ENVIRONMENTAL • GEOTECHNICAL
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January 24, 2018

Mr. Ed Ralston
Program Manager – Remediation Management
Phillips 66 Company
76 Broadway
Sacramento, CA, 95818

RE: PUMPING TEST WORK PLAN
Phillips 66 Facility No. 2701476 (AOC #2063)
12660 First Avenue, South
Seattle, Washington
ATC Project No. Z076000070
Washington State Department of Ecology VCP No. NW2718

Dear Mr. Ralston:

ATC Group Services LLC (ATC) is pleased to submit this Work Plan to Phillips 66 Company (Phillips 66) for the above referenced facility, located at 12660 1st Avenue South, in Burien, Washington (Site). The objective of this work plan is to present a scope of work to conduct aquifer testing activities at the Site. The site is shown relative to surrounding physical features on **Figure 1**. The current layout of the site is shown on **Figure 2.**

1.0 SITE DESCRIPTION

The Site is currently operating as a '76 branded retail gasoline station located on the northeast corner of 1st Avenue South and Southwest 128th Street in Seattle, Washington. The Site is located in King County in Section 8; Township 23 North; Range 4 East, in an area of residential and commercial development.

Current facilities at the Site include the gasoline station (which includes a convenience store), two fuel dispenser islands, each covered with a canopy, and one 12,000-gallon and two 10,000-gallon capacity underground storage tanks (USTs) containing unleaded gasoline. The remainder of the Site is covered with asphalt or concrete except for landscaped areas along the northern and eastern property boundaries (Figure 2).

Surrounding properties include a commercial building to the north, two residences and a vacant residential lot to the east, Southwest 128th Street to the south, beyond which is a restaurant, and 1st Avenue South to the west, beyond which is an Albertson's Grocery store and associated fueling station. The area is zoned as neighborhood center.

2.0 SITE HISTORY

The property was first developed as a gasoline and automobile service station facility in 1966, although first generation USTs were installed in December 1964 and January 1965. Site ownership history prior to 1996 is unknown. Circle K Corporation owned the site from at least

1996 until the end of 1999 at which time Tosco Corporation became the property owner. ABC Pacific Corporation bought the property (date unknown) and sold the property to Silverlake Ventures II, Inc. in December 2003. Juns Investment Inc. is listed as the current property owner.

Prior to 1966 a residence reportedly existed at the northern portion of the Site. A UST containing heating oil was encountered in January 1992 during trenching activities associated with fueling system upgrades. The heating oil UST was subsequently decommissioned by removal. An unknown volume of contaminated soil was removed by excavation during the decommissioning activities. Over-excavation activities were performed until confirmation soil sample analytical results were below laboratory reporting limits. The location of the former heating oil UST is shown on **Figure 2**.

According to Ecology's Toxics Cleanup Program Web Reporting Databases, one 500-gallon waste oil UST was installed in December 1964, one 6,000-gallon leaded gasoline UST, one 8,000-gallon unleaded gasoline UST, and one 10,000-gallon unleaded gasoline UST were installed in January 1965. Additionally, one 6,000-gallon unleaded gasoline UST was installed in January 1976. The location of the former gasoline USTs and waste oil UST are shown on **Figure 2**.

In 1992, four gasoline USTs including two 6,000-gallon capacity, one 8,000-gallon capacity, and one 10,000-gallon capacity tanks, were removed from the central portion of the Site during fueling facility upgrades.

In July 1995, two 500-gallon USTs, one containing used oil, the other containing heating oil, were decommissioned by removal. The used oil UST was located north of the convenience store building and the heating oil UST was located south of the convenience store building. The installation and in-service dates of these two USTs are unknown.

Current facilities at the Site include the gasoline station (which includes a convenience store), two fuel dispenser islands, each covered with a canopy, and one 12,000-gallon and two 10,000-gallon capacity underground storage tanks (USTs) containing unleaded gasoline. The remainder of the Site is covered with asphalt or concrete except for landscaped areas along the northern and eastern property boundaries (**Figure 2**).

2.1 REGULATORY STATUS

Evidence of a gasoline release was first documented during the first generation UST removal activities in 1992. Gasoline-impacted soil and groundwater were reported to Ecology and the property was listed with Ecology's Leaking UST (LUST) program and assigned LUST ID 1571. The LUST status with Ecology, as of January 1995, is listed as "Cleanup Started." The property was entered into Ecology's VCP in April 2013 and was assigned VCP No. NW2718.

