Zipper Geo Associates, LLC
Geotechnical and Environmental Consulting

September 12, 2013

Mill Creek Crossing LLC
22833 Bothell Everett Highway
Bothell, Washington

Attention: Mr. Nicholas Echelbarger

Subject: Supplemental Remedial Investigation and Pilot Study Work Plan
Prime Cleaners
18001 Bothell Everett Highway
Bothell, Snohomish County, Washington
ZGA Project No. 1001.22

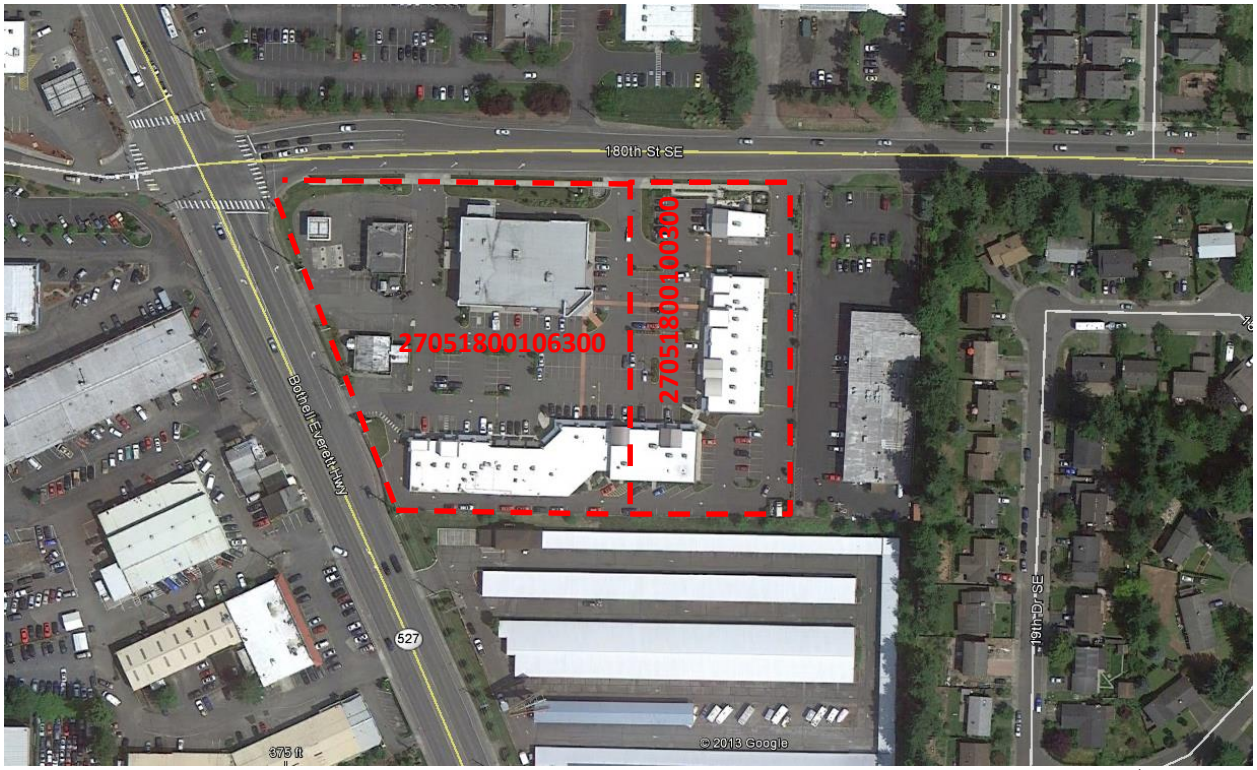
Dear Mr. Echelbarger:

Zipper Geo Associates, LLC (ZGA) appreciates the opportunity to submit this Supplemental Remedial Investigation and Pilot Study Work for the Prime Cleaners located at 18001 Bothell Everett Highway.

PROJECT INFORMATION

The Property comprises approximately 4.8 acres, which includes 3.15 acres in Snohomish County tax parcel #27051800106300 and 1.65 acres in tax parcel # 27051800100300. Tax parcel # is currently developed with the remnants of an L-shaped strip mall constructed in 1983 to 1984, a Plaid Pantry mini-mart/service station constructed in 1985, and Key Bank Branch constructed in 1990. The Property was expanded into the east adjoining parcel (tax parcel #27051800100300) in 2008. The north-trending portion of the initial strip mall was demolished at that time and replaced with a new stand-alone north-south oriented strip mall. The east-west trending remnant of the original strip mall was expanded in an easterly direction. A coffee shop and a Bartell's Drug Store were constructed in 2008 and 2009, respectively. The Property also includes asphalt-paved parking and landscaped areas. The location of the Property is indicated below.

It is our understanding that the building on the southwest part of the Property has included a dry cleaners since the building was initially constructed 1984. We understand that Prime Cleaners commenced operations in about 1984 in the end cap unit indicated below as "Former Dry Cleaner" and operated at that location until about 2000, then relocated to the unit shown as "Existing Dry Cleaner". The approximate location of the cleaners is indicated below. We are unaware of any other cleaners having been located on the Property.



The Property is located southeast of the intersection of Bothell Everett Highway (SR 527) and 180th Street Southeast. The tax parcel boundaries are approximate.

Location of former and current dry cleaning operations.

ZGA has been provided with six previously completed environmental reports for the Site:

- Phase I Environmental Site Audit, Marketplace Plaza, prepared by Environmental Associates, Inc. (April, 1999).
- Preliminary Subsurface Sampling and Testing, Marketplace Plaza Gas Station & Dry Cleaner, Environmental Associates, Inc. (March, 1999).
- Phase I Environmental Site Assessment, Marketplace Retail Center, Adapt Engineering, Inc. (November 2007).
- Limited Phase II Environmental Site Assessment, Marketplace Retail Center, Adapt Engineering, Inc. (November 2007).
- Limited Site Investigation, Marketplace Retail Center, Terracon Consultants (August, 2009)
- Supplemental Limited Site Investigation, Marketplace Retail Center, Terracon Consultants, (June 2011).

