Final

Sampling and Analysis Plan/ Quality Assurance Project Plan for Groundwater Monitoring at CMG Properties in Sunnyside, Washington

Prepared for:

State of Washington Department of Ecology

Toxics Cleanup Program

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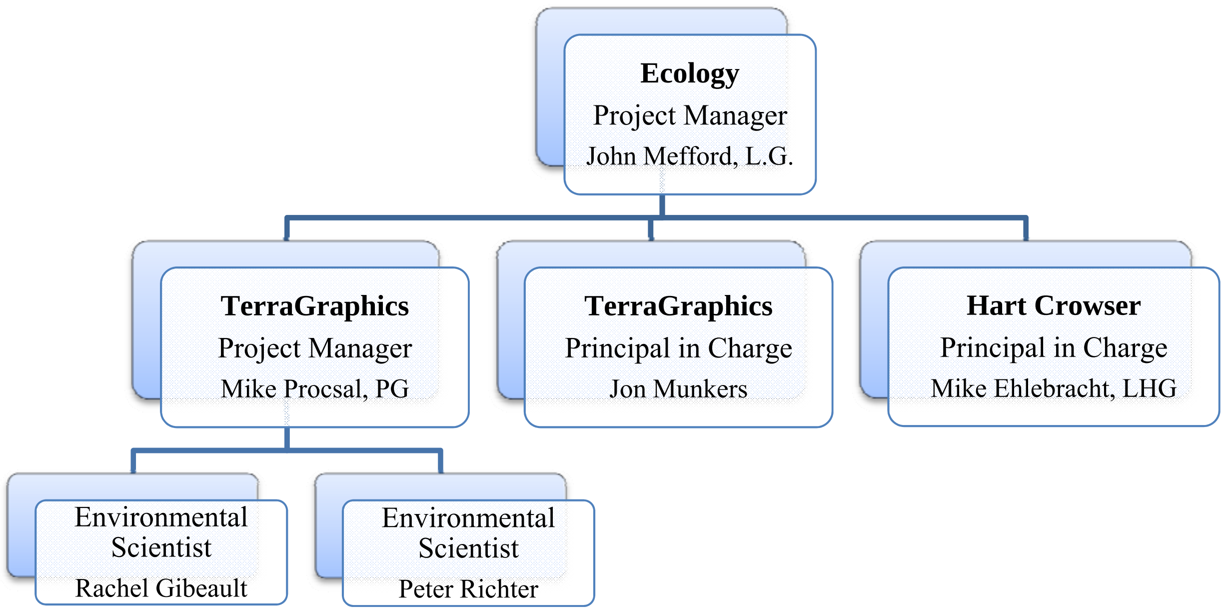
Acronyms and Abbreviations

µg/L	micrograms per liter
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEXN	benzene, toluene, ethylbenzene, total xylenes, and naphthalene
CFR	Code of Federal Regulations
DO	dissolved oxygen
DQO	Data Quality Objective
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
HCl	hydrochloric acid
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MTCA	Model Toxics Control Act
mV	millivolt
ORP	oxidation/reduction potential
PCOC	potential contaminant of concern
PID	photo-ionization detector
PVC	poly vinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SEC	specific electrical conductance
TerraGraphics	TerraGraphics Environmental Engineering, Inc.
TPH-Dx	Total Petroleum Hydrocarbons-Diesel and Oil Range Organics
TPH-Gx	Total Petroleum Hydrocarbons-Gasoline Range Organics
TPH-HCID	Total Petroleum Hydrocarbons-Hydrocarbon Identification
USEPA	US Environmental Protection Agency
UST	underground storage tank

WAC	Washington Administrative Code

Section 1.0 Project Management

1.1 Project/Task Organization



1.2 Problem Definition and Background

These site assessment activities are being conducted as part of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program. The primary goal is to conduct quarterly groundwater monitoring to evaluate natural attenuation and compare results to Washington's Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340) Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900). The following document outlines an explanation of the site problem and history, project schedules, data quality objectives, sampling, oversight, and data validation and use.

CMG Properties (hereinafter, referred to as "the site") is located at 502 North Avenue, Sunnyside, Washington (Figure 1). In April 2006, a 1,100-gallon leaking underground storage tank (UST) was removed from the site. The UST site assessment revealed concentrations of gasoline and benzene, ethyl benzene, toluene, and total xylenes (BTEX) exceeding MTCA Method A unrestricted soil cleanup levels (Table 740-1, WAC 173-340-900). In June 2006, a remedial investigation was conducted to further define the extent of petroleum contamination caused by the release. During that investigation, a drywell was encountered at the northeast portion of the excavation. Groundwater samples were not obtained during the tank removal, nor during the June 2006 investigation, but at approximately 8.5 feet below ground surface (bgs) the soil was observed to be very moist. The excavation was backfilled with soil removed from the pit during investigation activities.

TerraGraphics Environmental Engineering Inc. (TerraGraphics) and Hart Crowser completed an environmental assessment at the site in December 2011. Soil sampling data collected as part of this work indicated that gasoline-range hydrocarbons and BTEX compounds exceeded MTCA

Method A unrestricted cleanup levels in only one of the six borings at the site. The extent of soil petroleum contamination identified in 2011 appeared to be limited and did not significantly impact site groundwater quality.

Three groundwater monitoring wells (MW-1, MW-2, and MW-3) were also installed as part of the 2011 assessment. Diesel- and oil-range hydrocarbons and lead exceeded MTCA Method A Groundwater Cleanup Levels in wells MW-1 and MW-3, respectively. However, these exceedances may have been due to elevated turbidity and the presence of natural organics. Recommendations provided in the Environmental Site Assessment Report (TerraGraphics 2012) included conducting quarterly groundwater monitoring for one year using procedures to minimize turbidity and interference from natural organics.

