FINAL REMOVAL EVALUATION REPORT

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
December 2013

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Acronyms

2010 TCRA	time critical removal action performed at Site in 2010
2LAET	second lowest apparent effects threshold
AOC Consent	Administrative Settlement Agreement and Order on
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Cascade	Cascade Natural Gas Corporation
CSL	cleanup screening levels
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HPAH	high-molecular weight polycyclic aromatic hydrocarbon
KCHD	Kitsap County Health District
LPAH	low-molecular weight polycyclic aromatic hydrocarbon
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
NAPL	non-aqueous phase liquids
Order	Administrative Order for a Pollution Incident
PAH	polycyclic aromatic hydrocarbon
QAPP	Quality Assurance Project Plan
Report	Removal Evaluation Report
REWP	Removal Evaluation Work Plan
RI/FS	Remedial Investigation/Feasibility Study
Site	Bremerton Gas Works Site
SMS	Sediment Management Standards
TCRA	time critical removal action

TEQ	toxicity equivalent concentration
TOC	total organic carbon
USCG	U.S. Coast Guard
VOC	volatile organic compound

1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gas Works Superfund Site (Site) in Bremerton, Washington (Figure 1-1). The RI/FS is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013.

Prior to completing the RI/FS, the AOC requires the performance of a Removal Evaluation. The purpose of the Removal Evaluation is to assess whether releases or threatened releases of contamination at the Site warrant performance of a time critical removal action (TCRA) before completion of the RI/FS. Cascade conducted the Removal Evaluation between July 8, 2013 and September 4, 2013. This Removal Evaluation Report (Report) summarizes findings of the Removal Evaluation.

1.1 Purpose and Objectives

The Removal Evaluation was conducted consistent with requirements of the AOC. As stated in the AOC, the primary objectives of the Removal Evaluation are as follows:

- Assess whether contaminant migration or exposure pathways at the Site pose a threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS.
- Identify one or more removal actions that may be conducted to effectively control any such migration or exposure pathways, should any be identified.
- Determine whether the boundaries of the identified removal action(s) can be defined as discrete from the larger investigation of the nature and extent of contamination at the Site.
- Propose boundaries for the identified removal action(s).
- Document available information regarding the presence of Site-associated contaminants and any non-aqueous phase liquids (NAPL) in soil, groundwater, or sediments within the proposed boundaries of the identified removal action(s).
- Describe the recommended methods for completing the identified removal action(s).
- Describe how implementation of the identified removal action(s) will be consistent with and facilitate final remediation of the Site.

As required by the AOC, Cascade prepared and EPA approved a Final Removal Evaluation Work Plan (Final REWP; Appendix A) and a Final Quality Assurance Project Plan Addendum (Final QAPP Addendum; Appendix B) to establish the scope of work and other details of the Removal Evaluation. The Final REWP and Final QAPP Addendum defined targeted testing and inspection activities intended to identify potential releases or threatened releases of Site-associated chemicals that pose an immediate threat to human health, welfare, or the environment if left unaddressed before completion of the

RI/FS. Testing and inspection activities conducted during the Removal Evaluation included the following:

- **Sampling of Intertidal Beach Sediments:** Testing intertidal beach areas adjacent to the former gas works to evaluate current concentrations of polycyclic aromatic hydrocarbons (PAHs), and screening those data against preliminary human health and ecological reference values.
- **Bluff Inspection:** Inspecting the area along the base of the bluff (between the beach and the upland area where the former gas works was located) for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the shoreline.
- **Drainage System Inspection:** Inspecting former drainage and piping systems located in upland areas of the Site to evaluate whether additional actions are warranted to address potential migration pathways to the beach.

This Report presents data collected during the Removal Evaluation and reviews the significance of those findings. As described in this Report, the Removal Evaluation identified several conditions that were determined by EPA to warrant a TCRA.

1.2 Document Organization

This Report is organized as follows:

- **Section 2: Site Background.** The history of the Site and results of a previous 2010 TCRA are described in Section 2. Additional context describes the purpose of the Removal Evaluation.
- **Section 3: Removal Evaluation Methods.** Section 3 includes a summary of the sampling and inspection methods used to complete the Removal Evaluation.
- **Section 4: Removal Evaluation Findings.** Section 4 describes the results of all testing and inspection activities performed as part of the Removal Evaluation.
- **Section 5: Summary and Conclusions.** Section 5 describes the recommended TCRA that addresses potentially significant exposure pathways.
- **Section 6: References.** Section 6 provides a list of references cited in this Report.
- **Appendices:** Appendices to this Report include the Final REWP, the Final QAPP Addendum, risk screening values, copies of field records and boring logs, and copies of analytical testing data and data validation reports.

2 Site Background

A number of investigation activities have taken place in and around the location of the former Bremerton gas works and adjacent properties. A previous TCRA was successfully implemented in the eastern beach area below the Sesko property and adjacent to the former gas works in 2010 (2010 TCRA). This section describes the former gas works and vicinity, provides relevant history and describes how the Removal Evaluation relates to the RI/FS and Site cleanup process.

2.1 Site Description

The former Bremerton gas works was located on the south shore of Port Washington Narrows, a narrow channel that connects Dyes Inlet to Puget Sound. The gas works was located between Thompson Drive and Pennsylvania Avenue in west Bremerton, Washington (see Figure 1-1). Land use in the vicinity of the former gas works is currently industrial and light commercial.

The former gas works was located on the upland portion of two industrial properties as shown on Figure 2-1. The eastern property is owned by Natacha Sesko (Sesko property), and the western property is owned by the McConkey Family Trust (McConkey property); the beach areas that generally correspond to the boundaries of these two properties are herein described as the eastern beach area and the western beach area, respectively. The former gas works produced gas for lighting and heating through manufactured gas plant operations from approximately 1930 to 1955. Between approximately 1948 and 1955, liquefied petroleum (propane) was used to enrich the manufactured gas. Between approximately 1955 and 1963, the former gas works manufactured gas from blending propane and air. Production of gas terminated in 1963 upon completion of a natural gas pipeline to the region. Aboveground structures associated with the former gas works were removed between 1963 and the early 1970s.

The former gas works also included a dock (see Figure 2-1), formerly located within leased harbor areas owned by the State of Washington and managed by the Washington State Department of Natural Resources (DNR). The DNR-managed lands also include portions of the bluff, the intertidal beach area adjacent to the Site, and the subtidal lands of Port Washington Narrows.

As shown on Figure 2-1, a City of Bremerton sanitary sewer force main is located beneath portions of the beach at the Site. Based on available record drawings, the force main was installed initially during the 1950s and was replaced in the 1980s. The force main is buried several feet beneath the beach within the DNR-managed harbor areas and the northern portion of the Sesko property. Just south of the force main, is a steep bluff, which separates the beach from the upland area where the former gas works was located.

The property located immediately east of the former gas works is zoned for industrial use and is used as a bulk petroleum terminal. Properties further east are zoned for residential use and include single and multi-family residences.

Properties located immediately south and west of the former gas works are zoned for industrial uses. The Port Washington Marina is located to the west of the former gas works. The marina includes recreational boat moorage and live-aboard residents.

Three bulk fuel storage facilities were located in the immediate vicinity of the former gas works. One of these facilities is still in operation. The locations of the storage tanks associated with these facilities are shown on Figure 2-1. The three facilities are described as follows:

- **Former Sesko Facility:** A former bulk fuel storage facility operated on a portion of the Sesko property between the early to mid-1940s and approximately 1993.
- **Former ARCO Facility:** A former ARCO bulk fuel storage facility operated on property located to the southwest of the former gas works between approximately 1942 and 1992. This property is currently owned and operated by Pipeworks Mechanical & Service, Inc.
- **SC Fuels Facility:** A bulk fuel storage facility currently operated by SC Fuels is located to the east of the Sesko property, across Pennsylvania Avenue. A bulk fuel storage facility has operated in this location since the early to mid-1940s.

Historically, liquid petroleum products were delivered to all three bulk fuel storage facilities by barge. Three separate docks were used for product delivery over the years. Dock use was consolidated over time, and two or more of the fuel facilities shared a single dock in later years. Figure 2-1 shows the locations of the three historical fuel docks as well as the former gas works dock.

2.2 Historical Environmental Investigations

Multiple investigations have been performed at the former gas works and vicinity. Previous studies focusing primarily on the former gas works have included the following:

- Inspection Field Notes and Lab Report from initial investigation inspection (Ecology 1995)
- *Targeted Brownfields Assessment Report, Old Bremerton Gas Works – McConkey Properties* (Techlaw 2006)
- *Preliminary Upland Assessment Report, McConkey/Sesko Brownfields Site* (GeoEngineers 2007)
- *Historical Characterization and Data Gaps, Old Bremerton Gas Works Property 1725 Pennsylvania Avenue* (Hart Crowser 2007)
- *Final Bremerton Gas Works Targeted Brownfields Assessment Report* (Ecology and Environment 2009)

These studies have provided information regarding geology and hydrogeology of the area as well as the distribution of hydrocarbon compounds commonly associated with activities at manufactured gas plants.

Extensive environmental testing has also been performed at the adjacent SC Fuels Facility. Available data for the SC Fuels Facility did not affect the scope or results of the

Removal Evaluation, but will be considered further during performance of the RI/FS for the Site.

2.3 Previous Time Critical Removal Action

A previous TCRA was conducted in 2010 in the eastern portion of the beach adjacent to the former gas works (2010 TCRA). The 2010 TCRA was performed after hydrocarbon sheen was reported near the former gas works. On August 20, 20120, the Kitsap County Health District (KCHD) observed intermittent sheens on surface water of Port Washington Narrows. KCHD identified the source of the sheens to be a black oily liquid discharging from a dislocated joint in a concrete pipe buried approximately 1 foot below ground surface (bgs) in the intertidal area due north of the Sesko property. KCHD reported the release to EPA on October 4, 2010.

The EPA On-Scene Coordinator visited the Site on October 5, 2010, and collected samples of the oily liquid discharging from the pipe for chemical analysis. Results indicated that the liquid contained PAHs. EPA placed a temporary boom around the impacted beach area to prevent migration of the oily liquid. This action was intended to mitigate the release of PAHs to marine waters.

EPA notified the U.S. Coast Guard (USCG) of a release in its jurisdiction. The USCG mobilized to the site of the release, upgraded the temporary boom to address both floating and dense hydrocarbons, and commenced activities to mitigate the hydrocarbon discharge from the pipe. Mitigation activities included breaking a 4-foot section of the pipe with a hydraulic hammer, plugging the pipe-end in that area, and placing hydraulic cement over the temporary plug. EPA and USCG then conducted a joint removal assessment (including chemical testing within the beach area) to gain a basic understanding of any risks posed to human health and/or the environment by releases or threatened releases from the Site. USCG established a Unified Command to assist with response activities. The Unified Command initially included representatives of USCG, EPA, Washington State Department of Ecology (Ecology), DNR, and KCHD.

On October 18, 2010, Cascade first learned of the response activities and contacted EPA that same day expressing an interest in being involved in the response. On October 19, 2010, Cascade met with USCG, EPA, and the rest of the Unified Command to discuss additional actions appropriate at the release site. USCG subsequently added Cascade to the Unified Command and issued Cascade an Administrative Order for a Pollution Incident (Order) to implement response actions at the Site under oversight of USCG. Cascade accepted the Order in a letter dated October 29, 2010.

Under USCG and EPA oversight, Cascade implemented the 2010 TCRA by completing the following activities:

- Investigating the location and orienting the abandoned pipe.
- Permanently plugging the pipe as close as practicable to the shoreline.
- Removing all portions of the pipe from the new plug to the terminus of the pipe.
- Backfilling the excavation created by removing the pipe with clean beach material.

- Placing an organoclay mat and cobble cover layer over the hydrocarbon-impacted sediments near the terminus of the pipe. This cap was placed over those sediments that had been observed to generate sheen with only minimal disturbance.
- Inspect the pipe plug and cap to confirm they are effective and no sheen is manifesting on the beach.

The 2010 TCRA was successfully completed between November 5 and 8, 2010, and the results were documented in a Completion Report (Anchor QEA 2011).

Post-completion inspections of the 2010 TCRA area were performed between 2010 and 2013. These inspections were conducted pursuant to the TCRA Work Plan (Anchor QEA and Aspect 2010). The inspections show the 2010 TCRA has been successful. The pipe plug and cap are stable, no release of hydrocarbon sheen has been noted near the pipe plug or capped area, and the cover materials of the cap have been colonized by surface algae and invertebrate organisms.

2.4 National Priorities Listing and AOC Development

After reviewing available information and completing appropriate notifications, EPA placed the Bremerton Gas Works Superfund Site on the National Priorities List on May 10, 2012. EPA and Cascade subsequently negotiated the AOC, which was executed on May 1, 2013.

The AOC requires completion of the following activities:

- Removal Evaluation (including work plan development, sampling, and reporting)
- Removal Action (if directed by EPA; including work plan development, implementation, and reporting)
- RI/FS (including scoping, work plan development, multiple phases of investigation, risk assessment, and RI/FS report development)

This Report describes the findings of the Removal Evaluation, consistent with AOC requirements.

2.5 Focus of Removal Evaluation

The focus of the Removal Evaluation was to assess whether specific contaminant migration pathways at the Site pose a threat to human health, welfare, or the environment if left unaddressed before completing the RI/FS. The Removal Evaluation focused on those pathways that could result in a substantial uncontrolled risk to human health, and those that represent a potential immediate threat to Port Washington Narrows, including:

- **Direct Human Exposures to Intertidal Beach Sediments:** The potential risks associated with chemicals present in the intertidal beach areas will be fully assessed as part of the RI/FS and baseline risk assessment. However, the Removal Evaluation included a preliminary risk screening to evaluate whether current carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentrations pose a potentially significant health risk to beach users. This screening was conducted using a conservative child beach play exposure scenario. This

evaluation used current surface sediment testing data collected within the intertidal beach area as part of the Removal Evaluation.

- **Benthic Ecological Exposure to Intertidal Sediment:** Beach sediment data were also screened for potential impacts to benthic ecological receptors using the current benthic cleanup screening levels (CSL) promulgated under Washington's Sediment Management Standards (Ecology 2013).
- **Potential for Release of Hydrocarbon Materials from the Bluff**: The upland area of the Site where the former gas works was located slopes steeply down to the beach. This bluff area was inspected to identify whether there was evidence of hydrocarbon sheen or non-aqueous product seepage along the bluff/beach boundary.
- **Potential for Releases from Former Drainage and Piping System:** The 2010 TCRA included the plugging and partial removal of a concrete pipe that contained hydrocarbons. That pipe extends from the eastern beach area to the upland portion of the Sesko property where a manhole (Manhole "A") is located. The Removal Evaluation included an inspection to assess whether stormwater had the potential to infiltrate into Manhole A and place surcharge pressure on the plug installed as part of the 2010 TCRA. Though there has been no evidence of hydrocarbon releases near the plug, stormwater-induced surcharge within the pipe could increase the risk of future hydrocarbon releases.

EPA identified PAH compounds as the contaminants of interest for the Removal Evaluation. These compounds were selected by EPA based on their identified presence in the intertidal beach sediments during the 2010 TCRA. These compounds can be associated with gas works operations but also can be associated with petroleum hydrocarbons, treated wood piles, combustion byproducts, and stormwater or combined sewer discharges. PAH compounds included in the chemical analysis program are listed in Table 2-1.

3 Removal Evaluation Methods

This section provides a concise summary of methods by which the investigation, sampling, and analysis steps of the Removal Evaluation were conducted. These steps were defined in the EPA-approved Final REWP (Appendix A) and Final QAPP Addendum (Appendix B). Findings and conclusions of the Removal Evaluation are described separately in Sections 4 and 5.

3.1 Intertidal Sediment Testing

As detailed in the Final REWP, some previously collected sediment testing data were available for the intertidal beach area located adjacent to the former gas works. However, these previously collected data did not meet data quality objectives for the Removal Evaluation.

To meet objectives of the Removal Evaluation, sediment sampling was conducted throughout the intertidal beach area. A matrix of 30 target sampling locations was developed with EPA that included both testing at defined transects located approximately 100 feet apart and testing at additional sampling locations, particularly near the sediment cap placed during the 2010 TCRA. In addition to the 30 target sampling locations, the Final REWP also defined procedures for collecting additional contingent samples if additional areas of hydrocarbon sheen were noted or if directed by EPA.

Including both planned sediment and contingent sediment sampling, a total of 39 surface sediment samples were collected during the intertidal sediment sampling program. Final testing locations are shown on Figure 3-1 as documented using differential global positioning system methods described in the Final REWP. The bathymetric contours shown on Figure 3-1 are based on a bathymetric and topographic survey conducted by eTrac Engineering in May 2013.

Consistent with the Final REWP, intertidal sediment sampling included collecting surface sediment (0 to 4 inches) at all locations and additional opportunistic shallow subsurface sediment between 4 and up to 12 inches deep if hydrocarbon sheen or odor was observed at the sampling location. The following describes the sampling methods:

- Each surface sediment sample was collected at low tide using hand tools. Surface samples were collected from the 0- to 4-inch depth interval. Five equal-volume aliquots were collected at each sampling location to create a single composite sample. One aliquot was collected at the target location and the other four aliquots were collected approximately 3 feet from the target location at the approximate four points of the compass. The purpose of compositing five individual aliquots from a single sampling location was to average potential small-scale heterogeneity in the physical substrate and chemical contaminant concentrations at the sampling location. The compositing approach provides a more representative average exposure concentration for a given location than could be obtained from a single grab sample.
- Sediments were collected with decontaminated stainless-steel trowels, placed into decontaminated stainless-steel bowls, homogenized, and placed into pre-labeled sample containers.

- If hydrocarbon sheen or odor was noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample was collected and archived from the 4- to 12-inch sampling interval (or between 4 inches and the maximum depth that could be excavated with hand tools) at these locations. If hydrocarbon sheen or odor was noted in more than one subsample aliquot location, then the subsurface aliquots containing the sheen or odor were composited and archived. Where sample integrity was compromised by sloughing of the excavation side walls, this was noted on the sample logs. As discussed with EPA, samples with compromised sample integrity were not used for chemical analysis.

A summary of samples collected and submitted for analysis or archived is included in Table 3-1.

During the sediment sampling activities, hydrocarbon sheens were noted in one area of the western beach. In response to his observation, additional test plots were advanced in the western beach area. Each test plot included excavating a small pit approximately 18 inches below the mudline using hand tools. The exposed sediment within each pit was directly inspected for hydrocarbon sheen. Interstitial water accumulating within the pit was also inspected for hydrocarbon sheen. Test plot locations are shown on Figure 3-1.

Two small surficial deposits of solid hydrocarbon material were also noted in this area of the beach. Small black carbonaceous briquettes were noted scattered in the upper beach in this area. Consistent with the Final REWP, samples were collected from the solid hydrocarbon material, and a sample of the briquettes was also collected. These materials were chemically analyzed to determine their material properties and PAH content, which are presented in Appendix C.

3.2 Bluff Inspection

A visual inspection of the bluff was completed from the Thompson Avenue to Pennsylvania Avenue rights-of-way and extended from the toe of the slope to approximately 10 feet vertically above the beach surface. The inspection was limited to that portion of the bluff that was easily observable from the ground surface of the beach at the base of the bluff. The visual inspection was conducted to assess the potential presence of exposed soils or sediments containing hydrocarbon sheen or products that could represent an active contaminant migration pathway between the bluff area and the sediments and/or surface waters of Port Washington Narrows. The bluff inspection was conducted in parallel with the intertidal sediment sampling.

3.3 Supplemental Subsurface Testing

A supplemental subsurface testing program was implemented consistent with an EPA-approved Final QAPP Addendum (Appendix B). That testing program included collecting subsurface sediment or soil by direct push and hand auger methods at 8 locations. Testing locations included one upland location at the base of the bluff (GP-01) and seven sediment borings within the intertidal beach area (see Figure 3-1).

Intertidal beach area borings were all conducted at low tide using the direct-push equipment. Testing at the upland location was initially attempted using direct-push drilling methods. However, poor sample recoveries were achieved with this method.

Two borings were later completed in this location by hand auger. One of these hand auger borings was used to collect soil samples for chemical analysis.

The recovered subsurface soil and sediment samples were characterized for lithology, and drilling logs (see Appendix D) were prepared. Samples for volatile organic compound (VOC) testing were collected directly from the soil/sediment core. The remaining soil or sediment (excluding soil/sediment that was in contact with the side-walls of the sampler) was then placed in stainless-steel bowls and homogenized using stainless-steel spoons. Subsamples were then placed in pre-labeled sample containers.

Upland station BGW-GP-01 was located immediately south (upland) of a structure that appeared to be a concrete retaining wall or bin. Core refusal was encountered at depths of approximately 6 feet bgs, and sample recovery with the direct-push equipment was not sufficient for logging or analysis. Hand-auger methods were subsequently used to excavate two test borings to approximately 6 feet bgs. At that depth, refusal was encountered in both borings. The refusal was interpreted by field personnel to represent a concrete slab or footing associated with the concrete structure. A 1- to 2-foot-thick layer of black, dry carbonaceous material was noted above this slab/footing. A sample of this carbonaceous material was collected from the hand auger for chemical analysis.

3.4 Drainage System Inspection

The 2010 TCRA included removal and plugging of a portion of the concrete pipe located beneath the intertidal area just north of the Sesko property. Based on observations made during the 2010 TCRA and a review of the sewer record drawings, the pipe appears to have originally been installed as a municipal sewer overflow pipe. Details on the piping and sewer system are provided in the Final REWP (Appendix A). The pipe and associated drainage system (including catch basins, manholes, and connecting pipes) are shown on the City of Bremerton sewer cards provided in Appendix C of the Final REWP. A 16-foot-deep manhole (Manhole A) was identified on the City of Bremerton sewer documents as being located within the current Sesko property.

An existing manhole, consistent with Manhole A as shown on the City sewer drawings, is located on the Sesko property at the location shown on Figure 3-1. That manhole appears, based on available information, to be connected to the pipe that was plugged as part of the 2010 TCRA. The manhole is currently filled with debris but has not been fully abandoned or plugged. It was unclear at the time that the 2010 TCRA was performed whether all of the influent lines entering Manhole A had been plugged or removed.

The Removal Evaluation assessed whether further actions were necessary at Manhole A to prevent stormwater from entering the pipe and causing a surcharge that might jeopardize the integrity of the pipe plug installed during the 2010 TCRA. The following activities were performed during the Removal Evaluation:

- Field survey team removed debris located in the upper portion of Manhole A.
- Field team visually inspected Manhole A to identify and locate influent pipes connected to it.

- Field team inspected the surrounding area, including locations of former catch basins shown on City sewer drawings, to determine potential active connections to Manhole A.
- The condition of Manhole A and the surface conditions in the vicinity were inspected to evaluate the potential for stormwater runoff to enter the manhole.

4 Removal Evaluation Findings

This section summarizes the work conducted during the Removal Evaluation and the results of the Removal Evaluation. Inspection and sampling activities were completed between July 8 and September 4, 2013. Field logs and data presented in this section are attached in Appendices D, E, and F.

4.1 Intertidal Sediment Testing

Sampling of sediment in the intertidal beach area was completed during July 2013 consistent with the EPA-approved Final REWP (Appendix A). Chemical testing was performed at 39 locations, including the 30 initially planned sampling locations and the nine additional locations identified by EPA. At six of these locations, shallow subsurface (between 4 and up to 12 inches deep) sediments were collected and analyzed in addition to testing surface sediments (between 0 and 4 inches below mudline).

Table 4-1 summarizes results of chemical testing for both the surface and shallow subsurface sediments. PAH results are presented for individual PAHs, total cPAH, low-molecular weight polycyclic aromatic hydrocarbon (LPAH), and high-molecular weight polycyclic aromatic hydrocarbon (HPAH). The table also summarizes results for total organic carbon (TOC) and total solids and expresses PAH data on a total dry weight and carbon-normalized basis. Laboratory chemistry reports for these samples are provided in Appendix E, and data validation reports are provided in Appendix F. The sediment sampling results are summarized below:

- **PAH Concentrations in the Eastern Beach Area:** Testing results confirmed that the cap installed during the 2010 TCRA in the eastern portion of the beach area continues to be effective. No hydrocarbon sheen was observed in this area, which is consistent with results of previous visual monitoring activities. Concentrations of PAHs and cPAHs were lower in this area than in beach areas to the west (Figure 4-1). The easternmost stations, SG-28, SG-29, and SG-30, had the lowest cPAH toxicity equivalent quantity (TEQ) concentrations measured. Additionally, measured concentrations of cPAHs in the vicinity of the eastern cap area were lower than those measured previously in 2010. For example, along the western portion of the cap, the cPAH TEQ concentrations measured in 2010 at stations GL04W03 (12 milligrams per kilogram [mg/kg]), GL05W03 (24 mg/kg), GL06W02 (12 mg/kg), and GL06W03 (106 mg/kg) averaged approximately 38 mg/kg. In the same area in 2013, cPAH TEQ concentrations at stations SG-16 (14 mg/kg), SG-15 (26 mg/kg), SG-13 (9.5 mg/kg), and SG-12 (5.5 mg/kg) averaged approximately 14 mg/kg.
- **PAH Concentrations in the Western Beach Area:** In contrast to the eastern beach area, the PAH and cPAH concentrations measured in the intertidal sediments were higher in the western beach area (see Figure 4-1). The highest cPAH concentration (509 mg/kg cPAH TEQ) was measured at station SG-05. This station was located adjacent to localized surface deposits of solid hydrocarbon material. Hydrocarbon sheens were also noted in subsurface

sediments in this area, in the vicinity of stations SG-04 and SG-05 (see the SG-04/SG-05 area on Figure 4-1 and Figure 4-3).