These reports form the basis for our current understanding of the Site. Each report is briefly summarized below. The analytical results from the Terracon investigations are summarized in Table 1 and Table 2. Monitoring well locations are indicated on the Figure 2 and Figure 3 (attached). The locations of shallow geoprobe explorations completed by Terracon in 2009 are indicated on Figure 5 of the 2009 Terracon report (attached).

Phase I Environmental Site Audit (Environmental Associates, 1999)

According to the 1999 Site Audit, construction of the multi-tenant portion of the Marketplace Plaza (now Mill Creek Crossing) was completed in 1984. An operational dry cleaner was reportedly present in the end cap unit located at the west end of the south wing of the multi-tenant building from 1984 until 1999.

Preliminary Subsurface Sampling and Testing (Environmental Associates, 1999)

According to the 1999 Preliminary Subsurface Sampling and Testing report, four subsurface explorations were advanced to evaluate the potential for releases due to dry cleaning activities. These included two hand-advanced explorations inside the dry cleaner unit to depths ranging from two to six feet (SP-1 and SP-2), and two borings immediately west (outside) of the end cap unit to reported depths of approximately 24 feet (B-1 and B-2). One soil sample was collected from each exploration. Tetrachloroethylene (PCE) was detected in both of the interior soil samples at reported concentrations of 240 ug/kg and 560 ug/kg. PCE was not detected in concentrations above laboratory reporting limits in B-2, but was reported at a concentration of 200 ug/kg at a depth of approximately 22½ feet in B-1. The approximate location of boring B-1 is indicated on Figure 2. These reported concentrations (200 ug/kg to 560 ug/kg) exceed the current Model Toxics Control Act (MTCA, WAC 173-340) Method A cleanup level for PCE (50 ug/kg).

Phase I Environmental Site Assessment (Adapt Engineering, 2007)

The 2007 Phase I ESA indicated that the dry cleaner remained operational at that time.

Limited Phase II ESA (Adapt Engineering, 2007)

The 2007 Limited Phase II ESA described the installation of three groundwater monitoring wells on the Site. Two of the wells were completed near the Plaid Pantry service station. One of the wells was advanced a few feet south of the building housing the current and historical dry cleaning operations, and was completed at a depth of approximately 35 feet. This well is referred to as MW-4 in the Terracon and ZGA reports. Groundwater was measured in this well at a depth of approximately 25½ feet. One soil sample collected at a depth of approximately 30 feet in MW-4 contained PCE at a reported concentration of 63 ug/kg, slightly exceeding the current MTCA Method A cleanup level (50 ug/kg). A groundwater sample collected from MW-4 contained PCE at a reported concentration of 45 ug/L, which exceeds the current MTCA Method A cleanup level for groundwater (5 ug/L). The Adapt report includes a discussion of the Environmental Associates, Inc. (EAI) 1999 Preliminary Subsurface Sampling and Testing report, and includes the location of the EAI sampling locations on their Site and Exploration Plan.

Limited Site Investigation (Terracon Consultants, 2009)

Prime Cleaners was located in its existing location by this time. Terracon advanced a total of thirteen direct-push borings inside the building at the locations of both the current and former dry cleaning tenant spaces, and in the alley immediately south and southwest of the current and former dry cleaning tenant spaces. In addition, three hollow-stem auger borings were completed with groundwater monitoring wells (MW-1, MW-2, and MW-3) outside of the dry cleaner tenant spaces on the southwest part of the Property. A total of 29 soil samples were analyzed for this investigation. The well installed by Adapt in 2007 was designated as MW-4 and is located south of the original dry cleaning tenant space (currently occupied by Money Tree). In addition to the four wells installed near the Prime Cleaners, one well at the Plaid Pantry site was sampled for groundwater (PP-MW-2). PP-MW-2 on the Plaid Pantry site was sampled first on June 16. The reported analytical results for this well indicate the presence of a wide variety of gasoline components (i.e., all the analytes listed in Table 2 except PCE, TCE, and cis-1,2-DCE). These analytical results for PP-MW-2 are generally consistent with the overall groundwater quality data set that we have reviewed for the Plaid Pantry site. Due to the strong odor in groundwater extracted from this well, we collected an equipment blank after cleaning our equipment and before sampling the four wells near the Prime Cleaners. An equipment blank is created by pouring distilled water over the sampling equipment after it has been cleaned, and analyzing that water to evaluate the potential for cross-contamination. Analysis of the equipment blank revealed that the blank contained significant amounts of gasoline components. Therefore, the reported detection of gasoline components, particularly in MW-2 and MW-4 which were sampled on the same day as PP-MW-2, is suspect (see Table 2). The suspect nature of the reported concentrations of gasoline components in MW-2 and MW-4 may be supported by the relatively low concentrations of these compounds in MW-1 and the complete lack of these compounds in MW-3, both of which were sampled on June 17 after our sampling equipment had been cleaned multiple

times. Gasoline components were not detected in MW-1 through MW-4 in three subsequent sampling events.

Supplemental Limited Site Investigation (Terracon Consultants, 2011)

Terracon advanced three hollow-stem auger borings west of the facility, along the west side of the SR 527 right-of way (MW-5, MW-6, MW-7) in 2010, and one hollow-stem auger boring south of the facility on the east side of the SR 527 right-of-way (MW-8) in 2011. A total of 27 soil samples were analyzed.

The Terracon studies revealed that the concentration of PCE in three samples (110 ug/kg to 160 ug/kg) and TCE in three samples (33 ug/kg to 38 ug/kg) collected inside of the current and former dry cleaner tenant spaces exceed the Method A cleanup level for PCE (50 ug/kg) and TCE (30 ug/kg). The location of these samples is indicated on the attached figure from the 1999 Terracon report. Volatile organic compounds were not detected above Method A cleanup levels in any of the 42 soil samples collected from the seven borings completed by Terracon. The approximate extent of known soil contamination, including the results from the 1999 Environmental Associates report and the 2007 Adapt report, is indicated on Figure 2.