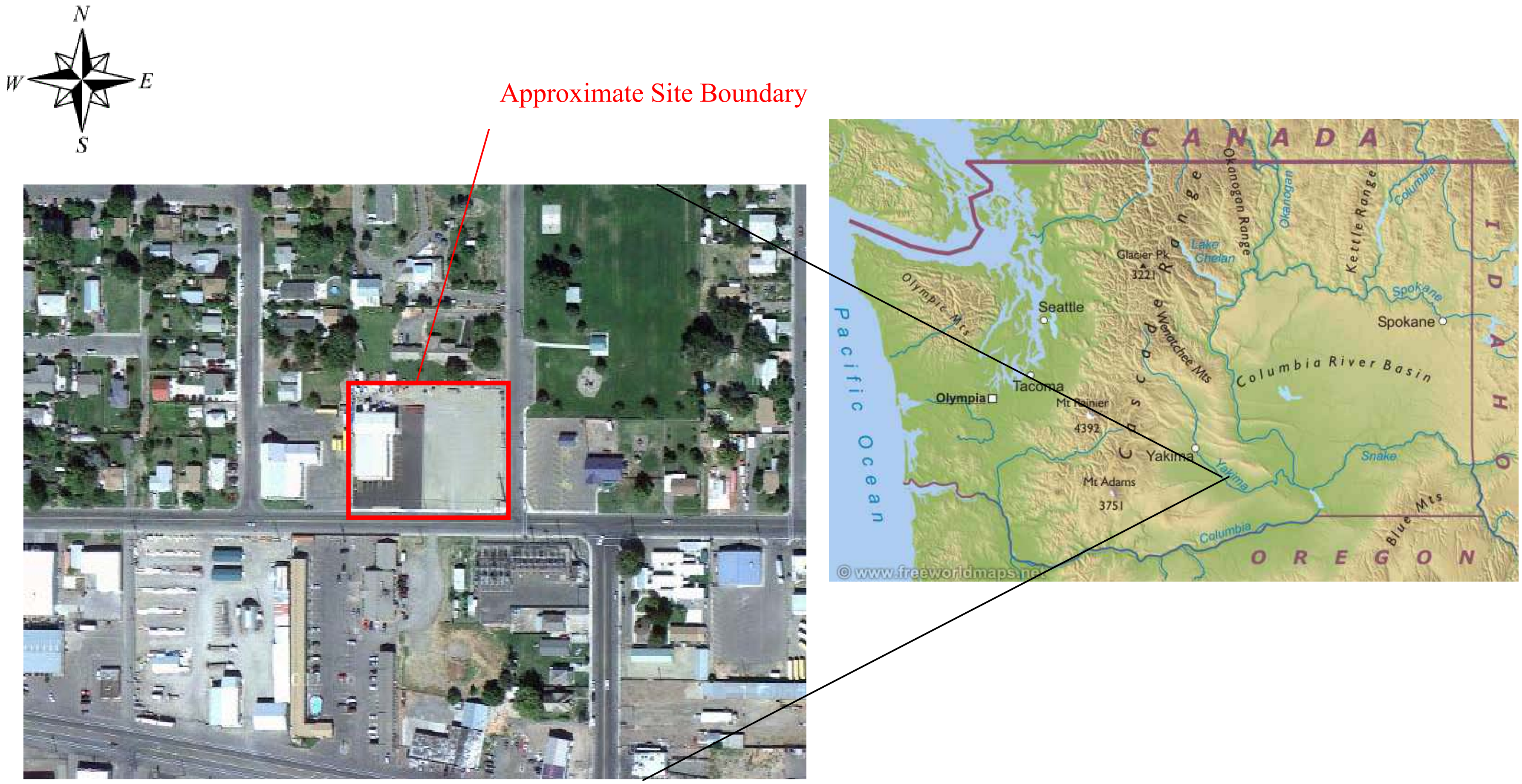
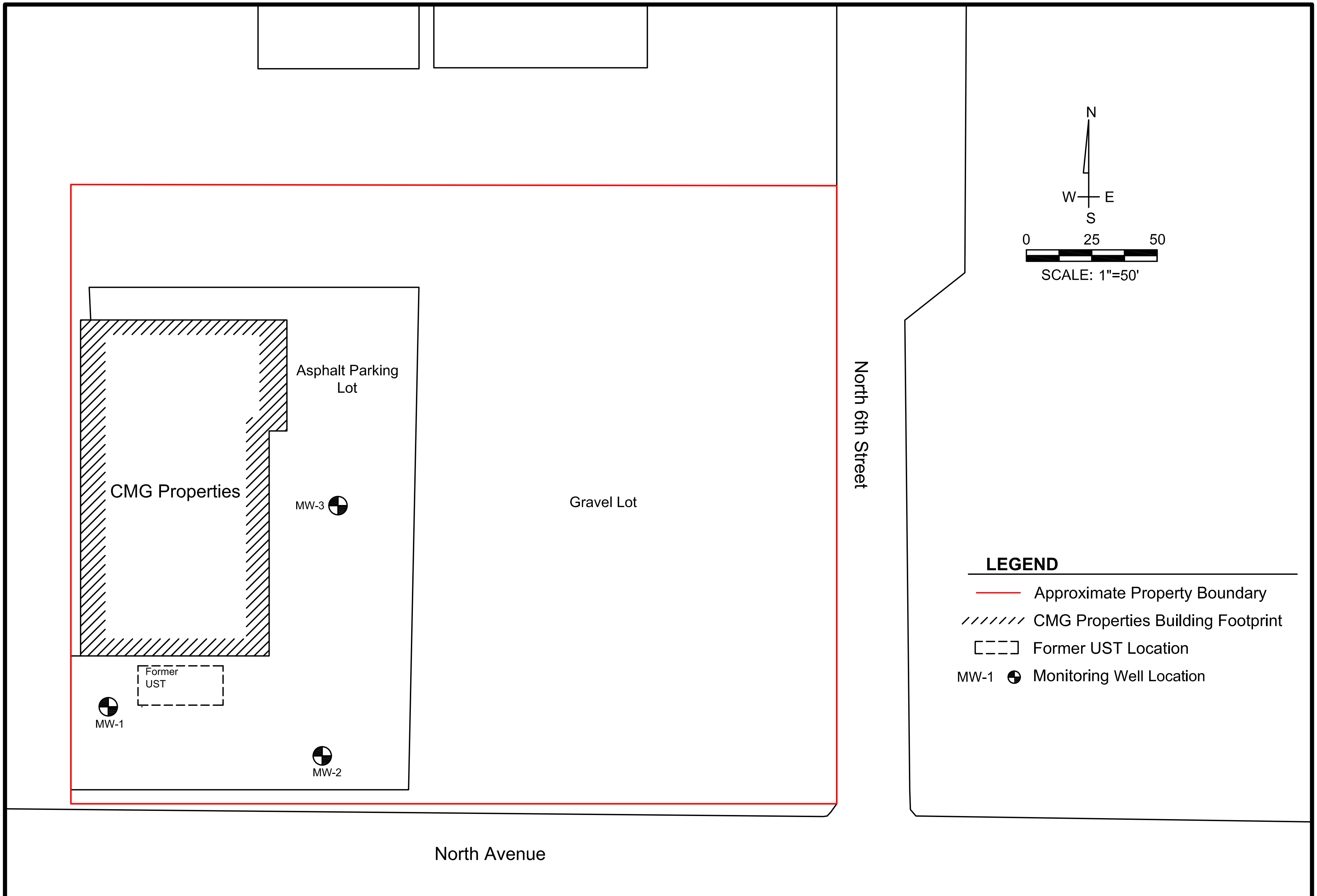


Image courtesy of Google Maps

Project No. 14030	TerraGraphics Environmental Engineering, Inc.	**CMG Properties** **502 North Avenue** **Sunnyside, Washington**	Date: 04/08/2014
Scale: not to scale		**Figure 1. Site Location**	
Requestor: M. Procsal			
Drafter: M. Studer			



TerraGraphics Environmental Engineering, Inc.

DRAWN BY: M. STUDER	PROJECT NO: 14030	PROJECT NAME: CMG PROPERTIES 502 NORTH AVENUE SUNNYSIDE, WA	FIGURE 2	SITE LAYOUT WITH SAMPLE LOCATIONS
PROJECT MANAGER: M. PROCSAL	DATE: 04/8/2014			

1.3 Project/Task Description

Figure 2 illustrates the approximate sample locations and Table 1 outlines the analytical methods for the samples.

