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WORKPLAN TO CONDUCT ADDITIONAL INVESTIGATION AT THE FORMER GLOVATORIUM SITE

3815 Broadway, Oakland, California

June 15, 2001

Project 01-2510

Prepared for

Smiland and Khachigian

601 West Fifth Street, 7th Floor

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Prepared by

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July 24, 2001

Scott O. Seery, CHMM
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

JUL 26 2001

Subject: Workplan to Conduct Additional Investigation at the Former Glovatorium Site

Dear Mr. Seery:

Please find enclosed the subject workplan, prepared by SOMA Environmental Engineering and dated June 15, 2001. Four quarters of sampling for bioattenuation parameters has been completed at the former Glovatorium and a fifth is scheduled for this week. That work has established there is strong evidence that natural bioattenuation in the form of reductive dehalogenation is occurring in the groundwater at the site. The objective of this workplan is to provide the data necessary "for conducting groundwater flow and chemical transport modeling and risk-based corrective action in order to define the Site's regulatory status."

This workplan is submitted for your review and approval. If you have comments or wish to propose changes to the plan, please contact me or Dr. Sepehr at SOMA.

Sincerely,

Bruce W. Page

Bruce W. Page, Ph.D.

cc w/o enclosure:

Albert M. Cohen, Esq., Smiland & Khachigian
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1.0 INTRODUCTION

This workplan has been prepared by SOMA Environmental Engineering, Inc. (SOMA) for the Law Offices of Smiland and Khachigian on behalf of their client, the owners of the former Glovatorium. The site is the former Glovatorium property located at 3815 Broadway Avenue, Oakland, California (the "Site"), as shown in Figure 1. The Site is located in an area consisting primarily of commercial and residential uses.

This workplan proposes conducting additional investigation for better definition of groundwater plume conditions and collecting additional data for conducting groundwater flow and chemical transport modeling and risk-based corrective action in order to define the Site's regulatory status. Upon completion of the tasks described in this workplan it will be decided whether or not active groundwater remediation is warranted.

1.1 Site background

The initial Site investigation was conducted in August 1997 by Geosolve, LLC (Geosolv). During this investigation Geosolv drilled fourteen soil borings and converted some of them into groundwater monitoring wells. In September 1998, Geosolv conducted further soil and groundwater investigation by drilling twelve additional soil borings. After collecting groundwater samples these borings were abandoned and grouted.

In July 1999, Levine.Fricke Recon (LFR) drilled 10 soil borings primarily along the 54-inch diameter storm drain and sanitary sewer system and collected grab groundwater samples. Some of the soil borings installed during this investigation were converted into groundwater monitoring wells (GW-1 through GW-8 and GW-5A and GW-6A).

In January and April 2000, LFR conducted first and second quarter 2000 groundwater monitoring events at the Site. During the monitoring events groundwater elevations in on- and off-site monitoring wells were measured.

In July and August 2000, LFR installed four groundwater monitoring wells, namely LFR-1 through LFR-4, and conducted the third quarter 2000 groundwater monitoring event. Figure 2 shows the location of groundwater monitoring wells. This was the first monitoring event in which bioattenuation parameters were collected. In late October and early November 2000, LFR conducted the fourth quarter 2000 groundwater monitoring event, including another round of bioattenuation sampling.

In January 2001, LFR field crew conducted groundwater monitoring including a bioattenuation study at the Site. SOMA was retained in March 2001 to conduct groundwater monitoring events and prepare the first quarter 2001 groundwater monitoring report (SOMA May 7, 2001). In April 2001, SOMA conducted the second quarter 2001 groundwater monitoring, including a bioattenuation study, at the subject property.

2.0 CURRENT STATUS OF SITE CONDITIONS

The results of the previous six groundwater monitoring events and four rounds of bioattenuation studies are summarized in the following sections:

2.1 Groundwater Flow Condition

In general, the depth to groundwater throughout the entire hydrologic cycle ranges between 7.66 and 13.98 feet beneath the Site. The groundwater level fluctuation can be attributed to the rainfall-related recharge and dry periods throughout the hydrological cycle. Figure 3 displays the groundwater elevation contour map. As Figure 3 shows, the general groundwater flow direction is from the northeast to southwest. In evaluating the groundwater flow direction and

gradient, water level data from GW-4, B-7 and B-9 were not utilized for the following reasons:

1. No accurate information about the construction details of the B-7 and B-9 wells installed by Geosolve is available, therefore water level data from these wells are questionable;
2. GW-4 was installed adjacent to the storm drain system in order to evaluate whether or not the storm drain system is leaking. This well was installed in the shallow formation, and may be partially penetrated into the underlying water-bearing zone. Therefore, the water level elevation recorded inside GW-4 may not be representative of the underlying water-bearing zone.