In addition, ZGA collected groundwater samples from MW-1 through MW-4 and MW-8 in May of 2012. The results are summarized in Table 2. Groundwater has been sampled four times in MW-1 to MW-4 and twice in MW-5 to MW-8. The concentration of PCE has exceeded the Method A cleanup level (5 ug/L) in MW-1 one time, and in MW-3, MW-4, and MW-8 during every sampling event with a maximum measured concentration of 170 ug/L. Dichloroethylene (DCE) and vinyl chloride have not been detected, and trichloroethylene (TCE) has only been detected one time. These results suggest that biodegradation is not occurring. Estimated groundwater contours and the approximate extent of known groundwater contamination in May of 2012 are indicated on Figure 3.

The estimated extent of soil and groundwater that exceeds MTCA Method A cleanup levels is indicated on Figure 2 and Figure 3, respectively. Based on the analytical results and estimated groundwater contours, it appears that the release occurred in the end cap unit and has migrated primarily in a southerly direction, with lesser westerly and easterly components.

Table 1. Summarized Analytical Results (Soil)

Sampling Event	Sample	Depth (Feet)	Location	Volatile Organic Compounds (ug/kg)		
				PCE	TCE	Cis-1,2-DCE
2009 LSI (Terracon, 2009)	B1	3	Existing Drycleaners	**160**	**38**	ND<1.5
	B2	3		1.1	18	ND<1.0
	B3	2½		1.9	20	ND<1.0
	B4	2½		17	29	ND<1.1
	B5	3	South Alley	ND<1.1	24	ND<1.1
	B6	3		1.2	15	ND<1.0
	B7	3		15	22	ND<1.1
	B8	3		28	30	28
	B9	2½	Money Tree (Former Drycleaner)	**110**	9.2	ND<1.1
	B9	5		4.1	27	ND<1.1
	B10	3		5.2	14	ND<1.1
	B10	5½		**160**	10	ND<1.1
	B11	3		ND<1.0	ND<1.0	ND<1.0
	B12	3		3.8	**38**	ND<1.1
	B13	3½		16	**33**	ND<1.0
	MW1-1	7½	Parking Lot	ND<1.1	ND<1.1	ND<1.1
	MW1-2	17½		ND<1.1	ND<1.1	ND<1.1
	MW1-3	25		2.1	ND<1.1	ND<1.1
	MW1-4	37		ND<1.3	ND<1.3	ND<1.3
	MW1-5	41		ND<1.2	ND<1.2	ND<1.2
	MW2-6	7½	West Alley	ND<1.1	ND<1.1	ND<1.1
	MW2-7	18		ND<1.0	ND<1.0	ND<1.0
	MW2-8	23		ND<1.1	ND<1.1	ND<1.1
	MW2-9	44		ND<1.1	ND<1.1	ND<1.1
	MW2-10	33		ND<1.0	ND<1.0	ND<1.0
	MW3-11	7½	South Alley	4.5	ND<1.2	ND<1.2
	MW3-12	13		3.9	ND<1.1	ND<1.1
	MW3-13	27½		9.3	ND<1.1	ND<1.1
	MW3-14	31		2.3	ND<1.1	ND<1.1
	MW3-15	37		ND<1.1	ND<1.1	ND<1.1
2010 Supplemental LSI (Terracon, 2011)	MW5 S-1	12½	West Side of the Bothell Everett Highway	ND<1.2	ND<1.2	ND<1.2
	MW5 S-2	20		ND<1.2	ND<1.2	ND<1.2
	MW5 S-3	25		ND<1.1	ND<1.1	ND<1.1
	MW5 S-4	30		ND<1.2	ND<1.2	ND<1.2
	MW5 S-5	35		ND<1.2	ND<1.2	ND<1.2
	MW6 S-1	15		ND<1.2	ND<1.2	ND<1.2
	MW6 S-2	20		ND<1.0	ND<1.0	ND<1.0
	MW6 S-3	26		ND<1.1	ND<1.1	ND<1.1
	MW6 S-4	30		ND<1.1	ND<1.1	ND<1.1
	MW6 S-5	35		1.3	ND<1.1	ND<1.1
	MW7 S-1	16		ND<1.2	ND<1.2	ND<1.2
	MW7 S-2	20		ND<1.1	ND<1.1	ND<1.1
	MW7 S-3	26		ND<1.1	ND<1.1	ND<1.1
	MW7 S-4	32.5		ND<1.1	ND<1.1	ND<1.1
	MW7 S-5	40		13	ND<1.2	ND<1.2
MTCA Method A Cleanup Level				*50*	*30*	*NE*

ug/kg: micrograms per kilogram (parts-per-billion); NE: Not established; <: Not detected above indicated laboratory reporting detection limit. Shaded values exceed MTCA Method A cleanup levels (see Section 4). PCE, tetrachloroethylene; TCE, trichloroethylene; Cis-1,2-DCE, cis-1,2-dichoroethylene. Reported sample depths are approximate.

Table 1. Summarized Analytical Results (Soil, Continued)

Sampling Event	Sample	Depth (Feet)	Location	Volatile Organic Compounds (ug/kg)		
				PCE	TCE	Cis-1,2-DCE
2011 Supplemental LSI (Terracon, 2011)	MW-8 S1	10	East Side of the Bothell Everett Highway	1.8	ND<1.2	ND<1.2
	MW-8 S2	15		ND<1.0	ND<1.0	ND<1.0
	MW-8 S3	20		8.9	ND<1.2	ND<1.2
	MW-8 S4	25		7.3	ND<1.1	ND<1.1
	MW-8 S5	30		45	ND<1.2	ND<1.2
	MW-8 S6	35		16	ND<1.2	ND<1.2
	MW-8 S7	40		25	ND<1.1	ND<1.1
	MW-8 S8	45		12	ND<1.1	ND<1.1
	MW-8 S9	50		16	ND<1.1	ND<1.1
	MW-8 S10	55		ND<1.0	ND<1.1	ND<1.1
	MW-8 S11	60		8.7	ND<1.1	ND<1.1
	MW-8 S12	70		7.0	ND<1.2	ND<1.2
MTCA Method A Cleanup Level				*50*	*30*	*NE*

ug/kg: micrograms per kilogram (parts-per-billion); NE: Not established; <: Not detected above indicated laboratory reporting detection limit. Shaded values exceed MTCA Method A cleanup levels (see Section 4). PCE, tetrachloroethylene; TCE, trichloroethylene; Cis-1,2-DCE, cis-1,2-dichoroethylene. Reported sample depths are approximate.