- **Screening of Sediment Data:** The measured PAH and cPAH concentrations in the intertidal beach area samples were screened against the preliminary human health and ecological reference values as described below:
  - *Screening of Surface Data Against Beach Play Scenario*: With the exception of the station located closest to the Port Washington Marina, most measured cPAH concentrations in the western beach area samples exceeded the preliminary screening level (8 mg/kg cPAH TEQ; defined in the EPA-approved Final REWP; Appendix A). That screening level was based on a child beach play exposure scenario and a target carcinogenicity risk-level of 1x10-4. In contrast, the samples in the eastern beach area and in the vicinity of the 2010 TCRA cap were generally below the 8 mg/kg screening level. The beach play screening evaluation documentation is presented in Appendix G.
  - *Screening of Surface Data Against Sediment management Standard Cleanup Screening Levels*: The screening of the surface sediment data against preliminary ecological screening levels is summarized on Figure 4-2. Specifically that figure presents sediment PAH data as a function of the Sediment Management Standards (SMS) Cleanup Screening Levels (the maximum exceedance of individual PAH CSL values and of the LPAH and HPAH CSL values is shown). Where the TOC in the sediment samples was greater than 5 percent or less than 0.5 percent, the PAH concentrations were compared against their respective dry weight second lowest apparent effects threshold (2LAET) values. In general, the pattern of exceedances of the ecological screening values reflects the patterns observed with the human health screening. The easternmost beach samples generally did not exceed the CSL/2LAET values. In contrast, most of the western beach area samples exceeded the CSL/2LAET values. Samples in the SG-05 area exceeded these values by the greatest amount.
- **Hydrocarbon Sheen in SG-04/SG-05 Area of Western Beach:** During intertidal sediment sampling, hydrocarbon sheen was noted in subsurface samples collected from the SG-04 area. Additional test plots were excavated in this area to delineate the area of hydrocarbon sheen. The extent of the sediments containing the hydrocarbon sheen is shown on Figures 4-1 and 4-3. The sheen was present in sediments adjacent to and beneath the footing of a concrete wall/bin located at the base of the bluff, and in sediments up to 50 feet offshore of this location (see Figure 4-1).
- **PAH Concentrations in Solid Hydrocarbon Material:** The solid hydrocarbon material present in two localized deposits in the SG-04/SG-05 area was tested separately for PAH concentrations. Measured cPAH concentrations in the solid hydrocarbon material were 1509 mg/kg cPAH TEQ.
- **PAH Concentrations in Briquettes.** Measured cPAH concentrations in the briquette materials were 1915 mg/kg cPAH TEQ. The results are presented in Appendix C.

4.2 Bluff Inspection

The majority of the bluff is covered by thick vegetation, including blackberry bushes and ivy, which prevented direct observation of most of the soil that comprises the bluff. Where bluff soil was exposed, soils were inspected for visual or olfactory evidence of contamination. No hydrocarbon staining or hydrocarbon odors were observed anywhere along the bluff. There were also no observed occurrences of liquid seeps along the bluff. Based on these observations, contingent soil or seep liquid samples were not collected during the Removal Evaluation.

4.3 Supplemental Subsurface Testing

Additional subsurface testing data in the area of subsurface sheen was collected to better define the extent of sheen and determine if the sheen was confined to a localized area of sediments or might be contiguous with contamination in the uplands. The scope of that sampling was defined in a Final QAPP Addendum (Appendix B). The supplemental subsurface testing was performed in early September 2013, after EPA approval of the Final QAPP Addendum. That sampling was performed at low-tide conditions and included sampling by both direct-push and hand auger sampling methods.

Figure 4-3 shows locations of the completed borings and the measured cPAH concentrations detected in collected subsurface soil and sediment samples.

Testing at all seven sediment sampling locations (BGW-GP-02 through BGW-GP-08) was completed using a track-mounted, direct-push sampler. This method achieved penetration depths between 4 and 5 feet bgs at all testing locations. Upper sediments transitioned from beach materials to native glacial sands and gravel to very dense glacial sand and gravel.

As noted in the logs (Appendix D), hydrocarbon sheen was observed in subsurface sediments at the following sediment drilling locations and depths:

- BGW-GP-02 (0.7-1 feet bgs): This sampling station was located adjacent (east) of the concrete wall/bin structure. The presence of hydrocarbon sheen in this sample is consistent with the presence of hydrocarbon sheen in a test plot located immediately beneath the footing of the wall/bin structure.
- BGW-GP-03 (1 to 1.8, 2.1 to 2.4, and 2.7 to 3.2 feet bgs): This sampling station was located immediately offshore (north) of the wall/bin structure. Observations in this boring were consistent with the presence of hydrocarbon sheen in adjacent test plots as described in Section 4.2.

At upland drilling station (BGW-GP-01) located just south (upland) of the wall/bin structure, the direct-push sampling methods hit refusal at depths of approximately 6.5 feet bgs. Recovery in the sampler was also very low. At this station, hand auger collection was subsequently used to install two testing borings. Hand auger borings were completed to depths of just over 6 feet. Both borings encountered refusal at that depth. The field sampling staff interpreted the refusal as a contact with a flat concrete slab or footing structure. A layer of black carbonaceous material between 1 and 2 feet thick was noted immediately above this refusal layer. The carbonaceous material had no noticeable

hydrocarbon sheen or odor. It was not possible to assess the quality of soils located beneath the slab or footing structure.

At each of the seven sediment sampling locations, the core was sectioned by lithology and at least two intervals were submitted for PAH, TOC, and total solids analysis. As noted above, a single sample of the black carbonaceous material from station BGW-GP-01 was also submitted for chemical analysis. PAH results from these samples are presented in Table 4-2. Measured cPAH concentrations are shown on Figure 4-3.

In addition to the testing performed for PAH compounds, four subsurface sediment samples containing hydrocarbon sheen were selected and submitted for analysis to determine the presence of VOCs. Results of the VOC analysis are presented in Table 4-3.

Observations from subsurface chemical testing included the following:

- **Elevated cPAH Concentrations in Upper Subsurface Sediment Samples:** Measured cPAH concentrations in the upper-most samples from all seven locations exceeded the 8 mg/kg reference value. The highest cPAH concentrations were noted in shallow subsurface sediments that contained hydrocarbon sheen or that were located near the solid hydrocarbon material and station SG-05. The maximum subsurface concentrations of cPAH noted in this area were 359 mg/kg.
- **Low cPAH Concentrations in the Deepest Subsurface Sediment Samples Analyzed:** At all seven sediment testing locations, the deepest samples submitted for analysis contained cPAH concentrations that were significantly below the 8 mg/kg reference value. The measured concentrations ranged from 0.0009 to 0.1 mg/kg in these samples. These samples were all collected from subsurface sediments located beneath the hydrocarbon sheen layer.
- **Lack of Significant Detectable Volatile Organic Compounds**: Low concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) were detected in samples containing hydrocarbon sheen. The highest benzene concentration detected was 0.0081 mg/kg. No chlorinated solvents were detected in any of the test samples.
- **Low cPAH Concentrations in Black Carbonaceous Material from Upland Boring BGW-GP-01:** The black carbonaceous material collected from upland station BGW-GP-01 contained low cPAH concentrations relative to those noted in sediment borings. The cPAH concentration measured in this sample was 1.5 mg/kg, indicating that the material is different than either the hydrocarbon sheen or the briquette materials.

The subsurface testing was successful in defining the depth of hydrocarbon sheen in subsurface beach sediments in the SG-04/SG-05 area of the western beach. The hydrocarbon sheen and elevated concentrations of cPAH compounds did not extend down into the dense sand and gravel layer located 4 to 5 feet below mudline. The sheen appears to be localized to shallow subsurface sediments in locations near the concrete wall/bin structure (Figure 4-3).

The lateral limits of the hydrocarbon sheen were determined to the north, east, and west. The hydrocarbon sheen was detected in subsurface sediments located immediately east of the wall/bin structure. Additional test plots (see Section 4-2) confirmed that the hydrocarbon sheen was present in sediments in a boring located immediately east of the wall/bin footing at the base of the bluff. However, due to the presence of a concrete slab or footing to the south of the wall/bin structure, the continuity of the sheen in locations upland (south) of the wall/bin structure could not be determined. Additional testing may be required in this area as part of the RI/FS to determine the extent of hydrocarbon sheen present in south of the wall/bin structure.

4.4 Drainage System Inspection

Manhole A was verified during the drainage system inspection as being a round, 3-foot diameter manhole constructed of brick. The size, location, and construction of Manhole A are consistent with City of Bremerton record drawings for a manhole associated with a former combined sewer overflow.

Manhole A was observed to be filled with debris, including rocks, vegetation, and soil. The manhole is uncovered at the ground surface and is filled from the bottom to within approximately 18 to 24 inches of the ground surface. Based on the City of Bremerton record drawings, the manhole extends 16 feet bgs and connects with the concrete pipe that was cut and plugged during the 2010 TCRA. The total depth and the connectivity of the manhole with the concrete pipe were not verified as part of the Removal Evaluation.

Stormwater may enter Manhole A in its current condition. Observations in this regard included the following:

- A potentially active connection was noted between the manhole and a drain sump located in a containment structure associated with the former bulk fuel storage facility on the Sesko Property. Stormwater accumulating in the drain sump may discharge via the observed connection to Manhole A.
- Manhole A is not sealed, and the ground surface slopes generally toward the manhole. During heavy rain events, stormwater may directly enter the manhole from the open top.

Stormwater entering Manhole A could cause hydraulic surcharge on the concrete pipe and plug that were addressed as part of the 2010 TCRA, which could increase the risk of future hydrocarbon releases from the pipe.

5 Summary and Conclusions

Section 5.1 summarizes the findings of the Removal Evaluation, including several conditions that warrant performance of a TCRA before completion of the RI/FS. These conditions represent pathways for releases or threatened releases of Site-associated chemicals that pose an immediate threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS.

Section 5.2 describes a proposed TCRA that addresses the conditions and pathways identified in Section 5.1 and discusses the implications of the TCRA to the RI/FS and future cleanup actions at the Site.

5.1 Summary of Removal Evaluation

A detailed discussion of the sampling and inspection data is provided in Section 4. Key findings of the Removal Evaluation are summarized on Figure 5-1 and include the following:

- **The plug and cap installed in 2010 TCRA remain effective:** The pipe plug and cap installed in the eastern portion of the beach area continue to be effective. No hydrocarbon sheen has been observed in this area. Sampling results indicate concentrations of cPAHs are lower in this area than in beach areas to the west. Additionally, the measured concentrations of cPAHs in the vicinity of the cap are lower than those measured previously in 2010.
- **PAH concentrations are elevated in the beach area surface sediments:** The measured cPAH concentrations at most stations exceed preliminary risk screening values defined in the Final REWP based on a child beach play exposure scenario. The cPAH concentrations are substantially higher within the SG-04/SG-05 area, near the solid hydrocarbon material and areas with hydrocarbon sheen in subsurface sediments.
- **Two surface deposits of solid hydrocarbon material containing elevated PAH concentrations are present in the western beach area:** Two localized surface deposits of solid hydrocarbon material containing elevated PAH concentrations have been identified. Both deposits are located in the SG-04/SG-05 area. The first deposit measures approximately 10 feet by 15 feet, and the second measures approximately 2 feet by 8 feet. Each deposit is less than 6 inches thick.
- **Hydrocarbon sheen was observed in subsurface sediments in the SG-04/SG-05 area:** An area of moderate to heavy hydrocarbon sheen was noted in subsurface sediments in the SG-04/SG-05 area. Based on supplemental test plots and subsurface soil and sediment testing, the hydrocarbon sheen appeared to be contiguous with the subsurface soils beneath the bluff. Within the beach area, the sheen is located in shallow subsurface sediments up to 3.2 feet below mudline and correlates with elevated PAH concentrations in sediment. Structures in the southern portion of the SG-04/SG-05 area prevent further evaluation of sediment in this area. Further assessment in this area will be conducted during the RI/FS.
- **Stormwater may continue to enter Manhole A:** Manhole A is associated with the pipe that was plugged at the beach north of the Sesko property during the

2010 TCRA. Manhole A has been partially abandoned. However, the current condition of Manhole A and potential connections to Manhole A may allow stormwater to enter and cause hydraulic surcharge on the pipe.

5.2 Proposed Removal Action

The objective of the Removal Evaluation was to identify whether contamination at the Site poses an unacceptable risk to human health or the environment if left unaddressed before completion of the RI/FS, and if a TCRA should be implemented to address such a risk. The Removal Evaluation was not designed to develop a complete understanding of the nature and extent of contamination in beach sediments, the sources of the contamination, the relationship between contamination in the uplands and contamination in beach sediments, or the transport mechanisms for contamination at the Site. These questions will be addressed in the upcoming RI/FS.

The Removal Evaluation has identified conditions and pathways that require the implementation of a TCRA. The conditions and pathways requiring a TCRA consist of the following:

- **Presence of two surface deposits of solid hydrocarbon material**: Two localized deposits of solid hydrocarbon material were identified in the SG-04/SG-05 area. Measured cPAH concentrations in the solid hydrocarbon material were 1509 mg/kg cPAH TEQ.
- **Presence of hydrocarbon sheen in the SG-04/SG-05 area:** Hydrocarbon sheen was identified in subsurface sediments in the SG-04/SG-05 area. Sheen was not evident elsewhere on the beach.
- **Presence of subsurface contamination in the SG-04/SG-05 area:** The highest cPAH concentrations in beach sediments were identified in subsurface sediments within the SG-04/SG-05 area, near the solid hydrocarbon material and areas with hydrocarbon sheen.
- **Potential stormwater inputs to Manhole A:** The Removal Evaluation also noted conditions were ongoing stormwater inputs to Manhole A could result in hydraulic surcharge of the pipe plug installed as part of the 2010 TCRA.
- **Elevated cPAH concentrations in surface sediments in beach area:** Concentrations of cPAH are elevated in surface sediments throughout the beach area, but at concentrations substantially lower than in the SG-04/SG-05 area.

Based on the findings of the Removal Evaluation, and consistent with direction from EPA, a TCRA that includes the following elements is proposed to address the conditions and pathways identified above:

- **Removing two surface deposits of solid hydrocarbon material:** Two localized surface deposits of solid hydrocarbon material will be removed to the extent practicable. The location of these deposits is shown on Figure 5-2. These thin deposits were found to contain elevated PAH concentrations. Because this material is located on the surface, it appears it can be removed safely without affecting adjacent structures or potentially unstable upland slopes. Scattered carbonaceous briquettes present on the beach surface will also be removed from

the beach area where they are exposed and accessible. Removal of the solid hydrocarbon material and accessible briquettes will reduce residual cPAH concentrations in the beach area.

- **Placing a sediment cap in SG-04/SG-05 area:** A sediment cap will be placed over the western beach area where a hydrocarbon sheen and elevated PAH concentrations were noted in subsurface sediments (see the SG-04/SG-05 area on Figure 5-2). The cap will consist of an organoclay mat covered by clean beach cobbles. The organoclay mat will prevent migration of the hydrocarbon sheen, and the cobbles will protect the cap against wave erosion and will limit potential human disturbance (e.g., digging) of the cap. The cap will use the same design as that successfully used in the eastern beach area during the 2010 TCRA. Cap placement will require removing one creosote-treated pile within the mat placement area. The cap will be placed during low-tide conditions (i.e., "in the dry") and best management practices will be followed to minimize disturbance to water quality and aquatic life.
- **Plugging connections to Manhole A:** Manhole A is associated with the pipe that was plugged at the beach during the 2010 TCRA. Plugging of the remaining connections to Manhole A will minimize the risk of potential hydraulic surcharge of the pipe from stormwater intrusion and thereby minimize the potential risk of future hydrocarbon releases from the pipe.
- **Installing signs in beach area:** Signs will be installed on each end of the intertidal beach area and on a path leading to the beach. These signs will contain wording to alert potential beach users of the presence of hydrocarbon contaminants, provide guidance on measures to protect their health, and identify contacts for additional information regarding the Site.

Figure 5-2 identifies the features of the proposed TCRA. The detailed methods and schedule for implementation of the TCRA are described in a separate document, the Removal Action Work Plan. That document has been prepared consistent with the AOC and has been submitted to EPA (Anchor QEA and Aspect 2013).

Actions to be taken as part of the proposed TCRA are expected to achieve the following goals:

- Limit potentially significant human health exposures to PAH-impacted sediments.
- Remove identified deposits of hydrocarbon materials from intertidal areas containing elevated PAH concentrations to the extent practicable.
- Prevent human exposures and physical disturbance of hydrocarbon sheen in the SG-04/SG-05 area.
- Limit potential hydraulic surcharge of the plugged concrete pipe in the eastern beach area.

Site conditions will be monitored while the RI/FS is ongoing to gauge the effectiveness of the TCRA. Additional removal of contaminated sediments is not recommended at this time because of potential technical challenges and because the proposed TCRA is expected to adequately protect human health and the environment until the RI/FS is

complete. The nature and extent of contamination, the location of contaminant sources, and the transport of contaminants from source areas require additional characterization before determining the appropriateness and scope of additional removal actions. Additional removal is also potentially limited by buried utilities, unstable slopes, and existing structures that would require additional characterization to design and implement an appropriate action. Further characterization will be conducted as part of the RI/FS to produce a comprehensive conceptual site model that addresses sources and pathways. Implementation of the proposed TCRA is not expected to interfere with the RI/FS or future cleanup actions. A final cleanup action for the Site, including the areas subject to the 2010 TCRA and the proposed TCRA, will be determined after the RI/FS is complete.

6 References

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TABLES

Table 2-1
PAH Compounds Included in the Removal Evaluation Testing Program

1-Methylnaphthalene	2-Methylnaphthalene	Acenaphthene[1]
Acenaphthylene[1]	Anthracene[1]	Benz(a)anthracene[2,3]
Benzo(a)pyrene [2,3]	Benzo(b)fluoranthene [2,3]	Benzo(g,h,i)perylene[2]
Benzo(j)fluoranthene[2]	Benzo(k)fluoranthene[2,3]	Chrysene[2,3]
Dibenzo[a,h]anthracene[2,3]	Dibenzofuran	Fluoranthene[2]
Fluorene[1]	Indeno(1,2,3-c,d)pyrene[2,3]	Naphthalene[1]
Phenanthrene[1]	Pyrene[2]	

Notes:
PAH = Polycyclic aromatic hydrocarbon
1 = Low-molecular weight PAHs (LPAH) are compounds evaluated for screening of potential ecological exposures as promulgated under the Washington State Department of Ecology's (Ecology) Sediment Management Standards (SMS) rule (Ecology 2013)
2 = High-molecular weight PAHs (HPAH) are compounds evaluated for screening of potential ecological exposures as promulgated under the Ecology's SMS rule (Ecology 2013)
3 = Carcinogenic PAHs (cPAH) are most relevant to evaluation of human health exposures. Calculation of cPAH toxic equivalency quotient (TEQ) was performed using current EPA-approved toxicity equivalency factors (TEF; EPA 1993). As an additional point of comparison, this report also presents the cPAH TEQ concentrations using the TEFs promulgated under Washington's current Model Toxics Control Act (MTCA) rule (Ecology 2007).

Table 3-1
Summary of Removal Evaluation Samples and Requested Laboratory Analysis

Migration Pathway Evaluation Task	Location ID	Sample ID	Depth		Requested Analysis			
					VOC	SVOC	TOC/TS	Archive
Intertidal Testing								
	BGW-RE-SG-01	BGW-RE-SG-01-130708	0-4	in		X	X	X
	BGW-RE-SG-02	BGW-RE-SG-02-130708	0-4	in		X	X	X
	BGW-RE-SG-03	BGW-RE-SG-03-130708	0-4	in		X	X	X
	BGW-RE-SG-04	BGW-RE-SG-04-130708	0-4	in		X	X	X
	BGW-RE-SG-04	BGW-RE-SG-04B-130708	4-12	in		X	X	X
	BGW-RE-SG-05	BGW-RE-SG-05-130708	0-4	in		X	X	X
	BGW-RE-SG-06	BGW-RE-SG-06-130708	0-4	in		X	X	X
	BGW-RE-SG-07	BGW-RE-SG-07-130708	0-4	in		X	X	X
	BGW-RE-SG-08	BGW-RE-SG-08-130708	0-4	in		X	X	X
	BGW-RE-SG-09	BGW-RE-SG-09-130708	0-4	in		X	X	X
	BGW-RE-SG-10	BGW-RE-SG-10-130708	0-4	in		X	X	X
	BGW-RE-SG-11	BGW-RE-SG-11-130708	0-4	in		X	X	X
	BGW-RE-SG-12	BGW-RE-SG-12-130708	0-4	in		X	X	X
	BGW-RE-SG-13	BGW-RE-SG-13-130708	0-4	in		X	X	X
	BGW-RE-SG-14	BGW-RE-SG-14-130708	0-4	in		X	X	X
	BGW-RE-SG-15	BGW-RE-SG-15-130708	0-4	in		X	X	X
	BGW-RE-SG-15	BGW-RE-SG-15B-130708	4-10	in		X	X	X
	BGW-RE-SG-16	BGW-RE-SG-16-130708	0-4	in		X	X	X
	BGW-RE-SG-17	BGW-RE-SG-17-130708	0-4	in		X	X	X
	BGW-RE-SG-17	BGW-RE-SG-17B-130708	4-9	in		X	X	X
	BGW-RE-SG-18	BGW-RE-SG-18-130708	0-4	in		X	X	X
	BGW-RE-SG-19	BGW-RE-SG-19-130708	0-4	in		X	X	X
	BGW-RE-SG-19	BGW-RE-SG-19B-130708	4-8	in		X	X	X
	BGW-RE-SG-20	BGW-RE-SG-20-130708	0-4	in		X	X	X
	BGW-RE-SG-20	BGW-RE-SG-20B-130708	4-12	in				X
	BGW-RE-SG-21	BGW-RE-SG-21-130708	0-4	in		X	X	X
	BGW-RE-SG-22	BGW-RE-SG-22-130708	0-4	in		X	X	X
	BGW-RE-SG-22	BGW-RE-SG-22B-130708	4-10	in		X	X	X
	BGW-RE-SG-23	BGW-RE-SG-23-130708	0-4	in		X	X	X
	BGW-RE-SG-23	BGW-RE-SG-23B-130708	4-12	in				X
	BGW-RE-SG-24	BGW-RE-SG-24-130708	0-4	in		X	X	X
	BGW-RE-SG-25	BGW-RE-SG-25-130708	0-4	in		X	X	X
	BGW-RE-SG-25	BGW-RE-SG-25B-130708	4-12	in		X	X	X
	BGW-RE-SG-26	BGW-RE-SG-26-130708	0-4	in		X	X	X
	BGW-RE-SG-26	BGW-RE-SG-26B-130708	4-12	in				X
	BGW-RE-SG-27	BGW-RE-SG-27-130708	0-4	in		X	X	X
	BGW-RE-SG-28	BGW-RE-SG-28-130708	0-4	in		X	X	X
	BGW-RE-SG-29	BGW-RE-SG-29-130708	0-4	in		X	X	X
	BGW-RE-SG-30	BGW-RE-SG-30-130708	0-4	in		X	X	X
	BGW-RE-SG-31	BGW-RE-SG-31-130807	0-4	in		X	X	X
	BGW-RE-SG-32	BGW-RE-SG-32-130807	0-4	in		X	X	X
	BGW-RE-SG-33	BGW-RE-SG-33-130807	0-4	in		X	X	X
	BGW-RE-SG-34	BGW-RE-SG-34-130807	0-4	in		X	X	X
	BGW-RE-SG-35	BGW-RE-SG-35-130807	0-4	in		X	X	X
	BGW-RE-SG-36	BGW-RE-SG-36-130807	0-4	in		X	X	X
	BGW-RE-SG-37	BGW-RE-SG-37-130807	0-4	in		X	X	X
	BGW-RE-SG-38	BGW-RE-SG-38-130807	0-4	in		X	X	X
	BGW-RE-SG-39	BGW-RE-SG-39-130807	0-4	in		X	X	X
	BGW-RE-SG-40	BGW-RE-SG-40-130807	0-4	in				X
	BGW-RE-SG-41	BGW-RE-SG-41-130807	0-4	in				X
	BGW-RE-SG-42	BGW-RE-SG-42-130807	0-4	in				X
	BGW-RE-SG-43	BGW-RE-SG-43-130807	0-4	in				X
	BGW-RE-SG-D4	BGW-RE-SG-D4-130807	0-4	in				X
	BGW-RE-SG-HLS	BGW-RE-SG-HLS-130807	0-4	in				X

Table 3-1
Summary of Removal Evaluation Samples and Requested Laboratory Analysis

Migration Pathway Evaluation Task	Location ID	Sample ID	Depth		Requested Analysis			
					VOC	SVOC	TOC/TS	Archive
Supplemental Subsurface Testing								
	BGW-RE-GP-01	BGW-RE-GP-01-0-1.2	0-1.5	ft		X	X	
	BGW-RE-GP-02	BGW-RE-GP-02-0.8-1	1-1.3	ft	X			
	BGW-RE-GP-02	BGW-RE-GP-02-0-1.2	0-1.4	ft		X	X	
	BGW-RE-GP-02	BGW-RE-GP-02-1.2-3.5	1.4-4	ft		X	X	X
	BGW-RE-GP-03	BGW-RE-GP-03-0.7-1.2	0.8-1.4	ft	X			
	BGW-RE-GP-03	BGW-RE-GP-03-0-2.0	0-2.3	ft		X	X	X
	BGW-RE-GP-03	BGW-RE-GP-03-2.0-2.8	2.3-3.2	ft	X			
	BGW-RE-GP-03	BGW-RE-GP-03-2.0-3.5	2.3-4	ft		X	X	X
	BGW-RE-GP-03	BGW-RE-GP-03-3.5-4.5	4-5	ft		X	X	
	BGW-RE-GP-04	BGW-RE-GP-04-0-1.2	0-2.2	ft		X	X	X
	BGW-RE-GP-04	BGW-RE-GP-04-1.2-2.2	2.2-4	ft		X	X	
	BGW-RE-GP-05	BGW-RE-GP-05-0.3-0.8	0.4-1.2	ft	X			
	BGW-RE-GP-05	BGW-RE-GP-05-0-1.0	0-1.5	ft		X	X	
	BGW-RE-GP-05	BGW-RE-GP-05-1.0-2.7	1.5-4	ft		X	X	X
	BGW-RE-GP-05	BGW-RE-GP-05-2.7-3.7	4-5	ft		X	X	X
	BGW-RE-GP-06	BGW-RE-GP-06-0.8-2.2	0.8-2.3	ft		X	X	
	BGW-RE-GP-06	BGW-RE-GP-06-2.2-3.9	2.3-4	ft		X	X	
	BGW-RE-GP-07	BGW-RE-GP-07-0-1.8	0-2.1	ft		X	X	X
	BGW-RE-GP-07	BGW-RE-GP-07-1.8-4.3	2.1-5	ft		X	X	X
	BGW-RE-GP-08	BGW-RE-GP-08-0-1.8	0-2.7	ft		X	X	X
	BGW-RE-GP-08	BGW-RE-GP-08-1.8-3.7	2.7-5	ft		X	X	X
	BGW-RE-HA-01-6.5	BGW-RE-HA-01-6.5	5-6.5	ft		X	X	X
Rinse Blank								
	Field QC	BGW-RE-GP-RB	NA			X		
	Field QC	BGW-RE-SG-RB-130708	NA			X		
	Field QC	BGW-RE-SG-RB-130807	NA			X		
Field Duplicate								
	BGW-RE-GP-02	BGW-RE-GP-52-0-1.2	0-1.4	ft		X	X	
	BGW-RE-GP-03	BGW-RE-GP-53-2.0-3.5	2.3-4	ft		X	X	
	BGW-RE-SG-08	BGW-RE-SG-58-130708	0-4	in		X	X	
	BGW-RE-SG-15	BGW-RE-SG-65-130708	0-4	in		X	X	
	BGW-RE-SG-38	BGW-RE-SG-88-130807	0-4	in		X	X	