Table 1. Techniques, Method Number, and Reporting Limits for Site Analyses

Analyte	Method	Reporting Limit
Water (µg/L)		
BTEX	USEPA 8260B	1.0 – 2.0
Naphthalene	USEPA 8260B	0.4
TPH-Gx	NWTPH-Gx	50.0
TPH-Dx (silica gel cleanup method)	NWTPH-Dx	125.0
TPH-Dx (standard)	NWTPH-Dx	250.0
TPH-HCID Gx	NWTPH-HCID Gx	100.0
TPH-HCID Dx	NWTPH-HCID Dx	250.0
Lead (Total and dissolved)	USEPA 200.8/6020	2.0
Natural Attenuation Parameters:		
Nitrate	USEPA 300.0/ 9056	900
Manganese	USEPA 200.7/6010 USEPA 200.8/6020	0.4
Ferrous Iron	Field Test	200
Sulfate	USEPA 300.0/9056	1,200
Alkalinity	USEPA 310.1/2320B	5,000
TSS	2540D	2,000

1.3.1 Utility Locates

The one call agency (Utility Notification Center) will be notified at least five days prior to groundwater monitoring well monument repair activities. The utilities will be marked by the appropriate utility company at locations where the underground lines enter the property.

1.3.2 Groundwater Sampling

Four groundwater samples (MW-1, MW-2, MW-3, and one duplicate) will be analyzed in sampling Events 1, 2, and 3 for benzene, toluene, ethylbenzene, total xylenes, and naphthalene (BTEXN), by US Environmental Protection Agency (USEPA) Method 8260B (USEPA 1996) ; for Total Petroleum Hydrocarbons-Gasoline Range Organics (TPH-Gx),Total Petroleum Hydrocarbons-Diesel and Oil Range Organics (TPH-Dx) using both silica gel and standard cleanup, and Total Petroleum Hydrocarbons-Hydrocarbon Identification (TPH-HCID) by Ecology’s Analytical Methods for Petroleum Hydrocarbons (Ecology 1997); for natural attenuation parameters (including nitrates, manganese, ferrous iron, sulfate, and alkalinity) by

USEPA Methods 300.0/9056 (USEPA 1993), 200.7/6010 (USEPA 1994a), 200.8/6020 (USEPA 1994b), and 310.1/2320B (USEPA 1978); for Total Suspended Solids (TSS) using Standard Method 2540D (1997); and for lead (both total and dissolved) using USEPA Method 200.8/6020 (USEPA 1994b) (Table 1).

1.3.3 Groundwater Monitoring Well Monument Repair

All three monitoring well monuments will be replaced to protect the integrity of the wells. The well monuments will be reconstructed with traffic grade monuments to withstand heavy traffic and snow removal. A handheld electric jackhammer (Bosch) will be used to remove the existing concrete from each well monument. The well plug will be tightened and secured to prevent debris from entering the well. The surrounding asphalt will be cut in a 1.5-foot by 1.5-foot square and soil will be excavated to approximately 1.5 feet bgs. The monuments will be replaced and set in concrete as a flush mount to the ground. Details of the procedure, including photographs, will be included in the data summary memo following groundwater sampling Event 1.

In the event that the 2 inch poly vinyl chloride (PVC) well casing is damaged during repair activities the damaged section will be replaced using a 2 inch slip union and a new 2 inch riser. The area will be excavated to at least 6 inches below the elevation where the casing is comprised. The casing will be cut off at an elevation below that of the comprised casing using an internal plastic pipe cutter (Wheeler Rex). A 2 inch PVC slip union 2 inch PVC riser will be secured to well. The well will be re-surveyed by a licensed surveyor and tied into the NAVD88 system.

1.3.4 Investigation-Derived Waste

Investigation derived waste will be collected in 55-gallon drums and stored on site for disposal depending on analytical results. All investigation derived waste will be removed within approximately 4 weeks following each sampling event. Approximately one drum of water per sampling event is expected.

1.4 Data Quality Objectives

Consideration of data quality begins with the identification of data uses and data types. The USEPA Data Quality Objective (DQO) process used as a model for this project is described in *USEPA Guidance on Systematic Planning Using the Data Quality Objectives Process, USEPA QA/G-4* (USEPA 2006). The following sections and Figure 3 outline the general processes for any environmental investigation.

1.4.1 State the Problem

1.4.1.1 Description of the Environmental Problem

The purpose of this assessment is to conduct quarterly groundwater monitoring for evaluation of natural attenuation and to minimize the effects of potential biogenic interference by minimizing turbidity and utilizing both silica gel and standard cleanup analytical methods for the TPH-Dx extended analyses. Results will be compared to MTCA Method A Groundwater Cleanup Levels.

In April 2006, a 1,100-gallon leaking UST was removed from the site. The UST site assessment revealed concentrations of gasoline and BTEX exceeding MTCA Method A unrestricted soil cleanup levels (Table 740-1, WAC 173-340-900). In June 2006, a remedial investigation was conducted to further define the extent of petroleum contamination caused by the release. During that investigation, a drywell was encountered at the northeast portion of the excavation. The excavation was backfilled with soil removed from the pit during investigation activities.

TerraGraphics and Hart Crowser completed an environmental assessment at the site in December 2011. Soil sampling data collected as part of this work indicated that gasoline-range hydrocarbons and BTEX compounds exceeded MTCA Method A unrestricted cleanup levels in only one of the six borings at the site. Detected concentrations (expressed in milligrams per kilogram [mg/kg]) above the cleanup levels listed below:

- BH-3 5 ft
  - benzene = 0.41 mg/kg, Cleanup Level = 0.03 mg/kg.
  - total xylenes = 18.8 mg/kg, Cleanup Level = 9 mg/kg.
  - gasoline range organics = 370 mg/kg, Cleanup Level = 30 mg/kg.
- BH-3 12 ft
  - benzene = 0.046 mg/kg, Cleanup Level = 0.03 mg/kg.

The extent of soil petroleum contamination identified in 2011 appeared to be limited and did not significantly impact site groundwater quality.

Three groundwater monitoring wells (MW-1, MW-2, and MW-3) were installed as part of the 2011 site assessment. A total of three water samples plus one duplicate were collected from the monitoring wells on December 16, 2011. At least one of the analytes detected in two of the three water samples were above the respective Method A Cleanup Levels. Detected concentrations (expressed in micrograms per liter [µg/L]) above the screening levels are listed below:

- MW-1
  - diesel range organics = 530 µg/L, Cleanup Level = 500 µg/L.
  - motor oil = 910 µg/L, Cleanup Level = 500 µg/L.
- MW-3 (duplicate listed)
  - lead = 22 µg/L, Cleanup Level = 15 µg/L.