Table 2. Summarized Analytical Results (Groundwater)

Monitoring Well	Date	Volatile Organic Compounds (ug/L)													
		PCE	TCE	Cis-1,2-DCE	Benzene	Ethylbenzene	Isopropylbenzene	p-Isopropyltoluene	Naphthalene	n-Propylbenzene	Toluene	1,2,4-Trimethylbenzene	1,2,3-Trimethylbenzene	1,3,5-Trimethylbenzene	Xylenes
MW-1	6-17-09	**12**	ND<1	4.8	1.7	1.1	ND<1	ND<1	ND<5	ND<1	6.9	1.2	ND<1	ND<1	**5.6**
	8-10-10	ND<1	3.2	1.4	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	5-10-11	1.3	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
	5-23-12	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<4
MW-2	6-16-09	ND<1	ND<1	ND<1	**27**	35	1.8	ND<1	9.5	7.7	190	48	10	13	210
	8-12-10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	5-10-11	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
	5-24-12	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<4
MW-3	6-17-09	**6.6**	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	8-12-10	**6.4**	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	5-10-11	**9.3**	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
	5-24-12	**15**	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<4
MW-4	6-16-09	**170**	ND<1	ND<1	**8.1**	11	ND<1	ND<1	ND<5	2.8	55	12	2.6	3.6	63
	8-12-10	**140**	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	5-10-11	**110**	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
	5-24-12	**140**	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<4
MW-5	8-10-10	0.61	ND<1	ND<1	1.4	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	5-09-11	0.60	ND<1	ND<1	0.61	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
MW-6	8-10-10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<1
	5-09-11	2.2	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
MW-7	8-10-10	0.55	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
	5-09-11	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
MW-8	5-10-11	**22**	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
	5-24-12	**36**	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<4
PP-MW-2	6-16-09	ND<1	ND<1	ND<1	**1,800**	**1,100**	41	11	140	130	**8,000**	770	180	210	**6,200**
Equipment Blank	6-16-09	ND<1	ND<1	ND<1	**12**	10	ND<1	ND<1	7	2.4	61	18	4.6	4.4	66
Equipment Blank	8-12-10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<5	ND<1	ND<5	ND<1	ND<1	ND<1	ND<3
MTCA Method A Cleanup Level		*5*	*5*	*NE*	*5*	*700*	*NE*	*NE*	*160*	*NE*	*1,000*	*NE*	*NE*	*NE*	*1,000*

ug/L: micrograms per liter (parts-per-billion); ND<: Not detected above indicated laboratory reported detection limit; NE: Not established; Shaded values exceed MTCA Method A cleanup levels. Monitoring well PP-MW-2 is located on the Plaid Pantry LUST site on the northwest corner of the overall Property.

WAC 173-340-200 defines the Site as "any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft; or any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located".

In accordance with this definition, the Site is located near the southwest corner of Snohomish County Tax Parcel #27051800106300 and extends onto the south adjoining mini-warehouse facility and the east side of the SR 527 right-of-way approximately 500 south of the intersection with 180th Street Southeast. The approximate limits of the Site as currently understood are indicated by the PCE contours on Figure 3. Some uncertainty remains in regard to the easterly and southerly extent of the plume.

Regulatory Status

The Site was enrolled in the Voluntary Cleanup Program in October of 2011. Ecology assigned Mr. Dale Meyers as the Site Manager. Mr. Meyers reviewed copies of the 2009 and 2011 reports prepared by Terracon Consultants. ZGA met with Mr. Meyers to discuss the project on May 29, 2012. Based our discussion with Mr. Meyers, it is Ecology's opinion that the Site has not been fully characterized. Mr. Meyers requested that additional wells be installed to more fully define the lateral extent of the groundwater plume in the areas east and south of the drycleaner tenant spaces (including on the adjacent private property south of the Property) and north of the drycleaner tenant spaces. Ecology's criteria for establishing the plume boundary consists of wells wherein the contaminants of concern are not detected above cleanup levels.

Ecology does not appear willing to support use of MNA as an acceptable remedial alternative at this time, nor does it appear they will approve a Remedial Investigation with the presently available information. To continue to pursue an NFA, we will need to install additional groundwater monitoring wells, and will likely need to implement an engineered remedial alternative to comply with applicable requirements under the state Model Toxics Control Act.

RECOMMENDED SCOPE OF WORK

The objective of the scope of services for the project is to complete the remedial investigation (e.g. better define the boundaries of the plume), evaluate the potential for vapor intrusion, and complete bioremediation, soil vapor extraction, and dual phase extraction pilot tests.

Task 1. Supplemental Remedial Investigation

We propose to complete the following activities prior to the initiation of the Remedial Investigation (RI) field work:

- Prepare a Remedial Investigation / Pilot Study Work Plan and a Site Specific Health and Safety Plan.

- Arrange for and coordinate the services of subcontractors.
- Contact the Utility Notification Center to arrange for publically owned underground utilities to be marked.
- Contract with a private utility locator to clear the locations of each of our boreholes.
- Complete a survey of the tenant spaces scheduled for indoor air sampling in an effort to identify and remove VOC emitters prior to sampling.

Soil Gas and Indoor Air Investigation

The Method B (unrestricted land use) air cleanup level for PCE is 9.6 ug/m^3. Using Equation 1 in the Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Washington State Department of Ecology, draft report dated October, 2009), the calculated generic groundwater vapor intrusion screening level for PCE is 12.8 ug/L. This concentration has been exceeded during all four sampling events in MW-4 and during one sampling event in MW-3. In addition, shallow soil beneath the current and former dry cleaner tenant spaces contains PCE and TCE in concentrations exceeding Method A cleanup levels. The scope of work for the RI therefore includes a soil gas and indoor air investigation to evaluate the soil to indoor air and groundwater to indoor air contaminant pathways.

