled for soluble lead from four samples which were reported as having concentrations below detection limits. Once remediated to non-detection levels and confirmed by analytical laboratory results of soil samples obtained from the remediated soil, the soil was used to help build up existing dirt roads on the Schropp property.

A series of five soil borings were drilled to between 31 and 36 feet bgs, sampled, and completed as 2" diameter ground water monitoring wells in September, 1993. Soil samples were collected at five foot intervals from the soil borings. Soil samples were analyzed using USEPA Test Method 8020 for BTEX and 8015(m) for TPH-g. All soil samples were reported to contain concentrations of analytes below analytical detection limits.

The five monitoring wells were completed to depths between 30 and 35 feet below ground surface and developed. The well casings were surveyed and tied into the U.S. Coast and Geodetic Survey elevation network by use of a local benchmark on Mountain House Road.

Quarterly groundwater monitoring of the wells was initiated during March, 1994. A total of five monitoring events were conducted between March, 1994 and April, 1996. Groundwater was found to be present at depths ranging from 12 to 15 feet bgs. Ground water samples collected from these wells were analyzed for benzene, toluene, ethylbenzene, and xylene by USEPA Test Method 602 in addition to total petroleum hydrocarbon as gasoline using USEPA Test Method 8015(m). All water samples were reported to contain concentrations of analytes below analytical method detection limits.

The ground water surface elevation measurements from the monitoring wells indicate a gradient that slopes gently to the northeast and approximately the same as the surface topography. Local ground water pumping on the adjacent property to the north by a domestic water well may be responsible for a small anomaly in the ground water surface that represents a cone of ground water surface depression.

A final monitoring of the five wells was conducted in March of 2002. Monitoring well MW-3 was found to be dry. Groundwater samples were collected from the other four monitoring well and the Mountain House School water supply well. Groundwater samples were submitted to Kiff Analytical LLC, Davis, California for analysis by USEPA Test Method 8260B for BTEX, TPH-G, 7 oxygenates, 1,2-DCA, and 1,2-EDB. All water samples were reported to contain concentrations of analytes below analytical method detection limits.

A review of regulatory agency records indicated that the Mountain House School had a former 1,000 gallon UST that was removed and the site subsequently closed.

The soil hydrocarbon contamination plume discovered in the soil in the northern portion of the main excavation had the appearance of unrefined crude oil. Unlike the gasoline contaminated soil which clearly had migrated to the north and northeast, the lateral extent of this contaminated soil appears to have migrated southward from the adjacent Castello property located immediately to the north. The volume of currently identified affected soil on the Schropp property was relatively small and is estimated to be about 10 cubic yards. This soil is located at a depth of 22 to 25 feet below ground surface and has encroached approximately 20 or 30 feet into the Schropp property. This soil was excavated and remediated with the gasoline contaminated soil.

The extent of this probable "crude oil" petroleum hydrocarbon soil contamination was not defined as this involved the adjoining property and permission was denied to enter the property by the owner. The source of this probable crude oil was identified to most likely be the Central Valley Pipeline (CVP) formerly owned and operated by Shell Oil Company that transported crude oil from Coalinga to Martinez. The CVP was abandoned in approximately 1970 after over fifty years of use. The pipeline was abandoned in place on the Schropp Property as permitted by the former owner, Mr. Wing.

The CVP crosses the Schropp property east of Mountain House Road. Because of the strong belief that the identified "crude oil" soil plume encountered the the main UST excavation in the shop yard emanated from the CVP and the lack of cooperation from Mr. Castello to continue the investigation onto his adjacent property, a series of trenches were placed along the former CVP easement in May, 1994 on Schropp property east of Mountain House Road. These trenches indicated the presence of a significant volume of "crude oil" contaminated soil along the former CVP easement. Shell Oil Company subsequently conducted a significant investigation and remediation of this "crude oil" contaminated soil and groundwater along the former CVP easement under regulatory oversight of the California Regional Water Quality Control Board (RWQCB). In August, 1999 the RWQCB issued a closure letter that indicated no further action was required by Shell Oil Company regarding the CVP "crude oil" release.

During January, 2002, Stephen G. Muir Consulting Geologist & Geophysicist was retained to answer remaining questions and submit a Final Problem Assessment Report (PAR) and a Closure Document for the site. All data was compiled from past investigations and placed into a comprehensive PAR. This document was submitted to ACEHD in April, 2003 for review and approval.

7. **STRATEGY AND PROCEDURES FOR A DEEP ZONE GROUNDWATER SITE ASSESSMENT INVESTIGATION FOR PETROLEUM HYDROCARBON CONTAMINATED GROUNDWATER**: The intent of this work plan is to present the methodologies to be used to assess the possible presence and extent of petroleum hydrocarbon contaminated groundwater from the release of product from the previous gasoline UST's at the site. The basic assumption regarding the petroleum hydrocarbon contamination in soil and groundwater beneath the site is that an ongoing unauthorized release of fuel was most likely occurring during the life of the USTs and dispensers at the site (approximately 40 years). Groundwater flow direction of the shallow aquifer is likely to the northeast.

The former domestic water supply well may have caused shallow depth petroleum hydrocarbon contaminated groundwater to be drawn into the wellborn and cross-contaminating deeper aquifers to the approximate total depth of the former domestic well (140 feet bgs). The former domestic wellbore was plugged and abandoned in accordance with ACEHD directives and is not available for inspection. The summary strategy to implement the tasks contained in the workplan is to initially define the vertical geologic section immediately adjacent to the former domestic well to a depth of the second water bearing zone immediately below the sanitary seal (about 50 to 75 feet bgs) and to determine if groundwater in this zone has been impacted by petroleum hydrocarbon contamination. An onsite groundwater sample will be collected using a Hydropunch II sampling system from a depth of approximately 75 feet bgs or within the identified second water bearing zone. A second soil boring (SB-2) will be drilled and sampled approximately 50 feet downgradient from the first soil boring. This soil boring will also have a groundwater grab sample collected from it.

A Sensitive Receptor Survey of the site and immediate surrounding area will develop a preliminary working model (Site Conceptual Model) for the deeper zone aquifers that are above 150 feet below ground surface. Zones of completion on adjacent water supply wells will be determined by DWR logs and a cross-section showing geologic stratigraphic units and subsurface analytical data will be constructed.

Soil samples will be collected from the soil boring every five feet or at lithologic boundaries. Soil samples from the two soil borings will be screened with a Photo Ionization Device (PID) and it is anticipated that 5 to 10 soil samples from each boring will be analyzed by a state certified analytical laboratory. It is anticipated that USEPA Test Method 8260B will be utilized to determine the concentrations of TPH-g, BTEX, 5 oxygenates, and lead scavengers (1,2-DCA and 1,2-EDB). USEPA Test Method 8015M will be used to identify the presence of TPH-gasoline in the soil samples. Groundwater grab samples will be analyzed for the same analyates.

Quarterly groundwater monitoring and sampling of the monitoring wells will be initiated. An updated Problem Assessment Report will be prepared and presented with all investigative results and recommendations for additional investigation, if any. Quarterly Status Reports (QSR's) will be submitted every ninety days as required by state regulations for hazardous waste sites.

8. DESCRIPTION OF WORK TO BE CONDUCTED: The work to be conducted will consist of the following tasks.

Task 1- Health and Safety Plan

Develop a work plan and worker health and safety plan for the expanded soil and groundwater site assessment. Procedures for conducting all work are outlined in the Worker Health and Safety Plan prepared by Consultant(Attachment 2). Site-specific information is provided on the cover page of the worker health and safety plan. All work will be completed in accordance with all regulatory requirements as defined by the State Water Resources Control Board's LUFT field manual and the Tri-Regional Water Quality Control Board Guidelines for Underground Storage Tank Investigations.

Task 2- Sensitive Receptor Survey

Consultant will conduct a sensitive receptor survey within a 2,000-foot radius of the site. A vehicular reconnaissance of the site vicinity will be conducted to identify surface water bodies, schools, and potential water well users. In addition, a request for water well records retained by the ACEHD and the California State Division of Water -Resources (DWR) will be submitted. Wells identified during the field reconnaissance, or by the ACEHD and/or the DWR will be plotted on a scaled vicinity map and included in a brief report. While copies of Water Well Drillers Reports cannot be provided as per Section 13752 of the California Water Code, much of pertinent information will be extracted and presented in tabular form and will include information pertaining to the type of receptor, distance from the former UST locations, and if readily available, information regarding well screen intervals.

Any wells that are found to be within 2,000 feet of the release will be closely reviewed and considered for sampling based on concurrence with ACEHD staff. Well water samples will be analyzed using the U.S. EPA Test Method 8260B for analytes listed in Task 4.

Task 3- **Site Assessment Subsurface Investigation**

To evaluate the horizontal and vertical extent of petroleum hydrocarbon impacted soil and to determine if groundwater beneath the site has been impacted by gasoline compounds, Consultant proposes to permit and advance a series of approximately two soil borings on the site. The soil borings will be drilled at the locations shown on Figure 5. Prior to conducting any intrusive methods at the site, Underground Service Alert of Northern California will be utilized to map out the underground structures. Based on the clearances obtained, Consultant will site the soil borings in a safe locations.

A licensed drilling contractor will advance the soil borings approximately 75 feet below the ground surface using a continuous flite auger drilling rig. The drilling contractor will be an experienced contractor who has worked in this portion of California successfully on previous projects. Drilling contractor will arrange for USA callout and will obtain all necessary permits for drilling.

During drilling, undisturbed soil samples will be collected at five-foot intervals into stainless steel or brass sample sleeves. In the field, a California registered geologist will log all soil samples for hydro geologic and lithologic characteristics according to the Unified Soil Classification System and screen each sample for any organic vapors using a photoionization detector (PID) calibrated to 100 ppmv isobutylene, and observations will be made for the visual identification of any soil staining or discoloration.

Soil samples will be wrapped in Teflon, followed by close-fitting plastic caps, and held at a temperature of 4 ^{0} C while in the field and in transit to the laboratory which will be a state of California certified analytical laboratory.

Soil boring locations will be surveyed in the field and tied to the California State Plane Coordinate System zone appropriate for this area as well as provide latitude and longitude coordinates.

Soil sampling equipment will be decontaminated between sampling attempts using a non-phosphate, soap and water wash; a tap-water rinse; and a distilled, deionized water rinse (see Attachments 3 and 4) for the Soil Boring and Well Construction Procedures. A groundwater grab sample will be collected from the second water bearing zone (about 65 feet bgs and below the 50 foot deep well seal) or as appropriate to determine if this zone has been impacted by petroleum hydrocarbons.

Task 4- Laboratory Analysis of Soil and Water Samples

Approximately 5 to 6 soil samples from each soil boring will be submitted for analysis. These samples will be submitted to Kiff Analytical for analysis by USEPA Test Method 8260B for TPH-gas, benzene, toluene, ethylbenzene, and xylene as well as 5 gasoline oxygenates/additives. The selected oxygenates/additives that will be analyzed for include: ethanol (E), tertiary-butanol (TBA), Di-isopropyl Ether (DIPE), Ethyl tertiary-butyl ether (ETBE), tertiary-amyl methyl ether (TAME), methyl tertiary butyl ether (MTBE). Lead scavengers will be analyzed and will include 1,2, Dichloroethane (1,2-DCA) and 1, 2- Dibromoethane (1,2-EDB). Water samples will be analyzed by the same analytical methods.