Based on the available information and site-specific data collected in 2011, TerraGraphics recommended the following:

- Monitor groundwater to evaluate concentrations over time for four quarters:
  - Reduce potential impacts caused by natural organics by minimizing turbidity and utilizing silica gel cleanup for NWTPH-D extended analyses.
  - Analyze samples for both total and dissolved (filtered) lead to determine if the concentrations exceed the MTCA Method A Groundwater Cleanup Level.
  - Utilize a multiparameter flow cell to more accurately characterize the groundwater field parameters.
  - Depending on analytical results implement semi-annual monitoring thereafter until concentrations have degraded to below cleanup levels.
- Implement an institutional control to ensure the long-term maintenance of the physical barriers that prevent exposure to soil contamination.

The work described in this Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) will fulfill Ecology's request for additional monitoring activities at the Site with the primary goal of seeking site closure through natural attenuation as a remedial action.

1.4.1.2 Planning Team Members

The planning team includes:

- Washington State Department of Ecology:
    - Mary Monahan – Project Manager
- Hart Crowser, Inc.
    - Mike Ehlebracht – Principal in Charge
- TerraGraphics Environmental Engineering, Inc.
    - Jon Munkers – Principal in Charge
    - Mike Procsal – Project Manager

TerraGraphics and Hart Crowser staff will review technical issues. Mike Procsal and Mike Ehlebracht will make recommendations, based on the technical review, to Ecology, which Mary Monahan will evaluate prior to making a final decision.

Figure 3. Data Quality Object Flow Chart

1. State the Problem – *Determine the natural attenuation of groundwater contamination through quarterly monitoring events.*

2. Identify the Decision – *Do concentrations exceed MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900)?*

3. Identify Inputs to the Decision – *Groundwater concentrations.*

4. Define the Study Boundaries – *Groundwater from a 67,082 square foot site.*

5. Develop a Decision Rule –*Groundwater concentrations for each sample will be compared against Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900).*

6. Specify Limits on Decision Errors – *Reporting limits will meet the DQOs for comparison to the MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900).*

7. Optimize the Design for Obtaining Data – *Samples will be collected to provide data.*

1.4.1.3 Resources and Relevant Deadlines

This project is funded through Ecology's Toxics Cleanup Program. The field work for this project is scoped to start in June 2014 with quarterly monitoring events in June 2014, September 2014, and December 2014. A final report will be completed by January 2015.

1.4.2 Identify the Decision

Samples will be collected during each sampling event at MW-1, MW-2, and MW-3 identified in Figure 2. The samples will be collected for those analytes shown in Table 1. Concentrations will be compared to MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900). Natural attenuation parameters will be collected at all monitoring wells. Geochemical trends in these parameters will be used to establish whether natural attenuation is an acceptable remediation approach.

1.4.3 Identify Information Inputs

1.4.3.1 Information Needed

In order to adequately evaluate potential impacts to the site, analyses of groundwater sampling are needed. The chemical and physical characteristics needed to adequately provide information for decisions on potential contaminants of concern (PCOCs) are provided in this SAP/QAPP (Section 1.3). Specifics on those methodologies and relevant measurement characteristics can be found in Section 2.0.

1.4.3.2 Identify the Action Level

Site groundwater collected during the environmental sampling events will be compared to MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900).

1.4.3.3 Sampling and Analysis Methods

Sampling and analysis methods will follow the USEPA, Ecology, and American Society for Testing and Materials (ASTM) methods. These methods can be found in Section 1.3 and Table 1.

1.4.4 Define the Boundaries of the Study

1.4.4.1 Define the Target Population

The target population for this project is the groundwater from MW-1, MW-2, and MW-3 (Figure 2).

1.4.4.2 Spatial Boundaries

The site is approximately 67, 082 square feet (Yakima County GIS: Land Information Portal) (Figure 2). The sample numbers, locations, and analyses for each subset are discussed in Section 2.0.

1.4.4.3 Time Frame

Sampling will take approximately one day for each Event and will occur in June 2014 for Event 1, September 2014 for Event 2, and December 2014 for Event 3. Table 2 indicates a project timeline and Table 3 provides holding times for the various types of samples and analyses.

Table 2. Project Schedule Timeline

Activity	Anticipated Date of Initiation	Anticipated Date of Completion	Deliverable and Due Date
SAP/QAPP	April 2014	May 2014	May 2014
Field Work	June 2014	June 2014 – Event 1 September 2014 – Event 2 December 2014 – Event 3	
Report	July 2014 – Event 1 October 2014 – Event 2 January 2015 – Event 3	3 weeks post Sampling Event	4 weeks post Sampling Event

1.4.4.4 Practical Constraints

The possible constraints for sample collection are inclement weather and proximity to underground and above ground utilities. These constraints are not expected to influence the data collection as the work is slated to occur before any severe weather, and as the utility locations have been outlined.

1.4.4.5 Reporting Limits

Reporting limits for the PCOCs described in Section 1.3 are shown in Table 1. Laboratory reporting limits for the ground water should be equal to or lower than the screening level concentrations listed in MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900) (Appendix A).

1.4.5 Develop a Decision Rule

1.4.5.1 Action Levels

Each groundwater sample will be evaluated individually. Concentrations will be compared to MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900).

1.4.5.2 Decision Rule

If the groundwater data results for Events 1, 2 and 3 are above MTCA Method A Groundwater Cleanup Levels (Table 720-1, WAC 173-340-900), then further assessment of the site conditions or remediation may be warranted to limit the risk to human health and the environment. If concentrations show a decreasing trend and geochemical trends show that natural attenuation is occurring, then additional remediation efforts may not be warranted.

1.4.6 Specify Performance or Acceptance Criteria

In order to ensure that the quality of data is acceptable for use, Section 3.0 outlines all the specified tolerable limits and decision errors for the data obtained during this project.

1.4.7 Optimize the Design for Obtaining Data

Section 3.0 discusses the methods for optimizing the design and obtaining useable data.

1.5 Special Training/Certification

Those individuals who will be collecting samples will have a 40-hour hazardous waste training certification as defined by the Code of Federal Regulations (CFR) Title 29 Sample Number 1920.120: Hazardous Waste Operations and Emergency Response.

1.6 Documents and Records

1.6.1 Field Operation Records

1.6.1.1 Sample Collection Records

A bound *Rite-in-the-Rain®* field notebook will be used in the field to document the samplers' names, sample numbers, sample times, collection points, maps and diagrams, equipment/method used for sample collection, weather conditions, and unusual observations. Field notebooks will be pre-numbered and will contain the date and signature lines. Copies of field notes will be provided in reports to Ecology.

1.6.1.2 Chain-of-Custody Records

The chain-of-custody record will be filled out and kept to track samples from collection through delivery to the laboratory following ASTM D 4840-99, *Standard Guide for Sampling Chain-of-Custody Procedures* (ASTM 2004).

1.6.1.3 Quality Assurance/Quality Control Sample Records

Quality Assurance (QA)/Quality Control (QC) samples (i.e., field blanks and field duplicates) will be documented in the field notebook. This documentation will include custody seals, calibration history, level of standards, and the frequency and type of the QA/QC sample.