The results of groundwater monitoring events indicate that electrical conductivity of the water-bearing zone beneath the Site varies between 600 and 1,300 µS/cm. Therefore, groundwater beneath the Site can be potentially used as a drinking water source. The significant difference between the electrical conductivity values at different wells suggests that the groundwater monitoring wells may have been completed in different water-bearing zones.

To evaluate such phenomenon, additional groundwater samples from B-10 and LFR-1 were collected and submitted to the laboratory for total anion and cation analyses. The results of the laboratory analyses indicated that due to the occurrence of biodegradation processes in source area well B-10, there is a dramatic difference in the ratio of anions compared to LFR-1. For instance, sulfate, an electron acceptor was not detected in the source area well B-10 due to the presence of anaerobic biodegradation process. In contrary to the source area well B-10, sulfate is present in LFR-1. Also, the chloride concentration is lower in B-10 than LFR-1, while one would expect the opposite result, since chloride is one the final products of the reduction of chlorinated solvents. This result indicate that the groundwater type in B-10 may be different than LFR-1. In

addition, the higher concentration of sodium in B-10 further suggests the difference in composition between the two different water samples. The difference between the two water types suggests that B-10 and LFR-1 may have been completed in two different water-bearing zones.

The available data is not sufficient to comment on the extent of saturated thickness and presence or absence of a multi-layer water-bearing zone beneath the Site. This is an important piece of information in connection with the Site's conceptual model for identification of the hydrogeologic flow system and potential groundwater exposure pathways.

3.1 Groundwater Quality

During the past groundwater monitoring events, the groundwater samples have been analyzed for petroleum hydrocarbons and volatile organic compounds using EPA Method 8015M and 8021B. The results of laboratory analyses indicates that groundwater beneath the Site has been impacted by TPH-ss, TPH-g, benzene, toluene, ethylbenzene, and total xylenes. Total petroleum hydrocarbons as gasoline (TPH-g) and as Stoddard solvent (TPH—ss) have been found at high concentrations beneath the Site. The maximum concentrations of TPH-g and TPH-ss have been reported in B-7, which is located inside the former Glovatorium building.

The results of monitoring events indicate minor concentrations of MtBE and BTEX at various groundwater monitoring wells. The maximum concentration of benzene has been reported in a split groundwater sample from GW-7 at 76 µg/L in July 1999. The maximum concentration of MtBe has been reported at 160 µg/L in B-10 in August 2000.

The results of monitoring events indicate the presence of volatile organic compounds (VOCs) in groundwater beneath the Site. Cis-1,2-dichloroethene

(cis-1,2-DCE) has been found most frequently. The maximum concentration of cis-1,2-DCE has been reported at 14,000 µg/L in B-10 in January 2000. Cis-1,2-DCE is produced during the reductive dechlorination of tetrachloroethene (PCE).

PCE and TCE have been reported at relatively high concentrations and frequencies in groundwater samples from the Site. PCE and TCE were detected in six out of ten groundwater monitoring wells at maximum concentrations of 2,900 and 2,400 µg/L, respectively, both in well B-10.

Historically, VC has been reported in two wells beneath the Site., GW-8 and LFR-2. The maximum concentration reported in GW-8 was 4.6 µg/L in January 2000. The latest result was 2.3 µg/L, reported in Aril 2000. The maximum concentration reported in LFR-2 was 15 µg/L in November 2000. The latest results were 1.3 µg/L and 1.9 µg/L in a duplicate, reported in April 2001. The presence of VC in the groundwater may indicate that the reductive dechlorination of PCE, TCE and Cis-1,2-DCE is strongly occurring beneath the Site.

The strong occurrence of bioattenuation processes in the subsurface is further evident by depletion of the PCE and TCE in some of the source area wells which used to contain elevated levels of PCE.

3.2 Bioattenuation Parameter Analysis Results

Bioattenuation parameters have been collected since the third quarter 2000 groundwater monitoring events. The objective of the bioattenuation study was to evaluate whether or not intrinsic bioremediation processes are active at the Site. The result of this study is that PCE and other dissolved organic compounds are biodegrading beneath the Site.