The soil and water samples will be analyzed by Kiff Analytical LLC, as California certified laboratory #2236.

Task 5- Site Conceptual Model

An initial site conceptual model will be developed using existing subsurface geological, chemical, and hydrological data. In addition, information from the sensitive receptor survey will be included in developing a model of the extent and nature of the identified petroleum hydrocarbon release and how best to implement additional site assessment work to define missing data points.

Task 6- Revised Problem Assessment Report Preparation

A Revised Problem Assessment Report (PAR) will be prepared that will have incorporated within it a Site Conceptual Model with all available data. This report will take all pertinent data and present it in the correct manner to describe the nature and extent of the soil and groundwater contamination encountered and recommended follow-up actions. At a minimum the report will include: (1) a discussion of the site history, (2) a description of the fieldwork conducted at the site, (3) the analytical laboratory results, (4) a scaled site plan map, (5) drilling logs, (6) an estimation of contaminant mass, (7) computerized modeling results, and (8) conclusions and recommendations. The PAR will also address data gaps that exist and any recommended further investigation required.

Task 7- Quarterly Status Reporting (4 events per year)

Quarterly Status Report (QSR) will be prepared and submitted every 90 days to ACEHD and the RWQCB as required until otherwise directed. The QSR will provide a summary of all actions conducted on the site during that quarter.

10. **EQUIPMENT DECONTAMINATION PROCEDURES**: Sampling equipment will be decontaminated using a non-phosphate, soap and water wash; a tap water rinse; and two distilled, deionized water rinses. The hollow-stem auger will be decontaminated in a similar manner before and after advancing the soil boring.

11. **WASTE DISPOSAL PROCEDURES**: The cuttings from the soil boring and the purge water will be containerized in 55-gallon Department of Transportation-approved drums pending laboratory analytical results. If contaminated, the waste will be hauled off site for disposal at an appropriate facility.

12. **EMERGENCY OR INTERIM CLEANUP:** Not applicable.

13. **WORK SCHEDULE**: Work will begin within 60 days subsequent to the approval of this Work Plan by the ACEHD and issuance of a soil boring permit by the ACEHD. The ACEHD will be notified at least 48 hours before any on-site work commences. A Preliminary Problem Assessment Report will be submitted to the ACEHD and RWQCB-CVR offices approximately 45 days after the completion of the fieldwork.

Thank you for your assistance on this project. If you have any questions or require additional information, please contact Mr. Stephen G. Muir at (209) 369-9421.

Sincerely,

Stephen G. Muir
Certified Engineering Geologist #1224
Expiration Date: 08/30/05

CERTIFIED ENGINEERING GEOLOGIST
STEPHEN G. MUIR
No. EG 1224
Exp. Date 08/30/05
STATE OF CALIFORNIA

Enclosures:

Figure 1 -Regional Location Map
Figure 2 -Site Location Map
Figure 3- Assessor's Parcel Map
Figure 4- Site Activity Map
Figure 5- Geologic Map of Site
Figure 6- Map of Excavation Showing Sample Locations, Activity and Proposed Soil Borings
Figure 7- Cross-Section A-A'

Attachment 1 -ACEHD Correspondence
Attachment 2 -Health and Safety Plan with Map
Attachment 3 -Soil Boring and Well Construction Procedures
Attachment 4 -Groundwater Monitoring, Sampling, and Sample Management Procedures

cc: Mr. James Barton, California Regional Water Quality Control Board, Central Valley Region (5)
Dick Jones, Agriculture Industries Inc.
Manfred Schropp

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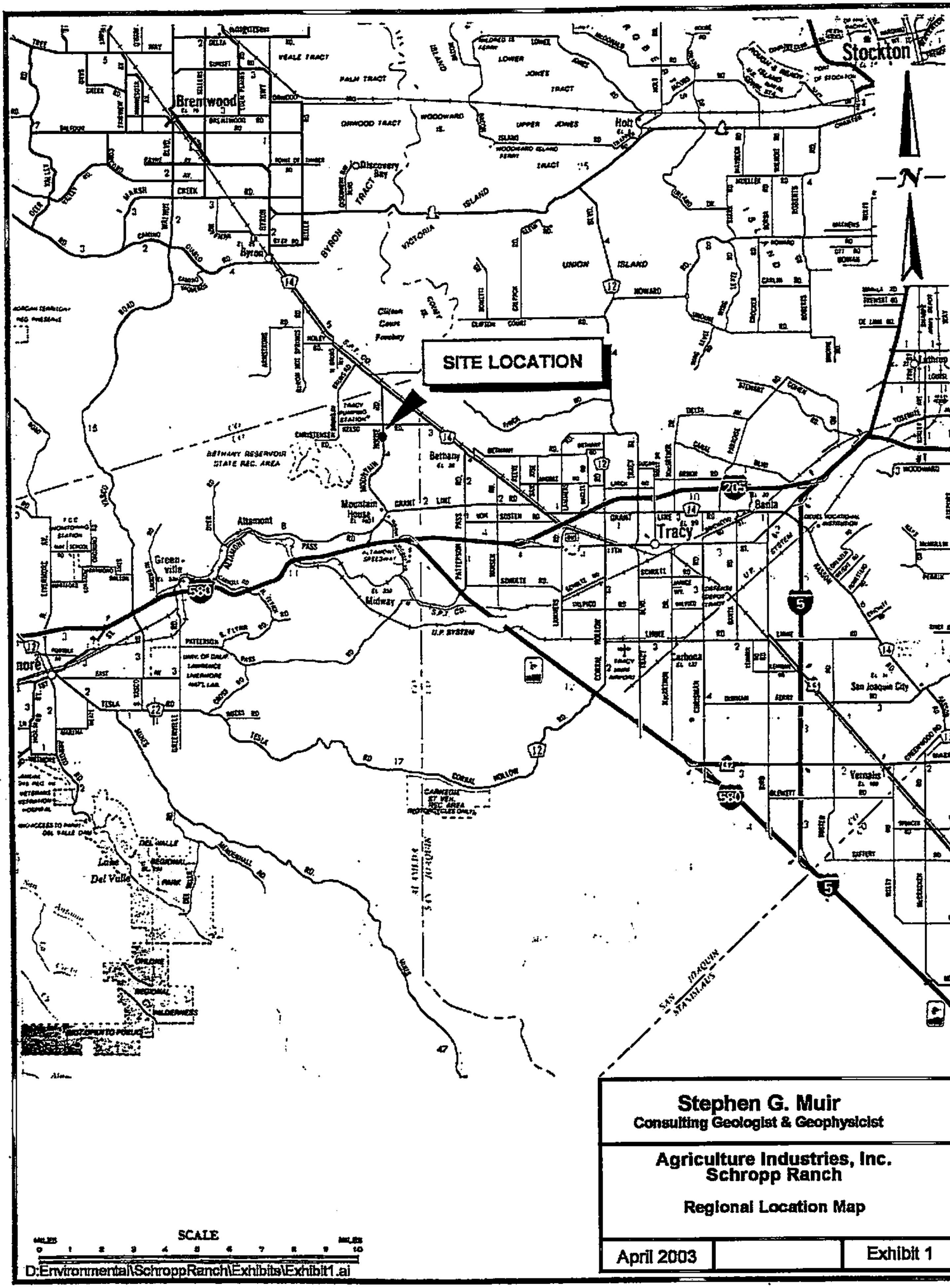

Stephen G. Muir
Consulting Geologist & Geophysicist

Agriculture Industries, Inc.
Schropp Ranch

Regional Location Map

April 2003		Exhibit 1

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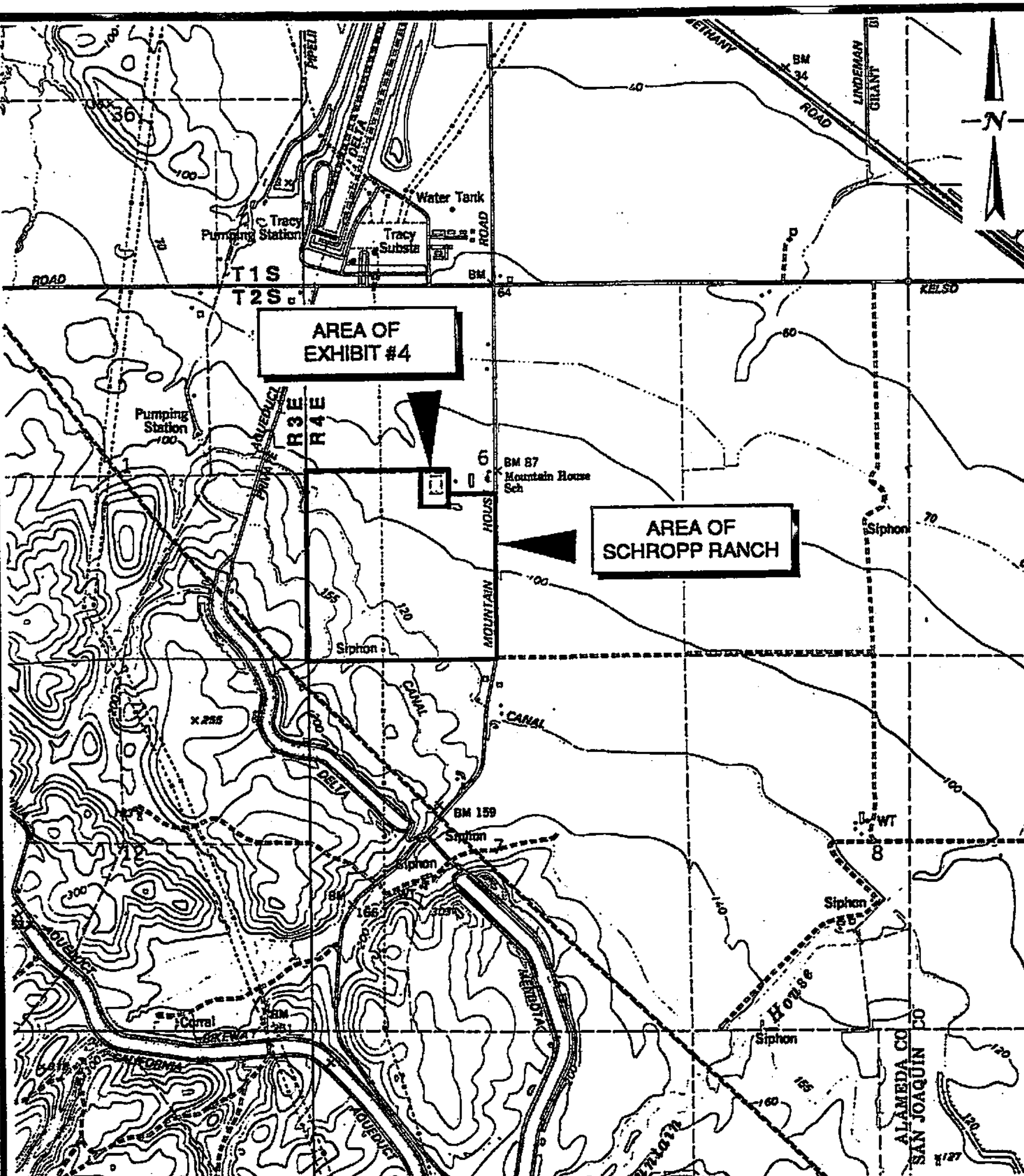