Ecology has received a total of 73 reports between 1992 and 2013. Most recently, Ecology provided an advisory opinion based on their review of the following reports that were submitted with the VCP Application:

- *Post Remediation Soil Assessment Report*, dated April 10, 2013, prepared by Cardno ATC;
- *Step-Drawdown Aquifer Test, Constant-Rate Aquifer Test, and Percolation Test for Circle K Store #1476*, dated October 31, 1995, prepared by SECOR International Inc.; and

Groundwater Monitoring Report (Third Quarter 2012), dated December 27, 2012, prepared by ATC Associates, Inc. (now known as Cardno ATC).

3.0 PREVIOUS INVESTIGATIVE AND REMEDIAL ACTIONS

Multiple investigations of soil have been conducted at the property between 1992 and 2012. The locations of all soil borings and samples collected during the previous investigation activities at the property are shown on **Figure 2**.

During the 1992 UST removal actions, confirmation soil samples were collected from the limits of the UST excavation pit. Analytical results from confirmation soil samples concentrations of petroleum hydrocarbons above the Model Toxics Control Act (MTCA) Method A cleanup levels. Based on these results, approximately 1,400 cubic yards of petroleum-impacted soil was over-excavated beneath the northern 6,000-gallon UST to a depth of approximately 15 feet below ground surface (BGS) and the southern dispenser island to a depth of 13 feet BGS. Analytical results from confirmation soil samples collected from the over-excavation limits of the 6,000-gallon UST indicated concentrations of petroleum hydrocarbons less than the MTCA Method A cleanup levels. Analytical results from confirmation soil samples collected from the over-excavation limits of the southern dispenser island (south of the current western dispenser and slightly southwest of previous boring B-1) indicated concentrations of petroleum hydrocarbons greater than the MTCA Method A cleanup levels.

In April and May 1992, a site assessment was conducted which included drilling five borings (B-1 to B-5) for the collection of soil samples and the installation of monitor wells. Boring B-3 was completed as well GW-2 and boring B-5 was completed as well GW-1 (shown on Figure 2). The remaining borings are identified as B-1, B-2 and B-4 (**Figure 2)**. Analytical results indicated concentrations of petroleum hydrocarbons above MTCA Method A clean up levels in soil samples from borings B-1, B-3, and B-4. Petroleum hydrocarbon constituents above MTCA Method A clean up levels were detected in groundwater samples collected from wells GW-1 and GW-2. Light non-aqueous phase liquid (LNAPL) was observed in well GW-2.

In 1994 and 1995, a total of 11 additional soil borings were advanced on- and off-site to depths between 75 and 94 feet BGS. Ten of the 11 borings were completed as monitor wells (identified as GW-3 through GW-12 on **Figure 2**). The remaining boring was completed as an air sparge well (identified as AS-1 on **Figure 2**). LNAPL was observed in monitor wells GW-2 and GW-6. In March and May 1994, LNAPL recovery programs were initiated for GW-2 and GW-6. In May 1994, an air sparge/soil vapor extraction (AS/SVE) pilot test was conducted at the site.

In July 1995, two 500-gallon USTs, one containing used oil, the other containing heating oil, were decommissioned by removal. The used oil UST was located north of the convenience store building and the heating oil UST was located south of the convenience store building. The installation and in-service dates of these two USTs are unknown. Heavy oil-range hydrocarbons were not detected in any of the confirmation soil samples collected from the excavation limits (**Figure 2**).

In August 1995, an aquifer pumping test was conducted to evaluate the feasibility of a groundwater pump and treat system, and a percolation test was conducted to evaluate the feasibility of an infiltration trench as a means of effluent discharge. Both were determined to be feasible options.