During the degradation process, the indigenous bacteria that exist in the subsurface consume electron acceptors such as dissolved oxygen. After the

dissolved oxygen is consumed, anaerobic microorganisms typically use alternative electron acceptors in the following order of preference: nitrate, ferric iron, oxyhydroxide, sulfate, and, finally, carbon dioxide. Evaluating the distribution of these electron acceptors has provided the evidence, which indicates that the chlorinated and aliphatic hydrocarbon biodegradation is occurring.

4.0 SCOPE OF WORK

The primary purpose of this workplan is to collect additional hydrogeologic and chemical data to define the Site's conceptual model. Once the Site's conceptual model is defined, the Site's regulatory status can be determined. The Site's regulatory status can lead to categorizing the Site as a "Low Risk" or "High Risk" chemical release Site. If the result of our investigation indicates that the Site is a Low Risk Site, no active groundwater remediation is warranted. To accomplish the purpose of this workplan, a two-phased approach is proposed. The first phase will define the Site's conceptual model, while the second phase will determine the Site's regulatory status.

PHASE I

4.1 Defining The Conceptual Site Model

The conceptual site model (CSM) synthesizes Site characterization data (geology, hydrogeology, contaminant distribution, migration pathways and potential human receptors) to provide a framework for selecting pathways for quantitative analysis in conducting a Risk-Based Correction Action (RBCA).

As explained in Section 3.0, the available hydrogeologic data is not sufficient to define the extent of saturated thickness and determine the presence or absence of a multi-layer water-bearing zone, if any. For instance, the well completion diagrams for the "B" series wells drilled by Geosolv are missing. The "B" series

wells and "GW" wells are ¾-inch in diameter (inside diameter) and they usually run dry during groundwater monitoring. As explained in the second quarter groundwater monitoring report (SOMA, June 15, 2001), the fact that these wells are ¾-inch in diameter makes it difficult to collect meaningful bioattenuation parameters such as dissolved oxygen.

The following tasks will be performed to collect sufficient data to build the CSM:

Task-1: Installation of Monitoring Wells
Task-2: Collection of Soil and Groundwater Samples
Task-3: Laboratory Analysis
Task-4: Perform Aquifer Tests
Task-5: Perform Sensitive Receptor Survey

The following is a brief description of each task.

4.1.1 Installation of Monitoring Wells

To define the hydrogeologic flow regime and the vertical extent of contaminants found in shallow groundwater, ~~three~~ deep 4-inch diameter groundwater monitoring wells will be installed in close proximity to the existing groundwater monitoring wells B-10, LFR-2 and ~~LFR-3~~ B-9. The wells will be drilled to a 35-40 feet depth and screened from the 20-feet depth interval (below the screen interval of the shallow wells). During the well installation, soil and groundwater samples will be collected and analyzed. Upon completion of this task the following information will be obtained:

4" wells

- Water level elevations in deep and shallow wells located adjacent to each other will be measured. This data will be used to evaluate the presence of upward or downward groundwater flow gradients and the possibility of interlayer leakage between the shallow and deep layers, if any. Since the

Site is located in a recharge area, it is expected that a vertical downward flow component will prevail;

- The Geosolv report dated January 16, 1998 indicates elevated PCE and TCE concentrations in soil samples collected from B-10. Geosolv failed to delineate the vertical extent of PCE and TCE concentration in the soil. For instance, PCE and TCE were detected at 5,500 and 270 mg/kg, respectively in B-10 at 15.5-16 feet depth. More importantly, the available data indicate that the concentration of PCE and TCE is increasing with depth (PCE and TCE at 15-15.5 feet depth were detected at 1,300 and 81 mg/kg, respectively at B-10, Geosolv (1998)). However, no information is available below 16 feet depth at this location. Installation of a deep groundwater monitoring well will reveal the vertical extent of PCE contamination in soil and groundwater. Due to the higher density of PCE and the fact that PCE was detected in high concentrations in the groundwater sample collected from B-10 (2.9 mg/l), it is expected that PCE in the form of DNAPL exists at the deeper depths.

Since "B" series wells such as B-10 and B-7 are ¾-inch in diameter and are therefore not suitable for monitoring purposes and collecting bioattenuation parameters, they will be decommissioned and replaced with 4-inch diameter wells. The new wells near decommissioned wells B-10 and B-7 will be installed at a 20-foot depth and screened from 10 to 20 feet below ground surface. The newly installed shallow and deep groundwater monitoring wells, will be developed and surveyed by a California licensed surveyor. Figure 4 shows the locations of the proposed deep groundwater monitoring wells.