REF: U.S. GEOLOGICAL SURVEY, CLIFTON COURT
FOREBAY 1:24,000 TOPOGRAPHIC MAP

0 1000 2000 3000 4000 FEET

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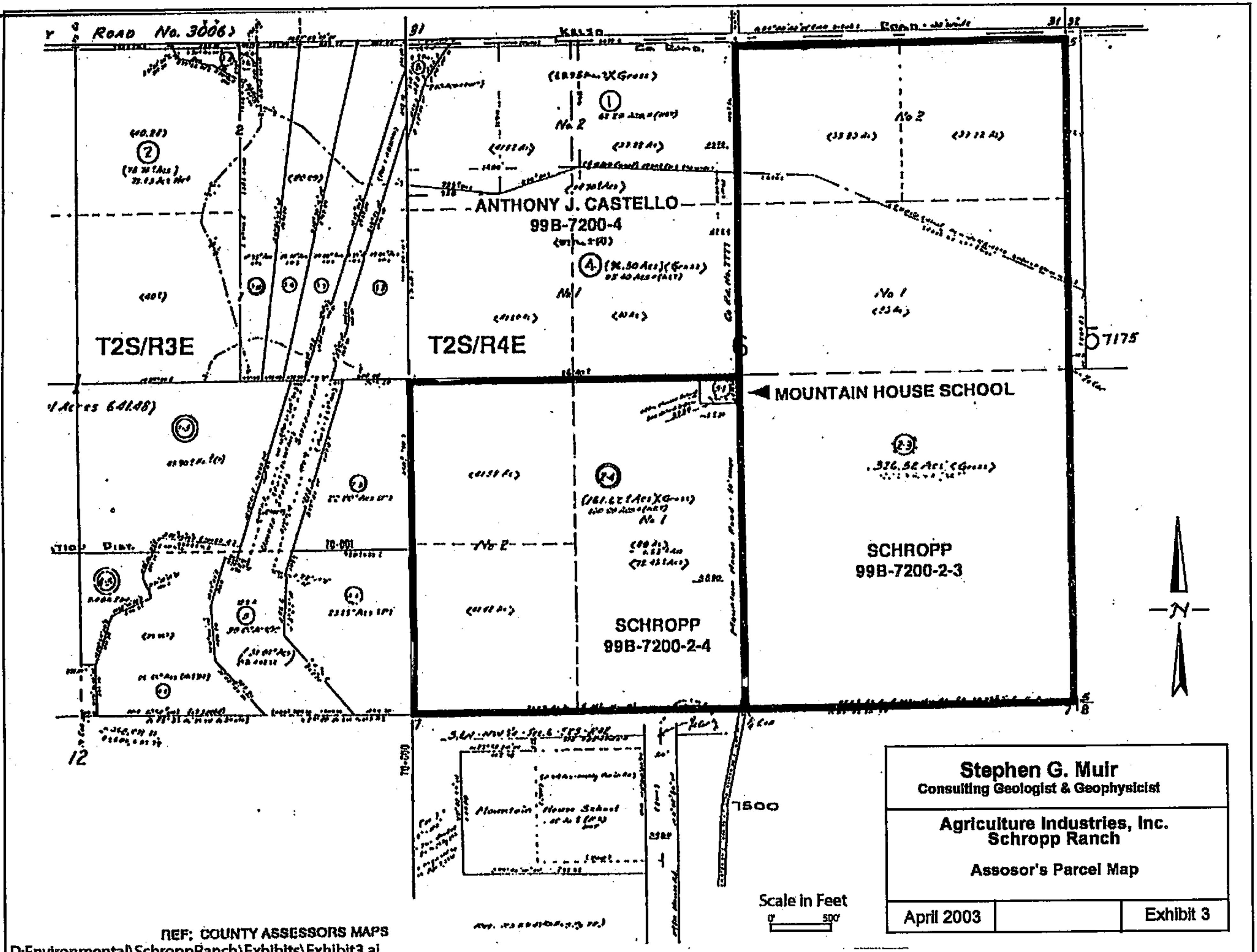
Stephen G. Muir **Consulting Geologist & Geophysicist**		
Agriculture Industries, Inc. **Schropp Ranch** **Site Location Map**		
April 2003		Exhibit 2



ROAD No. 3006
ANTHONY J. CASTELLO
99B-7200-4
T2S/R3E
T2S/R4E
MOUNTAIN HOUSE SCHOOL
SCHROPP
99B-7200-2-3
SCHROPP
99B-7200-2-4
7175
7500
12
N
Stephen G. Muir
Consulting Geologist & Geophysicist
Agriculture Industries, Inc.
Schropp Ranch
Assosor's Parcel Map
April 2003
Exhibit 3
Scale in Feet
REF: COUNTY ASSESSORS MAPS
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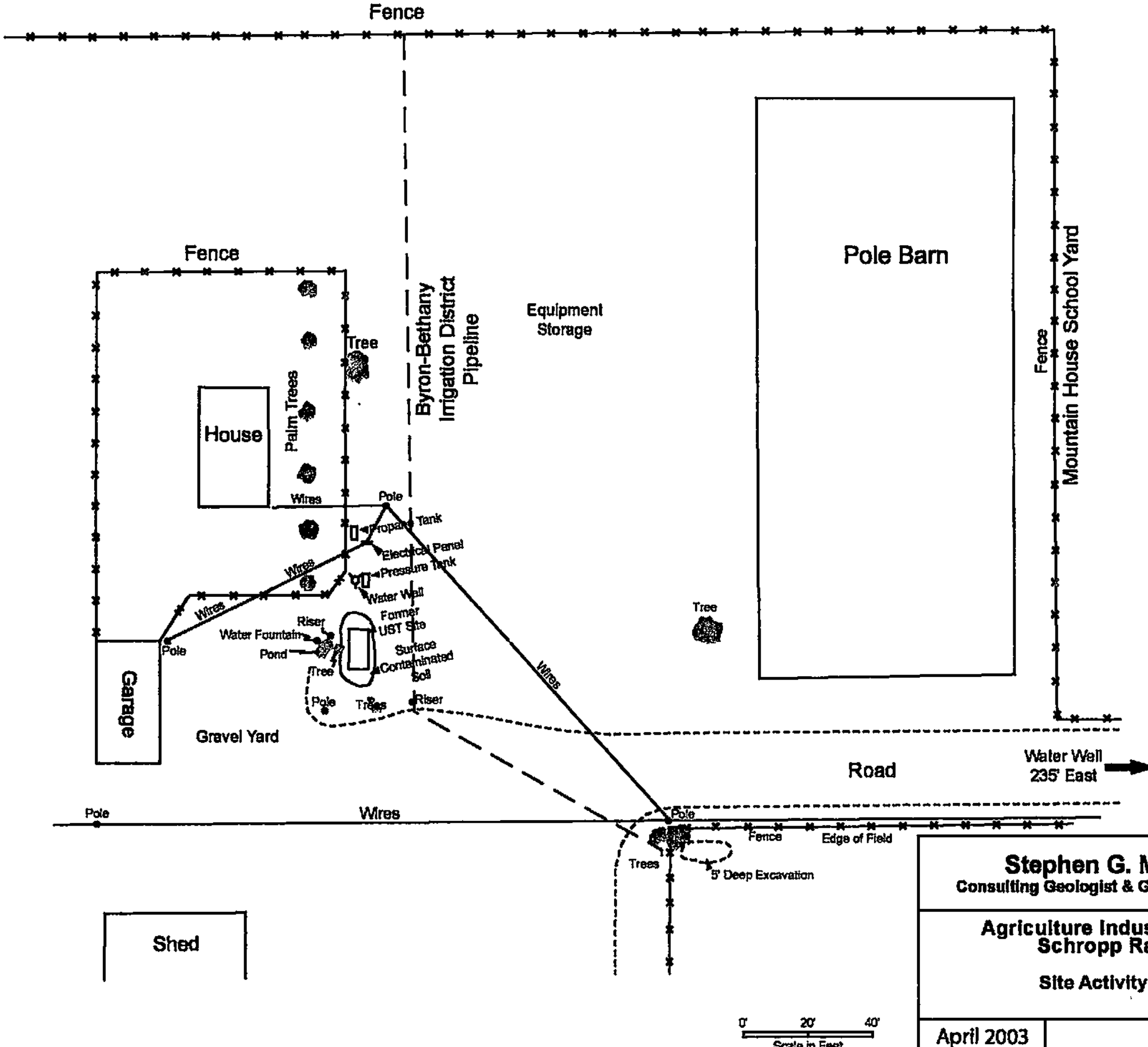

Stephen G. Muir
Consulting Geologist & Geophysicist

Agriculture Industries, Inc.
Schropp Ranch

Site Activity Map

April 2003		Exhibit 4

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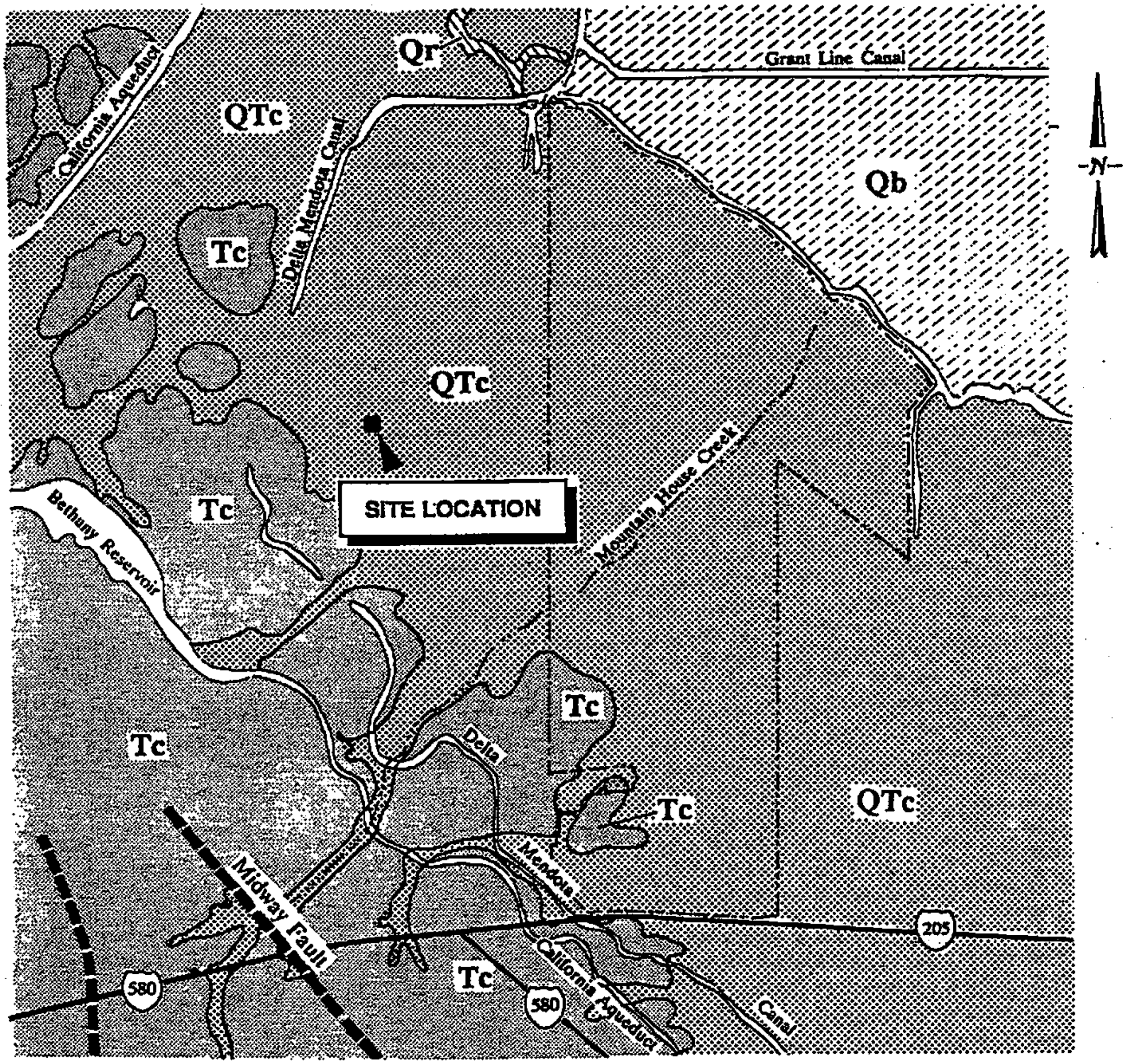