Notes:
NA = not applicable
QC = quality control
SVOC = semivolatile organic compound
TOC = total organic carbon
TS = total solids
VOC = volatile organic compound

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-01		BGW-RE-SG-02	
Sample ID				BGW-RE-SG-01-130708		BGW-RE-SG-02-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**6.79 J**	--	**1.61 J**	--
Total solids	SM2540B	--	--	**80.14**	--	**80.02**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.28**	0.4	**0.31**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**4.1**	NA	**19**	0.3
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.58**	--	**0.68**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.0**	0.7	**1.1**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.22**	0.3	**0.33**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**2.0**	1.5	**2.6**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.8**	0.4	**2.6**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**12**	7.5	**12**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**13**	4.3	**13**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**9.6**	--	**8.4**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**13**	18	**10**	14
Benzo(j)fluoranthene	SW8270DSIM	--	--	**4.9**	--	**4.6**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**4.6**	--	**4.1**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**19**	5.3	**17**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**13**	4.6	**11**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.5**	2.8	**1.2**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**24**	9.6	**24**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**1.0**	1.0	**1.2**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**8.8**	13	**7.3**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.5**	0.6	**1.2**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**11**	2.0	**10**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**36**	11	**31**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**140**	8.3	**127**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**18**	1.3	**18**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**17**	--	**16**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**18**	--	**17**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**17**	--	**16**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**18**	--	**17**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**15**	NA	**68**	1.1
Acenaphthene	SW8270DSIM	16	57	**3.2**	NA	**20**	0.4
Acenaphthylene	SW8270DSIM	66	66	**29**	NA	**161**	2.4
Anthracene	SW8270DSIM	220	1200	**27**	NA	**161**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**177**	NA	**745**	2.8
Benzo(a)pyrene	SW8270DSIM	99	210	**191**	NA	**807**	3.8
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**191**	NA	**621**	8.0
Chrysene	SW8270DSIM	110	460	**191**	NA	**683**	1.5
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**22**	NA	**75**	2.3
Fluoranthene	SW8270DSIM	160	1200	**353**	NA	**1491**	1.2
Fluorene	SW8270DSIM	23	79	**15**	NA	**75**	0.9
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**130**	NA	**453**	5.2
Naphthalene	SW8270DSIM	99	170	**22**	NA	**75**	0.4
Phenanthrene	SW8270DSIM	100	480	**162**	NA	**621**	1.3
Pyrene	SW8270DSIM	1000	1400	**530**	NA	**1925**	1.4
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**281**	NA	**1062**	2.4
Total HPAH (SMS) (U = 0)		960	5300	**2068**	NA	**7863**	1.5
Total LPAH (SMS) (U = 0)		370	780	**258**	NA	**1114**	1.4

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-03		BGW-RE-SG-04	
Sample ID				BGW-RE-SG-03-130708		BGW-RE-SG-04-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	2LAET Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.52 J**	--	**5.15 J**	--
Total solids	SM2540B	--	--	**80.46**	--	**77.20**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.22**	NA	**3.0**	4.3
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**6.3**	0.1	**58**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.33**	--	**18**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.57**	NA	**5.4**	3.9
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.22**	NA	**17**	23
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**1.3**	NA	**14**	11
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.3**	NA	**35**	8.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**11**	NA	**22**	14
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**14**	NA	**22**	7.3
Benzo(b)fluoranthene	SW8270DSIM	--	--	**8.6**	--	**12**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**11**	15	**14**	19
Benzo(j)fluoranthene	SW8270DSIM	--	--	**4.4**	--	**6.2**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**4.0**	--	**6.5**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**17**	NA	**25**	6.9
Chrysene	SW8270DSIM	*1.4*	*2.8*	**11**	NA	**24**	8.6
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.2**	NA	**1.9**	3.5
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**22**	NA	**61**	24
Fluorene	SW8270DSIM	*0.54*	*1*	**0.58**	NA	**33**	33
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**8.0**	NA	**9.5**	14
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.98**	NA	**10**	4.2
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**7.6**	NA	**120**	22
Pyrene	SW8270DSIM	*2.6*	*3.3*	**32**	NA	**95**	29
Total HPAH (SMS) (U = 0)		*12*	*17*	**127**	NA	**274**	16
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**12**	NA	**229**	18
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**17**	--	**27**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**18**	--	**28**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**17**	--	**27**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**18**	--	**28**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**16**	0.3	**105**	NA
Acenaphthene	SW8270DSIM	16	57	**6.3**	0.1	**330**	NA
Acenaphthylene	SW8270DSIM	66	66	**37**	0.6	**272**	NA
Anthracene	SW8270DSIM	220	1200	**37**	0.0	**680**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**313**	1.2	**427**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**398**	1.9	**427**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**313**	4.0	**272**	NA
Chrysene	SW8270DSIM	110	460	**313**	0.7	**466**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**34**	1.0	**37**	NA
Fluoranthene	SW8270DSIM	160	1200	**625**	0.5	**1184**	NA
Fluorene	SW8270DSIM	23	79	**16**	0.2	**641**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**227**	2.6	**184**	NA
Naphthalene	SW8270DSIM	99	170	**28**	0.2	**194**	NA
Phenanthrene	SW8270DSIM	100	480	**216**	0.4	**2330**	NA
Pyrene	SW8270DSIM	1000	1400	**909**	0.6	**1845**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**483**	1.1	**480**	NA
Total HPAH (SMS) (U = 0)		960	5300	**3614**	0.7	**5322**	NA
Total LPAH (SMS) (U = 0)		370	780	**340**	0.4	**4447**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-04		BGW-RE-SG-05	
Sample ID				BGW-RE-SG-04B-130708		BGW-RE-SG-05-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	2LAET Exceedance Factor
Sample Depth				4 - 12 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**2.45**	--	**12.6 J**	--
Total solids	SM2540B	--	--	**75.60**	--	**70.92**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**6.2**	NA	**13**	19
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**253**	4.4	**103**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**22**	--	**14**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**4.8**	NA	**12**	8.6
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**21**	NA	**160**	219
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**27**	NA	**42**	32
Anthracene	SW8270DSIM	*0.96*	*4.4*	**61**	NA	**180**	41
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**37**	NA	**310**	194
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**35**	NA	**400**	133
Benzo(b)fluoranthene	SW8270DSIM	--	--	**18**	--	**200**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**25**	NA	**260**	361
Benzo(j)fluoranthene	SW8270DSIM	--	--	**10**	--	**100**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**11**	--	**93**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**39**	NA	**393**	109
Chrysene	SW8270DSIM	*1.4*	*2.8*	**45**	NA	**270**	96
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**4.0**	NA	**38**	70
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**100**	NA	**1100**	440
Fluorene	SW8270DSIM	*0.54*	*1*	**61**	NA	**42**	42
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**17**	NA	**190**	275
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**9.0**	NA	**52**	22
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**230**	NA	**490**	91
Pyrene	SW8270DSIM	*2.6*	*3.3*	**140**	NA	**1400**	424
Total HPAH (SMS) (U = 0)		*12*	*17*	**442**	NA	**4361**	257
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**409**	NA	**966**	74
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**44**	--	**486**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**46**	--	**509**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**44**	--	**486**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**46**	--	**509**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**196**	3.1	**95**	NA
Acenaphthene	SW8270DSIM	16	57	**857**	15	**1270**	NA
Acenaphthylene	SW8270DSIM	66	66	**1102**	17	**333**	NA
Anthracene	SW8270DSIM	220	1200	**2490**	2.1	**1429**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**1510**	5.6	**2460**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**1429**	6.8	**3175**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**1020**	13.1	**2063**	NA
Chrysene	SW8270DSIM	110	460	**1837**	4.0	**2143**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**163**	4.9	**302**	NA
Fluoranthene	SW8270DSIM	160	1200	**4082**	3.4	**8730**	NA
Fluorene	SW8270DSIM	23	79	**2490**	32	**333**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**694**	7.9	**1508**	NA
Naphthalene	SW8270DSIM	99	170	**367**	2.2	**413**	NA
Phenanthrene	SW8270DSIM	100	480	**9388**	20	**3889**	NA
Pyrene	SW8270DSIM	1000	1400	**5714**	4.1	**11111**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**1592**	3.5	**3119**	NA
Total HPAH (SMS) (U = 0)		960	5300	**18041**	3.4	**34611**	NA
Total LPAH (SMS) (U = 0)		370	780	**16694**	21	**7667**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-06		BGW-RE-SG-07	
Sample ID				BGW-RE-SG-06-130708		BGW-RE-SG-07-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.66 J**	--	**4.69 J**	--
Total solids	SM2540B	--	--	**79.40**	--	**81.32**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.28**	NA	**0.22**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**7.7**	**0.1**	**4.7**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.57**	--	**0.35**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.91**	NA	**0.83**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.34**	NA	**0.059**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**1.7**	NA	**1.2**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.6**	NA	**1.0**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**9.1**	NA	**5.1**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**10**	NA	**5.5**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**7.0**	--	**4.3**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**9.0**	NA	**5.6**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**3.4**	--	**2.1**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**3.3**	--	**2.2**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**14**	NA	**8.6**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**9.2**	NA	**5.5**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.0**	NA	**0.66**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**18**	NA	**9.9**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.97**	NA	**0.54**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**6.3**	NA	**3.9**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.2**	NA	**1.1**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**9.1**	NA	**7.0**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**24**	NA	**15**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**100**	NA	**60**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**15**	NA	**11**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**13**	--	**7.2**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**13**	--	**7.5**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**13**	--	**7.2**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**13**	--	**7.5**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**25**	0.4	**18**	0.3
Acenaphthene	SW8270DSIM	16	57	**9.3**	0.2	**1.3**	0.0
Acenaphthylene	SW8270DSIM	66	66	**46**	0.7	**26**	0.4
Anthracene	SW8270DSIM	220	1200	**44**	0.0	**21**	0.0
Benzo(a)anthracene	SW8270DSIM	110	270	**249**	0.9	**109**	0.4
Benzo(a)pyrene	SW8270DSIM	99	210	**273**	1.3	**117**	0.6
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**246**	3.2	**119**	1.5
Chrysene	SW8270DSIM	110	460	**251**	0.5	**117**	0.3
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**27**	0.8	**14**	0.4
Fluoranthene	SW8270DSIM	160	1200	**492**	0.4	**211**	0.2
Fluorene	SW8270DSIM	23	79	**27**	0.3	**12**	0.1
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**172**	2.0	**83**	0.9
Naphthalene	SW8270DSIM	99	170	**33**	0.2	**23**	0.1
Phenanthrene	SW8270DSIM	100	480	**249**	0.5	**149**	0.3
Pyrene	SW8270DSIM	1000	1400	**656**	0.5	**320**	0.2
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**374**	0.8	**183**	0.4
Total HPAH (SMS) (U = 0)		960	5300	**2740**	0.5	**1274**	0.2
Total LPAH (SMS) (U = 0)		370	780	**407**	0.5	**232**	0.3

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-08		BGW-RE-SG-08	
Sample ID				BGW-RE-SG-08-130708		BGW-RE-SG-58-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		FD	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**9.31 J**	--	**4.98**	--
Total solids	SM2540B	--	--	**78.02**	--	**81.48**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.52**	0.7	**1.1**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**5.6**	NA	**22**	0.4
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.79**	--	**4.2**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**2.3**	1.6	**8.7**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.15**	0.2	**0.28**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**4.5**	3.5	**7.0**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**3.5**	0.8	**5.2**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**23**	14	**17**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**26**	8.7	**16**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**18**	--	**12**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**21**	29	**16**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**8.7**	--	**6.1**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**7.8**	--	**6.1**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**35**	9.6	**24**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**25**	8.9	**22**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**3.2**	5.9	**2.8**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**36**	14	**32**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**1.1**	1.1	**2.0**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**14**	20	**11**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**3.8**	1.6	**16**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**17**	3.1	**27**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**47**	14	**34**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**230**	14	**175**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**30**	2.3	**57**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**33**	--	**21**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**35**	--	**23**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**33**	--	**21**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**35**	--	**23**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**25**	NA	**175**	2.7
Acenaphthene	SW8270DSIM	16	57	**1.6**	NA	**5.6**	0.1
Acenaphthylene	SW8270DSIM	66	66	**48**	NA	**141**	2.1
Anthracene	SW8270DSIM	220	1200	**38**	NA	**104**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**247**	NA	**341**	1.3
Benzo(a)pyrene	SW8270DSIM	99	210	**279**	NA	**321**	1.5
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**226**	NA	**321**	4.1
Chrysene	SW8270DSIM	110	460	**269**	NA	**442**	1.0
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**34**	NA	**56**	1.7
Fluoranthene	SW8270DSIM	160	1200	**387**	NA	**643**	0.5
Fluorene	SW8270DSIM	23	79	**12**	NA	**40**	0.5
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**150**	NA	**221**	2.5
Naphthalene	SW8270DSIM	99	170	**41**	NA	**321**	1.9
Phenanthrene	SW8270DSIM	100	480	**183**	NA	**542**	1.1
Pyrene	SW8270DSIM	1000	1400	**505**	NA	**683**	0.5
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**371**	NA	**486**	1.1
Total HPAH (SMS) (U = 0)		960	5300	**2467**	NA	**3514**	0.7
Total LPAH (SMS) (U = 0)		370	780	**323**	NA	**1154**	1.5

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-09		BGW-RE-SG-10	
Sample ID				BGW-RE-SG-09-130708		BGW-RE-SG-10-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.83 J**	--	**2.89 J**	--
Total solids	SM2540B	--	--	**74.83**	--	**78.34**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.26**	NA	**0.25**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**6.8**	0.1	**8.7**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.47**	--	**0.48**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.0**	NA	**0.72**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.10**	NA	**0.094**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**2.0**	NA	**1.2**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.4**	NA	**1.9**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**8.4**	NA	**7.5**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**9.4**	NA	**9.3**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**6.6**	--	**5.9**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**8.1**	NA	**8.0**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**3.5**	--	**3.0**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**3.3**	--	**2.9**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**13**	NA	**12**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**8.7**	NA	**7.9**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.90**	NA	**0.70**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**13**	NA	**14**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.78**	NA	**0.68**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**5.5**	NA	**5.3**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.3**	NA	**1.2**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**7.8**	NA	**7.9**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**20**	NA	**22**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**87**	NA	**87**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**13**	NA	**13**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**12**	--	**12**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**12**	--	**12**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**12**	--	**12**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**12**	--	**12**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**26**	0.4	**25**	0.4
Acenaphthene	SW8270DSIM	16	57	**2.6**	0.0	**3.3**	0.1
Acenaphthylene	SW8270DSIM	66	66	**52**	0.8	**42**	0.6
Anthracene	SW8270DSIM	220	1200	**37**	0.0	**66**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**219**	0.8	**260**	1.0
Benzo(a)pyrene	SW8270DSIM	99	210	**245**	1.2	**322**	1.5
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**211**	2.7	**277**	3.5
Chrysene	SW8270DSIM	110	460	**227**	0.5	**273**	0.6
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**23**	0.7	**24**	0.7
Fluoranthene	SW8270DSIM	160	1200	**339**	0.3	**484**	0.4
Fluorene	SW8270DSIM	23	79	**20**	0.3	**24**	0.3
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**144**	1.6	**183**	2.1
Naphthalene	SW8270DSIM	99	170	**34**	0.2	**42**	0.2
Phenanthrene	SW8270DSIM	100	480	**204**	0.4	**273**	0.6
Pyrene	SW8270DSIM	1000	1400	**522**	0.4	**761**	0.5
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**350**	0.8	**408**	0.9
Total HPAH (SMS) (U = 0)		960	5300	**2282**	0.4	**2993**	0.6
Total LPAH (SMS) (U = 0)		370	780	**349**	0.4	**449**	0.6

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-11		BGW-RE-SG-12	
Sample ID				BGW-RE-SG-11-130708		BGW-RE-SG-12-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.28 J**	--	**2.34 J**	--
Total solids	SM2540B	--	--	**77.27**	--	**77.52**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.36**	NA	**0.18**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**11**	0.2	**7.7**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.92**	--	**0.34**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.7**	NA	**0.72**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.26**	NA	**0.12**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**2.7**	NA	**0.89**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**3.0**	NA	**0.89**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**9.4**	NA	**4.0**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**11**	NA	**4.3**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**7.4**	--	**2.8**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**10**	NA	**3.6**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**3.9**	--	**1.4**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**3.5**	--	**1.5**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**15**	NA	**5.7**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**11**	NA	**4.2**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.75**	NA	**0.33**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**20**	NA	**8.2**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**1.4**	NA	**0.52**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**7.1**	NA	**1.2**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**2.5**	NA	**1.2**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**16**	NA	**4.3**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**28**	NA	**13**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**112**	NA	**45**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**26**	NA	**7.9**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**14**	--	**5.3**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**14**	--	**5.4**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**14**	--	**5.3**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**14**	--	**5.4**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**52**	0.8	**31**	0.5
Acenaphthene	SW8270DSIM	16	57	**7.9**	0.1	**5.1**	0.1
Acenaphthylene	SW8270DSIM	66	66	**82**	1.2	**38**	0.6
Anthracene	SW8270DSIM	220	1200	**91**	0.1	**38**	0.0
Benzo(a)anthracene	SW8270DSIM	110	270	**287**	1.1	**171**	0.6
Benzo(a)pyrene	SW8270DSIM	99	210	**335**	1.6	**184**	0.9
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**305**	3.9	**154**	2.0
Chrysene	SW8270DSIM	110	460	**335**	0.7	**179**	0.4
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**23**	0.7	**14**	0.4
Fluoranthene	SW8270DSIM	160	1200	**610**	0.5	**350**	0.3
Fluorene	SW8270DSIM	23	79	**43**	0.5	**22**	0.3
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**216**	2.5	**51**	0.6
Naphthalene	SW8270DSIM	99	170	**76**	0.4	**51**	0.3
Phenanthrene	SW8270DSIM	100	480	**488**	1.0	**184**	0.4
Pyrene	SW8270DSIM	1000	1400	**854**	0.6	**556**	0.4
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**451**	1.0	**244**	0.5
Total HPAH (SMS) (U = 0)		960	5300	**3416**	0.6	**1903**	0.4
Total LPAH (SMS) (U = 0)		370	780	**788**	1.0	**338**	0.4

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-13		BGW-RE-SG-14	
Sample ID				BGW-RE-SG-13-130708		BGW-RE-SG-14-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**5.18 J**	--	**1.59 J**	--
Total solids	SM2540B	--	--	**76.12**	--	**83.35**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.39**	0.6	**0.080**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**7.5**	NA	**5.0**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.68**	--	**0.18 J**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.3**	0.9	**0.32**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.19**	0.3	**0.036**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**1.6**	1.2	**0.46 J**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.7**	0.4	**0.44**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**6.8**	4.3	**2.6**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**7.0**	2.3	**2.7**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**4.6**	--	**1.7**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**5.5**	7.6	**2.0**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**2.5**	--	**0.76**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**2.3**	--	**0.76**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**9.4**	2.6	**3.2**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**7.0**	2.5	**2.8**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.94**	1.7	**0.18**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**14**	5.6	**3.9**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**1.2**	1.2	**0.21 J**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**3.9**	5.7	**1.4**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**2.2**	0.9	**0.65**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**8.6**	1.6	**1.6**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**20**	6.1	**5.7**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**75**	4.4	**25**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**15**	1.2	**3.4 J**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**8.9**	--	**3.4**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**9.5**	--	**3.5**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**8.9**	--	**3.4**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**9.5**	--	**3.5**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**25**	NA	**20**	0.3
Acenaphthene	SW8270DSIM	16	57	**3.7**	NA	**2.3**	0.0
Acenaphthylene	SW8270DSIM	66	66	**31**	NA	**29 J**	0.4
Anthracene	SW8270DSIM	220	1200	**33**	NA	**28**	0.0
Benzo(a)anthracene	SW8270DSIM	110	270	**131**	NA	**164**	0.6
Benzo(a)pyrene	SW8270DSIM	99	210	**135**	NA	**170**	0.8
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**106**	NA	**126**	1.6
Chrysene	SW8270DSIM	110	460	**135**	NA	**176**	0.4
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**18**	NA	**11**	0.3
Fluoranthene	SW8270DSIM	160	1200	**270**	NA	**245**	0.2
Fluorene	SW8270DSIM	23	79	**23**	NA	**13 J**	0.2
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**75**	NA	**88**	1.0
Naphthalene	SW8270DSIM	99	170	**42**	NA	**41**	0.2
Phenanthrene	SW8270DSIM	100	480	**166**	NA	**101**	0.2
Pyrene	SW8270DSIM	1000	1400	**386**	NA	**358**	0.3
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**181**	NA	**203**	0.5
Total HPAH (SMS) (U = 0)		960	5300	**1439**	NA	**1541**	0.3
Total LPAH (SMS) (U = 0)		370	780	**299**	NA	**214 J**	0.3

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-15		BGW-RE-SG-15	
Sample ID				BGW-RE-SG-15-130708		BGW-RE-SG-15B-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		4 - 10 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**5.54 J**	--	**1.36**	--
Total solids	SM2540B	--	--	**69.85**	--	**70.88**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**1.2**	1.7	**0.58**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**22**	NA	**43**	0.7
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**3.5**	--	**1.2**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**5.5**	3.9	**2.0**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.96 J**	1.3	**0.49**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**6.4**	4.9	**4.6**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**7.4**	1.7	**6.7**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**23**	14	**15**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**24**	8.0	**16**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**16**	--	**8.9**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**20**	28	**12**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**8.3**	--	**5.2**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**8.7**	--	**5.3**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**33**	9.2	**19**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**24**	8.6	**17**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**3.6**	6.7	**2.3**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**45**	18	**29**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**3.5**	3.5	**1.7**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**14**	20	**8.6**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**7.1**	3.0	**3.1**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**29**	5.4	**13**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**64**	19	**36**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**251**	15	**155**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**54 J**	4.2	**30**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**31**	--	**20**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**33**	--	**22**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**31**	--	**20**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**33**	--	**22**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**99**	NA	**147**	2.3
Acenaphthene	SW8270DSIM	16	57	**17 J**	NA	**36**	0.6
Acenaphthylene	SW8270DSIM	66	66	**116**	NA	**338**	5.1
Anthracene	SW8270DSIM	220	1200	**134**	NA	**493**	0.4
Benzo(a)anthracene	SW8270DSIM	110	270	**415**	NA	**1103**	4.1
Benzo(a)pyrene	SW8270DSIM	99	210	**433**	NA	**1176**	5.6
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**361**	NA	**882**	11.3
Chrysene	SW8270DSIM	110	460	**433**	NA	**1250**	2.7
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**65**	NA	**169**	5.1
Fluoranthene	SW8270DSIM	160	1200	**812**	NA	**2132**	1.8
Fluorene	SW8270DSIM	23	79	**63**	NA	**125**	1.6
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**253**	NA	**632**	7.2
Naphthalene	SW8270DSIM	99	170	**128**	NA	**228**	1.3
Phenanthrene	SW8270DSIM	100	480	**523**	NA	**956**	2.0
Pyrene	SW8270DSIM	1000	1400	**1155**	NA	**2647**	1.9
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**596**	NA	**1426**	3.2
Total HPAH (SMS) (U = 0)		960	5300	**4523**	NA	**11419**	2.2
Total LPAH (SMS) (U = 0)		370	780	**981 J**	NA	**2176**	2.8

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-15		BGW-RE-SG-16	
Sample ID				BGW-RE-SG-65-130708		BGW-RE-SG-16-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				FD		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.93**	--	**1.75**	--
Total solids	SM2540B	--	--	**69.56**	--	**75.82**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.84**	NA	**0.36**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**21**	**0.4**	**21**	0.4
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**1.6**	--	**1.9**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**2.4**	NA	**4.0**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.54**	NA	**0.15**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**3.0**	NA	**3.2**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**4.3**	NA	**2.8**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**13**	NA	**10**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**14**	NA	**10**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**9.5**	--	**6.3**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**12**	NA	**8.4**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**5.0**	--	**3.8**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**4.7**	--	**3.4**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**19**	NA	**14**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**16**	NA	**11**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.9**	NA	**1.4**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**29**	NA	**16**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**1.4**	NA	**1.0**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**7.9**	NA	**5.9**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**4.4**	NA	**6.4**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**14**	NA	**11**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**36**	NA	**23**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**149**	NA	**99**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**28**	NA	**24.6**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**18**	--	**13**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**19**	--	**14**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**18**	--	**13**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**19**	--	**14**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**61**	1.0	**229**	3.6
Acenaphthene	SW8270DSIM	16	57	**14**	0.2	**8.6**	0.2
Acenaphthylene	SW8270DSIM	66	66	**76**	1.2	**183**	2.8
Anthracene	SW8270DSIM	220	1200	**109**	0.1	**160**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**331**	1.2	**571**	2.1
Benzo(a)pyrene	SW8270DSIM	99	210	**356**	1.7	**571**	2.7
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**305**	3.9	**480**	6.2
Chrysene	SW8270DSIM	110	460	**407**	0.9	**629**	1.4
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**48**	1.5	**80**	2.4
Fluoranthene	SW8270DSIM	160	1200	**738**	0.6	**914**	0.8
Fluorene	SW8270DSIM	23	79	**36**	0.5	**57**	0.7
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**201**	2.3	**337**	3.8
Naphthalene	SW8270DSIM	99	170	**112**	0.7	**366**	2.2
Phenanthrene	SW8270DSIM	100	480	**356**	0.7	**629**	1.3
Pyrene	SW8270DSIM	1000	1400	**916**	0.7	**1314**	0.9
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**489**	1.1	**771**	1.7
Total HPAH (SMS) (U = 0)		960	5300	**3791**	0.7	**5669**	1.1
Total LPAH (SMS) (U = 0)		370	780	**703**	0.9	**1403**	1.8