4.1.2 Collect Soil and Groundwater Samples

During installation of the three deep groundwater monitoring wells, soil and groundwater samples will be collected for better definition of vertical extent of chemicals in subsurface. Soil samples will be collected at 2-foot depth intervals using Encore samplers for protection of sample integrity. Upon completion and

development of groundwater monitoring wells, they will be sampled and the depth to groundwater will be measured for evaluation of the vertical groundwater gradient beneath the Site.

4.1.3 Laboratory Analysis

Soil and groundwater samples will be analyzed for the following constituents:

- TPH-g and TPH-ss using EPA Method 8015M
- BTEX and MtBe using 8021B and
- VOCs using EPA Method 8260B

In addition, certain soil samples will be analyzed for total organic carbon and bulk density for evaluation of soil and aquifer porosity. The data will be used in conducting groundwater flow and chemical transport modeling for implementation of the second phase of this workplan.

4.1.4 Perform Aquifer Tests

To evaluate hydraulic conductivity of the saturated sediments aquifer tests will be performed. Due to the fine-grained nature of saturated sediments, slug tests may be the most suitable form of aquifer tests. A slug test involves removing or adding certain volumes of water into the saturated sediments and measuring the water level elevations versus time inside the well until water levels recover to 90 percent of their static levels.

The field data gathered during aquifer testing will be analyzed using different methods to evaluate the range of hydraulic conductivity of saturated sediments. The estimated hydraulic conductivity values of the saturated sediments will be used to conduct groundwater flow and chemical transport modeling for implementation of the second phase of this workplan.

4.1.5 Perform Sensitive Receptor Survey

Sensitive receptors will include schools, day care centers, hospitals, adolescence homes, groundwater wells and surface water bodies such as lakes, estuaries, and reservoirs. The sensitive receptors will be surveyed and located within a 500-foot radius of the Site. To locate groundwater wells, a file review will be conducted in the Department of Water Resources, Sacramento California in order to find if any well permit have been issued to any property owner within 500-foot radius of the Site. In addition to a file review, SOMA's staff will conduct a door-to-door survey to identify the presence of any domestic or irrigation wells in the Site vicinity. The results of the receptor search will be used in conducting a risk-based corrective action (RBCA) study.

PHASE II

4.1 Defining The Site's Regulatory Status

State Water Control Board supplemental instructions dated December 8, 1995, entitled "Interim Guidance on Required Cleanup at Low Risk Fuel Site", will be followed to define the Site's regulatory status in connection with soil and groundwater contamination. Based on the interim guidance document, in order to define the Site's regulatory status the following items will be considered using the soil and groundwater data already generated by SOMA and the previous consultants:

ok for SS plume, but not for VOCs

1. The leak has been stopped and on-going source of chemicals have been removed or remediated to the extent practicable;
2. The Site has been adequately characterized;
3. Status of the dissolved chemical plumes; are they expanding plumes or shrinking ones?;

4. No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted;
5. The site presents no significant risks to human health and finally;
6. The site presents no significant risk to the environment.

Reportedly, there were six underground storage tanks (USTs) at the Site. Two USTs were located under the sidewalk on 38th Street and four USTs were located inside the building. In 1997 the USTs were abandoned in-place by backfilling with either cement-sand slurry or pea gravel. Therefore, it appears that the source of chemical including the USTs has been stopped and old USTs have been removed. Therefore, the first item has already been addressed. The development of the conceptual site model, explained in Section 4.1 will ensure that the Site has been adequately characterized.

To answer items 3 through 6 the following tasks will be performed:

Task-1 **Conducting Groundwater Flow and Chemical Transport Modeling**

Task-2 **Conducting Risk-Based Corrective Action**

The following is a brief description of the proposed tasks during the Phase II Investigation.