Soil gas and air samples will be collected in general accordance with the above referenced guidance document. We propose to collect two sub-slab soil gas samples inside each of the current dry cleaner tenant space, the former dry cleaner tenant space, and the tenant space adjoining the east side of the current dry cleaner. Permanent sub-slab soil gas probes will be installed so that they can also serve as pressure gradient data points for the dual phase extraction pilot study described in Task 2. We also propose to collect one indoor air sample inside each of the above referenced tenant spaces, and an up gradient ambient air sample from the roof of the building. Soil gas and air samples will be analyzed by a Washington State accredited laboratory using the techniques and analytical methods described below.

Soil Sampling and Monitoring Well Installation

The objective of this task is to further evaluate soil and groundwater quality on the Site in an effort to more fully define the plume boundaries. We propose to advance four borings using a truck-mounted hollow-stem drill rig. The anticipated boring locations are indicated on Figure 2 and Figure 3. These will include one boring up gradient of the plume, two borings east of the plume, and one boring down gradient of the plume (access to the adjacent property may be necessary). The ultimate boring locations selected will be a function of several factors including, but not limited to, access agreements, subsurface conditions observed in previously completed borings, overhead and/or underground utilities, property access, and drilling equipment accessibility. The maximum estimated depth of the borings is approximately 40 feet below grade surface. The borings will be completed by a Washington State-licensed driller.

Soil samples will be collected from these borings at approximately 5-foot intervals using a SPT split spoon

sampler. Soil will be observed to document subsurface conditions and visual or olfactory indications of contamination. In addition, the samples will be field screened with a photoionization detector (PID) to qualitatively evaluate the presence of volatile organic compounds (VOC) utilizing the "headspace method".

A maximum of eight soil samples will be collected for chemical analysis from each of the four soil borings. Soil samples for the analysis of VOC will be collected in general accordance with EPA Method 5035A. Soil samples will be analyzed by a Washington State accredited laboratory using the techniques and analytical methods described below.

Each boring will be completed with a groundwater monitoring well, designated as MW-9, MW-10, and MW-11, and MW-12. The wells will consist of 10 feet of slotted 2-inch diameter PVC screen mated to solid 2-inch diameter PVC riser to the ground surface. The annular space will be backfilled with clean sand to an elevation approximately two feet above the top of the screened interval, overlain by bentonite chips and a minimum of 2 feet of concrete at the top of the boring. The monitoring well will be completed with a locking plug, dedicated lock and secured with a flush monument plate.

The location and elevation of the new wells relative to the existing wells will be surveyed by a licensed surveyor.

Groundwater Sampling

We propose to sample all twelve wells. Prior to the groundwater sampling event, depth to groundwater from the top of each casing will be measured and recorded. The groundwater monitoring wells will then be purged using low-flow pumping and sampling methods in which flow rates will be maintained at approximately 0.2 to 1.0 liters per minute.

During the purging process, groundwater quality parameters including temperature, electrical conductivity (EC), pH, turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) will be measured at regular intervals using water quality meter. Purging will be considered complete when three consecutive readings for temperature, EC, and pH are observed within 10%. Once purging at a given well has been completed, a groundwater sample will be collected and transferred to appropriate laboratory prepared and supplied containers.

Laboratory Analyses

A maximum of 32 soil samples (a maximum of eight from each of four new borings) and 12 groundwater samples will be collected and preserved for analysis. The samples will be analyzed for volatile organic compounds (VOCs) using EPA Method 8260. Soil gas and air samples will be analyzed for VOCs using EPA Method TO-15.

Report Preparation

After completion of the tasks described above, we will prepare a Remedial Investigation Report documenting the field activities and methodologies and summarizing the subsurface conditions, analytical laboratory results, and conclusions. The Remedial Investigation Report will include:

- A description of the project site, with the locations of the explorations and appropriate surface features shown on a site plan.
- A summary of previous investigations.
- Descriptive logs of the subsurface explorations performed for this study.
- A summary of the subsurface conditions encountered.
- Discussion of site soil, groundwater, soil gas, indoor air, and ambient air conditions based upon the results of the field exploration relative to Washington State cleanup levels defined in the Model Toxics Control Act (WAC 173-340).
- Analytical laboratory test certificates.
- A conceptual site model.
- Recommendations for further investigation as appropriate.

One copy of the draft report will be submitted to the Client in electronic form. Once any comments of the Client are addressed, one PDF and three hardcopies of the final report will be submitted to the Client. Our fees assume one meeting with Ecology to discuss the results of the report.

Task 2. Pilot Studies

Selection of an appropriate remedial alternative at the Site is complicated by an apparently thick layer of contaminated vadose zone soil (the depth to groundwater in the apparent source area ranges up to about 26 feet), the presence of a building overlying the apparent source area, and dense to very dense soils that include gravel and cobbles (potentially limiting the ability of direct-push equipment to inject bioremediation formulations). Technologies that should be evaluated further are enhanced bioremediation for treating groundwater, soil vapor extraction for treating soil, and dual phase extraction for treating both soil and groundwater at the Site. We propose to further evaluate these technologies by completing pilot tests in the field as described below.

Bioremediation Pilot Test

Enhanced reductive dechlorination (ERD) is the practice of adding hydrogen (an electron donor) to groundwater to increase the number and vitality of indigenous microorganisms capable of performing anaerobic bioremediation (reductive dechlorination) on anaerobically biodegradable compounds. Reductive dechlorination is a term used to describe the biologically mediated process by which chlorinated hydrocarbons (such as PCE and TCE) are degraded under anaerobic conditions. During this naturally occurring process, anaerobic microbes (dehalogenators) substitute hydrogen (H) for chlorine (Cl)

on chlorinated contaminant molecules, thus dechlorinating the compound. ERD is not considered to be effective for vadose zone soils, particularly for soils beneath the building.