1.6.1.4 General Field Procedures

The field procedures will be documented in the field notebook and will specify the method of collection (i.e., bailer, low-flow peristaltic pump), location, and other potential areas of difficulty in the actual gathering of the samples.

1.6.1.5 Corrective Action Reports

Should the primary method of sample collection fail, the corrective action or alternative method will be documented in the field notebook and reported in the subsequent data summary report.

1.6.2 Laboratory Records

1.6.2.1 Sample Data

Laboratory QA/QC will follow the USEPA guidance *Contract Laboratory Program Statement of Work for Inorganic Superfund Methods (Multi-Media, Multi-Concentration) ISM01.2* (USEPA 2010) and *Contract Laboratory Program Statement of Work for Organics Analysis Multi-Media, Multi-Concentration SOM01.2* (USEPA 2007), which includes the recording of the times that samples were analyzed to verify holding times were met. The overall number of samples, sample location information, and date will be reported as well as any corrective action procedures for samples violating the work plan protocol.

1.6.2.2 Sample Management Records

The laboratory will provide original sample analysis documentation to TerraGraphics. After a technical data review, the data will be added to the Ecology Environmental Information Management (EIM) database website (<http://www.ecy.wa.gov/eim/index.htm>), where it will be archived according to any state or federal records retention policies.

1.6.2.3 Test Methods

The test methods used will be those identified as appropriate for inorganic and organic analysis. Should an alternative analysis be required, the laboratory will document and describe how the analyses were carried out in the laboratory. This will include sample preparation and analysis, instrument standardization, detection and reporting limits, and test-specific QC criteria.

1.6.2.4 Quality Assurance/Quality Control Reports

Laboratory QA/QC will follow the USEPA guidance *Contract Laboratory Program Statement of Work for Inorganic Superfund Methods (Multi-Media, Multi-Concentration) ISM01.2* (USEPA 2010) and *Contract Laboratory Program Statement of Work for Organics Analysis Multi-Media, Multi-Concentration SOM01.2* (USEPA 2007). The report will include blanks, spikes and matrix spike duplicates, and duplicates. TerraGraphics will complete an internal QA/QC to ensure the quality of the data.

1.6.3 Data Handling Records

The laboratory's QA personnel will perform the data validation. The data validation will convert raw data into reportable quantities and units by the proper use of significant figures, recording extreme values, and identification of any data qualifiers. The data will then be transmitted electronically in Microsoft Excel© to TerraGraphics which will perform an internal QA/QC, and make the data available for use in any necessary risk analysis.

Section 2.0 Measuring Data Acquisition

2.1 Sampling Process Design and Sampling Methods

Table 3. Recommended Bottle Type, Preservation, and Holding Times for Samples

Analysis	Bottle Type	Preservation	Holding Times
Water			
BTEXN	(3) 40-mL VOA Vial	HCl Acid pH <2 Ice to 4°C	14 Days
TPH-Gx	(3) 40-mL VOA Vial	HCl Acid pH <2 Ice to 4°C	14 Days
TPH-Dx – Motor Oil	(1) 1-liter amber glass container	HCl Acid pH <2 Ice to 4°C	14 Days before extraction
TPH-Dx (silica gel cleanup method)	(1) 1-liter amber glass container	HCl Acid pH <2 Ice to 4°C	14 Days before extraction
TPH-HCID	(1) 1-liter amber glass container	HCl Acid pH <2 Ice to 4°C	14 Days before extraction
Total Lead	(1) 500 mL HDPE	HNO_3 to pH<2	6 Months
Dissolved Lead	(1) 500 mL HDPE field filtered	HNO_3 to pH<2	6 Months
Natural Attenuation Parameters:			
Nitrate	(1) 100 mL HDPE	Ice to 4°C	48 Hours
Manganese	(1) 100 mL HDPE	HNO_3 to pH<2	6 Months
Ferrous Iron	Field Test	-	-
Sulfate	(1) 200 mL HDPE	Ice to 4°C	28 Days
Alkalinity	(1) 150 mL HDPE	Ice to 4°C	14 Days
TSS	(1) 50 mL HDPE	Ice to 4°C	7 Days

2.1.1 Groundwater Sampling

The groundwater monitoring wells will be developed and sampled using ASTM D-4448-01, *Standard Guide for Sampling Ground-Water Monitoring Wells* (ASTM 2007). Prior to collecting groundwater samples, wells will be purged using a peristaltic pump until water quality parameters have stabilized. Water quality parameters will be measured in the field utilizing a flow through cell. Parameters will be: temperature, pH, dissolved oxygen (DO), oxidation/reduction potential (ORP), and specific electrical conductance (SEC), (Table 4). Field parameters are primarily used to determine stability of recharge of the well and to ensure a groundwater sample is representative of the formation. Purge water will be containerized and stored on-site, then disposed of at an appropriate facility once characterized. Disposable single use ⅜-inch Teflon® lined tubing will be inserted into the screened interval. Water samples will be collected employing a low flow peristaltic pump. New peristaltic tubing will be used to collect water from each screen deployment. Samples being analyzed for volatile organic compounds will be preserved with hydrochloric acid (HCl). All samples will be placed in a cooler containing double-bagged ice (refrigerated) immediately after collection, cooled to 4°C, and held under chain-of-custody for shipment. Recommended bottle types and preservatives for each PCOC are listed in Table 3, although the laboratory generally determines the types and sizes of bottles to be used.

Table 4. Stabilization Criteria with References for Water-Quality-Indicator Parameters

Parameter	Stabilization Criteria	Reference
temperature	± 0.2°C	Wilde, 2008
pH	± 0.1	Puls and Barcelona, 1996; Wilde, 2008
DO	± 10% or ± 0.2 mg/L	Puls and Barcelona, 1996; Wilde, 2008
ORP	± 5 mV	Wilde, 2008
SEC	± 3%	Puls and Barcelona, 1996

Notes:

In general, the order of stabilization is pH, temperature, and SEC, followed by ORP, and DO.

2.2 Analytical Methods Requirements

The analytical methods and requirements will follow the USEPA methods shown in Table 1. The reporting limits are also shown in Table 1 for each analyte. Laboratory reporting limits for the groundwater should be equal to or lower than the screening level concentrations listed in Tables 720-1 of MTCA Method A Groundwater Cleanup Levels (WAC 173-340-900) (Appendix A).

Samples will be prepared and preserved appropriately as shown in Table 3.

2.3 Quality Control Requirements

2.3.1 Field Quality Control Requirements

The QC samples will consist of one water duplicate collected and submitted blind to the laboratory. A summary of QC checks for both field and laboratory is provided in Table 5.

Table 5. Project Quality Control Checks

Quality Control Check	Frequency	Total Number

Spikes		
matrix spike	1:Batch	1
matrix spike duplicate	1:Batch	1
Duplicates		
field duplicate	1:Matrix	1 per event
Blanks		
method blank	1:Batch	1 per event

2.3.2 Laboratory Quality Control Requirements

The laboratory QC requirements will follow the guidance outlined in the *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Data Review* (USEPA: OSRTI 2008) and the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (USEPA: OSRTI, 2010). The laboratory QC will include appropriate duplicates, laboratory control samples, matrix spikes/duplicates, method blanks, reporting limits, holding times, dilutions, etc. as outlined in the guidance document (Table 5).