Legend

Qr		Recent (Holocene) River Deposits
Qb		Recent (Holocene) Flood Basin Deposits
QTc		Young (Quaternary to Tertiary) Alluvial Deposits
Tc		Older (Tertiary and Pre-Tertiary) Marine and Continental Sedimentary Rocks

▬ ▬ ▬ ▬ Potentially Active Faults

- - - - Proposed Mountain House Project Site Boundary

Source: USGS, 1972 Miscellaneous Field Studies Map, MF-338
USGS, Open File Report, 80-535
USGS, 1986 Professional Paper, 140 1.C

Scale 1:62,500
0 — 1 Mile

Stephen G. Muir
Consulting Geologist & Geophysicist

Agriculture Industries, Inc.
Schropp Ranch

Geologic Map of Site

April 2003		Exhibit 5

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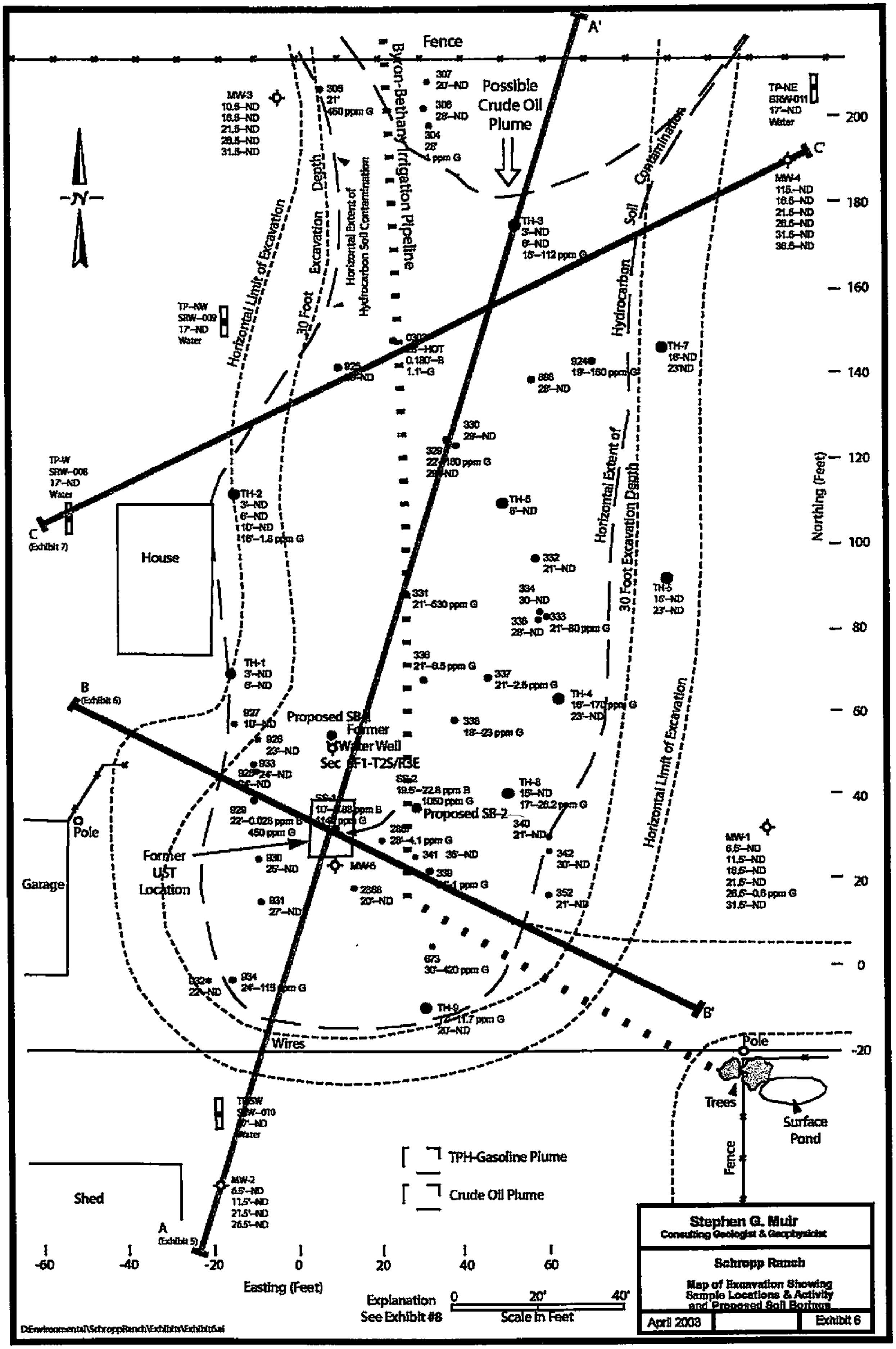

Fence
Byron-Bethany Irrigation Pipeline
Possible Crude Oil Plume
A'
C'
A
(Exhibit 5)
B
(Exhibit 6)
B'
C
(Exhibit 7)
N
MW-3
10.5–ND
16.5–ND
21.5–ND
26.5–ND
31.5–ND
305
21'
450 ppm G
307
20'–ND
306
28'–ND
304
28'
1 ppm G
TP-NE
SRW-011
17'–ND
Water
MW-4
11.5–ND
16.5–ND
21.5–ND
26.5–ND
31.5–ND
36.5–ND
TH-3
3'–ND
6'–ND
18'–112 ppm G
Horizontal Limit of Excavation
30 Foot Excavation Depth
Horizontal Extent of Hydrocarbon Soil Contamination
Hydrocarbon Soil Contamination
Horizontal Extent of 30 Foot Excavation Depth
TP-NW
SRW-009
17'–ND
Water
TH-7
16'–ND
23'ND
TP-W
SRW-008
17'–ND
Water
TH-2
3'–ND
6'–ND
10'–ND
16'–1.8 ppm G
House
TH-6
5'–ND
330
29'–ND
TH-5
16'–ND
23'–ND
331
21'–630 ppm G
TH-1
3'–ND
6'–ND
337
21'–2.5 ppm G
TH-4
16'–170 ppm G
23'–ND
927
10'–ND
Proposed SB-1
Former Water Well
Sec 31-T2S/R3E
338
18'–23 ppm G
926
23'–ND
933
24'–ND
TH-8
15'–ND
17'–26.2 ppm G
Proposed SB-2
929
22'–0.028 ppm B
450 ppm G
Pole
Garage
Former UST Location
MW-5
930
25'–ND
931
27'–ND
MW-1
6.5'–ND
11.5'–ND
16.5'–ND
21.5'–ND
26.5'–0.6 ppm G
31.5'–ND
673
30'–420 ppm G
934
24'–115 ppm G
TH-9
Wires
Pole
Trees
Surface Pond
Fence
TP-SW
SRW-010
Water
MW-2
6.5'–ND
11.5'–ND
21.5'–ND
26.5'–ND
Shed
TPH-Gasoline Plume
Crude Oil Plume
Northing (Feet)
200
180
160
140
120
100
80
60
40
20
0
-20
-60
-40
-20
0
20
40
60
Easting (Feet)
Explanation See Exhibit #8
0
20'
40'
Scale in Feet
Stephen G. Muir
Consulting Geologist & Geophysicist
Schropp Ranch
Map of Excavation Showing Sample Locations & Activity and Proposed Soil Borings
April 2003
Exhibit 6
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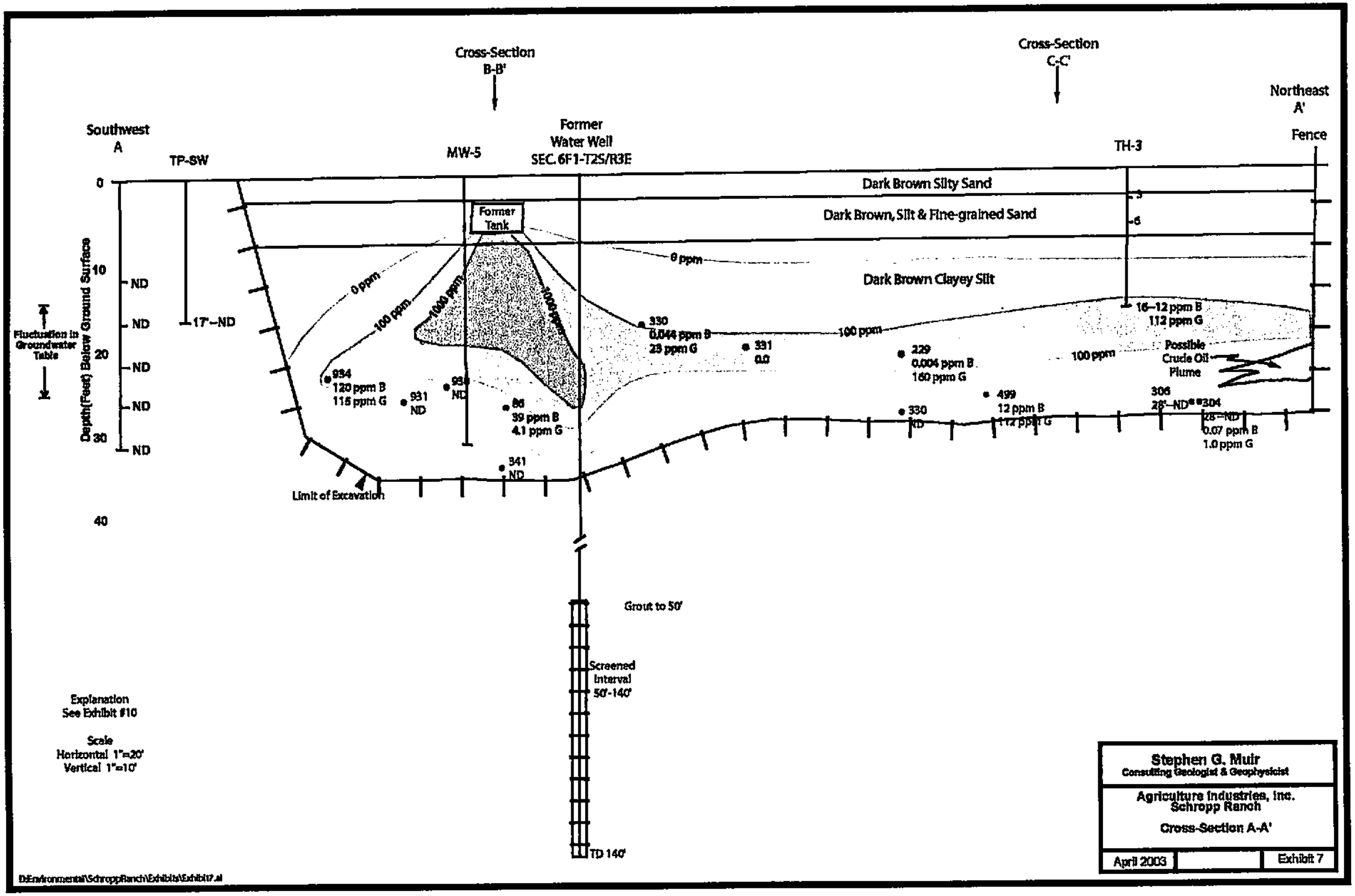