We propose to evaluate the potential effectiveness of ERD in a three step process. Firstly, we will engage a subcontractor to complete a "clean water injection" test in an existing 2-inch groundwater monitoring well. The test entails injecting potable water under pressure into the formation to evaluate hydraulic conductivity and to estimate radius of influence. If the results are favorable, a second clean water injection test will be completed in a hole advanced using direct-push equipment. The purpose of the second test is to determine if direct-push equipment can reach the target depths (up to about 40 feet below grade) and to estimate the radius of influence of the smaller hole. The results of these tests can be used to access the practicality of injecting bioremediation formulations at the Site.

If injections at the Site appear to be practical, we will follow-up with a bioremediation pilot test using Bio-Trap in-situ microcosms supplied by Microbial Insights. Bio-Trap® samplers are passive sampling tools that collect microbes over time for the purpose of better understanding biodegradation potential. The trap is filled with beads that are an engineered composite of Nomex® and powdered activated carbon. When a Bio-Trap sampler is deployed in a monitoring well, the beads absorb contaminants and nutrients present in the aquifer essentially becoming an in situ microcosm which is readily colonized by subsurface microorganisms. Once recovered from a monitoring well (30-60 days after deployment), DNA, RNA, or phospholipid fatty acids (PLFA) can be extracted from the beads for assays to evaluate the microbial community.

We propose to insert three microcosms into MW-4 (the most contaminated well). These will consist of:

1. A biostimulation unit containing an electron donor, such the Regenesis product HRC.

2. A bioaugmentation unit containing an electron donor and additionally pre-inoculated with *Dehalococcoides*. *Dehalococcoides* is a microbe known to be capable of degrading PCE completely to ethene.

3. A control unit with no electron donor and no biostimulation or bioaugmentation components. The purpose of this microcosm is to measure existing site conditions.

The results of the microcosm study will provide insight into the potential effectiveness of enhanced reduction dechlorination at the Site.

Soil Vapor Extraction/Dual-Phase Extraction Pilot Test

Soil vapor extraction involves extracting soil gas with a vacuum, and dual-phase extraction (DPE) involves extracting contaminated groundwater and soil gas simultaneously, from the same extraction well, both

using a high-vacuum pumping system. The advantage of DPE is that removal of groundwater depresses the water table and exposes the contaminated soil zone. The DPE process both creates a hydraulic barrier to further migration of the contaminants and enhances the effectiveness of soil vapor extraction. The extracted groundwater is typically treated using an air stripper or activated carbon vessels. The effluent vapor is either directly discharged or treated (dependent on contaminant concentrations) using activated carbon or a thermal oxidizer, and then discharged.

We propose to install a 4-inch DPE well to a total depth 40 feet. The well will be used as a vacuum point to test both SVE and DPE. The well will be screened from 5 feet to 40 feet below grade such that the vacuum can be applied to both groundwater and the vadose zone. We anticipate that the DPE well will be installed between MW-3 and MW-4, but the location will not be selected until the soil gas study has been completed. This well can be used as part of the full scale application if the DPE pilot test is successful.

The effectiveness of the DPE pilot test will be evaluated by monitoring the existing the groundwater monitoring wells (to measure vacuum induced groundwater drawdown), and a new (25 foot) vadose zone monitoring well and the dedicated soil gas probes to be installed inside of the building (to measure pressure gradients). In addition, a maximum of three soil gas samples will be collected from the DPE effluent and analyzed using EPA Method TO-15.

Groundwater effluent will be collected in a 2,400-gallon Baker tank and subsequently disposed at an off-site location licensed to accept water contaminated with PCE. Well development water and purge water generated in Task 1 will also be collected in the Baker tank.

We propose to engage the services of PNE Corporation of Longview, Washington to supply the pilot test equipment. PNE will provide a trailer mounted mobile DPE system, including:

- 20-hp Oil-sealed Liquid Ring Pump (28 inches Hg, 200 SCFM, 10 GPM).
- Variable Frequency Drive Controller (eliminates dilution air usage).
- 70 gallon Air/Water Separator (with high efficiency mist eliminator).
- 1-hp Centrifugal Condensate Pump (water transfer to holding tanks or GAC).
- Anemometers, magnehelic gauges, pressure gauges, photo ionization detector (PID), quad gas meters, hoses, well head adapters (1 to 4 inch) and hand tools.

PNE Corporation will be responsible for rigging the pilot test and will assist ZGA in evaluating the data.

Pilot Study Report

The Pilot Study Report will include:

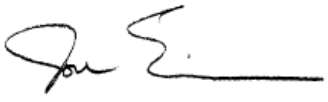
- A description of the project site, with the locations of the explorations and appropriate surface features shown on a site plan.
- Descriptive logs of the subsurface explorations performed for the Pilot Study.
- A summary of the subsurface conditions encountered.
- Analytical laboratory test certificates for DPE effluent.
- An evaluation of the estimated effectiveness of ERB, SVE, DPE at the Site based on the pilot studies. Recommendations for further evaluation, if necessary.

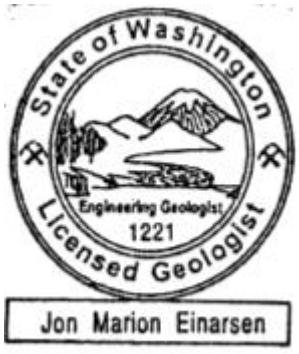
One copy of the draft report will be submitted to the Client in electronic form. Once any comments of the Client are addressed, one PDF and three hardcopies of the final report will be submitted to the Client.