2.4 Instrument/Equipment Calibration and Frequency

Laboratory instrument calibration and frequency will follow the guidance outlined in the *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Data Review* (USEPA: OSRTI 2008) and the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (USEPA: OSRTI 2010).

Field instruments (e.g., pH meters, thermometers, photo-ionization detector [PID], etc.) will be calibrated each morning prior to sample collection, and their calibration confirmation will be documented in the field notebook.

2.5 Data Management

2.5.1 Data Validation

The data validation will use *USEPA Guidance on Environmental Data Verification and Data Validation, USEPA QA/G-8* (USEPA 2002) that contains the details on what technical data review criteria such as Precision, Bias, Accuracy, Representativeness, Comparability, and Completeness. Specifics on each criterion are discussed in Section 4.0.

2.5.2 Data Recording

TerraGraphics will receive the data from the laboratory and pass it through internal data validation, after which an electronic spreadsheet will be developed. The hard copy data may contain professional judgment changes compared to the preliminary electronic spreadsheet data. TerraGraphics will then compare the electronic version of the data to the validated hard copies and make any necessary changes. In addition, the data will be submitted to the Ecology EIM database website.

2.5.3 Data Transformation

The raw data will be available for third party data transformation.

2.5.4 Data Transmittal

Either Microsoft Excel© or Microsoft Access© will be used for the transmittal and tracking of data.

2.5.5 Data Reduction

No data reduction will be completed as part of this project. Third parties may reduce the data in the future for analysis and modeling.

2.5.6 Data Analysis

For this SAP/QAPP, the analytical data will be subjected to basic graphical and spatial correlation analysis to determine if petroleum concentrations are decreasing at the site and if natural attenuation is occurring. Natural attenuation parameters will be evaluated based on increasing or decreasing trends in order to qualitatively determine if geochemical reactions are indicating biological activity. The geochemical parameters selected for groundwater monitoring at this site are based upon the sequential use of terminal electron acceptors (TEAs). In general as microorganisms consume petroleum contaminants in the hydrocarbon plume TEAs and their sequence of use are: DO, nitrate, manganese, ferric iron, sulfate, and carbon.

2.5.7 Data Tracking

This project will use Microsoft Excel© or Microsoft Access© to track sample numbers and forms.

2.5.8 Data Storage and Retrieval

The data will be stored in electronic form as a Microsoft Excel© or Microsoft Access© document. In addition, hard copies and electronic copies will be filed with Ecology and TerraGraphics. The data will also be submitted to the Ecology EIM database website.

Section 3.0 Assessment and Oversight

3.1 Assessment and Response Actions

3.1.1 Readiness Review

A readiness review will take place prior to mobilization to the job site. A checklist of supplies, logistics, and other relevant issues will be reviewed and problems will be identified with time for correction prior to the sampling event.

3.1.2 Surveillance

Mike Procsal will be aware of the status and progress of the current sampling event and it will be his responsibility that all specified requirements are being fulfilled as outlined in this SAP/QAPP.

3.1.3 Technical Systems Audits

A technical systems audit is not scheduled for this project.

3.1.4 Performance Evaluation Audits

Performance evaluation audits are not scheduled for this project.

3.1.5 Audit of Data Quality

The data will undergo internal QA/QC, from which an internal memorandum will be generated to identify any data quality problems. The memo will be submitted to Mike Procsal who will make decisions with regard to modification and/or correction of any identified problems.

3.1.6 Peer Review

An internal peer review will be completed at TerraGraphics on all data sets, memoranda, and reports.

3.2 Reports to Management

The data from the sampling event will be made available in raw form to Ecology. A data summary memorandum, including field notes, will be prepared and delivered to Ecology electronically for Events 1 and 2. A comprehensive groundwater sampling report will be prepared for Event 3 following the receipt of analytical results that summarize the findings from the previous sampling events. The first event memo will include documentation of the monitoring well monument repairs, including photographs and a detailed description of the procedure. Aside from the electronic copy, two hard copies of each memo will also be delivered. In addition, the data will be submitted to the Ecology EIM database website.

Section 4.0 Data Validation and Usability

4.1 Data Acquisition, Review, Verification, and Validation

Standard data acquisition requirements will be used when applicable. The following sections summarize those requirements.

TerraGraphics will provide the data review and validation. TerraGraphics will generate an internal QA/QC memorandum evaluating and verifying that data quality objectives were met based on the requirements outlined in this SAP/QAPP. The memorandum will be sent to Mike Procsal who will make decisions for any potential corrections that need to be made to the project database.

4.1.1 Precision

Precision is a measure of data variation when more than one measurement is taken on the same sample. The precision estimate for duplicate measurements can be expressed as the relative percent difference (RPD):

$$RPD = \left| \frac{(C_1 - C_2)}{\left(\frac{(C_1 + C_2)}{2} \right)} \right| \times 100\%$$

where: RPD = relative percent difference

C_1 = concentration of QA/QC sample

C_2 = concentration of associated original

The resultant RPD will be compared to the acceptance criteria present in Table 6 and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions. The RPD will be evaluated during data quality review, deviations from the specified limits will be noted, and the effect on reported data commented on by the data reviewer. Laboratory duplicate measurements will be obtained for each set of samples submitted and analyzed.

4.1.2 Accuracy

Accuracy of laboratory analysis is assessed by measuring standard reference material and spiked samples. Standard reference materials are utilized to calibrate laboratory measurement instruments.

Spike recovery is determined by splitting a sample into two portions, spiking one portion with a known quantity of a constituent of interest, and analyzing both portions to determine spike recovery. Spike recovery is expressed as percent recovery:

$$\%R_S = \left| \frac{(SC - OC)}{TV} \right| \times 100\%$$

where: $\%R_S$ = percent recovery of spike

SC = spiked sample concentration

OC = original concentration

TV = true value of the added spike

The resultant percent recoveries will be compared to the acceptance criteria presented in Table 6 and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer.

4.1.3 Completeness

Completeness is an estimate of the amount of valid data obtained from the analytical measurement system for a given set of data. Percent completeness is defined as the number of samples analyzed that meet the data quality goals, divided by the total number of samples analyzed, multiplied by 100. The completeness goal for this project is 95%.

$$\%C = \left(\frac{N_q}{N_t}\right) \times 100\%$$

where: %C = percent completeness

N_q = number of quality samples (i.e., those that meet data quality acceptance criteria)

N_t = total number of samples analyzed

4.1.4 Comparability

Using standard USEPA protocols, all matrix-specific samples will be collected, processed, and analyzed at sufficient reporting limits, precision, and accuracy for correlation with other data collected at the site.

Table 6. Data Quality Criteria

Data Quality Parameter	Acceptable Criteria
Precision	±20%
Accuracy	75% - 125%
Completeness	95%

4.2 Validation and Verification Methods

TerraGraphics will validate the data and verify the data meet the DQOs for this project. Any qualifying data or validation issues will be explained and documented in an internal data quality memorandum.