In 1998, the groundwater extraction/AS/SVE system plumbing was completed, and remediation activities were initiated. In 2006, six additional air sparge wells (identified as AI-1 through AI-6) were installed to depths of 90 feet BGS. The final system configuration consisted of seven air sparge wells (AS-1 and AI-2 through AI-7), six combination groundwater monitor/SVE wells (GW-1, GW-2, GW-5, GW-6, GW-7 and GW-10), and one combination groundwater monitor/extraction well (GW-5). The locations of the remediation wells are shown on **Figure 2**. Extracted vapors were passed through a catalytic oxidizer for treatment. Extracted groundwater was passed through an air stripper and two carbon adsorption units then discharged into an on-site infiltration trench. The system ran consistently until October 2006 when it was shut down due to asymptotic conditions. LNAPL has not been observed in monitor wells GW-2 and GW-6 since August 2001 and November 1995, respectively.

In July 2012, five soil borings (identified as SB-1 through SB-5 on **Figure 2**) were advanced in areas east, west and south of the southern fuel dispenser island and near those historical borings (completed prior to remediation actions) that previously exhibited concentrations of petroleum-related contamination greater than MTCA Method A cleanup levels to confirm current soil conditions and to analyze for all appropriate constituents associated with the contaminants. Each boring, with the exception of SB-3, was advanced to 50 feet BGS. Boring SB-3 was advanced to 55 feet BGS.

Samples submitted for laboratory analysis were generally selected based on the results of field screening evidence and/or from the approximate intervals where contamination was detected during previous investigations. The analytical results of the 2012 site assessment activities indicate that petroleum-related contamination is present at the locations of each soil boring. Petroleum-related contaminant concentrations greater than MTCA cleanup levels appear at depths of 20 feet BGS or greater. Field screening evidence and/or analytical results for those samples submitted above 20 feet BGS did not indicate petroleum-related contamination.

Groundwater sampling has been conducted at the Site since 1991. Shallow groundwater data indicate that 1) concentrations of gasoline range hydrocarbons and benzene have consistently exceeded MTCA Method A cleanup levels in groundwater samples collected from shallow monitor well GW-2 since LNAPL was last measured in August 2001, 2) gasoline-range hydrocarbons, one or more BTEX compounds, and total lead have periodically been detected at concentrations greater than corresponding MTCA Method A cleanup levels in groundwater samples collected from shallow monitor well GW-6 since LNAPL was last measured in the well in November 1995, and 3) gasoline-range hydrocarbons have not been detected at concentrations greater than corresponding MTCA Method A cleanup levels in groundwater samples collected from shallow monitor well GW-1 since April 2015. Deep groundwater data indicate that with the exception of benzene in GW-5 in 2015, TPH-D in GW-10 in 2014, and occasional total lead detections, petroleum-related contaminants have not been detected above the laboratory method reporting limits, or have been detected at concentrations less than the MTCA Method A cleanup levels in the groundwater samples obtained after October 2001 from the wells completed in the deeper water-bearing zone. The locations of the monitoring wells, as well as the most recent groundwater analytical data, is included on **Figure 3**.

4.0 POTABILITY EVALUATION

Environmental sampling conducted at the Site since 1991 has indicated a low recharge rate of groundwater within the shallow monitoring wells at the site. In order to demonstrate that the impacted shallow groundwater beneath the property was not a potable resource (potable

groundwater is defined by Ecology in WAC 173-340-720), ATC evaluated previous pump-test data. Nonpotable water is defined as not a current or potential drinking water source, according to MTCA.

According to the report *Results of Limited Site Assessment*, dated July 9, 1992, prepared by Environmental Science & Engineering, Inc., a limited pumping test was conducted in GW-1 on May 20, 1992. According to the well log, Well GW-1 was constructed in compliance with Chapter 173-160 WAC and in accordance with normal well construction practices for the area in which the property is located. The water in well GW-1 was completely evacuated (9.45 feet of drawdown) after less than 38 minutes of pumping at a rate of approximately 0.5-gallon per minute. After approximately 1 hour of recovery, approximately 1.5 feet of water, or approximately 1 gallon, had re-entered the well. The 1992 pumping test indicated the shallow water-bearing zone was insufficient in quantity to yield greater than 0.5 gpm on a sustainable basis (per WAC 173-340-720(2)(i). As such, the shallow perched discontinuous groundwater-bearing zone was determined not to be a potable resource (**Environmental Science & Engineering, Inc., 1992**).