Cross-Section B-B'
Cross-Section C-C'
Northeast A'
Fence
Southwest A
TP-SW
MW-5
Former Water Well SEC. 6F1-T2S/R3E
TH-3
Dark Brown Silty Sand
Dark Brown, Silt & Fine-grained Sand
Dark Brown Clayey Silt
Former Tank
0 ppm
100 ppm
1000 ppm
Depth(Feet) Below Ground Surface
0
10
20
30
40
ND
17'--ND
Fluctuation in Groundwater Table
934 120 ppm B 115 ppm G
931 ND
86 39 ppm B 4.1 ppm G
341 ND
330 0.044 ppm B 23 ppm G
331 0.0
229 0.004 ppm B 160 ppm G
330 ND
499 12 ppm B 112 ppm G
16--12 ppm B 112 ppm G
Possible Crude Oil Plume
306 28'--ND
304 28'--ND 0.07 ppm B 1.0 ppm G
Limit of Excavation
Grout to 50'
Screened Interval 50'-140'
TD 140'
Explanation See Exhibit #10
Scale Horizontal 1"=20' Vertical 1"=10'
Stephen G. Muir
Consulting Geologist & Geophysicist
Agriculture Industries, Inc. Schropp Ranch
Cross-Section A-A'
April 2003
Exhibit 7
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ATTACHMENT 1
ACEHD Correspondence

RO0002473

July 11, 2003

Mr. Richard Jones
Agriculture Industries, Inc.
P.O. Box 1076
West Sacramento, CA 95691

RE: Deep Aquifer Investigation at 3880 Mountain House Rd, Byron, CA

Dear Mr. Jones:

I have completed review of Stephen Muir's April 2003 *Final Problem Assessment Report (PAR) and Closure Request Document* prepared for the above referenced site. This report summarized activities conducted at the site to remediate hydrocarbon-impacted soil due to a former leaking underground storage tank (UST). Below are my technical comments:

- Table 2 of the PAR lists groundwater analytical data for sample 001(Feb 4,1992) containing 0.20ug/L TPHg and Non Detect for BTEX constituents. And in Nov 11, 1992, Well Sample #1 contained 79ug/L TPHg, 7.05ug/L benzene, etc. Please clarify if these are water samples collected from the former water supply well (2S/3E-6F1) located in the vicinity of the former UST or from another well. And please clarify if SRW and Schropp Well designations are for well 2S/3E-6F1.
- If the former water supply well was impacted by the gasoline release at the site, the extent of contamination in the deep aquifer must be delineated. If this is the case, a workplan for the required investigation is due within 45 days of the date of this letter, or by **August 25, 2003**.

Be advised that I am no longer working in the LOP/SLIC program. I may or may not be able to continue to provide regulatory oversight for this site to case closure. If the case is assigned to a new caseworker, you will be notified. Otherwise, you may continue to send correspondence to my attention. If you have any questions, I can be reached at (510) 567-6762 or by email at echu@co.alameda.ca.us.

eva chu
Sr. Environmental Health Specialist

c: Donna Drogos
CV-RWQCB, 3443 Routier Rd, Suite A, Sacramento, CA 95827-3098
email: Stephen Muir

ATTACHMENT 2.
HEALTH AND SAFETY PLAN

WORKER HEALTH AND SAFETY PLAN FOR UNDERGROUND STORAGE TANK INVESTIGATIONS SITE-SPECIFIC INFORMATION

Site Address: 3880 Mountain House Road, Byron, California
Name of Business Occupying Site: Schropp Ranch
Owner Name: Werner Schropp c/o Dick Jones Agriculture Industries Inc. (916) 372-5595
ACEHD Contact: Ms. Eva Chu: Telephone (510) 567-6762

FIELD ACTIVITIES AND GOALS OF THIS INVESTIGATION: Drill and sample 2 soil borings to 75 feet bgs and obtain groundwater grab samples in second water bearing zone. .

KNOWN HAZARDS AT THE SITE INCLUDE:
Gasoline hydrocarbons.

KEY PERSONNEL AND RESPONSIBILITIES:

NAME	RESPONSIBILITIES
Stephen G. Muir, CEG (209) 369-9421	SITE SAFETY OFFICER - Primarily responsible for site safety, response operations, and protection of the public. Responsible for work site inspections to identify particular hazards and define site security.
Stephen G. Muir, CEG	PROJECT MANAGER -Primarily responsible for site remediation. The project manager delineates authority, coordinates activities and functions, and directs activities related to mitigative efforts of cleanup contractors.
Stephen G. Muir, CEG	SITE INVESTIGATIVE PERSONNEL -Primarily responsible for actual field work including sampling, monitoring, equipment use, and other related tasks as defined by the project manager.

ANTICIPATED WEATHER CONDITIONS FOR THIS AREA DURING THE PROJECT'S DURATION WILL BE:

Temp. range: 50-70 F Humidity: 30-60% Ambient temp.: 60 F
Potential for heat stress: High: __ Medium:___ Low: _X__

ANTICIPATED PROTECTION LEVEL DURING THIS PROJECT
Level "D" Will be upgraded or downgraded to fit situations as they arise.

EMERGENCY INFORMATION:
All emergency calls: 911
Closest hospital with emergency room: Sutter Tracy Community Hospital
1420 North Tracy Blvd., Tracy, California 94571 (209) 835-1500
Map Showing Route from Site to Hospital Attached? Yes: No:X

WORKER HEALTH AND SAFETY PLAN FOR UNDERGROUND STORAGE TANK SITE INVESTIGATIONS

This document outlines Stephen G. Muir Consulting Geologist & Geophysicist (Consultant) worker health and safety plan for its employees and contractors to be used at Alameda County UST site investigations. Site-specific information is provided on the cover page to this document. This worker health and safety plan was developed by Consultant's industrial hygienist through consultation of the following documents:

- OSHA 29 CFR 1910- "Hazardous Waste Operations and Emergency Response, Final Ruling," March 1989;
- NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985 and;
- Consultant's Health and Safety Program.

This worker health and safety plan is divided into the following categories:

1. Job Hazard Assessment;
2. Exposure Monitoring Plan;
3. Personal Protective Equipment;
4. Work Zones and Security Measures;
5. Decontamination and Disposal;
6. Contractor and Employee Training; and
7. Emergency Procedures.

1. JOB HAZARD ASSESSMENT

Immediate tasks at any leaking UST site include an evaluation of any present or potential threat to public safety. Questions need to be answered regarding the dangers of significant vapor exposures and potential explosion hazards.

Potential Chemical Hazards
The chemical components of gasoline that are the most dangerous to site workers are the volatile aromatics, benzene, toluene, ethylbenzene, xylene, and potentially, organic lead (see attached Material Safety Data Sheet). Additionally, solvents such as 1,2-dichlorobenzene and 1,2-dichloroethane may also be used as cleaning solutions at service stations. The primary health risks associated with each of these chemicals are described below.

Gasoline -Suspected human carcinogen. A TLV of 300 ppm or 900 mg/m^3 has been assigned to gasoline. This value of 300 ppm was assigned based on an average of 3 percent benzene (10 ppm TLV) in gasoline. Low-level inhalation exposure to gasoline can cause irritation to the eyes, nose, and respiratory system; headache; and nausea.

Benzene -Suspected human carcinogen. A TLV of 10 ppm or 30 mg/m^3 has been assigned to benzene. Benzene has a low odor threshold limit of 1.4 ppm. Low-level inhalation exposure to benzene can cause irritation to the eyes, nose, and respiratory system; headache, and nausea. Toluene -A TLV OF 100 ppm or 375 mg/m^3 has been assigned to toluene. Toluene has a low odor threshold limit of 2.1 ppm. Low-level inhalation exposure to toluene can cause fatigue, weakness, confusion, and euphoria.

Ethyllbenzene -A TLV of 100 ppm or 435 mg/m^3 has been assigned to ethylbenzene. Ethylbenzene has a low odor threshold limit of 2 ppm. Low-level inhalation exposure to ethylbenzene can cause irritation to the eyes and mucous membranes.

Xylene -A TLV or 100 ppm or 435 $mg/\ m^3$ has been assigned to xylene. No low odor threshold limit has been established for xylene. Low-level inhalation exposure to xylene can cause dizziness, excitement, and drowsiness.

1,2-Dichlorobenzene -A TL V of 50 ppm or 306 mg/m^3 has been assigned to 1,2-dichlorobenzene. 1 ,2-dichlorobenzene has a low odor threshold limit of 4.0 ppm. Acute vapor exposure can cause coughing, dizziness, and drowsiness. It may cause skin irritation.

1.2-Dichloroethane -A TLV of 200 ppm. No data is available concerning odor threshold. Acute vapor exposure can cause coughing, dizziness, drowsiness, and skin irritation.

Tetraethyl Lead -A TL V of 0.1 mg/m^3 has been assigned to tetraethyl lead. Tetraethyl lead is a colorless or red-dyed liquid at atmospheric conditions. No data is available concerning odor threshold. Acute vapor exposure can cause insomnia, delirium, coma, and skin irritation.

Potential Physical Hazards

Trenching - Dangerously high fuel vapor levels will be monitored using an LEL meter. The presence of underground utilities are also of concern, and Underground Service Alert will be notified in advance of any trenching work for identification of all underground utilities in the immediate area.

Drilling -Dangerously high fuel vapor levels will be monitored using an LEL meter. The presence of underground utilities are also of concern, and Underground Service Alert will be notified in advance of any drilling work for identification of all underground utilities in the immediate area.

Sampling -Use of personal protective equipment will minimize the potential for exposure of personnel conducting site investigation activities.

Heat stress will be monitored by each individual and controlled through regular work breaks as outlined in the American Conference of Governmental Industrial Hygienists' TLVs for heat stress conditions.

2. EXPOSURE MONITORING PLAN

Potential exposure hazards found at UST sites primarily include toxic airborne vapors from leaking USTs.

The most dangerous airborne vapor likely to be encountered during a UST investigation is benzene. Gasoline vapor concentration levels will be monitored in the breathing zone with a PID calibrated to benzene. When the action level of 150 ppm (one half the TLV of gasoline) is detected in the breathing zone, respiratory protection will be required utilizing full-face or half-face respirators with organic vapor cartridges.