4.2.1 Conducting Groundwater Flow and Chemical Transport Modeling

During the last four groundwater monitoring events significant amounts of site-specific data were gathered to evaluate the natural attenuation processes in subsurface. The natural attenuation processes (biodegradation, dispersion, sorption, volatilization) affect the fate and transport of chlorinated solvents in subsurface. When these processes are shown to be capable of attaining site-specific remediation objectives in a time period that is reasonable compared to other alternatives, they may be selected alone or in combination with other more

active remedies as the preferred remedial alternative. Monitored Natural Attenuation (MNA) refers specifically to the use of natural attenuation processes as part of the overall Site remediation. To evaluate whether or not MNA alone will be sufficient to restore groundwater quality beneath the Site, groundwater flow and chemical transport modeling will be conducted. In conducting chemical transport modeling the following scenarios will be simulated:

1. Simulation of the future extent of chlorinated solvents and other chemicals assuming that no bioattenuation is occurring in the subsurface. The result of such an evaluation will reveal the worst-case scenario in terms of the future extent of chemical plumes. A simulation period of 30 years will be selected.
2. Using Site-specific bioattenuation parameters gathered during the last four groundwater monitoring events, the biodegradation rate of chlorinated solvents will be calculated. The calculated biodegradation rate will be used in future simulations of the extent of chemical plumes beneath the Site. The result of this simulation will reveal the most realistic scenario in terms of the future extent of chemical plumes.
3. If the result of the second scenario indicates that MNA alone is not capable of restoring groundwater quality within a reasonable time frame, another remedial action such as groundwater extraction and treatment will be simulated and designed in order to restore groundwater quality conditions to an acceptable level per RBCA recommendations.

4.2.2 Conducting Risk-Based Corrective Action

To evaluate the impact of Site related chemicals on on-site workers and off-site residents, SOMA proposes to use the ASTM-RBCA approach. The results of the RBCA study will reveal the impact of site related chemicals on current Site workers and nearby residents and determine risk-based cleanup levels of soil and groundwater, which will be protective of human health and the environment.

Finally, by taking the above-mentioned steps, SOMA will determine whether or not the Site should be categorized as a "High Risk Soil/Groundwater Site" based on the State Water Board Interim Guidance Document. Such a determination would necessitate and justify the need for soil and groundwater remediation in on- and off-site areas.