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-17		BGW-RE-SG-17	
Sample ID				BGW-RE-SG-17-130708		BGW-RE-SG-17B-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		4 - 9 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.14**	--	**1.97**	--
Total solids	SM2540B	--	--	**87.50**	--	**84.59**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.23**	NA	**0.37**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**7.3**	0.1	**19**	0.3
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.55**	--	**1.2**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.86**	NA	**2.1**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.14**	NA	**0.28**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**2.0**	NA	**3.2**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.3**	NA	**2.7**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**5.0**	NA	**10**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**4.2**	NA	**12**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**2.9**	--	**7.6**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**3.5**	NA	**10**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**1.7**	--	**4.3**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**1.6**	--	**3.8**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**6.2**	NA	**16**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**5.1**	NA	**12**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.67**	NA	**1.8**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**13**	NA	**23**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**1.0**	NA	**1.6**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**2.4**	NA	**7.5**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.2**	NA	**3.0**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**12**	NA	**12**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**18**	NA	**31**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**58**	NA	**123**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**18**	NA	**23**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**5.5**	--	**15**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**5.9**	--	**16**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**5.5**	--	**15**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**5.9**	--	**16**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**27**	0.4	**107**	1.7
Acenaphthene	SW8270DSIM	16	57	**4.5**	0.1	**14**	0.2
Acenaphthylene	SW8270DSIM	66	66	**64**	1.0	**162**	2.5
Anthracene	SW8270DSIM	220	1200	**41**	0.0	**137**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**159**	0.6	**508**	1.9
Benzo(a)pyrene	SW8270DSIM	99	210	**134**	0.6	**609**	2.9
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**111**	1.4	**508**	6.5
Chrysene	SW8270DSIM	110	460	**162**	0.4	**609**	1.3
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**21**	0.6	**91**	2.8
Fluoranthene	SW8270DSIM	160	1200	**414**	0.3	**1168**	1.0
Fluorene	SW8270DSIM	23	79	**32**	0.4	**81**	1.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**76**	0.9	**381**	4.3
Naphthalene	SW8270DSIM	99	170	**38**	0.2	**152**	0.9
Phenanthrene	SW8270DSIM	100	480	**382**	0.8	**609**	1.3
Pyrene	SW8270DSIM	1000	1400	**573**	0.4	**1574**	1.1
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**197**	0.4	**797**	1.8
Total HPAH (SMS) (U = 0)		960	5300	**1849**	0.3	**6244**	1.2
Total LPAH (SMS) (U = 0)		370	780	**562**	0.7	**1156**	1.5

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-18		BGW-RE-SG-19	
Sample ID				BGW-RE-SG-18-130708		BGW-RE-SG-19-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.514**	--	**2.29**	--
Total solids	SM2540B	--	--	**89.99**	--	**69.43**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.11**	NA	**0.095**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**21**	0.4	**4.1**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.58**	--	**0.26**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.22**	NA	**0.42**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.072**	NA	**0.12**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.20**	NA	**0.92**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.18**	NA	**0.89**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.48**	NA	**2.7**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.62**	NA	**3.0**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.34**	--	**1.8**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.57**	NA	**2.6**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.20**	--	**1.1**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.18**	--	**1.0**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.72**	NA	**3.9**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.53**	NA	**3.2**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.099**	NA	**0.49**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.97**	NA	**5.7**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.093**	NA	**0.47**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**0.39**	NA	**1.7**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.89**	NA	**0.58**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.86**	NA	**3.2**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**1.6**	NA	**8.3**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**6.0**	NA	**32**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**2.3**	NA	**6.2**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.77**	--	**3.8**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.84**	--	**4.1**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.77**	--	**3.8**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.84**	--	**4.1**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**43**	0.7	**18**	0.3
Acenaphthene	SW8270DSIM	16	57	**14**	0.2	**5.2**	0.1
Acenaphthylene	SW8270DSIM	66	66	**39**	0.6	**40**	0.6
Anthracene	SW8270DSIM	220	1200	**35**	0.0	**39**	0.0
Benzo(a)anthracene	SW8270DSIM	110	270	**93**	0.3	**118**	0.4
Benzo(a)pyrene	SW8270DSIM	99	210	**121**	0.6	**131**	0.6
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**111**	1.4	**114**	1.5
Chrysene	SW8270DSIM	110	460	**103**	0.2	**140**	0.3
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**19**	0.6	**21**	0.6
Fluoranthene	SW8270DSIM	160	1200	**189**	0.2	**249**	0.2
Fluorene	SW8270DSIM	23	79	**18**	0.2	**21**	0.3
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**76**	0.9	**74**	0.8
Naphthalene	SW8270DSIM	99	170	**173**	1.0	**25**	0.1
Phenanthrene	SW8270DSIM	100	480	**167**	0.3	**140**	0.3
Pyrene	SW8270DSIM	1000	1400	**311**	0.2	**362**	0.3
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**140**	0.3	**170**	0.4
Total HPAH (SMS) (U = 0)		960	5300	**1163**	0.2	**1379**	0.3
Total LPAH (SMS) (U = 0)		370	780	**446**	0.6	**270**	0.3

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-19		BGW-RE-SG-20	
Sample ID				BGW-RE-SG-19B-130708		BGW-RE-SG-20-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				4 - 8 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**1.14**	--	**2.92**	--
Total solids	SM2540B	--	--	**85.36**	--	**64.21**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.26**	NA	**0.67**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**23**	0.4	**23**	0.4
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.99**	--	**1.8**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.4**	NA	**1.5**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.34**	NA	**0.96**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**2.2**	NA	**7.6**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**2.3**	NA	**8.1**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**8.6**	NA	**47**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**8.5**	NA	**50**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**5.1**	--	**29**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**6.4**	NA	**39**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**2.9**	--	**16**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**3.0**	--	**18**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**11**	NA	**63**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**9.0**	NA	**48**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.2**	NA	**5.9**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**18**	NA	**87**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.93**	NA	**1.9**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**4.5**	NA	**27**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.7**	NA	**4.4**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**7.1**	NA	**27**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**24**	NA	**120**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**91**	NA	**487**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**15**	NA	**50**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**11**	--	**63**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**12**	--	**66**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**11**	--	**63**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**12**	--	**66**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**123**	1.9	**51**	0.8
Acenaphthene	SW8270DSIM	16	57	**30**	0.5	**33**	0.6
Acenaphthylene	SW8270DSIM	66	66	**193**	2.9	**260**	3.9
Anthracene	SW8270DSIM	220	1200	**202**	0.2	**277**	0.2
Benzo(a)anthracene	SW8270DSIM	110	270	**754**	2.8	**1610**	6.0
Benzo(a)pyrene	SW8270DSIM	99	210	**746**	3.6	**1712**	8.2
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**561**	7.2	**1336**	17.1
Chrysene	SW8270DSIM	110	460	**789**	1.7	**1644**	3.6
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**105**	3.2	**202**	6.1
Fluoranthene	SW8270DSIM	160	1200	**1579**	1.3	**2979**	2.5
Fluorene	SW8270DSIM	23	79	**82**	1.0	**65**	0.8
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**395**	4.5	**925**	10.5
Naphthalene	SW8270DSIM	99	170	**149**	0.9	**151**	0.9
Phenanthrene	SW8270DSIM	100	480	**623**	1.3	**925**	1.9
Pyrene	SW8270DSIM	1000	1400	**2105**	1.5	**4110**	2.9
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**965**	2.1	**2158**	4.8
Total HPAH (SMS) (U = 0)		960	5300	**8000**	1.5	**16675**	3.1
Total LPAH (SMS) (U = 0)		370	780	**1278**	1.6	**1711**	2.2

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-21		BGW-RE-SG-22	
Sample ID				BGW-RE-SG-21-130708		BGW-RE-SG-22-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.444**	--	**2.00**	--
Total solids	SM2540B	--	--	**91.67**	--	**80.23**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.0038 J**	0.0	**0.065**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**0.86 J**	NA	**3.3**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.010**	--	**0.16**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.0052**	0.0	**0.21**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.0055**	0.0	**0.044**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.032**	0.0	**0.44**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.024 J**	0.0	**0.44**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.10**	0.1	**1.7**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.13**	0.0	**2.0**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.074**	--	**1.2**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.098**	0.1	**1.7**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.046 J**	--	**0.68**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.04 J**	--	**0.65**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.16 J**	0.0	**2.5**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.13**	0.0	**2.1**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.018**	0.0	**0.25**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.23**	0.1	**3.7**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.022**	0.0	**0.20**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**0.070**	0.1	**1.1**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.0086**	0.0	**0.41**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.17**	0.0	**1.9**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**0.35**	0.1	**4.9**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**1.3 J**	0.1	**20**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.26 J**	0.0	**3.4**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.16 J**	--	**2.5**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.17 J**	--	**2.7**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.16 J**	--	**2.5**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.17 J**	--	**2.7**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**1.2**	NA	**11**	0.2
Acenaphthene	SW8270DSIM	16	57	**1.2**	NA	**2.2**	0.0
Acenaphthylene	SW8270DSIM	66	66	**7.2**	NA	**22**	0.3
Anthracene	SW8270DSIM	220	1200	**5.4 J**	NA	**22**	0.0
Benzo(a)anthracene	SW8270DSIM	110	270	**23**	NA	**85**	0.3
Benzo(a)pyrene	SW8270DSIM	99	210	**29**	NA	**100**	0.5
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**22**	NA	**85**	1.1
Chrysene	SW8270DSIM	110	460	**29**	NA	**105**	0.2
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**4.1**	NA	**13**	0.4
Fluoranthene	SW8270DSIM	160	1200	**52**	NA	**185**	0.2
Fluorene	SW8270DSIM	23	79	**5.0**	NA	**10**	0.1
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**16**	NA	**55**	0.6
Naphthalene	SW8270DSIM	99	170	**1.9**	NA	**21**	0.1
Phenanthrene	SW8270DSIM	100	480	**38**	NA	**95**	0.2
Pyrene	SW8270DSIM	1000	1400	**79**	NA	**245**	0.2
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**36 J**	NA	**127**	0.3
Total HPAH (SMS) (U = 0)		960	5300	**290 J**	NA	**999**	0.2
Total LPAH (SMS) (U = 0)		370	780	**59 J**	NA	**172**	0.2

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-22		BGW-RE-SG-23	
Sample ID				BGW-RE-SG-22B-130708		BGW-RE-SG-23-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				4 - 10 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**1.13**	--	**2.66**	--
Total solids	SM2540B	--	--	**79.32**	--	**79.19**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.12**	NA	**0.27**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**11**	0.2	**10**	0.2
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.30 J**	--	**0.96**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.36**	NA	**1.2**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.17 J**	NA	**0.27**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**1.2 J**	NA	**2.2**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.3 J**	NA	**2.4**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**5.6 J**	NA	**7.3**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**4.4 J**	NA	**7.8**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**2.9 J**	--	**5.2**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**3.8 J**	NA	**6.5**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**1.7 J**	--	**2.9**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**1.7 J**	--	**2.8**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**6.3 J**	NA	**11**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**5.6 J**	NA	**9.4**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.67 J**	NA	**1.1**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**13**	NA	**16**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.54 J**	NA	**1.6**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**2.6 J**	NA	**4.2**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.88 J**	NA	**1.4**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**4.4 J**	NA	**15**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**18**	NA	**24**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**60 J**	NA	**87**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**8.5 J**	NA	**23**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**5.8 J**	--	**10**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**6.2 J**	--	**11**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**5.8**	--	**10**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**6.2**	--	**11**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**32**	0.5	**45**	0.7
Acenaphthene	SW8270DSIM	16	57	**15 J**	0.3	**10**	0.2
Acenaphthylene	SW8270DSIM	66	66	**106 J**	1.6	**83**	1.3
Anthracene	SW8270DSIM	220	1200	**115 J**	0.1	**90**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**496 J**	1.8	**274**	1.0
Benzo(a)pyrene	SW8270DSIM	99	210	**389 J**	1.9	**293**	1.4
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**336 J**	4.3	**244**	3.1
Chrysene	SW8270DSIM	110	460	**496 J**	1.1	**353**	0.8
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**59 J**	1.8	**41**	1.3
Fluoranthene	SW8270DSIM	160	1200	**1150**	1.0	**602**	0.5
Fluorene	SW8270DSIM	23	79	**48 J**	0.6	**60**	0.8
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**230 J**	2.6	**158**	1.8
Naphthalene	SW8270DSIM	99	170	**78 J**	0.5	**53**	0.3
Phenanthrene	SW8270DSIM	100	480	**389 J**	0.8	**564**	1.2
Pyrene	SW8270DSIM	1000	1400	**1593**	1.1	**902**	0.6
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**558 J**	1.2	**410**	0.9
Total HPAH (SMS) (U = 0)		960	5300	**5307 J**	1.0	**3278**	0.6
Total LPAH (SMS) (U = 0)		370	780	**751 J**	1.0	**860**	1.1

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-24		BGW-RE-SG-25	
Sample ID				BGW-RE-SG-24-130708		BGW-RE-SG-25-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	2LAET Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.207**	--	**16.9**	--
Total solids	SM2540B	--	--	**88.68**	--	**79.23**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	0.0047 U	NA	**0.045**	0.1
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	2.3 U	NA	**0.27**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.0032 J**	--	**0.081 J**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.0067**	0.0	**0.16 J**	0.1
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	0.0047 U	--	**0.029**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.012**	0.0	**0.35 J**	0.3
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.0086**	0.0	**0.31 J**	0.1
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.060**	0.0	**1.5**	0.9
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.080**	0.0	**1.8**	0.6
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.048**	--	**1.1**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.072**	0.1	**1.7**	2.4
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.028**	--	**0.62**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.025**	--	**0.65**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.10**	0.0	**2.37**	0.7
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.074**	0.0	**1.8**	0.6
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.012**	0.0	**0.24**	0.4
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.13**	0.1	**3.3**	1.3
Fluorene	SW8270DSIM	*0.54*	*1*	**0.0035 J**	0.0	**0.10 J**	0.1
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**0.050**	0.1	**1.1**	1.6
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.011**	0.0	**0.34 J**	0.1
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.054**	0.0	**1.2**	0.2
Pyrene	SW8270DSIM	*2.6*	*3.3*	**0.18**	0.1	**4.4**	1.3
Total HPAH (SMS) (U = 0)		*12*	*17*	**0.76**	0.0	**18**	1.1
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.089 J**	0.0	**2.3 J**	0.2
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.10**	--	**2.3**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.11**	--	**2.4**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.10**	--	**2.3**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.11**	--	**2.4**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**3.2**	NA	**0.95 J**	NA
Acenaphthene	SW8270DSIM	16	57	2.3 U	NA	**0.17**	NA
Acenaphthylene	SW8270DSIM	66	66	**5.8**	NA	**2.1 J**	NA
Anthracene	SW8270DSIM	220	1200	**4.2**	NA	**1.8 J**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**29**	NA	**8.9**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**39**	NA	**11**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**35**	NA	**10**	NA
Chrysene	SW8270DSIM	110	460	**36**	NA	**11**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**5.8**	NA	**1.4**	NA
Fluoranthene	SW8270DSIM	160	1200	**63**	NA	**20**	NA
Fluorene	SW8270DSIM	23	79	**1.7 J**	NA	**0.59 J**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**24**	NA	**6.5**	NA
Naphthalene	SW8270DSIM	99	170	**5.3**	NA	**2.0 J**	NA
Phenanthrene	SW8270DSIM	100	480	**26**	NA	**7.1**	NA
Pyrene	SW8270DSIM	1000	1400	**87**	NA	**26**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**49**	NA	**14**	NA
Total HPAH (SMS) (U = 0)		960	5300	**367**	NA	**108**	NA
Total LPAH (SMS) (U = 0)		370	780	**43 J**	NA	**14 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-25		BGW-RE-SG-26	
Sample ID				BGW-RE-SG-25B-130708		BGW-RE-SG-26-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				4 - 12 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**1.14**	--	**1.15**	--
Total solids	SM2540B	--	--	**81.67**	--	**77.33**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.16**	NA	**0.14**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**14**	0.2	**12**	0.2
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.34**	--	**0.48**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.61**	NA	**0.50**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.084 J**	NA	**0.20**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**1.3**	NA	**0.82**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**1.8**	NA	**0.99**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**7.2**	NA	**2.9**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**8.0**	NA	**3.0**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**4.4**	--	**1.8**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**6.6**	NA	**2.5**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**2.5**	--	**0.97**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**2.6**	--	**0.94**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**9.5**	NA	**3.71**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**8.1**	NA	**3.2**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.0**	NA	**0.39**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**15**	NA	**6.5**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.44**	NA	**0.4**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**4.4**	NA	**1.6**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.3**	NA	**0.94**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**4.1**	NA	**4.3**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**19**	NA	**9.1**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**79**	NA	**33**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**9.0 J**	NA	**7.7**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**10**	--	**3.8**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**11**	--	**4.0**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**10**	--	**3.8**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**11**	--	**4.0**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**54**	0.8	**43**	0.7
Acenaphthene	SW8270DSIM	16	57	**7.4 J**	0.1	**17**	0.3
Acenaphthylene	SW8270DSIM	66	66	**114**	1.7	**71**	1.1
Anthracene	SW8270DSIM	220	1200	**158**	0.1	**86**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**632**	2.3	**252**	0.9
Benzo(a)pyrene	SW8270DSIM	99	210	**702**	3.3	**261**	1.2
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**579**	7.4	**217**	2.8
Chrysene	SW8270DSIM	110	460	**711**	1.5	**278**	0.6
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**88**	2.7	**34**	1.0
Fluoranthene	SW8270DSIM	160	1200	**1316**	1.1	**565**	0.5
Fluorene	SW8270DSIM	23	79	**39**	0.5	**35**	0.4
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**386**	4.4	**139**	1.6
Naphthalene	SW8270DSIM	99	170	**114**	0.7	**82**	0.5
Phenanthrene	SW8270DSIM	100	480	**360**	0.7	**374**	0.8
Pyrene	SW8270DSIM	1000	1400	**1667**	1.2	**791**	0.6
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**833**	1.9	**323**	0.7
Total HPAH (SMS) (U = 0)		960	5300	**6912**	1.3	**2861**	0.5
Total LPAH (SMS) (U = 0)		370	780	**792 J**	1.0	**665**	0.9

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-27		BGW-RE-SG-28	
Sample ID				BGW-RE-SG-27-130708		BGW-RE-SG-28-130708	
Sample Date				07/08/2013	2LAET Exceedance Factor	07/08/2013	2LAET Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.204**	--	**0.250**	--
Total solids	SM2540B	--	--	**86.86**	--	**86.96**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.048**	0.1	**0.00090**	**0.0**
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**24**	NA	**0.36**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.096**	--	**0.0020**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.18**	0.1	**0.0043**	0.0
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.032**	0.0	**0.0004 J**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.24**	0.2	**0.0053**	0.0
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.41**	0.1	**0.0034**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**1.5**	0.9	**0.022**	0.0
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**2.0**	0.7	**0.034**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**1.2**	--	**0.021**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**1.5**	2.1	**0.039**	0.1
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.70**	--	**0.011**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.63**	--	**0.010**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**2.53**	0.7	**0.042**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**1.7**	0.6	**0.028**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.28**	0.5	**0.0058**	0.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**3.2**	1.3	**0.034**	0.0
Fluorene	SW8270DSIM	*0.54*	*1*	**0.10**	0.1	**0.0018**	0.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**1.1**	1.6	**0.025**	0.0
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.32**	0.1	**0.0075**	0.0
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**1.3**	0.2	**0.015**	0.0
Pyrene	SW8270DSIM	*2.6*	*3.3*	**4.0**	1.2	**0.055**	0.0
Total HPAH (SMS) (U = 0)		*12*	*17*	**18**	1.0	**0.285**	0.0
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**2.4**	0.2	**0.033 J**	0.0
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**2.5**	--	**0.043**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**2.7**	--	**0.047**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**2.5**	--	**0.043**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**2.7**	--	**0.047**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**88**	NA	**1.7**	NA
Acenaphthene	SW8270DSIM	16	57	**16**	NA	**0.16 J**	NA
Acenaphthylene	SW8270DSIM	66	66	**118**	NA	**2.1**	NA
Anthracene	SW8270DSIM	220	1200	**201**	NA	**1.4**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**735**	NA	**8.8**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**980**	NA	**14**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**735**	NA	**16**	NA
Chrysene	SW8270DSIM	110	460	**833**	NA	**11**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**137**	NA	**2.3**	NA
Fluoranthene	SW8270DSIM	160	1200	**1569**	NA	**14**	NA
Fluorene	SW8270DSIM	23	79	**49**	NA	**0.72**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**539**	NA	**10**	NA
Naphthalene	SW8270DSIM	99	170	**157**	NA	**3.0**	NA
Phenanthrene	SW8270DSIM	100	480	**637**	NA	**6.0**	NA
Pyrene	SW8270DSIM	1000	1400	**1961**	NA	**22**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**1240**	NA	**17**	NA
Total HPAH (SMS) (U = 0)		960	5300	**8730**	NA	**114**	NA
Total LPAH (SMS) (U = 0)		370	780	**1177**	NA	**13 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-29		BGW-RE-SG-30	
Sample ID				BGW-RE-SG-29-130708		BGW-RE-SG-30-130708	
Sample Date				07/08/2013	CSL Exceedance Factor	07/08/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**1.10**	--	**1.22**	--
Total solids	SM2540B	--	--	**86.78**	--	**78.10**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.012**	NA	**0.057**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**1.1**	0.0	**4.7**	0.1
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.028**	--	**0.14**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.055**	NA	**0.28**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.0072**	NA	**0.058**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.078**	NA	**0.27**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.085**	NA	**0.35**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.36**	NA	**1.2**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.42**	NA	**1.6**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.26**	--	**0.94**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.40**	NA	**1.2**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.16**	--	**0.52**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.14**	--	**0.47**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.56**	NA	**1.9**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.38**	NA	**1.4**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.072**	NA	**0.24**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.79**	NA	**2.5**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.033**	NA	**0.16**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**0.28**	NA	**0.89**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.074**	NA	**0.34**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.32**	NA	**1.6**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**1.1**	NA	**3.3**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**4.4**	NA	**14**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.60**	NA	**2.8**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.54**	--	**2.0**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.58**	--	**2.1**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.54**	--	**2.0**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.58**	--	**2.1**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**5.0**	0.1	**23**	0.4
Acenaphthene	SW8270DSIM	16	57	**0.66**	0.0	**4.8**	0.1
Acenaphthylene	SW8270DSIM	66	66	**7.1**	0.1	**22**	0.3
Anthracene	SW8270DSIM	220	1200	**7.7**	0.0	**29**	0.0
Benzo(a)anthracene	SW8270DSIM	110	270	**33**	0.1	**98**	0.4
Benzo(a)pyrene	SW8270DSIM	99	210	**38**	0.2	**131**	0.6
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**36**	0.5	**98**	1.3
Chrysene	SW8270DSIM	110	460	**35**	0.1	**115**	0.2
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**6.5**	0.2	**20**	0.6
Fluoranthene	SW8270DSIM	160	1200	**72**	0.1	**205**	0.2
Fluorene	SW8270DSIM	23	79	**3.0**	0.0	**13**	0.2
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**25**	0.3	**73**	0.8
Naphthalene	SW8270DSIM	99	170	**6.7**	0.0	**28**	0.2
Phenanthrene	SW8270DSIM	100	480	**29**	0.1	**131**	0.3
Pyrene	SW8270DSIM	1000	1400	**100**	0.1	**270**	0.2
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**51**	0.1	**158**	0.4
Total HPAH (SMS) (U = 0)		960	5300	**397**	0.1	**1169**	0.2
Total LPAH (SMS) (U = 0)		370	780	**54**	0.1	**228**	0.3

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-31		BGW-RE-SG-32	
Sample ID				BGW-RE-SG-31-130807		BGW-RE-SG-32-130807	
Sample Date				08/07/2013	CSL Exceedance Factor	08/07/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.594**	--	**0.779**	--
Total solids	SM2540B	--	--	**89.23**	--	**77.08**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.017**	NA	**0.37**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**2.9**	0.0	**47**	0.8
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.047 J**	--	**2.1**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.12 J**	NA	**1.3**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.024 J**	NA	**2.1 J**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.17 J**	NA	**2.3**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.19 J**	NA	**2.0**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**1.2**	NA	**9.3**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**1.3**	NA	**8.2**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.77 J**	--	**4.8**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**1.2 J**	NA	**6.4 J**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.32 J**	--	**2.8**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.29 J**	--	**2.5**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**1.38 J**	NA	**10**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**1.1**	NA	**8.2**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.15 J**	NA	**0.96**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**2.7**	NA	**16**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.089 J**	NA	**1.4**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**0.84 J**	NA	**4.9 J**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.20 J**	NA	**2.8**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.95**	NA	**8.6**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**2.8**	NA	**22**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**13 J**	NA	**86 J**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**1.6 J**	NA	**19 J**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**1.6 J**	--	**11 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**1.7 J**	--	**11 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**1.6 J**	--	**11 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**1.7 J**	--	**11 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**20 J**	0.3	**167**	2.6
Acenaphthene	SW8270DSIM	16	57	**4.0 J**	0.1	**270 J**	4.7
Acenaphthylene	SW8270DSIM	66	66	**29 J**	0.4	**295**	4.5
Anthracene	SW8270DSIM	220	1200	**32 J**	0.0	**257**	0.2
Benzo(a)anthracene	SW8270DSIM	110	270	**202**	0.7	**1194**	4.4
Benzo(a)pyrene	SW8270DSIM	99	210	**219**	1.0	**1053**	5.0
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**202 J**	2.6	**822 J**	10.5
Chrysene	SW8270DSIM	110	460	**185**	0.4	**1053**	2.3
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**25 J**	0.8	**123**	3.7
Fluoranthene	SW8270DSIM	160	1200	**455**	0.4	**2054**	1.7
Fluorene	SW8270DSIM	23	79	**15 J**	0.2	**180**	2.3
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**141 J**	1.6	**629 J**	7.1
Naphthalene	SW8270DSIM	99	170	**34 J**	0.2	**359**	2.1
Phenanthrene	SW8270DSIM	100	480	**160**	0.3	**1104**	2.3
Pyrene	SW8270DSIM	1000	1400	**471**	0.3	**2824**	2.0
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**232 J**	0.5	**1297**	2.9
Total HPAH (SMS) (U = 0)		960	5300	**2133 J**	0.4	**11047 J**	2.1
Total LPAH (SMS) (U = 0)		370	780	**273 J**	0.4	**2465 J**	3.2