Monitoring for combustible gases will also be performed using an LEL meter when vapor concentrations above 2,000 ppm are detected with the PID. The action level is 35 percent of the LEL for gasoline vapors or 4,500 ppm. If this level is attained or exceeded, the work party will be **IMMEDIATELY** withdrawn.

3. PERSONAL PROTECTIVE EQUIPMENT

The level of protection during the site investigation will usually be level "D." Level D protective equipment includes coveralls, safety boots, safety glasses, gloves, and hard hats if drilling or trenching operations are in progress.

Upgrading the protection level would be based on airborne benzene concentration levels equal to or exceeding the action level. An upgrade to level "C" protection would be required if the action level is equaled or exceeded. Additional equipment required for level C would be a full-face or half-face air purifying canister-equipped respirator and Tyvek suits with taped arm and leg seals.

If the action level is met or exceeded (35 percent) for the LEL, work will cease until the vapor level is measured to be below 20 percent of the LEL.

A fire extinguisher will be maintained on site. Decisions for workers' safety are based on a continual evaluation of existing or changing conditions.

4. WORK ZONES AND SECURITY MEASURES

To facilitate a minimum exposure to dangerous toxic vapors and/or physical hazards, only authorized persons will be allowed on the job site. Work zones will be defined by Consultant staff who will also be responsible for maintaining security within these zones. Only the minimum number of personnel necessary for the UST investigation will be present in the work zone.

5. DECONTAMINATION AND DISPOSAL

Consultant's standard operating procedures establish practices that minimize contact with potentially contaminated materials. Decontamination procedures are utilized if there is suspected or known contamination of equipment, supplies, instruments or any personnel surfaces. Soap and water will be utilized to remove contaminants from personnel surfaces as well as equipment and instruments.

Contaminated wash water will be disposed of in accordance with procedures outlined in the State of California LUFT guidance document.

6. EMPLOYEE TRAINING

All Consultant's employees working on the site will have had, at a minimum, the required 40-hour OSHA Training for Hazardous Waste Site Activities (29 CFR 1910, 120), which includes training in the use of personal protective equipment. Individualized respirator fit testing is required of all Consultant's employees working at the site.

7. EMERGENCY PROCEDURES

Consultant's employees are trained in emergency first aid, and emergency first aid provisions will be brought to the site. In the event of overt personnel exposure (i.e., skin contact, inhalation, or ingestion), the victim will be transported to and treated at the closest hospital (see Hospital Map).

MATERIAL DATA SAFETY SHEETS

NO. 467

AUTOMOTIVE GASOLINE, LEAD-FREE

Date October 1981

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
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SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: AUTOMOTIVE GASOLINE, LEAD-FREE
DESCRIPTION: A volatile blend of hydrocarbons for automotive fuel
OTHER DESIGNATIONS: Petrol, CAS #008 006 619, ASTM D439
MANUFACTURER: Available from several suppliers.

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Gasoline A hydrocarbon blend that can include normal and branched chain alkanes, cycloalkanes, alkenes, aromatics and other additives.** (Lead max 0.013 g/L, phosphorus max 0.0013 g/L, sulfur max 0.10 wt%. May contain benzene, <5%; see ASTM D3606). *ACGIH 1981 TLV (Intended Changes List). See also Am. Ind. Hyg. A 39 110-117 (1978) **The composition of fuel is varied with altitude and seasonal requirements for a locality. The blend must meet antiknock requirements. (Antiknock Index min 85, ASTM D439.)	100	8-hr TWA 300 ppm or 900 mg/m³* Man Eye: 500 ppm/1H moderate irritation Inhalation: TCLo 900 ppm/1H TFX:CNS

SECTION III. PHYSICAL DATA

Distillation at 1 atm, Initial, deg C >39
50% distilled - 77-121
End point —— <240
Vapor density (Air=1) ———— 3.0-4.0
Solubility in water ———— Insoluble
Specific gravity, 60/60 F - 0.72-0.76
Melting point, deg C ——— -90.5-95.4
Evaporation rate ——— N/A

Appearance and Odor: A clear, mobile liquid with a characteristic odor which can be recognized at about 10 ppm in air. (Gasoline may be colored with dye.)

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method.	Autoignition Temp.	Flammability Limits In Air % by volume	LOWER	UPPER
-45 F	536-853 F		1.4	7.6

Extinguishing Media: Dry chemical, carbon dioxide, alcohol foam. Use of water may be ineffective to extinguish fire, but use water spray for cooling fire-exposed drums and tanks to prevent pressure rupture. It is a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow along surfaces, reach distant ignition sources and flash back. Can react violently with oxidizing agents.
Firefighters should wear self-contained breathing apparatus and full protective clothing.

SECTION V. REACTIVITY DATA

This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.
This is an OSHA Class IA flammable liquid. A mixture of gasoline vapors and air can be explosive. It is incompatible with oxidizing agents.
Thermal-oxidative degradation can yield carbon monoxide and partially oxidized hydrocarbons.

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SECTION VI. HEALTH HAZARD INFORMATION

TLV 300 ppm (See Sect. II)

Inhalation causes intense burning of the mucous membranes, throat and respiratory tract; overexposure to vapors can lead to bronchopneumonia. Inhalation of high conc. can cause fatal pulmonary edema. Repeated or prolonged skin exposure causes dermatitis. Can cause blistering of skin due to its defatting properties. Exposure to eyes can cause hyperemia of the conjunctiva.

Ingestion or excessive vapors can cause inebriation, drowsiness, blurred vision, vertigo confusion, vomiting and cyanosis (2000 ppm produces mild anesthesia in 30 min, higher conc. are intoxicating in less time.) Aspiration after ingestion causes bronchitis, pneumonia, or edema which can be fatal.

FIRST AID:

Eye Contact: Flush thoroughly with running water for 15 min. including under eyelids.
Skin Contact: Remove contaminated clothing. Wash affected area with soap and water.
Inhalation: Remove to fresh air. Restore breathing and administer oxygen if needed.
Ingestion: Do not induce vomiting. Aspiration hazard. Contact physician.

Seek prompt medical assistance for further treatment, observation and support.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of leaks or spills. Remove sources of heat or ignition. Provide adequate ventilation. Clean-up personnel require protection against liquid contact and vapor inhalation. If a leak or spill has not ignited, use water spray to disperse vapors and to protect men attempting to stop the leakage. Contain spill. Do not allow to enter sewer or surface water. Add absorbent solid to small spills or residues and pick up for disposal.

DISPOSAL: Burn scrap material in an approved incinerator. Burn contaminated liquid by spraying into an incinerator. Follow Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Use general and local exhaust ventilation (explosion-proof) to keep vapors below the TLV requirements in the workplace. Respirators should be available for nonroutine or emergency use above the TLV.

Avoid eye contact by use of chemical safety goggles and/or full faceshield where splashing is possible. Wear protective clothing appropriate for the work situation to minimize skin contact such as rubber gloves and boots. Clothing to be changed daily and laundered.

Eyewash fountains, showers and washing facilities should be readily accessible

Provide suitable training to those handling and working with this material.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area away from sources of heat, ignition and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IA liquid.

Outdoor or detached storage preferred. No smoking in areas of use. Prevent static electric sparks and use explosion-proof electrical services. (Must meet code.)

Avoid skin and eye contact. Avoid inhalation of vapors. Wear clean work clothing daily.

Indoor use of this material requires exhaust ventilation to remove vapors.

ICC Flammable Liquid, Red Label. LABEL: Flammable Liquid DOT I.D. No. UN 1203.

DOT Classification: FLAMMABLE LIQUID

DATA SOURCE(S) CODE: 2,4-9,31,37

APPROVALS:	MIS CRD [signature]
Industrial Hygiene and Safety	[signature]
MEDICAL REVIEW:	14 November 1981

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GASOLINE

CAS: 8006-61-9

Bulk Handling

TLV-TWA, 300 ppm (≈ 900 mg/m³)
TLV-STEL, 500 ppm (≈ 1500 mg/m³)

Gasoline is a clear, flammable, volatile liquid with a characteristic odor. It is a complex mixture of paraffinic, olefinic, and aromatic hydrocarbons ranging from C_5 to C_{11} compounds. These number as many as 250 separate hydrocarbons in various commercial gasolines.[1] Physiochemical properties include:

Specific gravity: 0.72 to 0.76 at 60°F
Boiling point:[2] 39°C; 60°C (10% distilled); 110°C (50%); 170°C (90%); 204°C
Flash point: −50°F (10°C)
Explosive limits: 1.3% and 6.0% by volume in air

Insoluble in water, it is freely soluble in ether, chloroform, benzene, and absolute alcohol.

Gasoline is a fuel for spark-ignited, reciprocating, internal combustion engines.

A typical modern gasoline composition would be 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content was found to be approximately 1%. Because it is the most significant potent health hazard found in gasoline, benzene deserves special mentioning in establishing a TLV.[1] Other compounds to be given particular attention, if present, are n-hexane, n-heptane, other aromatics, and certain olefins.[3,4] A chromatographic vapor identification method has been developed for 142 individual components of gasoline in one air sample of vapors.[1]

Acute toxicity is similar[5,6] for all gasolines. They act generally as an anesthetic and are mucous membrane irritants. The hazard is high because of the ease in which harmful concentration may develop. Inhalation is the most important route of occupational entry. Acute symptoms[5] of intoxication, headaches, blurred vision, dizziness, and nausea are most common symptoms of excessive vapors. Reported responses to gasoline vapors are: 160-270 ppm causes eye and throat irritation in several hours; 500-900 ppm causes eye, nose and throat irritation, and dizziness in 1 hour; and 2000 ppm produces mild anesthesia in 30 minutes.[5,6] Higher concentrations are intoxicating in 4-10 minutes.[5,6] The threshold for immediate mild toxic effect is 900-1000 ppm.[6]

There are reports of toxic neuritis after exposures to gasoline.[8,9] The role of n-hexane in these cases when potentiated by other hydrocarbon components is not clear. However, the low amount of n-hexane in typical gasoline[4] rules against this being a potential problem where the TLV of 300 ppm is observed.

McDermott and Killiany[4] reported that the vapor of gasoline during tank truck loading consisted of over 40% butane, on a volume basis, and 30% pentane. Hexanes comprised about 7%, but n-hexane only 1.5%, while isomers of heptane and octane amounted to less than 2%. Four olefins (isobutylene and three isomers of pentene) contributed between 5% and 6% of the total, while benzene (0.7%), toluene and xylene together constituted 3%. About 8% of the vapor consisted of other high boiling ingredients (C_7 to C_{11} compounds).

It is noteworthy that the concentration of aromatics in the vapor was much less than in the liquid, which, on the average, contains 14% aromatic hydrocarbons. Runion, however, reported 24% to 27% total aromatics in various grades of one brand of gasoline.[7] The olefin content of the vapor, on the other hand, was about the same as that of a typical gasoline,[1] or even slightly higher.[4]

Based on the above study,[4] a TLV of 300 ppm was recommended for gasoline vapor. This seems reasonable, even conservative, for the operations involved, the bulk handling of gasoline. In the case of spills onto a non-porous surface, or the use of gasoline as a solvent or thinner (not recommended), where most of the liquid is vaporized, a somewhat lower limit might be in order.