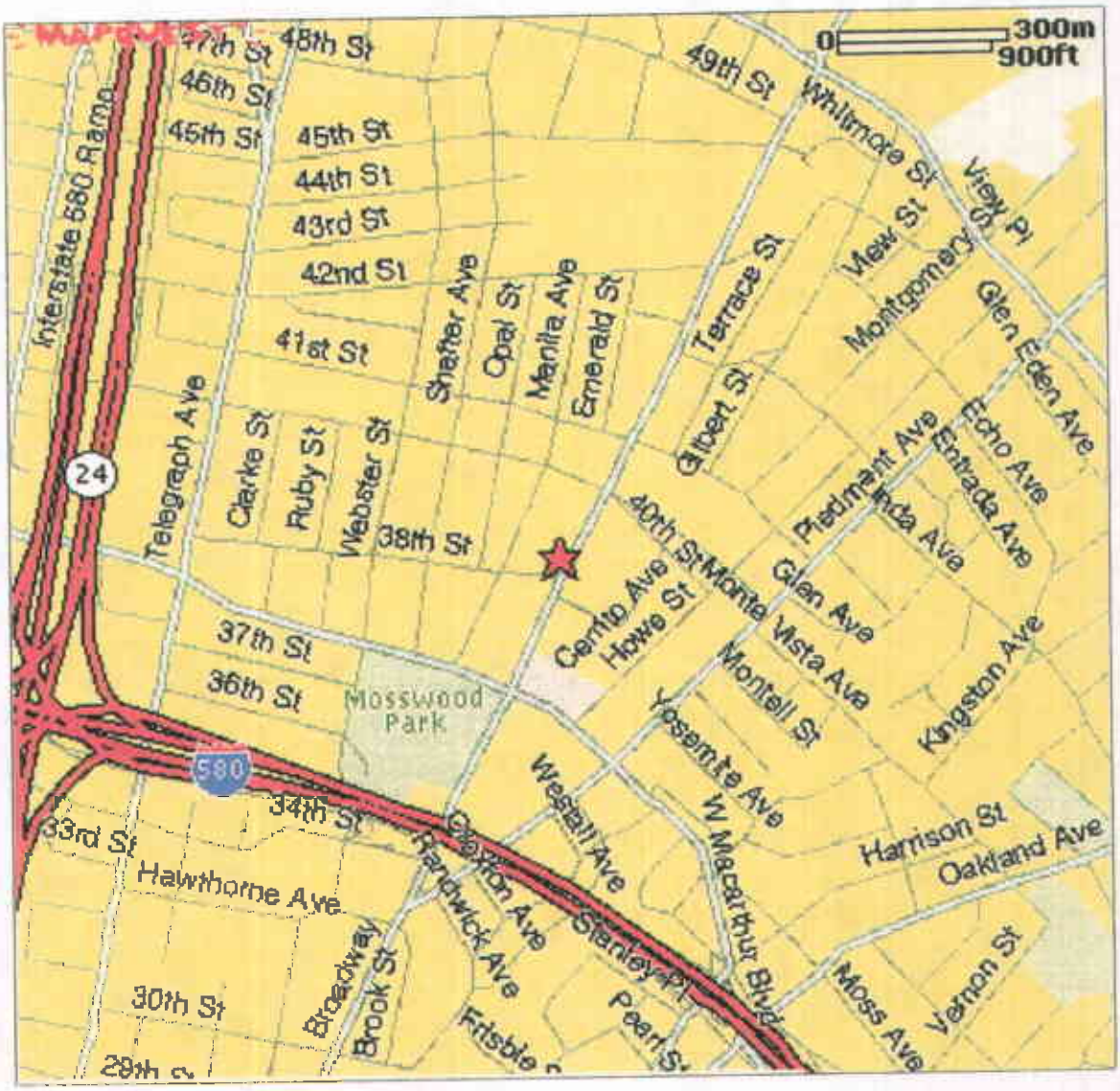

Figure 1: Site Location Map

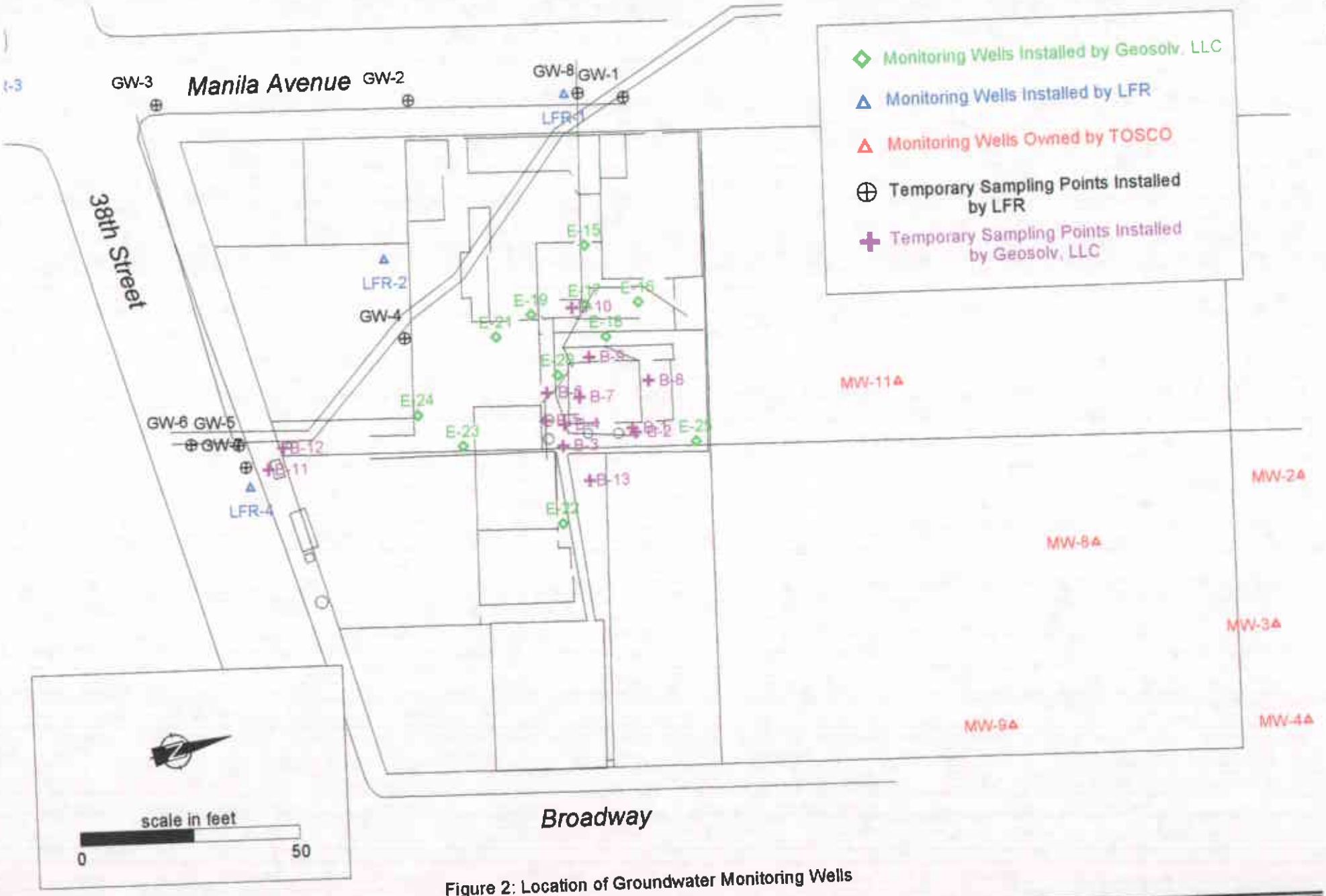