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-33		BGW-RE-SG-34	
Sample ID				BGW-RE-SG-33-130807		BGW-RE-SG-34-130807	
Sample Date				08/07/2013	2LAET Exceedance Factor	08/07/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**6.64**	--	**2.97**	--
Total solids	SM2540B	--	--	**76.37**	--	**83.41**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.63**	0.9	**0.30**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**9.5**	NA	**10**	0.2
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**1.7**	--	**0.51**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**2.7**	1.9	**0.85**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**1.4 J**	1.9	**0.73 J**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**6.1**	4.7	**3.9**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**8.2**	1.9	**5.8**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**38**	24	**23**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**46**	15	**27**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**25**	--	**15**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**39 J**	54	**25 J**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**14**	--	**8.6**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**14**	--	**8.1**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**53**	15	**32**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**40**	14	**23**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**4.3**	8.0	**0.12**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**77**	31	**58**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**2.6**	2.6	**1.2**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**29 J**	42	**18 J**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**4.8**	2.0	**3.4**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**30**	5.6	**18**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**86**	26	**57**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**412 J**	24	**263 J**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**53 J**	4.1	**33 J**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**57 J**	--	**34 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**60 J**	--	**33 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**57 J**	--	**34 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**60 J**	--	**33 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**41**	NA	**29**	0.4
Acenaphthene	SW8270DSIM	16	57	**21 J**	NA	**25 J**	0.4
Acenaphthylene	SW8270DSIM	66	66	**92**	NA	**131**	2.0
Anthracene	SW8270DSIM	220	1200	**123**	NA	**195**	0.2
Benzo(a)anthracene	SW8270DSIM	110	270	**572**	NA	**774**	2.9
Benzo(a)pyrene	SW8270DSIM	99	210	**693**	NA	**909**	4.3
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**587 J**	NA	**842 J**	10.8
Chrysene	SW8270DSIM	110	460	**602**	NA	**774**	1.7
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**65**	NA	**4**	0.1
Fluoranthene	SW8270DSIM	160	1200	**1160**	NA	**1953**	1.6
Fluorene	SW8270DSIM	23	79	**39**	NA	**40**	0.5
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**437 J**	NA	**606 J**	6.9
Naphthalene	SW8270DSIM	99	170	**72**	NA	**114**	0.7
Phenanthrene	SW8270DSIM	100	480	**452**	NA	**606**	1.3
Pyrene	SW8270DSIM	1000	1400	**1295**	NA	**1919**	1.4
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**798**	NA	**1067**	2.4
Total HPAH (SMS) (U = 0)		960	5300	**6209 J**	NA	**8849 J**	1.7
Total LPAH (SMS) (U = 0)		370	780	**800 J**	NA	**1112 J**	1.4

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-35		BGW-RE-SG-36	
Sample ID				BGW-RE-SG-35-130807		BGW-RE-SG-36-130807	
Sample Date				08/07/2013	CSL Exceedance Factor	08/07/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**4.00**	--	**4.84**	--
Total solids	SM2540B	--	--	**85.12**	--	**86.08**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.61**	NA	**0.44**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**15**	0.3	**9.1**	0.2
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**1.6**	--	**0.85**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.5**	NA	**1.5**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**3.6 J**	NA	**0.23 J**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**4.7**	NA	**5.5**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**7.0**	NA	**9.4**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**18**	NA	**35**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**21**	NA	**42**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**11**	--	**22**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**17 J**	NA	**34 J**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**6.5**	--	**13**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**5.9**	--	**12**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**23**	NA	**47**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**18**	NA	**37**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.8**	NA	**6.0**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**46**	NA	**62**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**3.8**	NA	**2.1**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**13 J**	NA	**24 J**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**4.2**	NA	**2.9**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**37**	NA	**21**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**47**	NA	**59**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**205 J**	NA	**346 J**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**60 J**	NA	**41 J**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**26 J**	--	**52 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**27 J**	--	**57 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**26 J**	--	**52 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**27 J**	--	**53 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**38**	0.6	**31**	0.5
Acenaphthene	SW8270DSIM	16	57	**90 J**	1.6	**4.8 J**	0.1
Acenaphthylene	SW8270DSIM	66	66	**118**	1.8	**114**	1.7
Anthracene	SW8270DSIM	220	1200	**175**	0.1	**194**	0.2
Benzo(a)anthracene	SW8270DSIM	110	270	**450**	1.7	**723**	2.7
Benzo(a)pyrene	SW8270DSIM	99	210	**525**	2.5	**868**	4.1
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**425 J**	5.4	**702 J**	9.0
Chrysene	SW8270DSIM	110	460	**450**	1.0	**764**	1.7
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**45**	1.4	**124**	3.8
Fluoranthene	SW8270DSIM	160	1200	**1150**	1.0	**1281**	1.1
Fluorene	SW8270DSIM	23	79	**95**	1.2	**43**	0.5
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**325 J**	3.7	**496 J**	5.6
Naphthalene	SW8270DSIM	99	170	**105**	0.6	**60**	0.4
Phenanthrene	SW8270DSIM	100	480	**925**	1.9	**434**	0.9
Pyrene	SW8270DSIM	1000	1400	**1175**	0.8	**1219**	0.9
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**585**	1.3	**971**	2.2
Total HPAH (SMS) (U = 0)		960	5300	**5130 J**	1.0	**7149 J**	1.3
Total LPAH (SMS) (U = 0)		370	780	**1508 J**	1.9	**850 J**	1.1

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-37		BGW-RE-SG-38	
Sample ID				BGW-RE-SG-37-130807		BGW-RE-SG-38-130807	
Sample Date				08/07/2013	CSL Exceedance Factor	08/07/2013	CSL Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				N		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**4.57**	--	**4.43**	--
Total solids	SM2540B	--	--	**84.14**	--	**77.79**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.15**	NA	**0.47**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**3.3**	0.1	**11**	0.2
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.24**	--	**1.2**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.56**	NA	**1.6**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.38 J**	NA	**1.5 J**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**1.9**	NA	**6.8**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**2.0**	NA	**6.8**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**16**	NA	**24**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**22**	NA	**26**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**12**	--	**13**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**20 J**	NA	**19 J**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**6.6**	--	**7.9**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**6.2**	--	**6.6**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**25**	NA	**28**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**18**	NA	**23**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.9**	NA	**3.4**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**40**	NA	**49**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**0.57**	NA	**2.4**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**14 J**	NA	**13 J**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1.7**	NA	**3.3**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**8.2**	NA	**16**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**39**	NA	**55**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**20 J**	NA	**240 J**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**15 J**	NA	**37 J**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**27 J**	--	**32 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**28 J**	--	**34 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**27 J**	--	**32 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**27 J**	--	**34 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**12**	0.2	**36**	0.6
Acenaphthene	SW8270DSIM	16	57	**8.3 J**	0.1	**34 J**	0.6
Acenaphthylene	SW8270DSIM	66	66	**42**	0.6	**153**	2.3
Anthracene	SW8270DSIM	220	1200	**44**	0.0	**153**	0.1
Benzo(a)anthracene	SW8270DSIM	110	270	**350**	1.3	**542**	2.0
Benzo(a)pyrene	SW8270DSIM	99	210	**481**	2.3	**587**	2.8
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**438 J**	5.6	**429 J**	5.5
Chrysene	SW8270DSIM	110	460	**394**	0.9	**519**	1.1
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**42**	1.3	**77**	2.3
Fluoranthene	SW8270DSIM	160	1200	**875**	0.7	**1106**	0.9
Fluorene	SW8270DSIM	23	79	**12**	0.2	**54**	0.7
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**306 J**	3.5	**293 J**	3.3
Naphthalene	SW8270DSIM	99	170	**37**	0.2	**74**	0.4
Phenanthrene	SW8270DSIM	100	480	**179**	0.4	**361**	0.8
Pyrene	SW8270DSIM	1000	1400	**853**	0.6	**1242**	0.9
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**543**	1.2	**621**	1.4
Total HPAH (SMS) (U = 0)		960	5300	**4282 J**	0.8	**5415 J**	1.0
Total LPAH (SMS) (U = 0)		370	780	**322 J**	0.4	**831 J**	1.1

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-1
Summary of Intertidal Beach Area Surface and Shallow Subsurface Sediment Sampling Data

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-SG-38		BGW-RE-SG-39	
Sample ID				BGW-RE-SG-88-130807		BGW-RE-SG-39-130807	
Sample Date				08/07/2013	CSL Exceedance Factor	08/07/2013	2LAET Exceedance Factor
Sample Depth				0 - 4 in		0 - 4 in	
Sample Type				FD		N	
Matrix	Method	SCO/LAET	CSL/2LAET	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**4.60**	--	**0.208**	--
Total solids	SM2540B	--	--	**85.41**	--	**76.75**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.49**	NA	**0.27**	0.4
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**11**	0.2	**130**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**2.0**	--	**0.76**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**1.7**	NA	**1.7**	1.2
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**3.2 J**	NA	**0.58 J**	0.8
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**8.0**	NA	**3.4**	2.6
Anthracene	SW8270DSIM	*0.96*	*4.4*	**6.2**	NA	**2.7**	0.6
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**20**	NA	**11**	6.9
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**24**	NA	**11**	3.7
Benzo(b)fluoranthene	SW8270DSIM	--	--	**13**	--	**6.8**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**16 J**	NA	**10 J**	13.9
Benzo(j)fluoranthene	SW8270DSIM	--	--	**7.6**	--	**4.0**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**6.2**	--	**3.3**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**26.8**	NA	**14**	3.9
Chrysene	SW8270DSIM	*1.4*	*2.8*	**21**	NA	**11**	3.9
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**1.9**	NA	**1.1**	2.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**43**	NA	**20**	8.0
Fluorene	SW8270DSIM	*0.54*	*1*	**1.7**	NA	**0.89**	0.9
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	0.69	**12 J**	NA	**7.4 J**	10.7
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**3.6**	NA	**2.8**	1.2
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**15**	NA	**9.9**	1.8
Pyrene	SW8270DSIM	*2.6*	*3.3*	**44**	NA	**24**	7.3
Total HPAH (SMS) (U = 0)		*12*	*17*	**209 J**	NA	**110 J**	6.4
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**38 J**	NA	**20 J**	1.6
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**30 J**	--	**14 J**	
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**30 J**	--	**15 J**	
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**30 J**	--	**14 J**	
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**30 J**	--	**17 J**	
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**37**	0.6	**817**	NA
Acenaphthene	SW8270DSIM	16	57	**70 J**	1.2	**279 J**	NA
Acenaphthylene	SW8270DSIM	66	66	**174**	2.6	**1635**	NA
Anthracene	SW8270DSIM	220	1200	**135**	0.1	**1298**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**435**	1.6	**5288**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**522**	2.5	**5288**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**348 J**	4.5	**4808 J**	NA
Chrysene	SW8270DSIM	110	460	**457**	1.0	**5288**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**41**	1.3	**529**	NA
Fluoranthene	SW8270DSIM	160	1200	**935**	0.8	**9615**	NA
Fluorene	SW8270DSIM	23	79	**37**	0.5	**428**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**261 J**	3.0	**3558 J**	NA
Naphthalene	SW8270DSIM	99	170	**78**	0.5	**1346**	NA
Phenanthrene	SW8270DSIM	100	480	**326**	0.7	**4760**	NA
Pyrene	SW8270DSIM	1000	1400	**957**	0.7	**11538**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**583**	1.3	**6779**	NA
Total HPAH (SMS) (U = 0)		960	5300	**4537 J**	0.9	**52692 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**820 J**	1.1	**9745 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-01		BGW-RE-HA-01	
Sample ID				BGW-RE-GP-01-0-1.2		BGW-RE-HA-01-6.5	
Sample Date				09/03/2013	2LAET Exceedance Factor	09/04/2013	2LAET Exceedance Factor
Sample Depth				0 - 1.5 ft		5 - 6.5 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SO		SO	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**5.2**	--	**68.5 J**	--
Total solids	SM2540B	--	--	**91.24**	--	**73.54 J**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**82**	0.1	**2.6 J**	3.7
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**1.6**	NA	**3.8 J**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.20**	NA	**3.7 J**	NA
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.34**	0.2	**9.9 J**	7.1
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.023 J**	0.0	**0.11 J**	0.2
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.43**	0.3	**2.5 J**	1.9
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.5**	0.1	**2.3 J**	0.5
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**2.0**	1.3	**2.4 J**	1.5
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**2.1**	0.7	**0.75 J**	0.3
Benzo(b)fluoranthene	SW8270DSIM	--	--	**1.9**	--	**2.5 J**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**2.4**	3.3	**0.51 J**	0.7
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.78**	--	**0.86 J**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.89**	--	**0.88 J**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**3.57**	1.0	**4.2 J**	1.2
Chrysene	SW8270DSIM	*1.4*	*2.8*	**2.4**	0.9	**9.6 J**	3.4
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.35 J**	0.6	**0.25 J**	0.5
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**2.8**	1.1	**39 J**	16
Fluorene	SW8270DSIM	*0.54*	*1*	**0.12**	0.1	**0.59 J**	0.6
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**1.4**	2.0	**0.47 J**	0.7
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.64**	0.3	**40 J**	17
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**2.1**	0.4	**76 J**	14
Pyrene	SW8270DSIM	*2.6*	*3.3*	**4.3**	1.3	**19 J**	5.8
Total HPAH (SMS) (U = 0)		*12*	*17*	**21 J**	1.3	**76 J**	4.5
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**3.8 J**	0.3	**122 J**	9.3
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**2.8 J**	--	**1.5 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**3.0 J**	--	**1.6 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**2.8 J**	--	**1.5 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**3.0 J**	--	**1.6 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**6.5**	NA	**14 J**	NA
Acenaphthene	SW8270DSIM	16	57	**0.44 J**	NA	**0.16 J**	NA
Acenaphthylene	SW8270DSIM	66	66	**8.3**	NA	**3.7J**	NA
Anthracene	SW8270DSIM	220	1200	**9.6**	NA	**3.4 J**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**38**	NA	**3.5 J**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**40**	NA	**1.1 J**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**46**	NA	**0.75 J**	NA
Chrysene	SW8270DSIM	110	460	**46**	NA	**14 J**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**6.7 J**	NA	**0.37 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**54**	NA	**57 J**	NA
Fluorene	SW8270DSIM	23	79	**2**	NA	**0.86 J**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**27**	NA	**0.69 J**	NA
Naphthalene	SW8270DSIM	99	170	**12**	NA	**58 J**	NA
Phenanthrene	SW8270DSIM	100	480	**40**	NA	**111 J**	NA
Pyrene	SW8270DSIM	1000	1400	**83**	NA	**28 J**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**69**	NA	**6.2 J**	NA
Total HPAH (SMS) (U = 0)		960	5300	**410 J**	NA	**111 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**73 J**	NA	**177 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-02		BGW-RE-GP-02	
Sample ID				BGW-RE-GP-02-0-1.2		BGW-RE-GP-02-1.2-3.5	
Sample Date				09/03/2013	CSL Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				0 - 1.4 ft		1.4 - 4 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.69**	--	**0.091**	--
Total solids	SM2540B	--	--	**83.53**	--	**83.16**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**16**	NA	**0.0046**	0.0
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**434**	7.5	**5.1**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**140**	--	**0.016**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**210**	NA	**0.027**	0.0
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**13**	NA	**0.0015**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**160**	NA	**0.065**	0.1
Anthracene	SW8270DSIM	*0.96*	*4.4*	**180**	NA	**0.064**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**210**	NA	**0.095**	0.1
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**220**	NA	**0.14**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**86**	--	**0.073**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**150**	NA	**0.11**	0.2
Benzo(j)fluoranthene	SW8270DSIM	--	--	**49**	--	**0.038**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**46**	--	**0.034**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**181**	NA	**0.145**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**200**	NA	**0.091**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**22 J**	NA	**0.02 J**	0.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**410**	NA	**0.24**	0.1
Fluorene	SW8270DSIM	*0.54*	*1*	**150**	NA	**0.028**	0.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**72**	NA	**0.072**	0.1
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**49**	NA	**0.032**	0.0
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**580**	NA	**0.29**	0.1
Pyrene	SW8270DSIM	*2.6*	*3.3*	**680**	NA	**0.37**	0.1
Total HPAH (SMS) (U = 0)		*12*	*17*	**2145 J**	NA	**1.3 J**	0.1
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**1132**	NA	**0.48**	0.0
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**266 J**	--	**0.17 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**279 J**	--	**0.18 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**266 J**	--	**0.17 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**279 J**	--	**0.18 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**5691**	89	**30**	NA
Acenaphthene	SW8270DSIM	16	57	**352**	6.2	**1.6**	NA
Acenaphthylene	SW8270DSIM	66	66	**4336**	66	**71**	NA
Anthracene	SW8270DSIM	220	1200	**4878**	4.1	**70**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**5691**	21	**104**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**5962**	28	**154**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**4065**	52	**121**	NA
Chrysene	SW8270DSIM	110	460	**5420**	12	**100**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**596 J**	18	**22 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**11111**	9.3	**264**	NA
Fluorene	SW8270DSIM	23	79	**4065**	51	**31**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**1951**	22	**79**	NA
Naphthalene	SW8270DSIM	99	170	**1328**	7.8	**35**	NA
Phenanthrene	SW8270DSIM	100	480	**15718**	33	**319**	NA
Pyrene	SW8270DSIM	1000	1400	**18428**	13	**407**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**4905**	11	**159**	NA
Total HPAH (SMS) (U = 0)		960	5300	**58130 J**	11	**1410 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**30678**	39	**528**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-02		BGW-RE-GP-03	
Sample ID				BGW-RE-GP-52-0-1.2		BGW-RE-GP-03-0-2.0	
Sample Date				09/03/2013	2LAET Exceedance Factor	09/03/2013	CSL Exceedance Factor
Sample Depth				0 - 1.4 ft		0 - 2.3 ft	
Sample Type				FD		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**7.08**	--	**1.92**	--
Total solids	SM2540B	--	--	**84.25**	--	**81.49**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**11**	16	**11**	NA
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**155**	NA	**573**	9.9
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**80**	--	**100**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**150**	107	**130**	NA
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**9.3**	13	**19**	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**120**	92	**87**	NA
Anthracene	SW8270DSIM	*0.96*	*4.4*	**140**	32	**160**	NA
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**170**	106	**54**	NA
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**160**	53	**54**	NA
Benzo(b)fluoranthene	SW8270DSIM	--	--	**66**	--	**25**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**88**	122	**35**	NA
Benzo(j)fluoranthene	SW8270DSIM	--	--	**37**	--	**13**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**39**	--	**14**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**142**	39	**52**	NA
Chrysene	SW8270DSIM	*1.4*	*2.8*	**150**	54	**48**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**16 J**	30	**7.5 J**	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**340**	136	**140**	NA
Fluorene	SW8270DSIM	*0.54*	*1*	**88**	88	**110**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**53**	77	**21**	NA
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**33**	14	**15**	NA
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**380**	70	**280**	NA
Pyrene	SW8270DSIM	*2.6*	*3.3*	**550**	167	**210**	NA
Total HPAH (SMS) (U = 0)		*12*	*17*	**1669 J**	98	**622 J**	NA
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**770**	59	**671**	NA
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**195 J**	--	**67 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**205 J**	--	**72 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**195 J**	--	**67 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**205 J**	--	**72 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**2119**	NA	**6771**	106
Acenaphthene	SW8270DSIM	16	57	**131**	NA	**990**	17
Acenaphthylene	SW8270DSIM	66	66	**1695**	NA	**4531**	69
Anthracene	SW8270DSIM	220	1200	**1977**	NA	**8333**	6.9
Benzo(a)anthracene	SW8270DSIM	110	270	**2401**	NA	**2813**	10
Benzo(a)pyrene	SW8270DSIM	99	210	**2260**	NA	**2813**	13
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**1243**	NA	**1823**	23
Chrysene	SW8270DSIM	110	460	**2119**	NA	**2500**	5.4
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**226 J**	NA	**391 J**	12
Fluoranthene	SW8270DSIM	160	1200	**4802**	NA	**7292**	6.1
Fluorene	SW8270DSIM	23	79	**1243**	NA	**5729**	73
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**749**	NA	**1094**	12
Naphthalene	SW8270DSIM	99	170	**466**	NA	**781**	4.6
Phenanthrene	SW8270DSIM	100	480	**5367**	NA	**14583**	30
Pyrene	SW8270DSIM	1000	1400	**7768**	NA	**10938**	7.8
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**2006**	NA	**2708**	6.0
Total HPAH (SMS) (U = 0)		960	5300	**23573 J**	NA	**32370 J**	6.1
Total LPAH (SMS) (U = 0)		370	780	**10880**	NA	**34948**	45