CLOSING

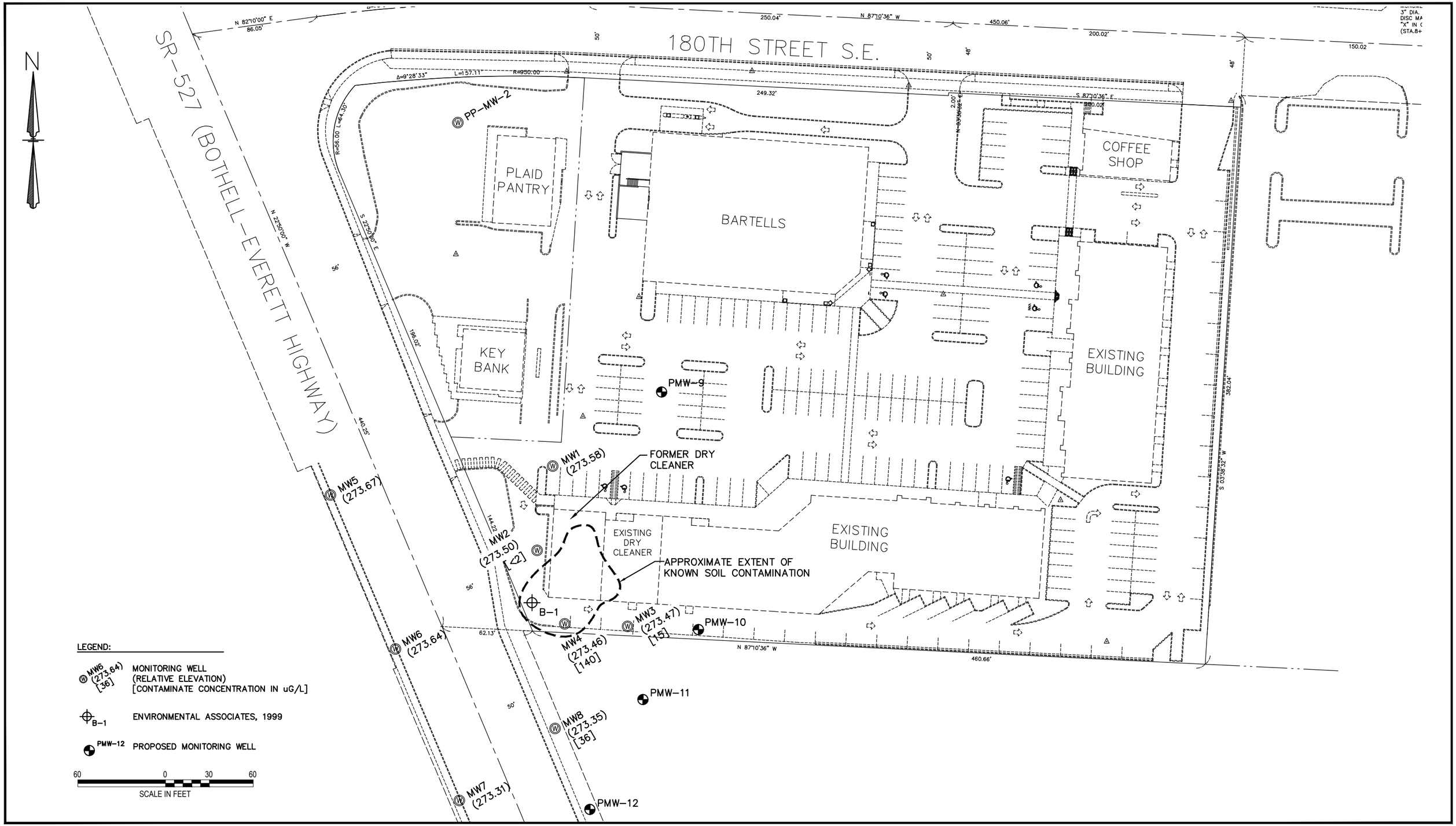
We appreciate the opportunity to provide our services. If you have any questions or comments, please call us at (425) 582-9928.

Sincerely,
Zipper Geo Associates, LLC





Jon Einarsen, L.G.
Principal



SUBMITTAL RECORD			
NO.	DATE	BY	DESCRIPTION

DESIGNED:	JME
DRAWN:	RAR
CHECKED:	JME
SCALE:	AS SHOWN
DATE:	04/24/2013
JOB NO.	1001.24
PLOT DATE:	4/30/13
LAST EDIT:	Base Station

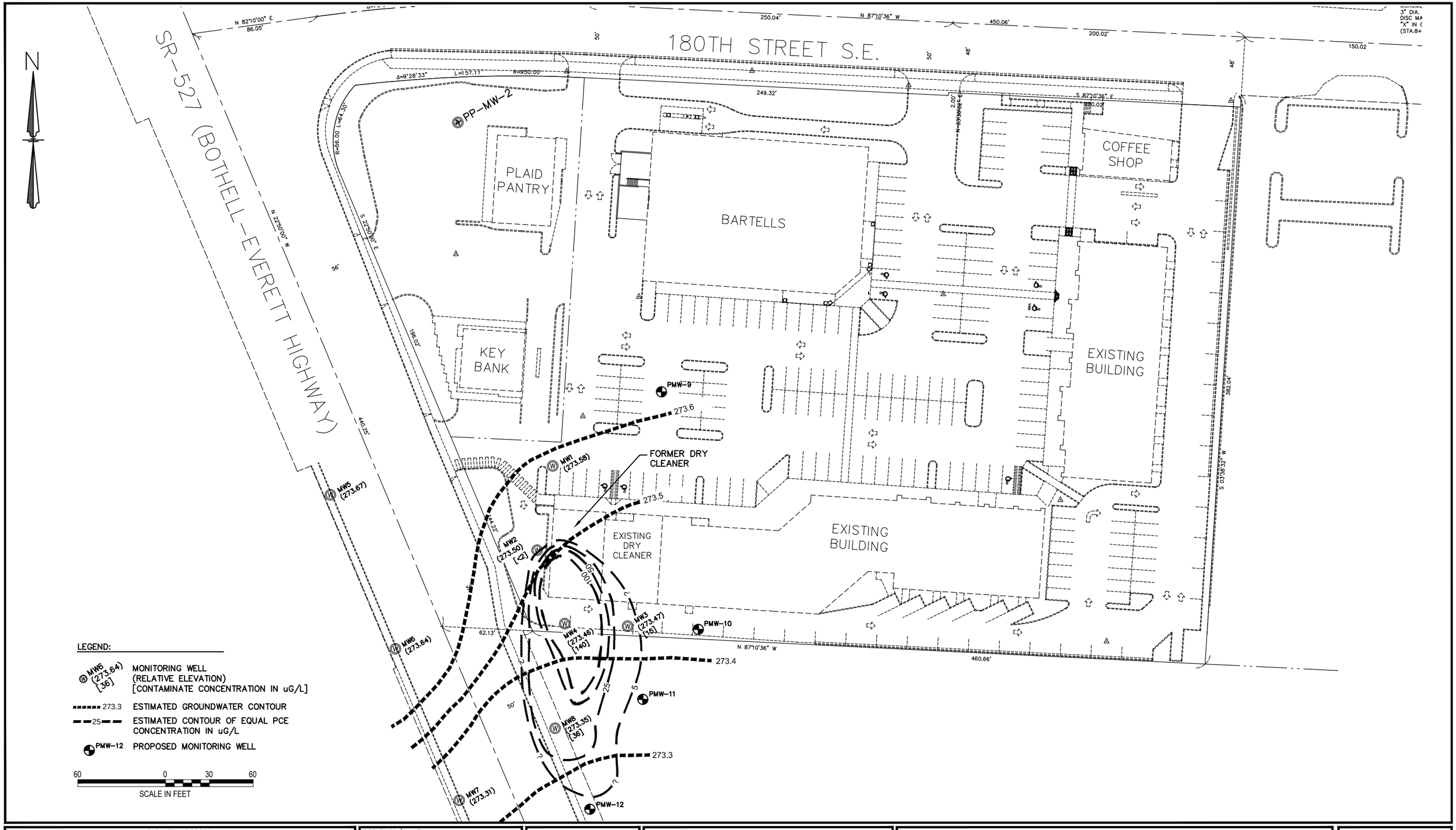
ZGA Zipper Geo Associates, LLC
Geotechnical and Environmental Consultants
19023 36th Avenue West, Suite D | Lynnwood, WA 98036
PH: (425) 582-9928 | Fax: (425) 582-9930 | www.zippergeo.com