According to Department of Ecology's Model Toxic Control Act (WAC 173-340-720(2)), a site's groundwater is considered potable unless the following criteria are met:

a) The ground water does not serve as a current source of drinking water
b) The ground water is not a potential future source of drinking water for any of the following reasons:
    i. The ground water is present in insufficient quantity to yield greater than 0.5 gallon per minute on a sustainable basis to a well constructed in compliance with chapter 173-360 WAC an in accordance with normal domestic water well construction practices for the area in which the site is located;
    ii. The ground water contains natural background concentrations of organic or inorganic constituents that make use of the water as a drinking water source not practicable. Ground water containing total dissolved solids at concentrations greater than 10,000 mg/l shall normal be considered to have fulfilled this requirement;
    iii. The ground water is situated at a great depth or location that makes recovery of water for drinking water purposes technically impossible; and
c) The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to a ground water that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection, at concentrations which exceed groundwater quality criteria published in chapter 173-200WAC.

In making this determination, Ecology also considers site-specific factors including:

i. The extent of affected groundwater;
ii. The distance to existing water supply wells;
iii. The likelihood of interconnection between the contaminated groundwater and groundwater that is a current or potential future source of drinking water due to well construction practices in the area of the state where the site is located;
iv. The physical and chemical characteristics of the hazardous substance;
v. The hydrogeologic characteristics of the site;
vi. The presence of discontinuities in the affected geologic stratum; and
vii. The degree of confidence in any predictive modeling performed.

In order to supplement the data previously gathered, ATC plans to conduct additional pumping tests of the shallow groundwater wells at the Site. The goal of this pumping test event is to determine if the flow rate in the shallow wells at the site meet the criteria for potable water (WAC 173-340-720(2)(b)(i), such that the yield on the monitoring wells can sustain a greater than 0.5 gallon/minute pumping rate. If the yield on the wells cannot maintain greater than 0.5 gallons /minute flow rate, this information will be used as one of the pieces of information to verify that the site has shallow non-potable water.

4.1 SITE HEALTH AND SAFETY PLAN

ATC will update the site-specific HASP for the proposed pumping test activities. The HASP will be reviewed by field staff and any contractors before beginning field operations, and will be in the possession of ATC personnel while conducting work activities at the site.

4.2 PUMPING TEST ACTIVITIES

We recommend that a step down pumping test be completed to evaluate the well yield rates. Monitoring wells GW1, GW2, and GW6 are recommended for the pumping tests. All three of the wells are located in the vicinity of the southern pump island. The locations of the well network and the planned pumping test wells are provided in **Figure 3**.

The scope of work identified for the pumping test will include the following:

1) Measure depth-to-water in the surrounding monitoring well network. Measure depth to water, depth to bottom, and calculated well height for all wells used in the pumping tests.
2) Install vented pressure transducers into all pumping and observation wells in order to collect continuous depth-to-water measurements. The transducers will be calibrated to record the temperature and water level once every second, and will be installed one hour prior to testing to allow for stabilization of temperature and water level. The transducers will also record water levels in GW-1, GW-2, and GW-6 when these wells are serving as observation wells.
3) In order to provide quality data, the transducers will not be placed on the bottom of the wells, where sediment could impact the readings, but approximately one inch above the bottom of the wells (or higher, depending on depth of sediment).
4) Place barometric pressure transducer onsite, to record changes in barometric pressure throughout the test period. The water level measurements will be adjusted after the test to reflect changes in atmospheric pressure fluctuations for more accurate water level readings. The measurements will be adjusted using appropriate software.
5) the following rate schedule will be used:

Pumping Rate (gallons/minute): 0.25, then 0.50, then 0.75
Pumping Duration: 2 hours with stabilized depth-to-water or until dry
Sequence of Test Well/Observation Wells:
First test: Test Well: GW-2
Observation Wells: GW-1, GW-6, GW-5, and GW-11
Second test: Test Well: GW-1
Observation Wells: GW-2, GW-6, GW-5, and GW-11

Third test: Test Well: GW-6
Observation Wells: GW-1, GW-2, GW-5, and GW-11

6) Begin drawdown on lowest pumping rate (0.25 gal/min) in first well using a Geotech SS Geosub submersible pump. The pumping rate will be verified by measurement of the discharge water using a stopwatch and a 5-gallon bucket with graduated volume levels.

7) Pumping will continue until either the well runs dry OR until there has been 2 hours of constant pumping and depth to water has stabilized.