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-03		BGW-RE-GP-03	
Sample ID				BGW-RE-GP-03-2.0-3.5		BGW-RE-GP-03-3.5-4.5	
Sample Date				09/03/2013	CSL Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				2.3 - 4 ft		4 - 5 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**3.87**	--	**0.051**	--
Total solids	SM2540B	--	--	**84.55**	--	**83.87**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**69**	NA	**0.019**	0.0
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**1783**	31	**37**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**900**	--	**0.073**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**600**	NA	**0.028**	0.0
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**76**	NA	**0.019**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**840**	NA	**0.1**	0.1
Anthracene	SW8270DSIM	*0.96*	*4.4*	**680**	NA	**0.15**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**280**	NA	**0.051**	0.0
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**280**	NA	**0.052**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**110**	--	**0.023**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**150**	NA	**0.036**	0.1
Benzo(j)fluoranthene	SW8270DSIM	--	--	**64**	--	**0.014**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**59**	--	**0.015**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**233**	NA	**0.052**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**260**	NA	**0.051**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**30 J**	NA	**0.0065 J**	0.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**770**	NA	**0.23**	0.1
Fluorene	SW8270DSIM	*0.54*	*1*	**600**	NA	**0.072**	0.1
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**91**	NA	**0.026**	0.0
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1700**	NA	**0.058**	0.0
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**1700**	NA	**0.72**	0.1
Pyrene	SW8270DSIM	*2.6*	*3.3*	**1200**	NA	**0.36**	0.1
Total HPAH (SMS) (U = 0)		*12*	*17*	**3294 J**	NA	**0.86 J**	0.1
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**5596**	NA	**1.1**	0.1
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**340 J**	--	**0.065 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**359 J**	--	**0.069 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**340 J**	--	**0.065 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**359 J**	--	**0.069 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**15504**	242	**55**	NA
Acenaphthene	SW8270DSIM	16	57	**1964**	34	**37**	NA
Acenaphthylene	SW8270DSIM	66	66	**21705**	329	**196**	NA
Anthracene	SW8270DSIM	220	1200	**17571**	15	**294**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**7235**	27	**100**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**7235**	34	**102**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**3876**	50	**71**	NA
Chrysene	SW8270DSIM	110	460	**6718**	15	**100**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**775 J**	23	**13 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**19897**	17	**451**	NA
Fluorene	SW8270DSIM	23	79	**15504**	196	**141**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**2351**	27	**51**	NA
Naphthalene	SW8270DSIM	99	170	**43928**	258	**114**	NA
Phenanthrene	SW8270DSIM	100	480	**43928**	92	**1412**	NA
Pyrene	SW8270DSIM	1000	1400	**31008**	22	**706**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**6021**	13	**102**	NA
Total HPAH (SMS) (U = 0)		960	5300	**85116 J**	16	**1695 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**144599**	185	**2194**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-03		BGW-RE-GP-04	
Sample ID				BGW-RE-GP-53-2.0-3.5		BGW-RE-GP-04-0-1.2	
Sample Date				09/03/2013	2LAET Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				2.3 - 4 ft		0 - 2.2 ft	
Sample Type				FD		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**6.89**	--	**0.066**	--
Total solids	SM2540B	--	--	**84.37**	--	**84.87**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**69**	99	**0.021 J**	0.3
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**987**	NA	**32 J**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**810**	--	**0.068**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**530**	379	**0.13**	0.1
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**79**	108	**0.0036**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**730**	562	**0.024 J**	0.0
Anthracene	SW8270DSIM	*0.96*	*4.4*	**430**	98	**0.02 J**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**250**	156	**0.057**	0.0
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**240**	80	**0.056**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**110**	--	**0.042 J**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**150**	208	**0.048**	0.1
Benzo(j)fluoranthene	SW8270DSIM	--	--	**63**	--	**0.022 J**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**64**	--	**0.019 J**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**237**	66	**0.083 J**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**220**	79	**0.073**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**27 J**	50	**0.011 J**	0.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**680**	272	**0.13**	0.1
Fluorene	SW8270DSIM	*0.54*	*1*	**510**	510	**0.0079 J**	0.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**89**	129	**0.043 J**	0.1
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**1500**	625	**0.22**	0.1
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**1500**	278	**0.32**	0.1
Pyrene	SW8270DSIM	*2.6*	*3.3*	**1100**	333	**0.18**	0.1
Total HPAH (SMS) (U = 0)		*12*	*17*	**2993 J**	176	**0.681 J**	0.0
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**4749**	365	**0.60 J**	0.0
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**296 J**	--	**0.074 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**313 J**	--	**0.081 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**296 J**	--	**0.074 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**313 J**	--	**0.081 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**7692**	NA	**197**	NA
Acenaphthene	SW8270DSIM	16	57	**1147**	NA	**5**	NA
Acenaphthylene	SW8270DSIM	66	66	**10595**	NA	**36 J**	NA
Anthracene	SW8270DSIM	220	1200	**6241**	NA	**30 J**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**3628**	NA	**86**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**3483**	NA	**85**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**2177**	NA	**73**	NA
Chrysene	SW8270DSIM	110	460	**3193**	NA	**111**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**392 J**	NA	**17 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**9869**	NA	**197**	NA
Fluorene	SW8270DSIM	23	79	**7402**	NA	**12 J**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**1292**	NA	**65 J**	NA
Naphthalene	SW8270DSIM	99	170	**21771**	NA	**333**	NA
Phenanthrene	SW8270DSIM	100	480	**21771**	NA	**485**	NA
Pyrene	SW8270DSIM	1000	1400	**15965**	NA	**273**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**3440**	NA	**126 J**	NA
Total HPAH (SMS) (U = 0)		960	5300	**43440 J**	NA	**1032 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**68926**	NA	**902 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-04		BGW-RE-GP-05	
Sample ID				BGW-RE-GP-04-1.2-2.2		BGW-RE-GP-05-0-1.0	
Sample Date				09/03/2013	2LAET Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				2.2 - 4 ft		0 - 1.5 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.116**	--	**5.3**	--
Total solids	SM2540B	--	--	**94.35**	--	**77.73**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.0016**	0.0	**6.1**	8.7
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**1.4**	NA	**115**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.019**	--	**37**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.018**	0.0	**4.7**	3.4
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.0027**	0.0	**130**	178
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.032**	0.0	**8.6**	6.6
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.0028**	0.0	**110**	25
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.016**	0.0	**110**	69
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.06**	0.0	**130**	43
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.034**	--	**65**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.073**	0.1	**93**	129
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.013**	--	**30**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.012**	--	**30**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.059**	0.0	**125**	35
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.018**	0.0	**110**	39
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.012 J**	0.0	**10 J**	19
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.029**	0.0	**350**	140
Fluorene	SW8270DSIM	*0.54*	*1*	**0.0055**	0.0	**12**	12
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**0.048**	0.1	**47**	68
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.041**	0.0	**27**	11
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.016**	0.0	**390**	72
Pyrene	SW8270DSIM	*2.6*	*3.3*	**0.04**	0.0	**440**	133
Total HPAH (SMS) (U = 0)		*12*	*17*	**0.36 J**	0.0	**1415 J**	83
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.1**	0.0	**677.6**	52
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.072 J**	--	**157 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.082 J**	--	**163 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.072 J**	--	**157 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.082 J**	--	**163 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**16**	NA	**89**	NA
Acenaphthene	SW8270DSIM	16	57	**2**	NA	**2453**	NA
Acenaphthylene	SW8270DSIM	66	66	**28**	NA	**162**	NA
Anthracene	SW8270DSIM	220	1200	**2**	NA	**2075**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**14**	NA	**2075**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**52**	NA	**2453**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**63**	NA	**1755**	NA
Chrysene	SW8270DSIM	110	460	**16**	NA	**2075**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**10 J**	NA	**189 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**25**	NA	**6604**	NA
Fluorene	SW8270DSIM	23	79	**5**	NA	**226**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**41**	NA	**887**	NA
Naphthalene	SW8270DSIM	99	170	**35**	NA	**509**	NA
Phenanthrene	SW8270DSIM	100	480	**14**	NA	**7358**	NA
Pyrene	SW8270DSIM	1000	1400	**34**	NA	**8302**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**51**	NA	**2358**	NA
Total HPAH (SMS) (U = 0)		960	5300	**306 J**	NA	**26698 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**86**	NA	**12785**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-05		BGW-RE-GP-05	
Sample ID				BGW-RE-GP-05-1.0-2.7		BGW-RE-GP-05-2.7-3.7	
Sample Date				09/03/2013	2LAET Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				1.5 - 4 ft		4 - 5 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.176**	--	**0.15**	--
Total solids	SM2540B	--	--	**89.63**	--	**88.96**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.013**	0.0	**0.015**	0.0
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**7.4**	NA	**10**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.032**	--	**0.032**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.016**	0.0	**0.018**	0.0
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.11**	0.2	**0.082**	0.1
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.021**	0.0	**0.031**	0.0
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.045**	0.0	**0.088**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.03**	0.0	**0.072**	0.0
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.034**	0.0	**0.076**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.02**	--	**0.045**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.041**	0.1	**0.078**	0.1
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.0077**	--	**0.023**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.0075**	--	**0.026**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.035**	0.0	**0.094**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.032**	0.0	**0.12**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.0043 J**	0.0	**0.011 J**	0.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.22**	0.1	**0.35**	0.1
Fluorene	SW8270DSIM	*0.54*	*1*	**0.044**	0.0	**0.036**	0.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**0.027**	0.0	**0.051**	0.1
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.063**	0.0	**0.064**	0.0
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.13**	0.0	**0.24**	0.0
Pyrene	SW8270DSIM	*2.6*	*3.3*	**0.32**	0.1	**0.5**	0.2
Total HPAH (SMS) (U = 0)		*12*	*17*	**0.74 J**	0.0	**1.4 J**	0.1
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.41**	0.0	**0.54**	0.0
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.043 J**	--	**0.098 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.046 J**	--	**0.10 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.043 J**	--	**0.10 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.046 J**	--	**0.10 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**9**	NA	**12**	NA
Acenaphthene	SW8270DSIM	16	57	**63**	NA	**55**	NA
Acenaphthylene	SW8270DSIM	66	66	**12**	NA	**21**	NA
Anthracene	SW8270DSIM	220	1200	**26**	NA	**59**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**17**	NA	**48**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**19**	NA	**51**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**23**	NA	**52**	NA
Chrysene	SW8270DSIM	110	460	**18**	NA	**80**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**2 J**	NA	**7 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**125**	NA	**233**	NA
Fluorene	SW8270DSIM	23	79	**25**	NA	**24**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**15**	NA	**34**	NA
Naphthalene	SW8270DSIM	99	170	**36**	NA	**43**	NA
Phenanthrene	SW8270DSIM	100	480	**74**	NA	**160**	NA
Pyrene	SW8270DSIM	1000	1400	**182**	NA	**333**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**20**	NA	**63**	NA
Total HPAH (SMS) (U = 0)		960	5300	**422 J**	NA	**901 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**235**	NA	**361**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-06		BGW-RE-GP-06	
Sample ID				BGW-RE-GP-06-0.8-2		BGW-RE-GP-06-2-3.9	
Sample Date				09/03/2013	2LAET Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				0.8 - 2.3 ft		2.3 - 4 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**11.9**	--	**0.151**	--
Total solids	SM2540B	--	--	**82.7**	--	**90.96**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**3.2**	4.6	**0.0014**	0.0
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**27**	NA	**0.93**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**6.7 J**	--	**0.0062**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**2.8**	2.0	**0.0062**	0.0
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**12**	16	**0.0012**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**32**	25	**0.0074**	0.0
Anthracene	SW8270DSIM	*0.96*	*4.4*	**24**	5.5	**0.0013**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**40**	25.0	**0.0014**	0.0
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**55**	18	**0.0016**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**25**	--	**0.0012**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**49**	68	**0.0025**	0.0
Benzo(j)fluoranthene	SW8270DSIM	--	--	**14**	--	**0.0005**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**14**	--	**0.0005**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**53**	15	**0.0022**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**45**	16	**0.002**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**5.7 J**	11	**0.0003 J**	0.0
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**140**	56	**0.015**	0.0
Fluorene	SW8270DSIM	*0.54*	*1*	**14**	14	**0.0021**	0.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**24**	35	**0.0015**	0.0
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**20**	8.3	**0.022**	0.0
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**130**	24	**0.012**	0.0
Pyrene	SW8270DSIM	*2.6*	*3.3*	**160**	48	**0.017**	0.0
Total HPAH (SMS) (U = 0)		*12*	*17*	**572 J**	34	**0.044 J**	0.0
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**232**	18	**0.046**	0.0
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**66 J**	--	**0.0021 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**70 J**	--	**0.0023 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**66 J**	--	**0.0021 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**70 J**	--	**0.0023 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**24**	NA	4.1	NA
Acenaphthene	SW8270DSIM	16	57	**101**	NA	0.8	NA
Acenaphthylene	SW8270DSIM	66	66	**269**	NA	4.9	NA
Anthracene	SW8270DSIM	220	1200	**202**	NA	0.9	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**336**	NA	0.9	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**462**	NA	1.1	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**412**	NA	1.7	NA
Chrysene	SW8270DSIM	110	460	**378**	NA	1.3	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**48 J**	NA	0.20 J	NA
Fluoranthene	SW8270DSIM	160	1200	**1176**	NA	9.9	NA
Fluorene	SW8270DSIM	23	79	**118**	NA	1.4	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**202**	NA	1.0	NA
Naphthalene	SW8270DSIM	99	170	**168**	NA	14.6	NA
Phenanthrene	SW8270DSIM	100	480	**1092**	NA	7.9	NA
Pyrene	SW8270DSIM	1000	1400	**1345**	NA	11.3	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**445**	NA	1.5	NA
Total HPAH (SMS) (U = 0)		960	5300	**4804 J**	NA	29 J	NA
Total LPAH (SMS) (U = 0)		370	780	**1950**	NA	30	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-07		BGW-RE-GP-07	
Sample ID				BGW-RE-GP-07-0-1.8		BGW-RE-GP-07-1.8-4.3	
Sample Date				09/03/2013	CSL Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				0 - 2.1 ft		2.1 - 5 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.635**	--	**0.127**	--
Total solids	SM2540B	--	--	**88.92**	--	**84.08**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.025**	NA	**0.00003 J**	0.0
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**3.9**	0.1	**0.24 J**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.077**	--	**0.0012**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.053**	NA	**0.0016**	0.0
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.073**	NA	**0.0004 J**	0.0
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.097**	NA	**0.0007**	0.0
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.081**	NA	**0.0003 J**	0.0
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.58**	NA	**0.0003 J**	0.0
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.73**	NA	**0.0005 J**	0.0
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.43**	--	**0.0004 J**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.76**	NA	**0.0009**	0.0
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.25**	--	0.0005 U	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.2**	--	0.0005 U	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.88**	NA	**0.0004 J**	0.0
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.6**	NA	**0.0005 J**	0.0
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.088 J**	NA	0.0005 U	NA
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**1.4**	NA	**0.0016**	0.0
Fluorene	SW8270DSIM	*0.54*	*1*	**0.048**	NA	**0.0003 J**	0.0
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**0.51**	NA	**0.0004 J**	0.0
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.25**	NA	**0.0054**	0.0
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.37**	NA	**0.003**	0.0
Pyrene	SW8270DSIM	*2.6*	*3.3*	**1.6**	NA	**0.0016**	0.0
Total HPAH (SMS) (U = 0)		*12*	*17*	**7.1 J**	NA	**0.0062 J**	0.0
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.919**	NA	**0.010 J**	0.0
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.92 J**	--	**0.0007 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.98 J**	--	**0.0009 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.92 J**	--	**0.0006 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.98 J**	--	**0.0006 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**8.3**	0.1	**1.3**	NA
Acenaphthene	SW8270DSIM	16	57	**11**	0.2	**0.32 J**	NA
Acenaphthylene	SW8270DSIM	66	66	**15**	0.2	**0.6**	NA
Anthracene	SW8270DSIM	220	1200	**13**	0.0	**0.24 J**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**91**	0.3	**0.24 J**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**115**	0.5	**0.40 J**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**120**	1.5	**0.7**	NA
Chrysene	SW8270DSIM	110	460	**94**	0.2	**0.40 J**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**14 J**	0.4	0.394 U	NA
Fluoranthene	SW8270DSIM	160	1200	**220**	0.2	**1.3**	NA
Fluorene	SW8270DSIM	23	79	**7.6**	0.1	**0.24 J**	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**80**	0.9	**0.32 J**	NA
Naphthalene	SW8270DSIM	99	170	**39**	0.2	**4.3**	NA
Phenanthrene	SW8270DSIM	100	480	**58**	0.1	**2.4**	NA
Pyrene	SW8270DSIM	1000	1400	**252**	0.2	**1.3**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**139**	0.3	**0.32 J**	NA
Total HPAH (SMS) (U = 0)		960	5300	**1126 J**	0.2	**4.9 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**145**	0.2	**8.0 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-2
Summary of Supplemental Soil and Subsurface Sediment Testing

Task				2013 Removal Evaluation		2013 Removal Evaluation	
Location ID				BGW-RE-GP-08		BGW-RE-GP-08	
Sample ID				BGW-RE-GP-08-0.8-1.8		BGW-RE-GP-08-1.8-3.7	
Sample Date				09/03/2013	CSL Exceedance Factor	09/03/2013	2LAET Exceedance Factor
Sample Depth				0 - 2.7 ft		2.7 - 5 ft	
Sample Type				N		N	
Matrix	*Method*	*SCO/LAET*	*CSL/2LAET*	SE		SE	
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	--	--	**0.521**	--	**0.127**	--
Total solids	SM2540B	--	--	**83.26**	--	**92.41**	--
Semivolatile Organics (mg/kg)							
Dibenzofuran	SW8270DSIM	*0.54*	*0.7*	**0.0096**	NA	**0.00003 J**	0.0
Semivolatile Organics (mg/kg-OC)							
Dibenzofuran	SW8270DSIM	15	58	**1.8**	0.0	**0.24 J**	NA
Polycyclic Aromatic Hydrocarbons (mg/kg)							
1-Methylnaphthalene	SW8270DSIM	--	--	**0.022**	--	**0.0026**	--
2-Methylnaphthalene	SW8270DSIM	*0.67*	*1.4*	**0.014**	NA	**0.0005**	0.00
Acenaphthene	SW8270DSIM	*0.5*	*0.73*	**0.0044**	NA	0.0005 U	NA
Acenaphthylene	SW8270DSIM	*0.56*	*1.3*	**0.026**	NA	**0.0008**	0.00
Anthracene	SW8270DSIM	*0.96*	*4.4*	**0.024**	NA	**0.0003**	0.00
Benzo(a)anthracene	SW8270DSIM	*1.3*	*1.6*	**0.1**	NA	**0.0011**	0.00
Benzo(a)pyrene	SW8270DSIM	*1.6*	*3*	**0.15**	NA	**0.0012**	0.00
Benzo(b)fluoranthene	SW8270DSIM	--	--	**0.12**	--	**0.0009**	--
Benzo(g,h,i)perylene	SW8270DSIM	*0.67*	*0.72*	**0.19**	NA	**0.0014**	0.00
Benzo(j)fluoranthene	SW8270DSIM	--	--	**0.53**	--	**0.0005 J**	--
Benzo(k)fluoranthene	SW8270DSIM	--	--	**0.46**	--	**0.0005**	--
Total Benzofluoranthenes (b,j,k) (U = 0)		*3.2*	*3.6*	**0.22**	NA	**0.0019 J**	0.00
Chrysene	SW8270DSIM	*1.4*	*2.8*	**0.15**	NA	**0.0014**	0.00
Dibenzo(a,h)anthracene	SW8270DSIM	*0.23*	*0.54*	**0.026 J**	NA	**0.0002 J**	0.00
Fluoranthene	SW8270DSIM	*1.7*	*2.5*	**0.32**	NA	**0.0023**	0.00
Fluorene	SW8270DSIM	*0.54*	*1*	**0.0058**	NA	0.0005 U	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	*0.6*	*0.69*	**0.12**	NA	**0.001**	0.00
Naphthalene	SW8270DSIM	*2.1*	*2.4*	**0.087**	NA	**0.014**	0.01
Phenanthrene	SW8270DSIM	*1.5*	*5.4*	**0.17**	NA	**0.0026**	0.00
Pyrene	SW8270DSIM	*2.6*	*3.3*	**0.28**	NA	**0.0025**	0.00
Total HPAH (SMS) (U = 0)		*12*	*17*	**1.6 J**	NA	**0.013 J**	0.00
Total LPAH (SMS) (U = 0)		*5.2*	*13*	**0.32**	NA	**0.018 J**	0.00
Total cPAH Toxic Equivalency (mg/kg)							
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		--	--	**0.19 J**	--	**0.0016 J**	--
Total cPAH TEQ (EPA 1993) (U = 1/2)		--	--	**0.21 J**	--	**0.0017 J**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		--	--	**0.19 J**	--	**0.0016 J**	--
Total cPAH TEQ (EPA 1993) (U = 0)		--	--	**0.21 J**	--	**0.0017 J**	--
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270DSIM	38	64	**2.7**	0.0	**0.4**	NA
Acenaphthene	SW8270DSIM	16	57	**0.8**	0.0	0.40 U	NA
Acenaphthylene	SW8270DSIM	66	66	**5.0**	0.1	**0.6**	NA
Anthracene	SW8270DSIM	220	1200	**4.6**	0.0	**0.24 J**	NA
Benzo(a)anthracene	SW8270DSIM	110	270	**19.2**	0.1	**0.9**	NA
Benzo(a)pyrene	SW8270DSIM	99	210	**28.8**	0.1	**0.9**	NA
Benzo(g,h,i)perylene	SW8270DSIM	31	78	**36.5**	0.5	**1.1**	NA
Chrysene	SW8270DSIM	110	460	**28.8**	0.1	**1.1**	NA
Dibenzo(a,h)anthracene	SW8270DSIM	12	33	**5.0 J**	0.2	**0.20 J**	NA
Fluoranthene	SW8270DSIM	160	1200	**61.4**	0.1	**1.8**	NA
Fluorene	SW8270DSIM	23	79	**1.1**	0.0	0.40U	NA
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	34	88	**23.0**	0.3	**0.8**	NA
Naphthalene	SW8270DSIM	99	170	**16.7**	0.1	**11.0**	NA
Phenanthrene	SW8270DSIM	100	480	**32.6**	0.1	**2.0**	NA
Pyrene	SW8270DSIM	1000	1400	**53.7**	0.0	**2.0**	NA
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450	**42.0**	0.1	**1.5 J**	NA
Total HPAH (SMS) (U = 0)		960	5300	**298 J**	0.1	**10 J**	NA
Total LPAH (SMS) (U = 0)		370	780	**61**	0.1	**14 J**	NA

Notes:

Bold = Detected result

cPAH = carcinogenic polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters and toxic equivalence factor references)

CSL = Cleanup screening level

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

FD = field duplicate sample

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

LAET = lowest apparent effects threshold

2LAET = second lowest apparent effects threshold

mg/kg = milligrams per kilograms

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

NA = Not applicable due to total organic carbon result (see note 1 and 2)

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

1 = Locations with organic carbon content between 0.5 and 5 percent are compared to Sediment Management Standards (SMS) criteria (SCO and CSL)

2 = Locations with organic carbon content below 0.5 and greater than 5 percent are compared to LAET criteria (LAET and 2LAET)

Table 4-3
Results of Testing for Volatile Organic Compounds

Task		2013 Removal Evaluation	2013 Removal Evaluation	2013 Removal Evaluation	2013 Removal Evaluation
Location ID		BGW-RE-GP-02	BGW-RE-GP-03	BGW-RE-GP-03	BGW-RE-GP-05
Sample ID		BGW-RE-GP-02-0.8-1	BGW-RE-GP-03-0.7-1.2	BGW-RE-GP-03-2.0-2.8	BGW-RE-GP-05-0.3-0.8
Sample Date		09/03/2013	09/03/2013	09/03/2013	09/03/2013
Sample Depth		1 - 1.3 ft	0.8 - 1.4 ft	2.3 - 3.2 ft	0.4 - 1.2 ft
Sample Type		N	N	N	N
Matrix	Method	SE	SE	SE	SE
Volatile Organics (µg/kg)					
1,1,1,2-Tetrachloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,1,1-Trichloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,1,2,2-Tetrachloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,1,2-Trichloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	SW8260C	6600 U	160 U	2700 U	2.4 U
1,1-Dichloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,1-Dichloroethene	SW8260C	3300 U	78 U	1300 U	1.2 U
1,1-Dichloropropene	SW8260C	3300 U	78 U	1300 U	1.2 U
1,2,3-Trichlorobenzene	SW8260C	16000 U	390 U	6700 U	6.1 U
1,2,3-Trichloropropane	SW8260C	6600 U	160 U	2700 U	2.4 U
1,2,4-Trichlorobenzene	SW8260C	16000 U	390 U	6700 U	6.1 U
1,2,4-Trimethylbenzene	SW8260C	3300 U	78 U	**980 J**	**2.4**
1,2-Dibromo-3-chloropropane	SW8260C	16000 U	390 U	6700 U	6.1 U
1,2-Dichlorobenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
1,2-Dichloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,2-Dichloroethene, cis-	SW8260C	3300 U	78 U	1300 U	1.2 U
1,2-Dichloroethene, trans-	SW8260C	3300 U	78 U	1300 U	1.2 U
1,2-Dichloropropane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,3,5-Trimethylbenzene (Mesitylene)	SW8260C	3300 U	78 U	1300 U	1.2 U
1,3-Dichlorobenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
1,3-Dichloropropane	SW8260C	3300 U	78 U	1300 U	1.2 U
1,3-Dichloropropene, cis-	SW8260C	3300 U	78 U	1300 U	1.2 U
1,3-Dichloropropene, trans-	SW8260C	3300 U	78 U	1300 U	1.2 U
1,4-Dichloro-2-butene, trans-	SW8260C	16000 U	390 U	6700 U	6.1 U
1,4-Dichlorobenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
2,2-Dichloropropane	SW8260C	3300 U	78 U	1300 U	1.2 U
2-Butanone (MEK)	SW8260C	16000 U	390 U	6700 U	6.1 U
2-Chloroethylvinyl ether	SW8260C	16000 UJ	390 UJ	6700 UJ	6.1 UJ
2-Chlorotoluene	SW8260C	3300 U	78 U	1300 U	1.2 U
2-Hexanone (Methyl butyl ketone)	SW8260C	16000 U	390 U	6700 U	6.1 U
4-Chlorotoluene	SW8260C	3300 U	78 U	1300 U	1.2 U
4-Isopropyltoluene (4-Cymene)	SW8260C	3300 U	78 U	1300 U	1.2 U
Acetone	SW8260C	16000 U	390 U	6700 U	6.1 U
Acrolein	SW8260C	160000 U	3900 U	67000 U	61 U
Acrylonitrile	SW8260C	16000 U	390 U	6700 U	6.1 U
Benzene	SW8260C	3300 U	78 U	1300 U	**8.1**
Bromobenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
Bromochloromethane	SW8260C	3300 U	78 U	1300 U	1.2 U
Bromodichloromethane	SW8260C	3300 U	78 U	1300 U	1.2 U
Bromoform (Tribromomethane)	SW8260C	3300 U	78 U	1300 U	1.2 U
Bromomethane (Methyl bromide)	SW8260C	6600 U	160 U	2700 U	1.2 U
Carbon disulfide	SW8260C	3300 U	78 U	1300 U	**4.3**
Carbon tetrachloride (Tetrachloromethane)	SW8260C	3300 U	78 U	1300 U	1.2 U
Chlorobenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
Chloroethane	SW8260C	3300 U	78 U	1300 U	1.2 U
Chloroform	SW8260C	3300 U	78 U	1300 U	1.2 U
Chloromethane	SW8260C	3300 U	78 U	1300 U	1.2 U
Dibromochloromethane	SW8260C	3300 U	78 U	1300 U	1.2 U
Dibromomethane	SW8260C	3300 U	78 U	1300 U	1.2 U
Dichloromethane (Methylene chloride)	SW8260C	18000 U	160 U	6800 U	4.9 U
Ethyl bromide (Bromoethane)	SW8260C	6600 U	160 U	2700 U	2.4 U
Ethylbenzene	SW8260C	3300 U	78 U	1300 U	**24**
Ethylene dibromide (1,2-Dibromoethane)	SW8260C	3300 U	78 U	1300 U	1.2 U
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SW8260C	16000 U	390 U	6700 U	6.1 U
Isopropylbenzene (Cumene)	SW8260C	3300 U	78 U	1300 U	**9**
m,p-Xylene	SW8260C	6600 U	160 U	2700 U	**1.7**
Methyl iodide (Iodomethane)	SW8260C	3300 U	78 U	1300 U	1.2 U
Methyl isobutyl ketone (4-Methyl-2-pentanone or (MIBK))	SW8260C	16000 U	390 U	6700 U	6.1 U
Naphthalene	SW8260C	**400000**	**1800**	**120000**	**46**
n-Butylbenzene	SW8260C	3300 U	**84**	1300 U	1.2 U
n-Propylbenzene	SW8260C	3300 U	78 U	1300 U	**8.3**
o-Xylene	SW8260C	3300 U	78 U	1300 U	**3.9**
sec-Butylbenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
Styrene	SW8260C	3300 U	78 U	1300 U	1.2 U
tert-Butylbenzene	SW8260C	3300 U	78 U	1300 U	1.2 U
Tetrachloroethene (PCE)	SW8260C	3300 U	78 U	1300 U	1.2 U
Toluene	SW8260C	3300 U	78 U	1300 U	**1.5**
Trichloroethene (TCE)	SW8260C	3300 U	78 U	1300 U	1.2 U
Trichlorofluoromethane (Fluorotrichloromethane)	SW8260C	3300 U	78 U	1300 U	1.2 U
Vinyl acetate	SW8260C	16000 U	390 U	6700 U	6.1 U
Vinyl chloride	SW8260C	3300 U	78 U	1300 U	1.2 U
Total Xylene (U = 0)		6600 U	160 U	2700 U	**5.6**

Notes:

Bold = Detected result

Exceedance Factor = Concentration divided by Criteria (CSL or 2LAET)

HPAH = high molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

J = Estimated value

LPAH = low molecular weight polycyclic aromatic hydrocarbon (see Table 2-1 for included parameters)

mg/kg-OC = milligrams per kilograms organic carbon normalized basis

N = normal environmental sample

SCO = Sediment Cleanup Objective

SE = Sediment

TEQ = toxic equivalency

U = Compound analyzed, but not detected above detection limit

FIGURES

0 750 1,500
Feet

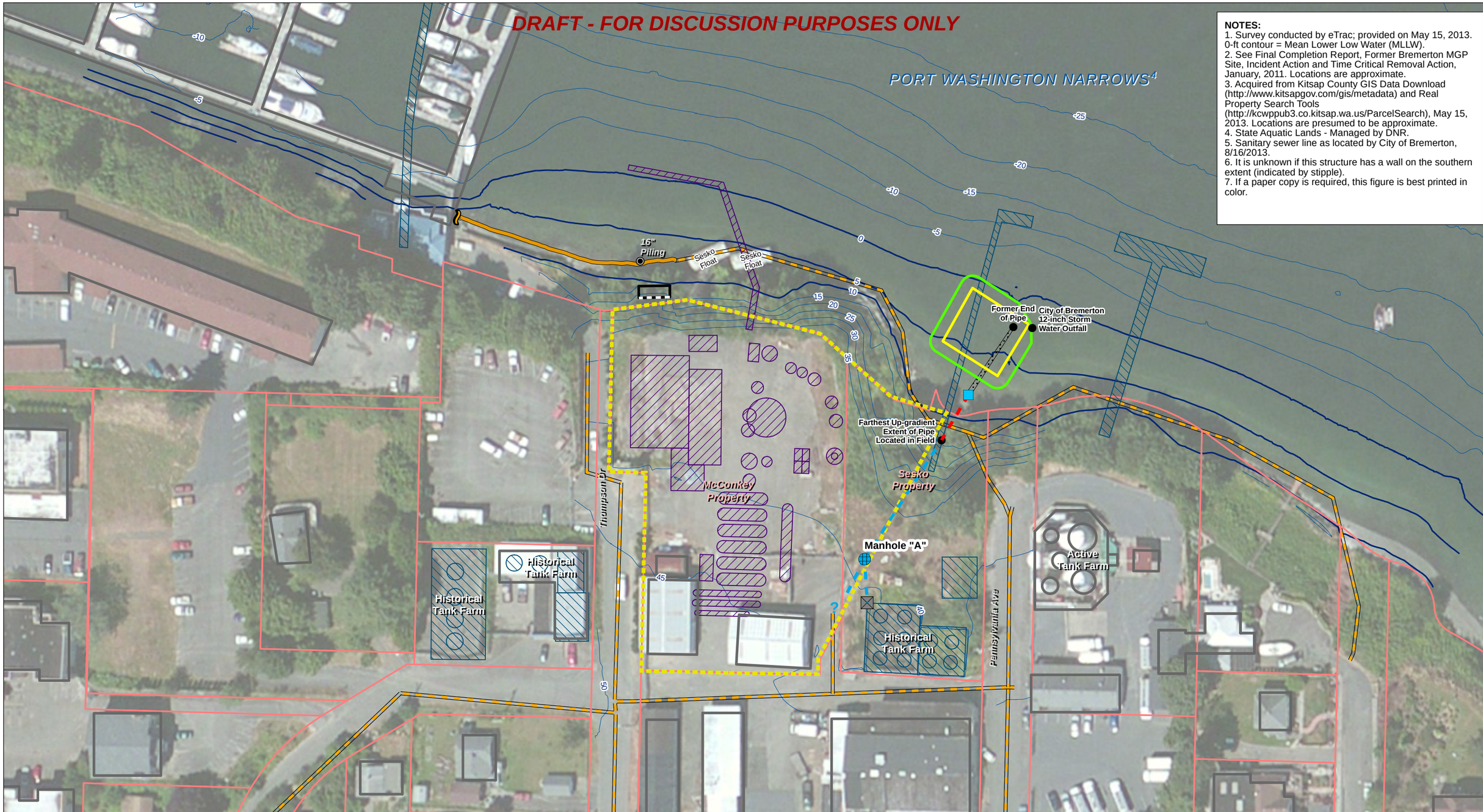
1:18,000

NOTE:
If a paper copy is required, this figure is best printed in color.