MILL CREEK CROSSING
18001 BOTHELL EVERETT HIGHWAY
BOTHELL, WASHINGTON

APPROXIMATE EXTENT OF CONTAMINATED SOIL

DRAWING
FIGURE 2
SHEET 1 OF 2

C:\Users\ZGA\Projects\1001-1050\1001\1001.24 Site Plan (4-10-2013).dwg



SUBMITTAL RECORD			
NO.	DATE	BY	DESCRIPTION

DESIGNED:	JME
DRAWN:	RAR
CHECKED:	JME
SCALE:	AS SHOWN
DATE:	04/24/2013
JOB NO.	1001.24
PLOT DATE:	4/24/13
LAST EDIT:	Base Station

ZGA Zipper Geo Associates, LLC
Geotechnical and Environmental Consultants
19023 36th Avenue West, Suite D | Lynnwood, WA 98036
PH: (425) 582-9928 | Fax: (425) 582-9930 | www.zippergeo.com

MILL CREEK CROSSING
18001 BOTHELL EVERETT HIGHWAY
BOTHELL, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWING
FIGURE 3
SHEET 2 OF 2

C:\Users\ZGA\Projects\1001-1050\1001\1001.24 Site Plan (4-10-2013).dwg

N

MONEY TREE

PRIME CLEANERS

BOTHELL EVERETT HWY

MW1		
DEPTH	PCE	TCE
7 1/2'	ND<1.1	ND<1.1
17 1/2'	ND<1.1	ND<1.1
25'	2.1	ND<1.1
37'	ND<1.3	ND<1.3
41'	ND<1.2	ND<1.2

B13		
DEPTH	PCE	TCE
3 1/2'	16	33

B12		
DEPTH	PCE	TCE
3'	3.8	38

B10		
DEPTH	PCE	TCE
3'	5.2	14
5 1/2'	160	10

B2		
DEPTH	PCE	TCE
3'	1.1	18

MW2		
DEPTH	PCE	TCE
7 1/2'	ND<1.1	ND<1.1
18'	ND<1.0	ND<1.0
23'	ND<1.1	ND<1.1
44'	ND<1.1	ND<1.1
33'	ND<1.0	ND<1.0

B4		
DEPTH	PCE	TCE
2 1/2'	17	29

B8		
DEPTH	PCE	TCE
3'	28	30

B3		
DEPTH	PCE	TCE
2 1/2'	1.9	20

B1		
DEPTH	PCE	TCE
3'	160	38

B5		
DEPTH	PCE	TCE
3'	ND<1.1	24

B11		
DEPTH	PCE	TCE
3'	ND<1.0	ND<1.0

MW3		
DEPTH	PCE	TCE
7 1/2'	4.5	ND<1.2
13'	3.9	ND<1.1
27 1/2'	9.3	ND<1.1
31'	2.3	ND<1.1
37'	ND<1.1	ND<1.1

B9		
DEPTH	PCE	TCE
2 1/2'	110	9.2
5'	4.1	27

B7		
DEPTH	PCE	TCE
3'	15	22

B6		
DEPTH	PCE	TCE
3'	12	15

LEGEND:

- DIRECT PUSH SOIL EXPLORATIONS
- **MW1** MONITORING WELL NUMBER AND APPROXIMATE LOCATION
- **MW4** WELL INSTALLED BY OTHERS

ANALYTICAL RESULTS REPORTED IN ug/kg

20 0 5 10 20
SCALE IN FEET

Project Mngr:	JME
Drawn By:	JD
Checked By:	JME
Approved By:	JME
Project No.	81097016
Scale:	AS SHOWN
File No.	Fig4.DWG
Date:	July, 2009

Terracon
Consulting Engineers and Scientists
21905 64th Avenue W., Ste 100 Mountlake Terrace, WA 98043
PH. (425) 771-3304 FAX. (425) 771-3549

SOIL ANALYTICAL RESULTS

Limited Subsurface Investigation Marketplace Retail Center
Bothell, Snohomish County, Washington
Prepared for: Mill Creek Crossing LLC

FIG. No. 5