8) Verify depth-to-water measurements within the pumping well using a water level meter to get measurements within one hundredth of a foot. Measurements should take place every 1 minute for the first ten minutes, every 10 minutes for the first hour of each pumping test, and every 10 minutes for each subsequent hour.

9) Verify depth-to-water measurements in observation wells every 15 minutes throughout the pumping test

10) Once pumping duration is completed, the discharge should be increased to the next rate level of 0.50 gal/minute, and then to 0.75 gal/minute, as necessary.

11) The second and third monitoring wells will be tested, if time permits, during the pumping test.

12) Depth-to-water measurements will be collected after the pumping tests are completed using the transducers for at least 12 hours to record recovery.

Purge water will be stored in labeled drums for temporary storage

4.3 REPORTING

The Pumping Test Report will include cross-sections with water levels and screened intervals. The report will also include boring/well logs for all wells used in the test. Data generated during both drawdown and recovery during the pumping tests will be tabulated and graphed. The graphs will be used to calculate hydraulic conductivity. The Dupuit Equation for unconfined aquifers will be used to calculate hydraulic conductivity:

$$K = \frac{Q \ln \frac{r_1}{r_2}}{\pi\left(h_1^2 - h_2^2\right)}$$

Data will be evaluated against Ecology requirements. Specifically, the following will be presented:

- If groundwater serves as a current source of drinking water,
- The extent of affected groundwater;
- The distance to existing water supply wells;
- The likelihood of interconnection between the contaminated groundwater and groundwater that is a current or potential future source of drinking water;
- The physical and chemical characteristics of the hazardous substance;

- The hydrogeologic characteristics of the site;
- The presence of discontinuities in the affected geologic stratum;
- The degree of confidence in any predictive modeling performed; and
- If ground water is not a potential future source of drinking water if ground water is present in insufficient quantity to yield greater than 0.5 gallon per minute on a sustainable basis;

Conclusions from the calculations and investigation will be summarized in a report that includes a determination regarding the site's ability for the groundwater wells to meet a 0.5 gal/minute yield, and if groundwater at the Site is considered to be potable.

5.0 WORK SCHEDULE

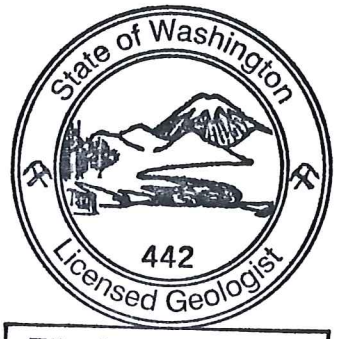
ATC anticipates completing the field work associated with the pumping test during the first or second quarter of 2018. The draft report will be provided within six (6) weeks of completing the field work.

We appreciate the opportunity to be of service in this matter. If you have questions regarding this Pumping Test Work Plan, please contact me at (206) 781-1449.