The average concentration of benzene in American gasoline is 1% or less and 2% is seldom exceeded.[1] One large refiner has a self-imposed limit of 4%. European gasolines reportedly may contain up to 5% benzene.[1] Analysis of 86 samples of gasoline from American filling stations revealed that 5% contained more than 2.5% benzene, with the highest benzene content being 4.8%.[1]

Some of the additives to leaded gasoline, such as ethylene dichloride and especially ethylene dibromide, are quite toxic, but are present in such small amounts that they make a negligible contribution to the toxicity under most condition.[1] Tetraethyl and tetramethyl lead are so low in volatility that they also ordinarily produce little health hazard in the handling of leaded gasoline.

In comparison with organic solvents, gasoline has a very wide boiling range. The 300 ppm TLV is limited to bulk handling processes, including filling station operations, since it does not represent the toxicities of the higher boiling ingredients which might be in other operations involving gasoline.

Because of the wide variation in molecular weights of its components, the conversion of ppm to mg/m³ is approximate. The identified components of gasoline vapor studied by McDermott and Killiany[4] have a mean molecular weight of 68. Assuming the unidentified 8% to consist of C_8 hydrocarbons, the average molecular weight would be 72.5. Therefore, at 25°C and 76 torr, 300 ppm would correspond to about 900 mg/m³.

A time-weighted average TLV of 300 ppm is recommended, for bulk handling of gasoline based on Runion's[7] calculations on hydrocarbon content of gasoline vapor. A STEL of 500 ppm is also recommended.

References

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ATTACHMENT 3.
STANDARD OPERATING PROCEDURES FOR SOIL BORING AND WELL CONSTRUCTION PROCEDURES

Revised 06/30/02

1. Pre-Drilling Protocol

Prior to the start of drilling, necessary permits, site access agreements, and/or encroachment permits are obtained. "As-built" drawings are obtained if possible. At least 48 hours prior to drilling, Underground Service Alert or an equivalent utility notification service is notified. A geophysical survey may be conducted to locate subsurface utilities by either Consultant or other outside third party geophysical contractors.

Underground Service Alert North (USA North) is located at 4090 Nelson Avenue, Suite A, Concord, California 94520-1232 and at telephone number (800) 227-2600. USA North requires a 48 hour pre-work notification.

Site plans and/or "as-built" drawings are compared to actual conditions observed at the site. The property owner/retailer is interviewed to gain information about locations of former UST systems including dispensers, product lines, and vent lines. A visual inspection is made of the locations of the existing UST system, and scars and patches in pavement are noted. The emergency shut-off switch is located for safety purposes. The critical zone, which is defined as 10 feet from any part of the UST system, is identified, and any proposed drilling locations within the critical zone may be subject to special hole clearance techniques. Drilling locations within the critical zone are avoided if possible.

Notifications are made at least 2 weeks in advance of drilling to the property owner, client representative, on-site facility manager, regulatory agency, and/or other appropriate parties.

A site-specific, worker health and safety plan for the site is available on site at all times during drilling activities. Prior to commencing drilling, a health and safety meeting is held among all on-site personnel involved in the drilling operation, including subcontractors and visitors, and is documented with a health and safety meeting sign-in form. A traffic control plan is developed prior to the start of any drilling activities for both on-site and off-site drilling operations. The emergency shut-off switch for the service station is located prior to the start of the drilling activities. A fire extinguisher and "No Smoking" signs (and Proposition 65 signs in California) are present at the site prior to the start of the drilling activities).

The first drilling location is the one located furthest from any suspected underground improvements in order to determine the natural subsurface conditions, to be able to better recognize fill conditions, and to prevent cross contamination. For monitoring wells, a 2 x 2-foot square or 2-foot diameter circle is the minimum removal. For soil borings and push-type samplers, the minimum pavement removal is 8-inches. When pea gravel, sand, or other non-indigenous material is encountered, the drilling location will be abandoned unless the absence of subsurface facilities can be demonstrated and client approval to proceed is obtained. If hole clearance activities are conducted prior to the actual day of drilling, the clearance holes are covered with plates and/or backfilled.

The minimum hole clearance depths are 4 feet below ground surface (bgs) outside the critical zone and 8 feet bgs within the critical zone and are conducted as follows:

- 0 to 4 bgs: The area to be cleared exceeds the diameter of the largest tool to be advanced and is sufficiently large enough to allow for visual inspection of any obstructions encountered. The first 1 to 2 feet is delineated by hand digging to remove the soil, then the delineated area is probed to ensure that no obstructions exist anywhere near the potential path of the drill auger or push-type sampler.

  Probing is extended laterally as far as possible. Hand augering or post-hole digging then proceeds, but only to the depth that has been probed. If subsurface characteristics prohibit effective probing, a hand auger is carefully advanced past the point of probing. In this case, sufficient hand augering or post-hole digging is performed to remove all the soil in the area to be delineated. For soil borings located outside of the critical zone, an attempt should be made to probe an additional 4 feet.

- 4 to 8 bgs: For the soil borings located inside the critical zone, probing and hand clearing an additional 4 feet is performed. If probing is met with refusal, then trained personnel advance a hand auger without excessive force. An alternate or additional subsurface clearance procedures may also be employed, as required by clients, permit conditions, and/or anticipated subsurface conditions (for example, near major utility corridors or in hard soils). Alternate clearance techniques may include performing a geophysical investigation or using an air knife or water knife. If subsurface conditions prevent adequate subsurface clearance, the drilling operation is ceased until the client approves a procedure for proceeding in writing. If any portion of the UST system is encountered, or if there is any possibility that it has been encountered, the work ceases, and the client is notified immediately. If there is reason to believe that the product system has been damaged, the emergency shut-off switch is activated. The client will decide if additional uncovering by hand is required. If it is confirmed that the UST system has been encountered, tightness tests are performed. The hole is backfilled only with client approval.

2 Drilling and Soil Sampling Procedures

Soil boring are drilled using one of the following methods:

- Manual or Hand Auger Drilling: Manual or hand auger drilling utilizes a 2-inch-OD, hand auger manufactured by Xitech Industries, Art's Manufacturing Company, or similar equipment. Soil samples are collected with a drive sampler, which is outfitted with 1.5-inch by 3-inch steel or brass sleeves. The specific equipment used is noted on a soil boring log.
- Truck-mounted, powered drilling: Truck-mounted, powered drilling utilizes hollow-stem flight auger drilling, air rotary drilling, or percussion hammer drilling, or similar technologies. Soil samples are collected in steel or brass sleeves with a California-modified, split-spoon sampler or, for specific projects, a continuous sampler. The specific drill system and equipment used is noted on a soil boring log.
- Direct push sampling: Direct push sampling utilizes Geoprobes, cone penetrometer testing rigs (CPT), or similar technologies. Soil samples are collected with a drive sampler, which is outfitted with steel or brass sleeves. The specific equipment used is noted on a soil boring log.

Before each soil sampling episode, the sampling equipment is decontaminated using a non-phosphate soap wash, a tap-water rinse, and a deionized water rinse. The drill string of all systems is decontaminated with a steam cleaner between each soil boring.

Soil samples that are collected in steel or brass sleeves are covered with aluminum foil or Teflon tape followed by plastic caps. If U.S. Environmental Protection Agency (USEPA) Test Method 5035 is required, then 5 to 20 grams of soil is extracted from the sample and placed in methanol-preserved containers supplied by the laboratory, or sub samples are collected using Encore samplers. During the drilling process, soil samples and cuttings are field screened for volatile organic compounds (VOCs) using a photoionization detector calibrated to 100 parts per million by volume (ppmv) isobutylene. Any soil staining or discoloration is visually identified.

Soils are classified according to the Unified Soil Classification System. Specific geologic and hydro geologic information collected includes grading, plasticity, density, stiffness, mineral composition, moisture content, soil structure, grain size, degree of rounding, and other features that could affect contaminant transport. All data is recorded on a soil boring log under the supervision of a geologist registered in the state in which the site is located. The samples are labeled, sealed, recorded on a chain-of-custody record, and chilled to 4 ° Celsius in accordance with the procedures outlined in the California State Water Resources Control Board's Leaking Underground Fuel Tank Field Manual (CSWRCB, 1987) and the Arizona Department of Environmental Quality's Leaking Underground Storage Tank Site Characterization Manual. Sample preservation, handling, and transportation procedures are consistent with Consultants's quality assurance/quality control procedures. The samples are transported in a chilled container to a state-certified, hazardous waste testing laboratory .

Cuttings from the soil borings are stored in 55-gallon, U.S. Department of Transportation (DOT)-approved drums, roll-off bins, or other appropriate containers, as approved by the client. Each container is labeled with the number of the soil boring(s) from which the waste was derived, the date the waste was generated, and other pertinent information. The drums are stored at the site of generation until sample laboratory analytical results are obtained, at which time the soil is disposed of appropriately. A soil boring log is completed for each soil boring and includes the following minimum information:

- date of drilling;
- location of soil boring;
- project name and location;
- soil sample names and depths;
- soil descriptions and classifications;
- standard penetration counts (rigs);
- photoionization detector readings;
- drilling equipment;
- soil boring diameter;
- sampling equipment;
- depth to groundwater in soil boring;
- name of person performing logging;
- name of supervising registered geologist; and
- name of drilling company (rigs and direct push)

3 Soil Boring Completion Procedures

All soil borings are either properly abandoned or completed as a well.

3.1 Abandonment

Each soil boring that is not completed as a well is backfilled with bentonite grout, neat cement, concrete, or bentonite chips with a permeability less than that of the surrounding soils, and/or soil cuttings, depending on local regulatory requirements or client instructions. Grout is placed by the tremie method. Backfilling is performed carefully to avoid bridging. The type of backfill material is noted on the soil boring log.

3.2 Well Installation

Wells are designed according to applicable state and local regulations as well as project needs. Details of the well design and construction are recorded on the soil boring log and include the following minimum information (in addition to the items noted above for soil borings):

- detailed drawing of well;
- type of well (groundwater, vadose, or air sparging);
- casing diameter and material;

- screen slot size;
- well depth and screen length (± 1 foot);
- filter pack material, size, and placement depths;
- annular seal material and placement depths;
- surface seal design/construction;
- well location ((± 0.5 foot horizontal in State Plane and latitude and longitude coordinates and ±0.01 foot vertical tied to the nearest vertical datum);
- well development procedures.

Groundwater monitoring wells are generally designed with 30 feet of slotted casing centered on the water table, unless site conditions, project needs, or local regulations dictate a diff~rent well design. The sand pack is placed at least two feet above the top of the screen, and at least 3 feet of low permeability seal material is placed between the sand pack and the surface seal. The sand pack and low permeability seal material are placed in the annular space from the bottom up using the tremie method. When drilling in asphalt, a 24-inch round cut is made for the well pad. When drilling on concrete, a 2 x 2-foot square is saw cut. The well cover is traffic-rated and has a white lid with a black triangle painted on it (3 inches per side) or a black lid with a white triangle (3 inches per side). The completed well pad should is concrete of matching color with the existing surface. The well number is labeled on the outside of the well box/pad and the inside of the well box. The number on the outside is painted on with a stencil, stamped, or attached to the well with a metal plate. The number on the inside is written on the well cap with waterproof ink. The casing has a notch or indication on its north side indicating a unique measuring/surveying point.