Former Gas Works Location and Vicinity
Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING	ANCHOR QEA	FIRM: ANCHOR QEA DRAWN BY: ckiblinger	FIGURE NO. 1-1

AO GIS Path: Q:\Jobs\100719-01_Bremerton MGP\Maps\2013_09\Vicinity Map REF.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 9/12/2013 || User: ckiblinger || Print Date: 9/12/2013



NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR.
5. Sanitary sewer line as located by City of Bremerton, 8/16/2013.
6. It is unknown if this structure has a wall on the southern extent (indicated by stipple).
7. If a paper copy is required, this figure is best printed in color.

- Historical Structures Associated with the Gas Works
- Historical Structures Not Associated with the Gas Works
- Existing Buildings
- Concrete Wall or Bin (Field Located)[6]
- Former Gas Works Location
- 2010 TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Field Verified Pipe Location
- Sump *(Not Field Located)*
- Cover of Existing Organoclay Mat (10-inch minus rock)[2]
- Extent of Existing Organoclay Mat[2]
- Field-located Sanitary Sewer Line[5]
- Sanitary Sewer *(Not Field Located)*
- Sewer Line Continues West from this Location
- Storm Sewer *(Not Field Located)*
- Parcel Boundaries[3]
- Bathymetry/Topography Contours (MLLW ft)[1]

N

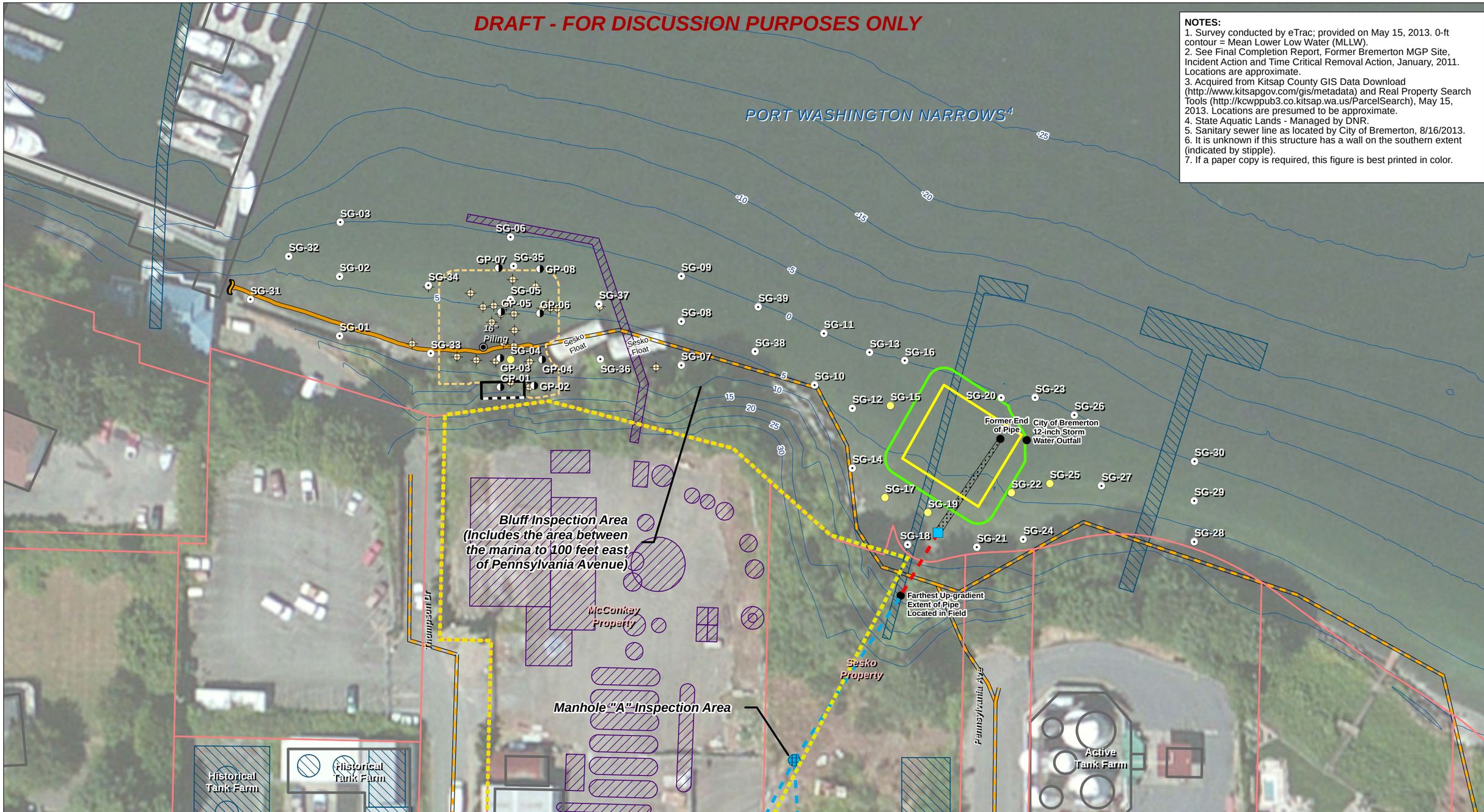
0 75 150
Feet
1:900

Historical and Current Site Features

Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA | FIRM: ANCHOR QEA | DRAWN BY: ckiblinger | FIGURE NO. **2-1**

AO GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_09\Historical and Current Site Features RER.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/10/2013 || User: ckiblinger || Print Date: 10/10/2013



NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR.
5. Sanitary sewer line as located by City of Bremerton, 8/16/2013.
6. It is unknown if this structure has a wall on the southern extent (indicated by stipple).
7. If a paper copy is required, this figure is best printed in color.

- Surface Sample
- Surface and Shallow Subsurface Sample
- Subsurface Sample (Direct Push and Hand Auger)
- Test Plot
- SG-04 and SG-05 Area
- 2010 TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Field Verified Pipe Location
- Pipe Removed and Backfilled to Grade[2]
- Concrete Wall or Bin (Field Located)[6]
- Former Gas Works Location
- Cover of Existing Organoclay Mat (10-inch minus rock)[2]
- Extent of Existing Organoclay Mat[2]
- Parcel Boundaries[3]
- Field-located Sanitary Sewer Line[5]
- Sanitary Sewer *(Not Field Located)*
- Sewer Line Continues West from this Location
- Storm Sewer *(Not Field Located)*
- Bathymetry/Topography Contours (MLLW ft)[1]
- Historical Structures Associated with the Gas Works
- Historical Structures Not Associated with the Gas Works
- Existing Buildings

N

0 25 50
Feet
1:650

Removal Evaluation Sampling Locations

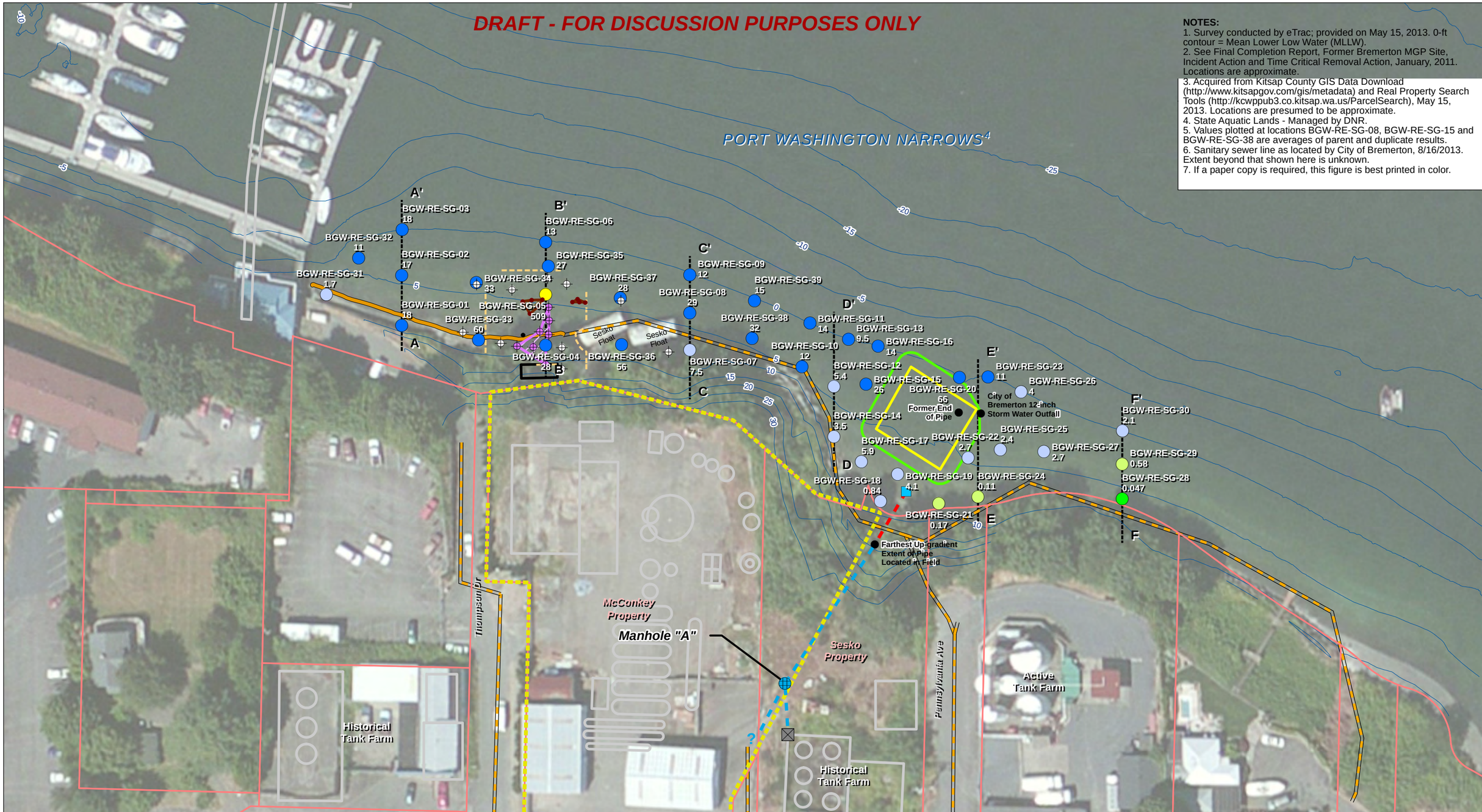
Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO. 3-1

AO GIS Path: Q:\Jobs\10071\9-01 Bremerton MGP\Maps\2013 09\Removal Evaluation Sampling Locations REE.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: ckiblinger || Print Date: 10/10/2013



NOTES:

1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR.
5. Values plotted at locations BGW-RE-SG-08, BGW-RE-SG-15 and BGW-RE-SG-38 are averages of parent and duplicate results.
6. Sanitary sewer line as located by City of Bremerton, 8/16/2013. Extent beyond that shown here is unknown.
7. If a paper copy is required, this figure is best printed in color.

Test Plots with no Observed Sheen
Test Plots with Observed Sheen
Hydrocarbon-like Solid Observations
100-Foot Transects
Area of Observed Hydrocarbon Sheen
Solid Hydrocarbon Material
SG-04 and SG-05 Area

Surface Sediment cPAH mg/kg TEQ[5]
- 0.047 - 0.08
- 0.081 - 0.8
- 0.81 - 8
- 8.1 - 80
- 81 - 509

2010 TCRA/IA Pipe Plug Location[2]
Remaining 12-inch Concrete Pipe[2]
Field Verified Pipe Location
Sump *(Not Field Located)*
Pipe Removed and Backfilled to Grade[2]
Concrete Wall or Bin (Field Located)
Historical Structures
Former Gas Works Location

Cover of Existing Organoclay Mat (10-inch minus rock)[2]
Extent of Existing Organoclay Mat[2]
Parcel Boundaries[3]
Field-located Sanitary Sewer Line[6]
Sanitary Sewer *(Not Field Located)*
Storm Sewer *(Not Field Located)*
Bathymetry/Topography Contours (MLLW ft)[1]

N

0 25 50
Feet
1:770

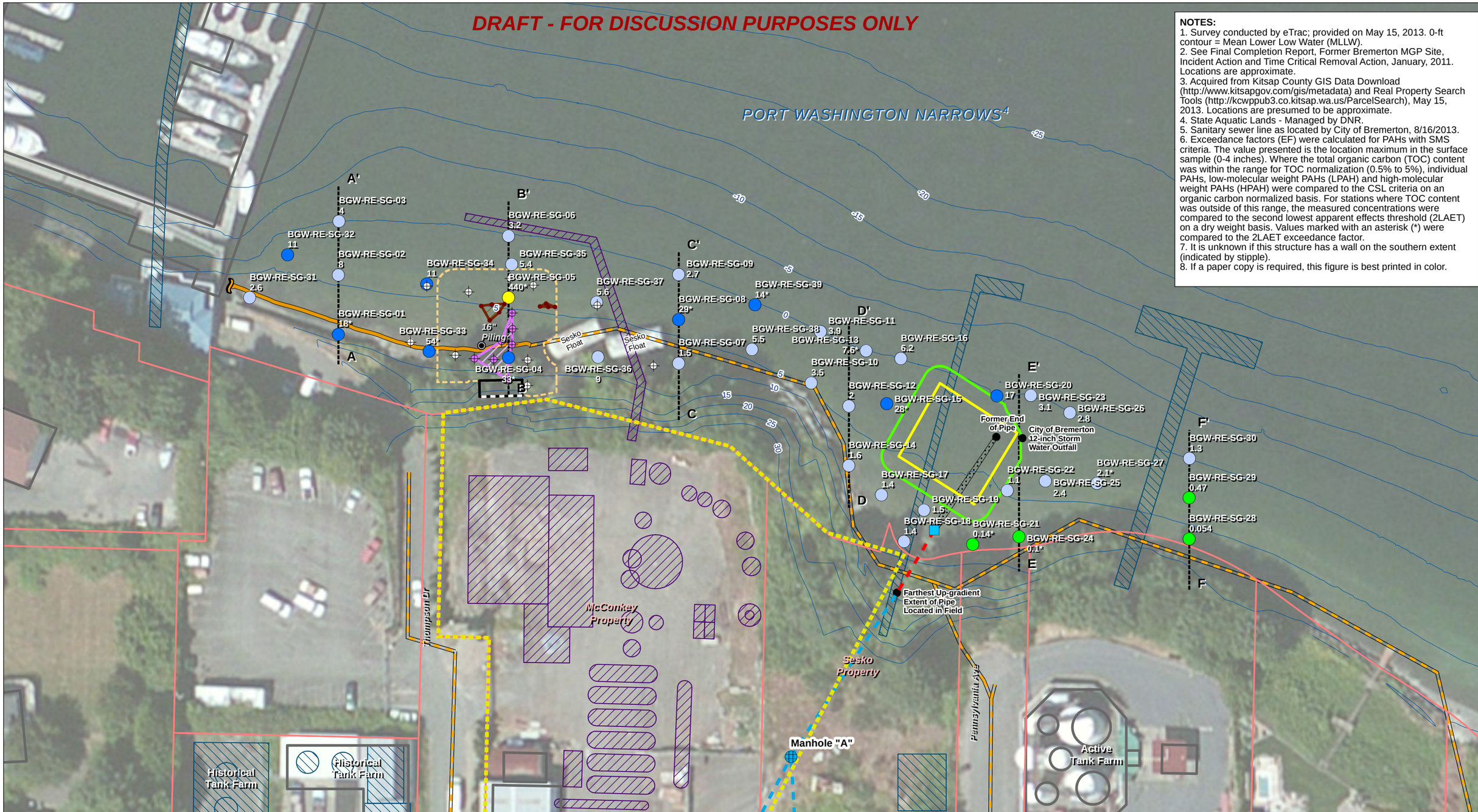
Results of Intertidal Surface Sediment Sampling (cPAH TEQ)
Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO.
4-1

AO GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_09\Results Intertidal Surf Sed Samp cPAH TEQ-REF.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/3/2013 || User: ckiblinger || Print Date: 10/3/2013



NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR.
5. Sanitary sewer line as located by City of Bremerton, 8/16/2013.
6. Exceedance factors (EF) were calculated for PAHs with SMS criteria. The value presented is the location maximum in the surface sample (0-4 inches). Where the total organic carbon (TOC) content was within the range for TOC normalization (0.5% to 5%), individual PAHs, low-molecular weight PAHs (LPAH) and high-molecular weight PAHs (HPAH) were compared to the CSL criteria on an organic carbon normalized basis. For stations where TOC content was outside of this range, the measured concentrations were compared to the second lowest apparent effects threshold (2LAET) on a dry weight basis. Values marked with an asterisk (*) were compared to the 2LAET exceedance factor.
7. It is unknown if this structure has a wall on the southern extent (indicated by stipple).
8. If a paper copy is required, this figure is best printed in color.

- Test Plots with no Observed Sheen
- Test Plots with Observed Sheen
- Hydrocarbon-like Solid Observations
- 100-Foot Transects
- Historical Structures Associated with the Gas Works
- Historical Structures Not Associated with the Gas Works
- Existing Buildings

Maximum Exceedance of SMS CSL or 2LAET[6]
- < 1
- 1 - 10
- 10 - 100
- > 100
- Area of Observed Hydrocarbon Sheen
- Solid Hydrocarbon Material
- SG-04 and SG-05 Area

- 2010 TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Field Verified Pipe Location
- Pipe Removed and Backfilled to Grade[2]
- Concrete Wall or Bin (Field Located)[7]
- Former Gas Works Location

- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Extent of Organo-Clay Mat[2]
- Parcel Boundaries[3]
- Field-located Sanitary Sewer Line[5]
- Sanitary Sewer *(Not Field Located)*
- Sewer Line Continues West from this Location
- Storm Sewer *(Not Field Located)*
- Bathymetry/Topography Contours (MLLW ft)[1]

N

0 25 50
Feet
1:650

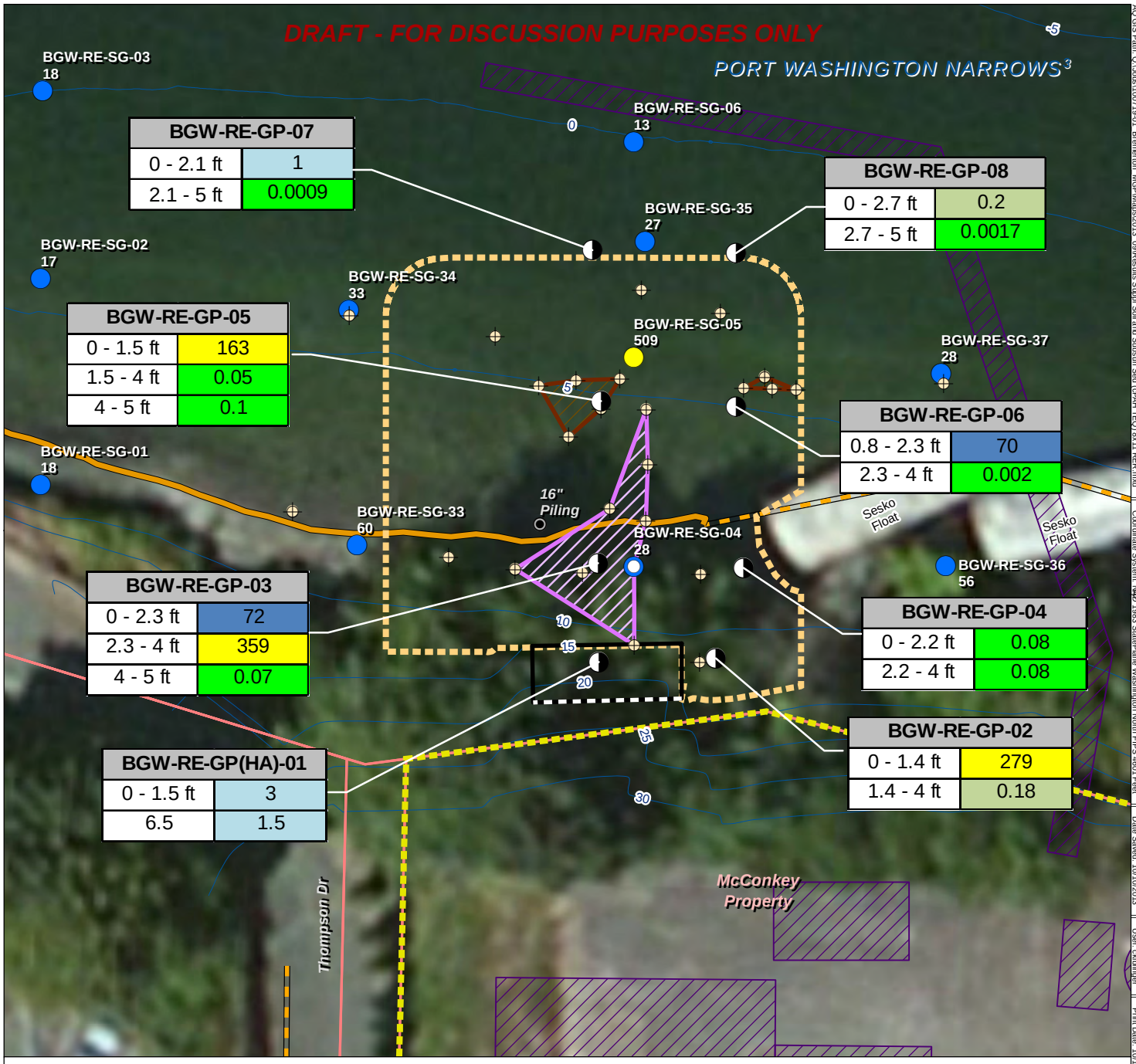
Comparison of Intertidal Surface Sediment Data to SMS Cleanup Screening Levels
Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO.
4-2

AO GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_09\Comparison_Intertidal_Surf Sed to SMS REP.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/10/2013 || User: ckiblinger || Plot Date: 10/10/2013



BGW-RE-GP-07	
0 - 2.1 ft	1
2.1 - 5 ft	0.0009

BGW-RE-GP-08	
0 - 2.7 ft	0.2
2.7 - 5 ft	0.0017

BGW-RE-GP-05	
0 - 1.5 ft	163
1.5 - 4 ft	0.05
4 - 5 ft	0.1

BGW-RE-GP-06	
0.8 - 2.3 ft	70
2.3 - 4 ft	0.002

BGW-RE-GP-03	
0 - 2.3 ft	72
2.3 - 4 ft	359
4 - 5 ft	0.07

BGW-RE-GP-04	
0 - 2.2 ft	0.08
2.2 - 4 ft	0.08

BGW-RE-GP-02	
0 - 1.4 ft	279
1.4 - 4 ft	0.18

BGW-RE-GP(HA)-01	
0 - 1.5 ft	3
6.5	1.5

Subsurface Sample (Direct Push and Hand Auger)
Surface and Shallow Subsurface Grab Sample
Test Plot
Historical Structures Associated with the Gas Works
Historical Structures Not Associated with the Gas Works
Existing Buildings

Surface Sediment cPAH mg/kg TEQ[4]
- 0.0009 - 0.08
- 0.081 - 0.8
- 0.81 - 8
- 8.1 - 80
- 81 - 509

Area of Observed Hydrocarbon Sheen
Solid Hydrocarbon Material
SG-04 and SG-05 Area

Field-located Sanitary Sewer Line[5]
Sanitary Sewer *(Not Field Located)*
Concrete Wall or Bin (Field Located)[6]
Former Gas Works Location
Parcel Boundaries[2]
Bathymetry/Topography Contours (MLLW ft)[1]

NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
3. State Aquatic Lands - Managed by DNR.
4. Values plotted at locations BGW-RE-SG-08, BGW-RE-SG-15 and BGW-RE-SG-38 are averages of parent and duplicate results.
5. Sanitary sewer line as located by City of Bremerton, 8/16/2013.
6. It is unknown if this structure has a wall on the southern extent (indicated by stipple).
7. If a paper copy is required, this figure is best printed in color.