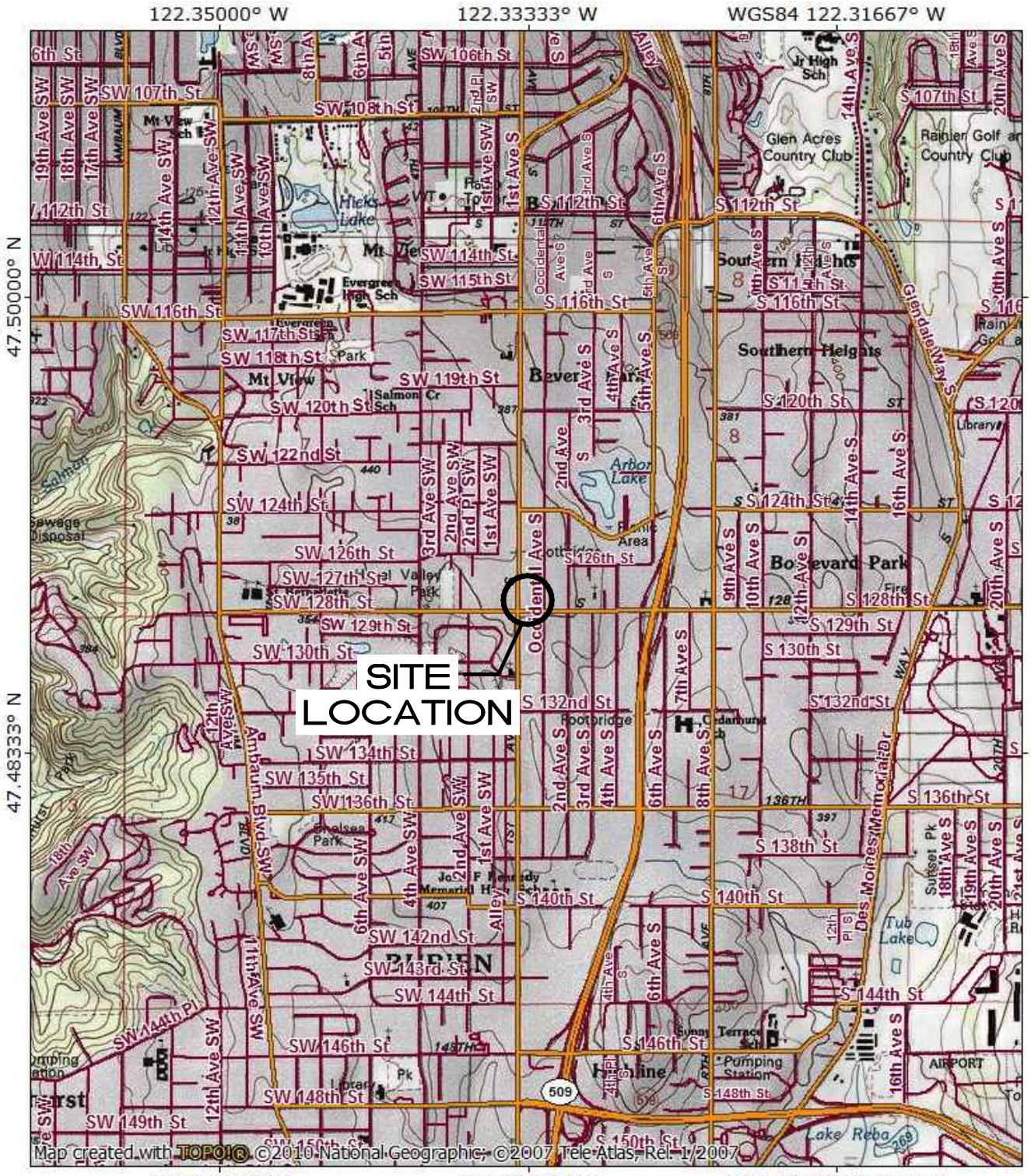
Sincerely,

ATC Group Services LLC

Elisabeth Silver, L.G.
Senior Project Manager



Enc: Figure 1 Site Vicinity Map
Figure 2 Site Plan – Historical Site Configuration, Soil Borings, and Well Locations
Figure 3 Groundwater Analytical Map (09/19/17 & 09/20/17)