Well development is conducted by simple pumping if bridging of the screen does not occur. If bridging occurs, well surging is conducted for adequate well production. Well surging is created by the use of surge blocks, bailers, or pumps, whichever method is most appropriate for the well use. Only formation water is used for surging the well. Well development continues until non-turbid groundwater is produced or turbidity stabilizes. All purged groundwater is held on site in covered 55-gallon DOT -approved drums or other appropriate containers until water sample analytical results are received. The elevation of the north side of the top of well casing (or other appropriate reference point from which the depth to groundwater can be measured) is surveyed to an accuracy of ± 0.01 foot. All measurements are reproduced to assure validity. Surveying is conducted by a California state-licensed surveyor or California state Registered Civil Engineer with a registration prior to 1988 if required by state or local regulations. In the State of California, wells are surveyed in accordance with AB2886.

4. Data Reduction

The data compiled from the soil borings is summarized and analyzed. A narrative summary of the soil characteristics is also presented. The soil boring logs are checked for the following information:

- correlation of stratigraphic units among borings;
- identification of zones of potentially high hydraulic conductivity;
- identification of the confining layer;
- indication of unusual/unpredicted geologic features (fault zones, fracture traces, facies changes, solution channels, buried stream deposits, cross-cutting structures, pinchout zones, etc.);
- continuity of petrographic features such as sorting, grain-size distribution, cementation, etc.

Soil boring/well locations are plotted on properly scaled map. If appropriate, soil stratigraphy of the site is presented in a scaled cross section. Specific features that may impact contaminant migration, (fault zones or impermeable layers) are discussed in narrative form and supplemented with graphical presentations as deemed appropriate.

ATTACHMENT 4
GROUNDWATER MONITORING, SAMPLING, AND SAMPLE MANAGEMENT PROCEDURES

1. Notifications

Prior to performing any field work, the client, regulatory agency, and property owner/manager with jurisdiction over the subject site are notified. Notifications are made a minimum of 48 hours prior to sampling, or as required by the client or regulator.

2. Water Level Measurements

Prior to performing purge or no-purge sampling, water level measurements are collected according to the following procedures:

- All wells are checked for phase-separated hydrocarbons with an acrylic bailer or oil/water interface meter.
- To avoid cross contamination, water levels are measured starting with the historically "cleanest" wells and proceeding to the historically "dirtiest."
- Water levels within each well are measured to an accuracy of ±0.01 foot using an electric measuring device and are referenced to the surveyed datum (well cover or top of casing). When measuring to top of casing, measurements are made to the notched (or otherwise marked) point on casing. If no marking is visible, the measurement is made to the northern side of the casing.
- If possible, all wells are gauged within a short time interval on the same day to obtain accurate measurements of the potentiometric surface.
- All measurements are reproduced to assure validity, and measuring equipment is decontaminated between wells.

3. Phase Separated Hydrocarbon

If phase-separated hydrocarbon (PSH) is encountered, its thickness in the well and the depth to the interface between the PSH and the water in the well are measured using one or both of the following methods:

- an electronic oil-water interface meter is used to measure the depths to the top of the PSH and to the top of the water, and/or
- an electronic water level meter is used to measure the depth to the top of the water and a clear bailer is used to measure the PSH thickness.

The potentiometeric surface elevation is calculated as:

TOC - DTW + 0.74PT

Where TOC = top-of-casing elevation, DTW = depth to water (interface), and PT = PSH thickness.

If PSH thickness is less than 0.02 foot, and the well is planned for purging prior to sample collection, the well is purged and sampled in accordance with the sample collection section of this SOP. If the PSH thickness is 0.02 foot or greater, the PSH is bailed from the well, and left onsite in a labeled and sealed container. No sample is collected for analysis from wells having a PSH thickness of greater than 0.02 foot.

4. No-Purge Sampling

Well purging is not conducted prior to sampling if purging is not needed to meet technical and/or regulatory project requirements. Following collection of water level measurements, wells that are not purged are sampled according to the protocol in the sample collection section of this SOP .

5. Purging Procedures

Well purging is conducted prior to sampling if purging is needed to meet technical and/or regulatory project requirements. If purging is conducted, the monitoring wells are purged using a vacuum truck, submersible electric pump, bailer, hand pump, or bladder pump, as appropriate for site conditions. A surge block may be used if it becomes apparent during purging that the well screen has become bridged with sediment or the produced groundwater is overly turbid.
During the purging process, groundwater is monitored for temperature, pH, conductivity, turbidity, odor, and color. These parameters are recorded on a water sample log. Purging continues until all stagnant, water within the wells is replaced by fresh formation water, as indicated by removal of a minimum number I of well volumes and/or stabilization of the above-outlined parameters. Sampling is performed after the well recharges to at least 80 percent of hydrostatic.

Purge water is stored on site in Department of Transportation-approved, 55-gallon drums until water sample analytical results are received from the laboratory. If active groundwater treatment is occurring at the site, purge water may be disposed of through the treatment system, or the purge water may be transported off site as non-hazardous waste to an approved off-site disposal facility. If permanent pumps are installed in the wells for groundwater remediation, purging may be accomplished by operating the pumps for at least 24 hours before sampling to ensure adequate purging.

6. Sample Collection Procedures

Groundwater samples are collected as follows:

- A 1-liter Teflon bailer is lowered and partially submerged into the well water to collect a groundwater sample.
- If visible PSH is present in the sample bailer, PSH thickness is recorded on the field log, and no sample is collected for laboratory analysis.
- For volatile organic analyses, groundwater samples are collected in chilled, 40-milliliter, VOA vials having Teflon-lined caps. Hydrochloric acid preservative is added to all vials by the laboratory to lower sample pH to 2. Samples are held at 2 to 4 ° Celsius while in the field and in transit to the laboratory. Other appropriate containers, preservatives, and holding protocols are used for non-volatile analyses.
- VOA vials are filled completely so that no headspace or air bubbles are present within the vial. Care is taken so that the vials are not overfilled and the preservative is not lost.
- Sample containers are immediately labeled and sealed after collection to prevent confusion. For VOA vials, the label is placed to overlap the edge of the cap as a custody seal, unless a separate custody seal is being used.
- Samples are stored in a cooler while on site and in transport to the laboratory or office. The cooler has sufficient ice to maintain appropriate temperature prior to collecting samples. The VOA vials are kept cool both prior to and after filling. Hot or warm containers are not used when volatile compounds are the target analytes.

7. Decontamination Procedures

Decontamination of monitoring and sampling equipment is performed prior to all monitoring and sampling activities. Decontamination procedures utilize a three~step process as described below:

- The initial decontamination is performed using a non-phosphate soap, such as Simple Green or Alconox, in tap water in a 5-gallon bucket. A soft-bristle bottlebrush is used to thoroughly clean the inside and outside of the equipment.
- A second 5-gallon bucket of tap water is used as a first rinse.
- A third 5-gallon bucket of deionized water is used as a final rinse.
- The brush is used in the first bucket only; it does not travel from bucket to bucket with the equipment. This minimizes any transport of the contaminants that should stay in the first bucket.

8. Quality Assurance/Quality Control Samples

At a minimum, a trip blank and a temperature blank are maintained for QA/QC purposes.

- A trip blank sample (TRIP) is kept with any samples being analyzed for VOCs. This is a sample of clean water that is supplied by the laboratory and is transported to and from the field and to the laboratory with the field samples. The designation "QCTRIPBK" or "QCTB" is used for sample name on the field label. Samplers record the date that the TRIP is taken to the field for sampling, not the date that the TRIP was prepared by the laboratory on the chain-of-custody (COC). One TRIP per cooler per day is collected.
- Unused trip blank samples are stored at the consulting office in a cooler dedicated to this purpose. The trip blank cooler is not refrigerated, but is kept in a clean location away from possible VOC contaminants.
- Temperature blank sample containers are supplied by the laboratory and kept in a cooler used to transport samples. The temperature blank is placed in the cooler prior to going to the field and kept there until the cooler is delivered to the laboratory.

9. Completion of Chain of Custody

- A separate COC is completed for each day of sampling. If samples are collected on separate days for the same site, a separate COC is completed for each sampling day, and the COC is always kept with the samples. If samples are shipped off site for laboratory analysis, individual coolers with separate COCs are sent for each day/cooler shipped.
- All fields/spaces on the COC are filled out completely, and all persons having control of the samples sign the COC to show transfer of sample control between individuals. At times when the field sampler is not delivering samples directly to the laboratory, the samples may be turned over to a sample manager for shipping. In this instance, the sample manager takes custody of the samples, and both the sampler and sample manager sign and date the COC to clearly show custody transfer.
- The COC is placed inside the cooler, and a custody seal is placed on the outside of the cooler prior to shipping. The receiving laboratory indicates if the cooler was received with the custody seal intact.
- If samples are sent to the laboratory via UPS, FEDEX, etc., this is indicated on the COC, and the sample manager indicates the date and time custody seal is placed on cooler for delivery to the shipping agent (shipping agent does not sign the COC).
- For trip blanks, the COC indicates the date the TRIP was taken to the field for sampling, not the date the TRIP was prepared by the laboratory, which may appear on the VOA label.
- New electronic deliverable format (EDF) requirements of California AB2886 mandate that COCs and laboratory reports maintain consistent and unique names between sites (Global ID) and sample location/well names (Field Point ID). This information must be consistent with the initial information supplied to Geotracker, and for each subsequent quarterly sampling event.

10. Sample Handling

10.1 Refrigerator Storage and Temperature Log

Samples may be stored in a refrigerator at the consulting office prior to transport to the laboratory. Refrigerator storage is maintained under the following conditions:

- Refrigerators used for sample storage are dedicated for that usage only (no food or other materials are stored in sample refrigerators).
- Refrigerators can be locked from the outside by a sample manager, and only the sample manager has access to samples while in storage.
- Refrigerators are maintained at temperatures between 2 to 4° C, and are adjusted daily depending on thermometer readings.
- Each refrigerator contains a dedicated, reliable thermometer. The thermometer is designed for use in a refrigerator and is fixed/secured to the inside of the unit. The thermometer range is specific for measuring temperatures in the 2 to 4 ° C range.
- A temperature log is kept on the outside of the refrigerator in a lightweight, three-ring binder, or similar logbook. Temperatures are recorded daily or when the refrigerator is open for sample management.
- Completed COCs are kept with the samples stored in the refrigerators. The COCs may be held on a clipboard outside the refrigerator, or may be placed inside the cooler if the entire cooler is placed inside the refrigerator.
- If a cooler is placed in the refrigerator, the cooler lid remains open to insure that samples are maintained at the refrigerator temperature.

10.2 Cooler Packing

The sample coolers are packed as directed by the receiving laboratory. Standard procedures for cooler packing include:

- The cooler contains enough ice to maintain the required temperature of 2 to 4° C (roughly 20 percent of the volume of the cooler).
- Water ice (not dry ice or ice packs) is used for shipping.
- The ice is placed above and below the samples in at least two sealable plastic bags. This requires that the packing/divider material is removed and replaced.
- The COC is placed in the cooler in a sealed plastic bag, and the cooler lid is taped closed to secure it for transport and to minimize loss of temperature. A custody seal is placed vertically across the seam of the cooler lid.