Figure 2: Location of Groundwater Monitoring Wells

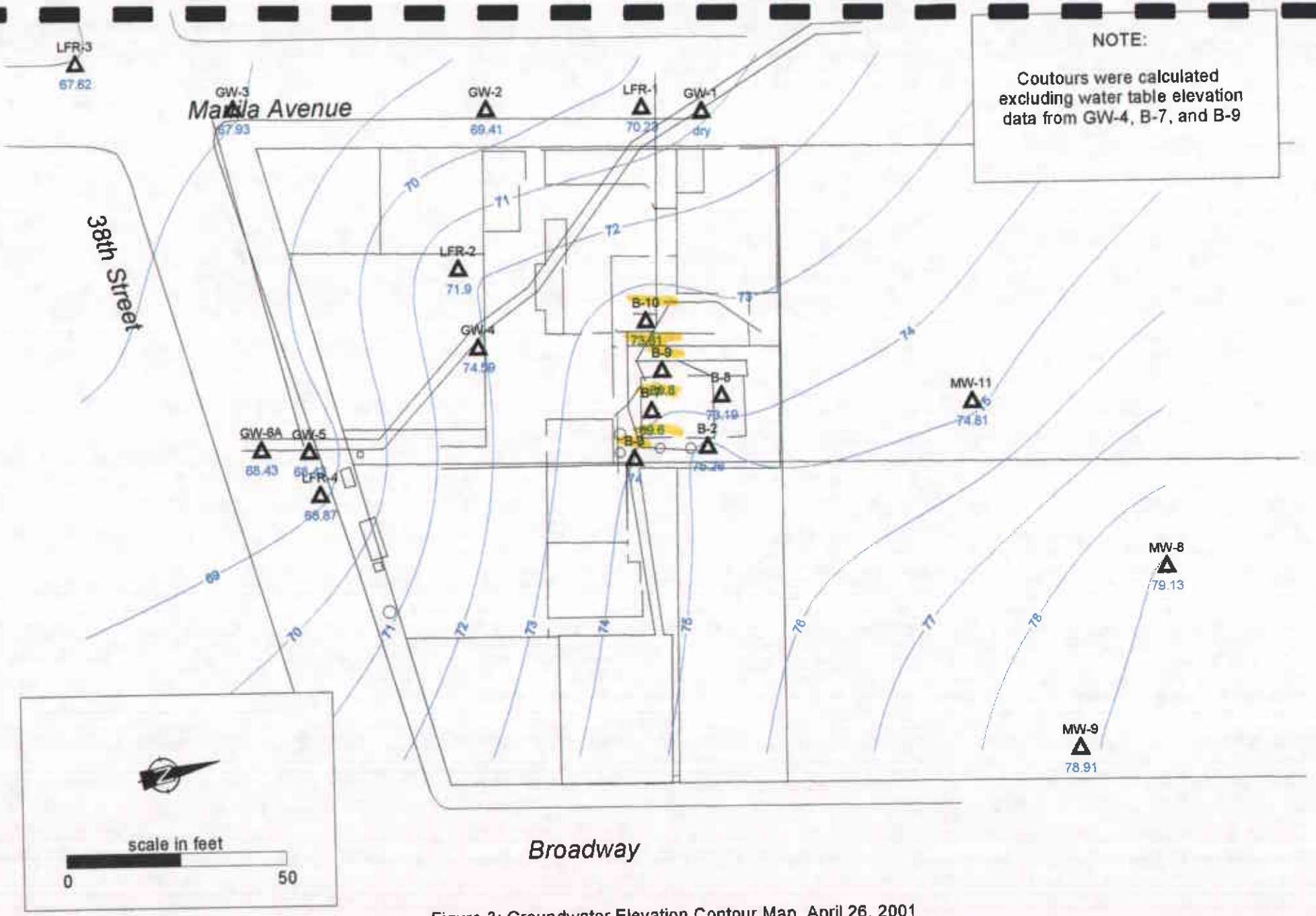

Figure 3: Groundwater Elevation Contour Map, April 26, 2001