SOURCE: USGS TOPO MAP, DES MOINES, WA QUAD, 1995

SITE VICINITY MAP

PHILLIPS 66 FACILITY NO. 2701476 (AOC #2063)
12660 FIRST AVENUE SOUTH
SEATTLE, WA

PROJECT NUMBER: Z076000048		DATE: 4/26/16	FIGURE 1
APPROVED BY: KS		DRAWN BY: BK	

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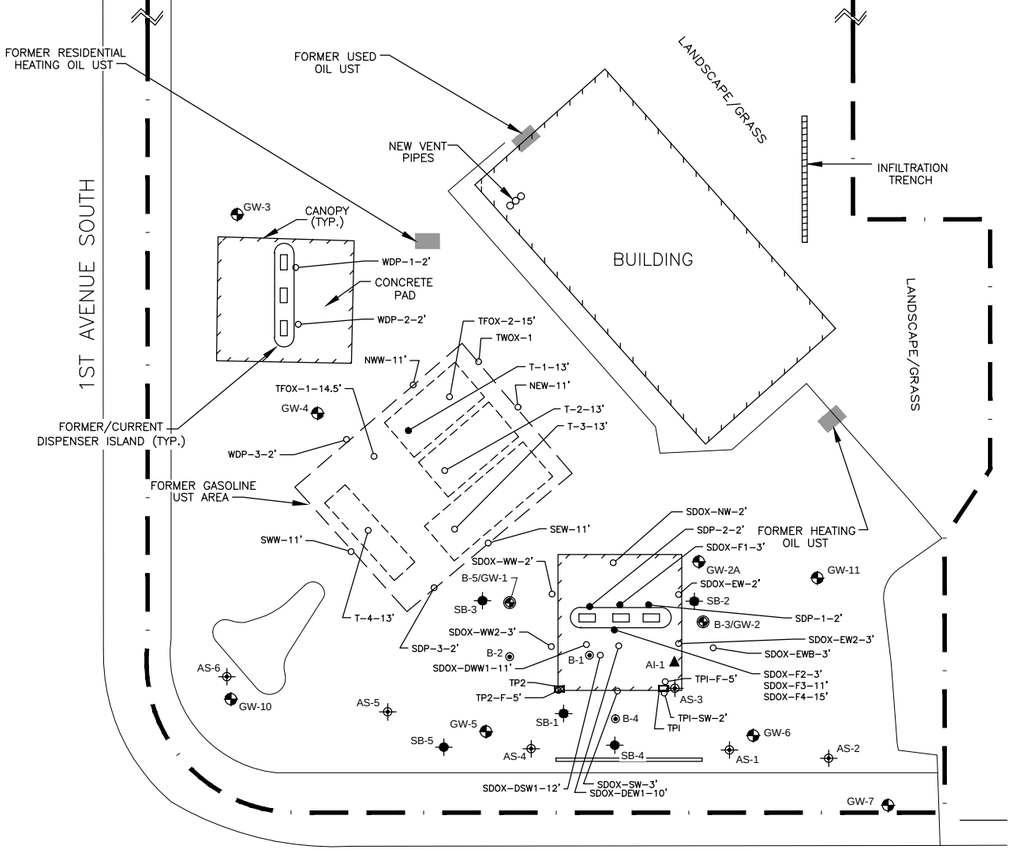
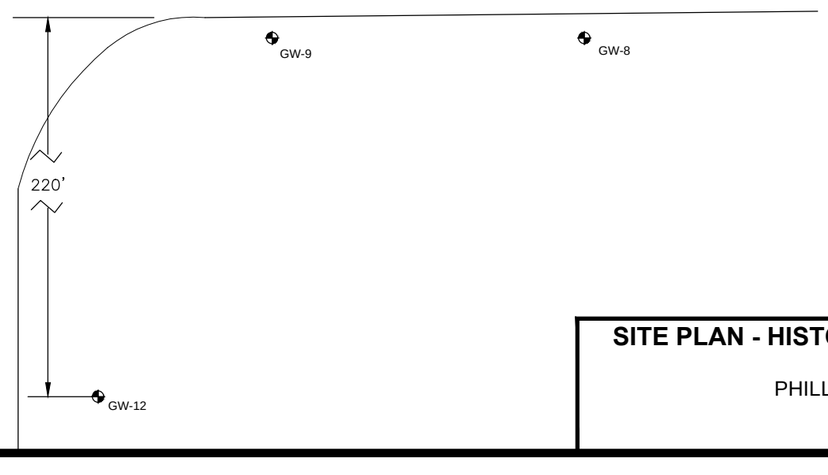


SOUTHWEST 128TH STREET



LEGEND

- SOIL BORING/MONITOR WELL (APRIL & MAY 1992)
- AIR SPARGE WELL (1994)
- AIR SPARGE POINT (1998)
- MONITOR WELL (1994/1995)
- SOIL BORING (JULY 2012)
- SOIL SAMPLE CONTAINING PETROLEUM HYDROCARBONS LESS THAN SCLG'S
- SOIL SAMPLE CONTAINING PETROLEUM HYDROCARBONS GREATER THAN SCLG'S
- TRENCH WITH ID
- FORMER UST
- CATCH BASIN
- APPROXIMATE SITE BOUNDARY