4.3 Reconciliation with Data Quality Objectives

The main question to be investigated at this site is: "have the identified PCOCs been released into the subsurface groundwater environment where they could pose a potential human health risk based on the MTCA Method A Groundwater Cleanup Levels?" With that focus in mind, the laboratory data validation and verification will be reconciled with the DQOs put forth in this SAP/QAPP. The review will summarize data and QC deficiencies and evaluate the impact on overall data quality, assign data validation qualifiers as necessary, and prepare an internal analytical data validation report.

Section 5.0 References and Resources Used

29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," Title 29, Code of Federal Regulations, Part 1910.

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USEPA, 1994a. Method 200.7: Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Spectrometry, Revision 4.4.

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USEPA: OSRTI, 2010. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*. OSWER 9240.1-51; USEPA 540-R-10-011; January.

Washington Administrative Code (WAC) 173-340. Title 173, Chapter 173-340: Model Toxics Control Act – cleanup. Last update: 10/12/07, <http://apps.leg.wa.gov/wac/default.aspx?cite=173-340>.

Wilde, F.D., ed., 2008. Field measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, accessed July 12, 2010, http://pubs.water.usgs.gov/twri9A6/.

Yakima County GIS: Land Information Portal, accessed April 7, 2014. <http://yakimap.com>.

Appendix A
MTCA Method A Groundwater Cleanup Levels (WAC 173-340-900)

Table 720-1

Method A Cleanup Levels for Groundwater.[a]

Hazardous Substance	CAS Number	Cleanup Level
Benzene	71-43-2	5 µg/liter[b]
1,2 Dichloroethane (EDC)	107-06-2	5 µg/liter[c]
Ethylbenzene	100-41-4	700 µg/liter[d]
Ethylene dibromide (EDB)	106-93-4	0.01 µg/liter[e]
Lead	7439-92-1	15 µg/liter[f]
MTBE	1634-04-4	20 µg/liter[g]
Naphthalenes	91-20-3	160 µg/liter[h]
Toluene	108-88-3	1,000 µg/liter[i]
Total Petroleum Hydrocarbons[j]		
[Note: Must also test for and meet cleanup levels for other petroleum components--see footnotes!]		
Gasoline Range Organics		
Benzene present in groundwater		800 µg/liter
No detectable benzene in groundwater		1,000 µg/liter
Diesel Range Organics		500 µg/liter
Heavy Oils		500 µg/liter
Mineral Oil		500 µg/liter
Xylenes	1330-20-7	1,000 µg/liter[k]

Footnotes:

a. Caution on misusing this table. This table has been developed for specific purposes. It is intended to provide conservative cleanup levels for drinking water beneficial uses at sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. This table may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in this table should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in this table do not necessarily mean the groundwater must be restored to those levels at all sites. The level of restoration depends on the remedy selected under WAC 173-340-350 through 173-340-390.

b. Benzene. Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

c. 1,2 Dichloroethane (ethylene dichloride or EDC). Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

d. Ethylbenzene. Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

e. Ethylene dibromide (1,2 dibromoethane or EDB). Cleanup level based on concentration derived using Equation 720-2, adjusted for the practical quantitation limit.

f. Lead. Cleanup level based on applicable state and federal law (40 C.F.R. 141.80).

g. Methyl tertiary-butyl ether (MTBE). Cleanup level based on federal drinking water advisory level (EPA-822-F-97-009, December 1997).

h. Naphthalenes. Cleanup level based on concentration derived using Equation 720-1. This is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

i. Toluene. Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

j. Total Petroleum Hydrocarbons (TPH). TPH cleanup values have been provided for the most common petroleum products encountered at contaminated sites. Where there is a mixture of products or the product composition is unknown, samples must be tested using both the NWTPH-Gx and NWTPH-Dx methods and the lowest applicable TPH cleanup level must be met.

• **Gasoline range organics** means organic compounds measured using method NWTPH-Gx. Examples are aviation and automotive gasoline. The cleanup level is based on protection of groundwater for noncarcinogenic effects during drinking water use. Two cleanup levels are provided. The higher value is based on the assumption that no benzene is present in the groundwater sample. If any detectable amount of benzene is present in the groundwater sample, then the lower TPH cleanup level must be used. No interpolation between these cleanup levels is allowed. The groundwater cleanup level for any carcinogenic components of the petroleum [such as benzene, EDB and EDC] and any noncarcinogenic components [such as ethylbenzene, toluene, xylenes and MTBE], if present at the site, must also be met. See Table 830-1 for the minimum testing requirements for gasoline releases.

• **Diesel range organics** means organic compounds measured using NWTPH-Dx. Examples are diesel, kerosene, and #1 and #2 heating oil. The cleanup level is based on protection from noncarcinogenic effects during drinking water use. The groundwater cleanup level for any carcinogenic components of the petroleum [such as benzene and PAHs] and any noncarcinogenic components [such as ethylbenzene, toluene, xylenes and naphthalenes], if present at the site, must also be met. See Table 830-1 for the minimum testing requirements for diesel releases.

• **Heavy oils** means organic compounds measured using NWTPH-Dx. Examples are #6 fuel oil, bunker C oil, hydraulic oil and waste oil. The cleanup level is based on protection from noncarcinogenic effects during drinking water use, assuming a product composition similar to diesel fuel. The groundwater cleanup level for any carcinogenic components of the petroleum [such as benzene, PAHs and PCBs] and any noncarcinogenic components [such as ethylbenzene, toluene, xylenes and naphthalenes], if present at the site, must also be met. See Table 830-1 for the minimum testing requirements for heavy oil releases.

• **Mineral oil** means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors measured using NWTPH-Dx. The cleanup level is based on protection from noncarcinogenic effects during drinking water use. Sites using this cleanup level must analyze groundwater samples for PCBs and meet the PCB cleanup level in this table unless it can be demonstrated that: (1) The release originated from an electrical device manufactured after July 1, 1979; or (2) oil containing PCBs was never used in the equipment suspected as the source of the release; or (3) it can be documented that the oil released was recently tested and did not contain PCBs. Method B (or Method C, if applicable) must be used for releases of oils containing greater than 50 ppm PCBs. See Table 830-1 for the minimum testing requirements for mineral oil releases.

k. Xylenes. Cleanup level based on xylene not exceeding the maximum allowed cleanup level in this table for total petroleum hydrocarbons and on prevention of adverse aesthetic characteristics. This is a total value for all xylenes.

Appendix B
Health and Safety Plan

TerraGraphics

Site Safety Plan

GENERAL INFORMATION

CLIENT: Washington State Department of Ecology
PROJECT MANAGER: Jon Munkers / Mike Procsal
SITE NAME: CMG Properties
SITE LOCATION: Sunnyside, WA
PURPOSE OF FIELD VISIT(S): Collect groundwater samples
DATE OF VISIT(S): June, September, and December 2014

Article I. Site Characteristics

AREA DESCRIPTION

The site is located at 502 North Avenue in Sunnyside, Washington. The site was most recently occupied by a commercial truck operation. The site is located north and adjacent to North Avenue, east of Sunnyside, Washington, and is in a transitional area between commercial and residential/agricultural properties.