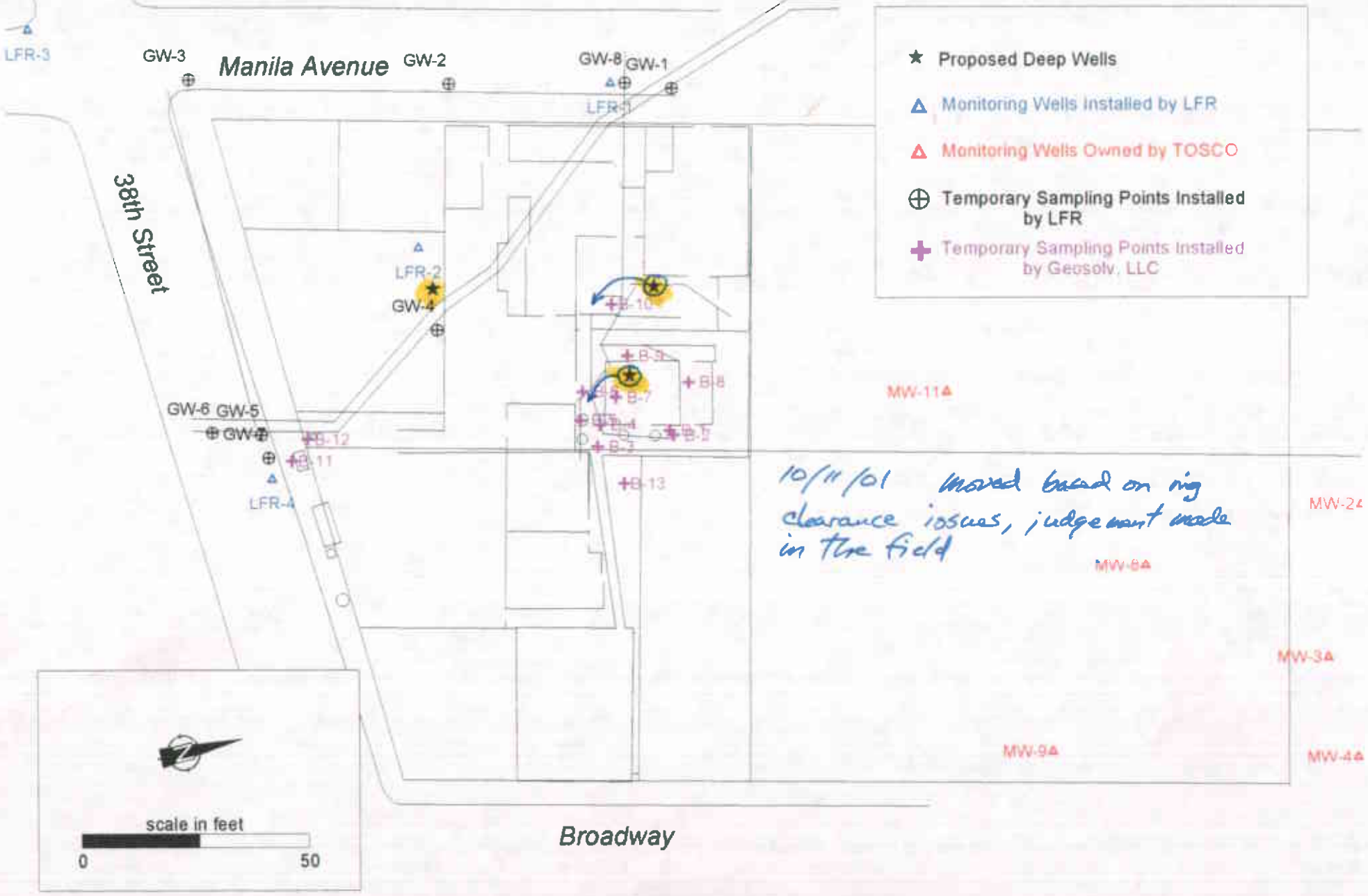

Figure 4: Location of Proposed Deep Groundwater Monitoring Wells