N

0 30 60

SCALE, FT

NOTE: ALL LOCATIONS ARE APPROXIMATE

SITE PLAN - HISTORICAL SITE CONFIGURATION, SOIL BORINGS AND WELL LOCATIONS

PHILLIPS 66 FACILITY NO. 2701476 (AOC 2063)
12660 FIRST AVENUE SOUTH
SEATTLE, WA

PROJECT NUMBER: Z076000048		DATE: 11/8/17	FIGURE 2
APPROVED BY: ES		DRAWN BY: BK	

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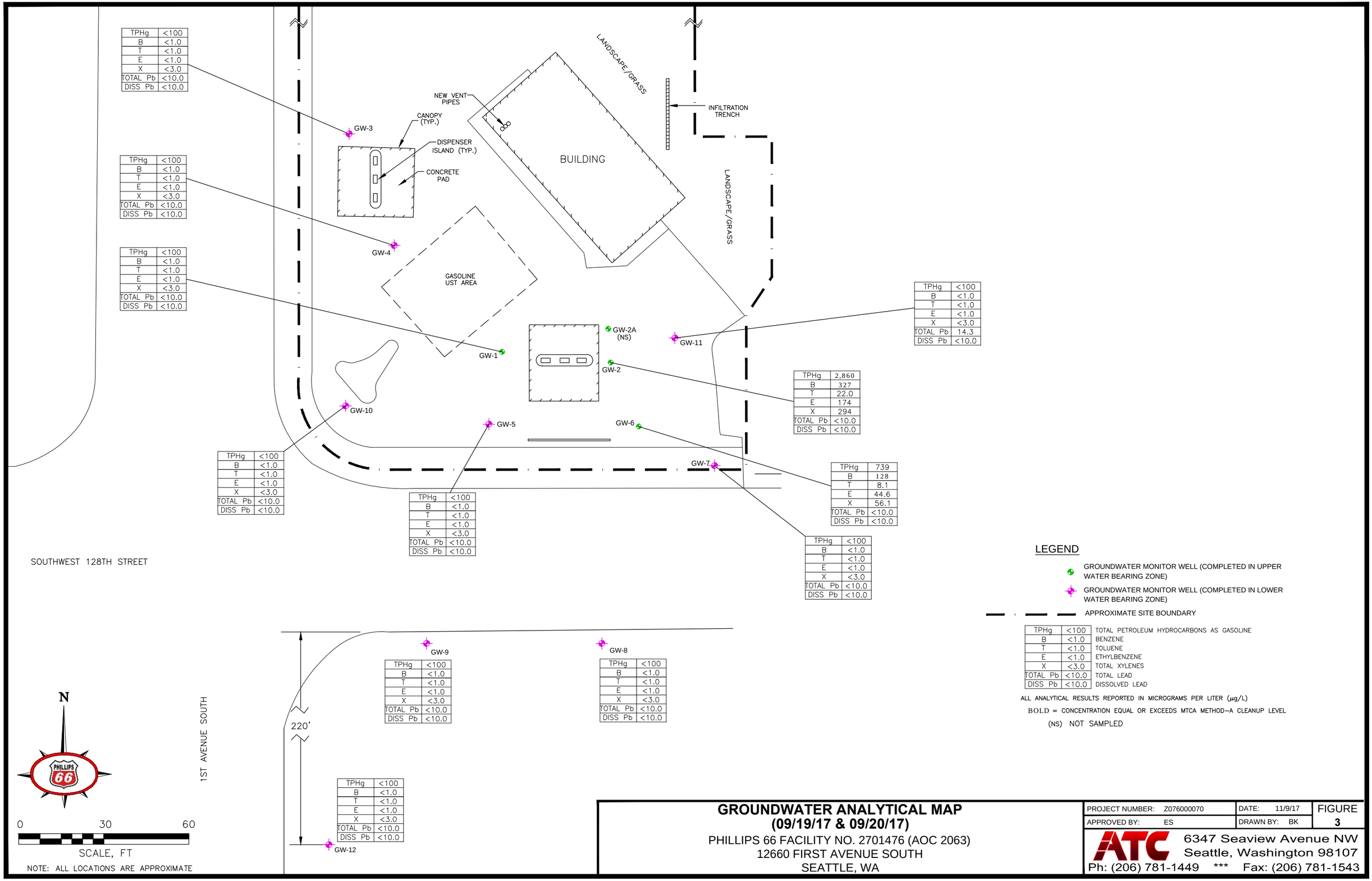

GROUNDWATER ANALYTICAL MAP (09/19/17 & 09/20/17)

PHILLIPS 66 FACILITY NO. 2701476 (AOC 2063)
12660 FIRST AVENUE SOUTH
SEATTLE, WA

PROJECT NUMBER: Z076000070	DATE: 11/9/17	FIGURE
APPROVED BY: ES	DRAWN BY: BK	3

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