Possible Contaminate Characteristics

a) Waste Type(s)

Liquid__X__ Solid__X__ Sludge____ Gas____ Dust _X__

b) Characteristics

Corrosive____ Ignitable____ Radioactive____ Volatile __X_
Toxic ____ Reactive____ Unknown____ Other____

Article II. Hazard Evaluation

CHEMICAL HAZARDS

Based upon review of the previous assessments, potential chemical hazards on the site include petroleum products from historic underground storage tanks (USTs).

Site personnel are trained in hazard recognition and will use personal protective equipment (PPE) appropriate to the potential hazards.

a) Air Monitoring

Direct read air monitoring equipment may be employed to screen for contaminants and toxic or flammable atmospheres prior to collecting samples if the project manager, or site supervisor, deems it appropriate.

b) General Safety Hazards

Sampling at the proposed sites will be unlikely to pose any unanticipated safety hazard to workers. The proposed scheme involves subsurface water sampling. TerraGraphics Environmental Engineering, Inc. (TerraGraphics) site investigators are 40-hour HAZWOPER trained and can identify site hazards during site investigations.

Because bore holes are no larger than 6 inches in diameter, there is no trenching or confined space hazard. If sampling will be performed along roads and alleys, personnel will don “OSHA Orange” vests and traffic control measures will be initiated. The site supervisor will identify any site-specific hazards during pre-job safety meetings. The site supervisor will update employees if site hazards change.

The most likely hazards to be encountered are those commonly encountered on many work-sites (heat stress, working around machinery, noise, etc.). All TerraGraphics employees performing field work on this project will comply with the most current Health and Safety Manual and Health and Safety Standard Operating Procedures for TerraGraphics. Each employee has been provided access to this manual.

Article III. Work Practices

Workers will comply with all TerraGraphics Health and Safety Manual rules. Workers will comply with all state and federal regulations.

PERSONAL PROTECTIVE EQUIPMENT

Section 100.5 of the most current Health and Safety Manual and Health and Safety Standard Operating Procedures for TerraGraphics addresses PPE selection:

- A Class A, B, or C hard hat as appropriate to the site,
- Steel-toed, steel shank work boots,
- Hearing protection, and
- Safety Glasses.

DECONTAMINATION PROCEDURES

a) Personnel

Before leaving the sample area, thoroughly wash hands and face with soap and water before eating, drinking, or smoking. If water is not available use pre-moistened towelettes to wash face and hands.

Do not track contaminated soils and dust off-site.

b) Samples

After the sample containers are filled they will be sealed shut, marked with indelible marker, and any excess dirt will be wiped from the outside of the sample containers before they are stored. Sample containers will be transported in suitable sealed containers placed in stable containers that can be securely closed.

c) Disposal of Materials Generated On-Site

Collect trash and non-hazardous waste and place it in appropriate trash receptacles for municipal trash pick up. Potentially contaminated materials will be separated, sealed in chemically compatible containers, and labeled for appropriate off-site disposal.

d) Safety Equipment and Materials

Each sampling team will have access to a first aid kit, clean water, paper cups, and pre-moistened towelettes. Site supervisors will ensure appropriate safety gear is available for site operations. The site supervisor will also be equipped with a cell phone in case of an emergency requiring outside assistance.

Article IV. Emergency Procedures

If an injury occurs, take the following steps:

- Prevent further injury and notify the site supervisor.
- Initiate first aid and get medical attention for the injured person immediately.
- Depending on the type and severity of the injury, call for medical attention.
- Prepare an incident report.
- The crew chief / site safety officer will assume charge during a medical emergency.

a) Local Emergency Phone Numbers

Ambulance:	911
Hospital: Sunnyside Community Hospital 1016 Tacoma Avenue Sunnyside, WA 98944	 (509) 837-1500 (non-emergency) 911 (emergency department)
Poison Control Center:	800-222-1222
Sheriff/Police:	911 (509) 836-6200 (City of Sunnyside Police Dept. non-emergency)
Fire Department:	911 (509) 837-3999 (non-emergency)

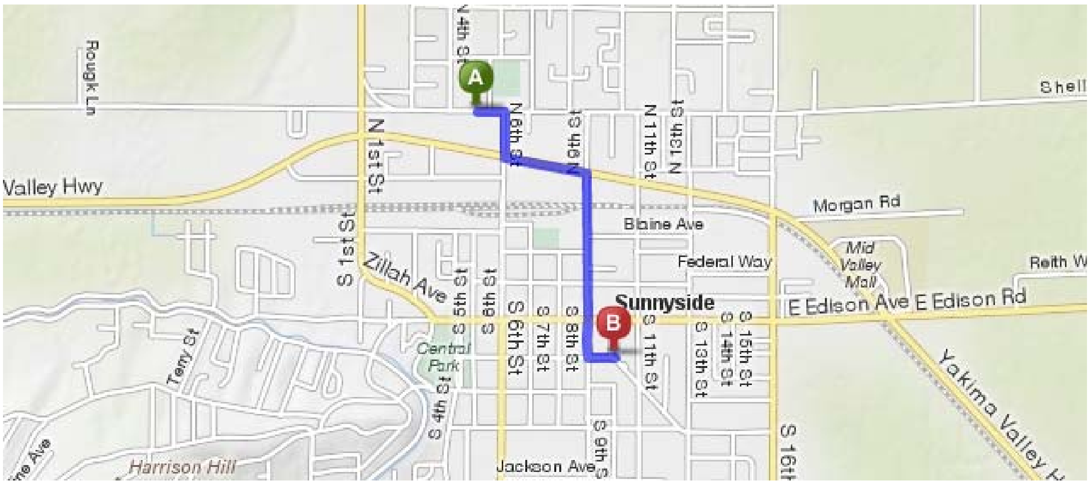
b) Emergency Contacts

8 am to 5 pm:	TerraGraphics Moscow office	(208) 882-7858
After hours:	Jon Munkers (Mobile)	(208) 791-3663
	Jerry Lee (Mobile)	(509) 330-1700

Article V. Site Organization

Map/Sketch Attached	<u>YES</u>	Site Secured	<u>NO</u>
Perimeter Identified	<u>YES</u>		

EMERGENCY ROUTE



Driving directions to Sunnyside Community Hospital

Total Travel Estimates: about 3 minutes / 0.89 miles

1.	Start out going **EAST** on **North Avenue** toward **Doolittle Avenue**	0.07 miles
2.	Take the **1st RIGHT** onto **North 6th Street**	0.1 miles
3.	Take the **1st LEFT** onto **Yakima Valley Highway**	0.2 miles
4.	Take the **1st RIGHT** onto **North 9th Street**	0.4 miles
5.	Turn **LEFT** onto **Franklin Avenue**	0.04 miles
6.	**Franklin Avenue** becomes **Tacoma Avenue**	0.03 miles
7.	**1016 Tacoma Avenue** is on the **LEFT**.	