N

0 25
Feet
1:300

Results of Supplemental Soil and Subsurface Sediment Testing (cPAH TEQ)

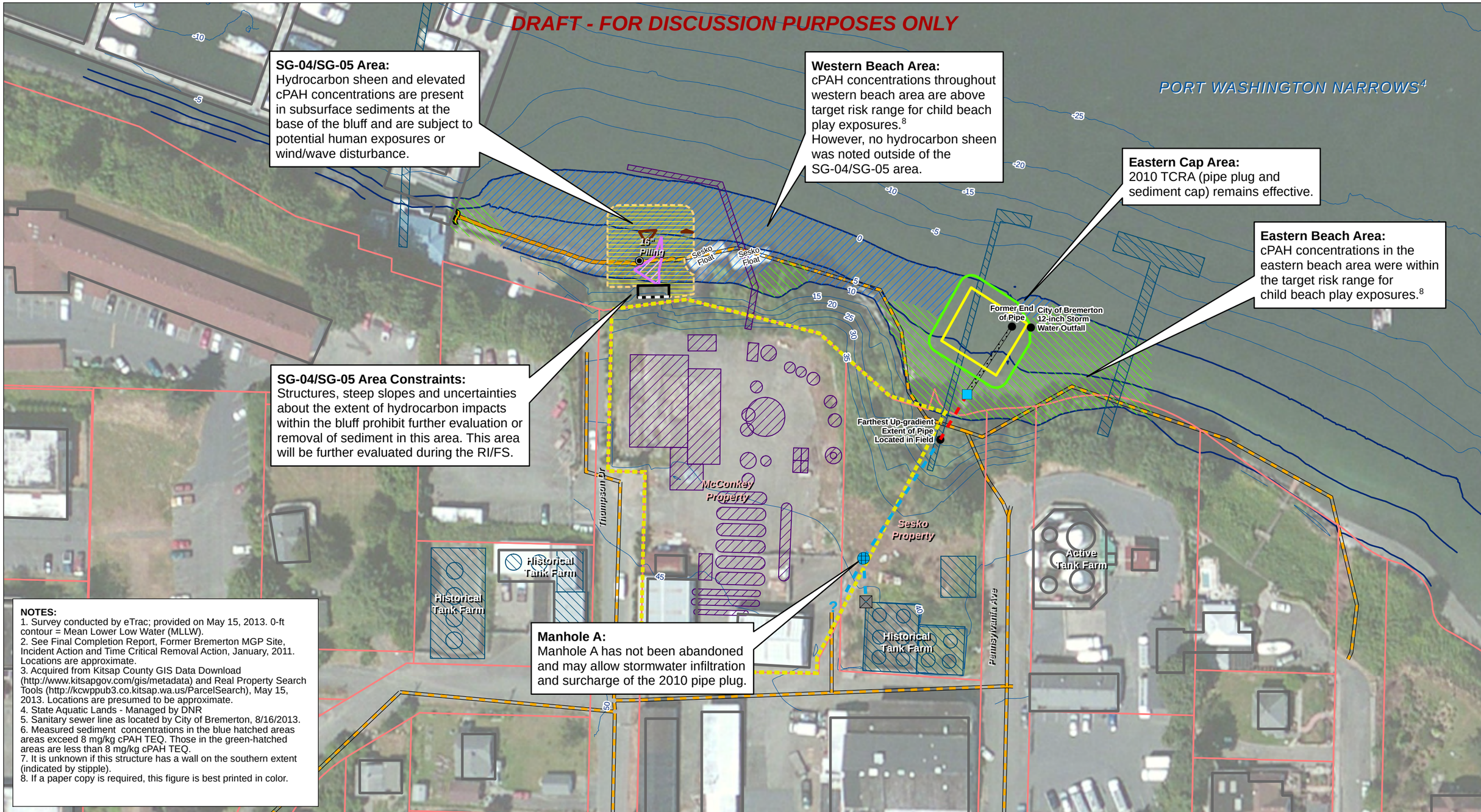
Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO. 4-3

AG GIS Path: Q:\Jobs\100719-01 Bremerton MGP\Maps\2013 09\Results Suppl Soil and Subsurf Sed (cPAH TEQ) 8x11 REF.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/10/2013 || User: ckiblinger || Print Date: 10/11/2013



NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. Sanitary sewer line as located by City of Bremerton, 8/16/2013.
6. Measured sediment concentrations in the blue hatched areas areas exceed 8 mg/kg cPAH TEQ. Those in the green-hatched areas are less than 8 mg/kg cPAH TEQ.
7. It is unknown if this structure has a wall on the southern extent (indicated by stipple).
8. If a paper copy is required, this figure is best printed in color.

- Historical Structures Associated with the Gas Works
- Historical Structures Not Associated with the Gas Works
- Existing Buildings
- Concrete Wall or Bin (Field Located)[6]
- Former Gas Works Location
- 2010 TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Field Verified Pipe Location
- Sump *(Not Field Located)*
- Cover of Existing Organoclay Mat (10-inch minus rock)[2]
- Extent of Existing Organoclay Mat[2]
- Area of Observed Hydrocarbon Sheen
- Solid Hydrocarbon Material
- SG-04 and SG-05 Area
- Parcel Boundaries[3]
- Field-located Sanitary Sewer Line[5]
- Sanitary Sewer *(Not Field Located)*
- Sewer Line Continues West from this Location
- Storm Sewer *(Not Field Located)*
- Bathymetry/Topography Contours (MLLW ft)[1]

N

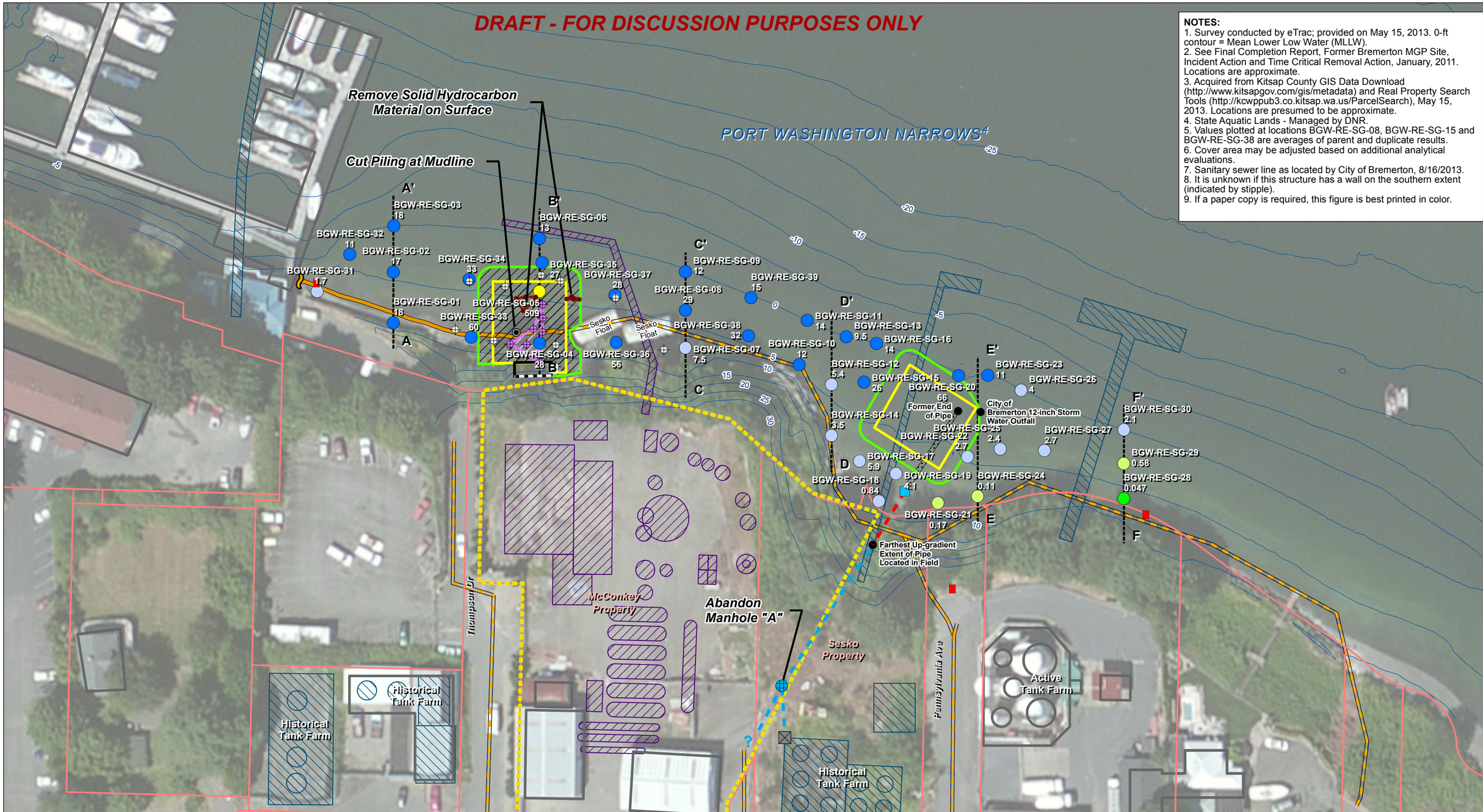
0 75 150
Feet
1:900

Summary of Key Findings from the Removal Evaluation

Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA | FIRM: ANCHOR QEA | DRAWN BY: ckiblinger | FIGURE NO. **5-1**

AO GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_09\Summary Key Findings Remd Eval REP.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: ckiblinger || Print Date: 10/10/2013



NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013. 0-ft contour = Mean Lower Low Water (MLLW).
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR.
5. Values plotted at locations BGW-RE-SG-08, BGW-RE-SG-15 and BGW-RE-SG-38 are averages of parent and duplicate results.
6. Cover area may be adjusted based on additional analytical evaluations.
7. Sanitary sewer line as located by City of Bremerton, 8/16/2013.
8. It is unknown if this structure has a wall on the southern extent (indicated by stipple).
9. If a paper copy is required, this figure is best printed in color.

Test Plots with no Observed Sheen
Test Plots with Observed Sheen
Hydrocarbon Solid Observations
Approximate Public Notice Sign Location
Historical Structures Associated with the Gas Works
Historical Structures Not Associated with the Gas Works
Existing Buildings

Surface Sediment cPAH mg/kg TEQ[5]
- 0.047 - 0.08
- 0.081 - 0.8
- 0.81 - 8
- 8.1 - 80
- 81 - 509

Area of Observed Hydrocarbon Sheen
Solid Hydrocarbon Material

2010 TCRA/IA Pipe Plug Location[2]
Remaining 12-inch Concrete Pipe[2]
Field Verified Pipe Location
Sump *(Not Field Located)*
Pipe Removed and Backfilled to Grade[2]
Concrete Wall or Bin (Field Located)[8]
Former Gas Works Location
Approximate Proposed Reactive Core Mat Cover[6]
Approximate Proposed Reactive Core Mat

Cover of Existing Organoclay Mat (10-inch minus rock)[2]
Extent of Existing Organoclay Mat[2]
Parcel Boundaries[3]
100-Foot Transects
Field-located Sanitary Sewer Line[7]
Sanitary Sewer *(Not Field Located)*
Sewer Line Continues West from this Location
Storm Sewer *(Not Field Located)*
Bathymetry/Topography Contours (MLLW ft)[1]

N

0 25 50
Feet
1:760

Proposed Removal Action
Removal Evaluation Report
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO.
5-2

AO GIS Path: Q:\Jobs\100719-01 Bremerton MGP\Maps\2013_09\Proposed Removal Action RER.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/10/2013 || User: ckiblinger || Print Date: 10/10/2013

APPENDIX A
FINAL REMOVAL EVALUATION WORK PLAN

FINAL REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Prepared by

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
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FINAL REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC & Anchor QEA, LLC

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EPA Remedial Project Manager
William Ryan, EPA

7/2/13
Date

EPA Project On Scene Coordinator
Kathy Parker, EPA

7/2/2013
Date

EPA Region 10 QA Manager
Ginna Grepo-Grove, EPA

7/2/2013
Date

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A Field Sampling Plan

B Quality Assurance Project Plan

C Record Drawings of Former Drainage and Piping System Addressed by November 2010 Time Critical Removal Action

D Preliminary Screening Evaluation for Recreational Beach User Scenario

Acronyms

Anchor QEA	Anchor QEA, LLC
AOC	Administrative Settlement Agreement and Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
Aspect	Aspect Consulting, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COI	chemicals of interest
cPAH	carcinogenic polycyclic aromatic hydrocarbon
DGPS	differential global positioning system
DNR	Washington Department of Natural Resources
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentrations
FID	Flame Ionization Detector
FSP	Field Sampling Plan
Gas Works	Former Bremerton gas works facility
GIS	geographic information system
HHRA	Human Health Risk Assessment
HPAH	high molecular weight PAH
IDW	inverse distance weighting
KCHD	Kitsap County Health District
LDW	Lower Duwamish Waterway
LPAH	low molecular weight PAH
mg/kg	milligrams per kilogram
MLLW	mean lower low water
NPL	National Priorities List
OC	organic carbon
Order	Administrative Order for a Pollution Incident

PAH	polycyclic aromatic hydrocarbons
PID	Photoionization Detector
Pipe	12-inch concrete pipe
QAPP	Quality Assurance Project Plan
RBTC	risk-based threshold concentration
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
SMS	Sediment Management Standards
SWAC	surface-weighted average concentration
TCRA	Time Critical Removal Action
TEF	toxicity equivalency factor
TOC	total organic carbon
UCL	upper confidence limit
USCG	U.S. Coast Guard
Work Plan	Removal Evaluation Work Plan

1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gas Works Site (Site) in Bremerton, Washington. Prior to completion of the RI/FS, a removal evaluation is required to assess whether releases or threatened releases of contamination at the Site present an imminent and substantial endangerment to public health or welfare or the environment that warrant performance of an additional removal action. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013. Figure 1 shows the location of the former Bremerton gas works facility (Gas Works), and Section 2 provides a summary of Site history and background.

1.1 Purpose and Objectives

Submittal of this Removal Evaluation Work Plan (Work Plan) is the first task under the AOC. This Work Plan includes a detailed Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The Work Plan presents detailed descriptions of the data collection tasks to be performed to complete the removal evaluation.

The sampling and analysis activities to be performed are intended to meet the following data quality objectives:

- Collect the information necessary to evaluate whether current surface sediment contamination within the intertidal beach area adjacent to the former Gas Works poses an imminent and substantial threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. Intertidal beach area sampling activities were specified in the AOC, as follows:
  - Samples will be collected in surface sediment within the beach area between the high tide line and the mean lower low water (MLLW) line.
  - The depth of sampling will be surface composites in the 0 to 10 cm (0 to 4 inch) depth interval.
  - Samples will be analyzed for polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC).
  - These data will be used to estimate potential Site-related risks to beach users (evaluated using a recreational beach use scenario) and to benthic ecological receptors.
- Inspect the former drainage and piping system connected to the 12-inch pipe addressed during the November 2010 Time Critical Removal Action (TCRA) by evaluating potential influent sources to a manhole (Manhole “A”) believed to be connected to the pipe that was plugged. This information will be used to identify potential ongoing or threatened contaminant migration pathways to the beach.

- Inspect the area between the bluff and the high tide line for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the beach. If potential hydrocarbon seeps are indicated by visual observation of sheen, product, hydrocarbon odor, or photoionization detector or flame ionization detector (PID/FID) readings, soil samples will be collected and archived for potential analysis of PAHs and TOC.

Data generated as part of the removal evaluation will be summarized in a Removal Evaluation Report to be prepared following completion of sampling, analysis, and data validation. All work will be performed in accordance with the project schedule as defined in Section 7.

1.2 Document Organization

This Work Plan was prepared in accordance with the following EPA requirements and guidance:

- EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, Final, March 2001 (EPA 2001a).
- EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans, December 2002 (EPA 2002c).
- EPA QA/G-4, EPA Guidance on Systematic Planning Using the Data Quality Objectives Process, February 2006 (EPA 2006).

This Work Plan is organized as follows:

- **Section 2: Site Background.** This section provides a summary of the Site history, historical environmental investigations, and the 2010 TCRA.
- **Section 3: Focus of Removal Evaluation.** This section describes the focus of the removal evaluation, which has been developed based on current and historical Site conditions and the requirements of the AOC. This section also identifies the contaminants of interest (COIs), and provides a summary of how detected concentrations of COIs will be screened to evaluate potential impacts to human health and ecological receptors.
- **Section 4: Sampling of Intertidal Beach Area.** This section details the sampling and analysis rationale and methods to characterize surface sediment contamination at the beach from the high tide line to MLLW and to evaluate whether PAH concentrations pose an imminent and substantial threat to public health or the environment.
- **Section 5: Inspection of Former Drainage and Piping System**. This section details the rationale and methods to investigate the drainage and piping system connected to the 12-inch pipe addressed by the 2010 TCRA.
- **Section 6: Bluff Inspection and Contingent Sampling**. This section summarizes work to be performed to inspect the base of the bluff along Port Washington Narrows for potential hydrocarbon seeps.

- **Section 7: Project Reporting and Schedule.** This section describes how information will be communicated and data managed, and summarizes the current removal evaluation schedule.
- **Appendix A:** Field Sampling Plan.
- **Appendix B:** Quality Assurance Project Plan.
- **Appendix C**: Record Drawings of Former Drainage and Piping System Addressed by November 2010 Time Critical Removal Action.
- **Appendix D**: Risk Screening Input Parameters for Recreational Beach User Scenario.

2 Site Background

This section provides background information regarding the Site. Consistent with the AOC, the Site includes the area where the Gas Works was formerly located (Figure 1) and areas suspected/anticipated to be affected by contamination originating from the former Gas Works.

2.1 Site History

The Gas Works was formerly located on approximately 2.8 acres of property along the south shore of Port Washington Narrows in Bremerton, Washington, between Thompson and Pennsylvania Avenues (Figure 1). As shown in Figure 2, the Gas Works was located on portions of properties that are currently owned by the McConkey Family Trust (McConkey, Paul and Margaret Trustees) (McConkey Property) and Natacha Sesko (Sesko Property). A dock associated with Gas Works operations was located within Port Washington Narrows as shown in Figure 2.

The Gas Works produced gas for lighting and heating through manufactured gas plant operations from approximately 1930 to the mid-1950s and through blending of propane and air from the mid-1950s to 1963. The Gas Works structures were removed between 1963 and the early 1970s.

After the Gas Works properties were sold, the McConkey Property and the Sesko Property were used for industrial purposes, including metal fabrication, concrete forming, and boat repair. The Sesko Property has also been used for the storage of miscellaneous equipment and debris. The Sesko Property and the majority of the McConkey Property are currently vacant. The following three petroleum storage and distribution facilities were formerly or are currently present in the immediate vicinity of the former Gas Works:

- A bulk petroleum facility operated on a portion of the Sesko Property between the early to mid-1940s and approximately 1993.
- A former ARCO bulk petroleum facility operated on property located to the southwest of the former Gas Works between approximately 1942 and 1992; this property is currently owned and operated by Pipeworks Mechanical & Service, Inc.
- A bulk petroleum facility currently operated by SC Fuels is located to the east of the Sesko Property, across Pennsylvania Avenue. A bulk petroleum terminal has operated in that location since the early to mid-1940s.

Historically, petroleum products were delivered to all three fuel facilities by barge. Three separate docks were used for product delivery over the years. Use of the docks was consolidated over time, and two or more of the fuel facilities shared a single dock in later years. Figure 2 shows the locations of the three historical fuel docks as well as the former Gas Works dock.

2.2 Historical Environmental Investigations

The former Gas Works, the bulk fuel facilities, and other former and current operations in the vicinity of the Site have been the subject of multiple environmental studies. A list of studies focused primarily on the former Gas Works has been provided to EPA for their files and includes:

- Inspection Field Notes and Lab Report from initial investigation inspection (Ecology 1995).
- Targeted Brownfields Assessment Report, Old Bremerton Gas Works – McConkey Properties (Techlaw 2006).
- Preliminary Upland Assessment Report, McConkey/Sesko Brownfields Site (GeoEngineers 2007).
- Historical Characterization and Data Gaps, Old Bremerton Gas Works Property 1725 Pennsylvania Avenue (Hart Crowser 2007).
- Final Bremerton Gas Works Targeted Brownfields Assessment Report (Ecology and Environment 2009).

A detailed review of historical environmental investigations will be performed to determine the usability of these data for the RI/FS and risk assessment. The results of this review will be presented in the RI/FS Work Plan.

2.3 2010 Time Critical Removal Action

On August 20, 2010, the Kitsap County Health District (KCHD) observed intermittent sheens on surface water of Port Washington Narrows near the former Gas Works. Further investigation by KCHD on October 4, 2010, identified a 12-inch concrete pipe (Pipe) buried beneath the intertidal beach sediments that appeared to be discharging hydrocarbon product to marine waters. KCHD reported the finding to EPA. EPA relayed the finding to the U.S. Coast Guard (USCG) on October 5, 2010, because the Pipe was within USCG's area of responsibility (EPA 2010).

USCG mobilized to the Site on October 6, 2010. USCG took immediate action to contain the hydrocarbon sheen by installing a containment system as of October 10, 2010, and conducting frequent monitoring of Site conditions. On October 16, 2010, USCG commenced activities to mitigate the apparent discharge from the Pipe. The activities included breaking of a 4-foot section of the Pipe with a hydraulic hammer, plugging the Pipe-end in that area, and placing hydraulic cement over the temporary plug. These activities were implemented by an emergency response contractor working at the direction of USCG.

EPA, in coordination with USCG and in conjunction with the response activities, collected surface sediment samples for analysis of PAHs. Samples collected by EPA as part of this effort are shown on Figure 4 (that figure also shows the locations of previous sediment samples collected in August 2009 by Ecology and Environment as part of the Targeted Brownfields Assessment). The Washington State Department of Ecology (Ecology) analyzed a sample of material collected near the Pipe by KCHD on September

24, 2010, only for hydrocarbon identification by HC-ID (Appendix B). The sample was characterized by the laboratory as a "coal-tar creosote" type of product.

EPA collected a sample of material from inside the Pipe on October 5, 2010, and analyzed it for PAHs.

The USCG established a Unified Command to assist with the response activities. The Unified Command initially included representatives of USCG, EPA, Ecology, Washington Department of Natural Resources (DNR), and KCHD.

On October 18, 2010, Cascade first learned of the response activities at the Site and contacted EPA that same day expressing an interest in being involved in the response. On October 19, 2010, Cascade met with USCG, EPA, and the rest of the Unified Command to discuss additional actions appropriate at the Site. The USCG subsequently added Cascade to the Unified Command and issued Cascade an Administrative Order for a Pollution Incident (Order) to implement response actions at the Site under oversight of USCG. Cascade accepted the Order (Acceptance of Order) in a letter dated October 29, 2010.

Under EPA and USCG oversight, Cascade implemented a TCRA including completion of the following activities:

- Investigation of the location and orientation of the abandoned Pipe.
- Permanent plugging of the Pipe as close as practicable to the shoreline.
- Removal of all portions of the Pipe from the new plug to the terminus of the Pipe.
- Backfilling of the excavation created by removal of the Pipe with clean beach material.
- Placement of an Organo-Clay mat over impacted sediments near the terminus of the Pipe that had been observed to generate sheen with only minimal disturbance.
- Continued maintenance of a containment system and field observations and inspections to confirm the situation remains stable (no sheen).

The TCRA was successfully completed between November 5 and November 8, 2010. The results of the removal action were documented in a Completion Report (Anchor QEA 2011).

Post-completion inspections of the removal action area have been performed on behalf of Cascade between 2010 and 2013. These inspections have been conducted pursuant to the TCRA Work Plan (Anchor QEA and Aspect 2010). Results of monitoring have shown that the removal action has contained the hydrocarbon sheen, and the temporary cap has been colonized by surface algae.

2.4 NPL Listing and AOC Development

EPA placed the Site on the National Priorities List (NPL) on May 10, 2012. EPA and Cascade subsequently negotiated an AOC for performance of a RI/FS at the Site. The AOC was executed on May 1, 2013.

As required by the AOC, a removal evaluation will be performed prior to initiation of the RI/FS. The removal evaluation is intended to assess whether releases or threatened releases of contamination at the Site present an imminent and substantial endangerment to public health or welfare or the environment that warrants performance of an additional removal action before completion of the RI/FS and selection of a final remedy. This Work Plan outlines the sampling activities to be performed to support the removal evaluation.

3 Focus of Removal Evaluation

This Section describes the focus areas for the removal evaluation, including potential migration pathways and COIs. This analysis is based on the history of the Site and the requirements of the AOC.

3.1 Potential Contaminant Migration Pathways to Washington Narrows

Consistent with the AOC, the focus of the removal evaluation is on potential releases or threatened releases of contamination at the Site, in particular potential releases from the Site to the sediments and water of Port Washington Narrows. Such releases could potentially occur via three pathways:

- Residual Contamination in Intertidal Beach Sediments: The 2010 TCRA addressed areas of hydrocarbon impacts in surface sediments within a portion of the intertidal beach area. Visual monitoring since November 2010 has indicated that the TCRA has successfully contained areas of intertidal sediments with hydrocarbon sheen. Chemical sampling will be performed to document current PAH concentrations in surface sediments. This sampling will be used to assess whether contaminant concentrations present an imminent and substantial risk to human health or the environment. Data interpretation will include estimation of potential Site-related risks to beach users (evaluated using a recreational beach user scenario that includes early childhood exposure) and to benthic ecological receptors. These results will be used to determine if additional removal actions are required prior to initiation of the RI/FS. This work is described in Section 4 of this Work Plan.
- Migration via Former Drainage and Piping System: The 2010 TCRA included excavation and plugging of the Pipe, which was located within the intertidal beach area. The Pipe may be connected to a manhole (identified in record drawings as Manhole “A”; Appendix C) located on the McConkey Property. This manhole will be inspected to determine if further measures are required to remove or mitigate contaminants or their migration pathways between the upland area of the Site and Port Washington Narrows before completion of the RI/FS. A description of the former drainage and piping system and the proposed inspection program is described in Section 5 of this Work Plan.
- Potential Hydrocarbon Migration along the Bluff: The upland area of the Site slopes steeply down to the beach. To date, no areas of hydrocarbon sheen or seepage have been noted along the bluff/beach line. This area will be further inspected as part of the removal evaluation to determine if additional actions are warranted to remove or mitigate contaminants or their migration pathways between the upland area of the Site and Port Washington Narrows before completion of the RI/FS. This work is described in Section 6 of this Work Plan.

3.2 Contaminants of Interest for the Removal Evaluation

The COIs for the removal evaluation were identified by EPA in the AOC based on their identified presence in the intertidal sediments during the 2010 TCRA. These compounds can be associated with Gas Works operations, but also with petroleum hydrocarbons, treated wood pilings, combustion byproducts, and stormwater. The following PAH compounds will be included in the chemical analysis performed during the removal evaluation:

- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benz(a)anthracene*
- Benzo(a)pyrene*
- Benzo(b)fluoranthene*
- Benzo(g,h,i)perylene
- Benzo(j)fluoranthene*
- Benzo(k)fluoranthene*
- Chrysene*
- Dibenzo[a,h]anthracene*
- Dibenzofuran
- Fluoranthene
- Fluorene
- Indeno(1,2,3-c,d)pyrene*
- Naphthalene
- Phenanthrene
- Pyrene

Carcinogenic PAHs (cPAHs) are noted with an asterisk.

For the purpose of calculating indicator chemical sums, one-half the detection limit will be applied if an individual compound in the total is undetected. If all compounds in the total are undetected, the maximum detection limit will be applied and the result will be flagged with a “U” qualifier.

Calculation of cPAH totals will be performed as part of the health screening task during the removal evaluation. The total cPAH concentration is expressed as a benzo(a)pyrene toxicity equivalency quotient (TEQ). The total cPAH concentration is computed with

individual cPAHs weighted according to their benzo(a)pyrene toxicity equivalency factor (TEF; EPA 1993). As an additional point of comparison, the TEFs promulgated under the current MTCA rule (2007) will be applied to calculate cPAH TEQ values used in exposure estimates. The MTCA cPAH TEQ values will be calculated because they represent a more current evaluation of cPAH potency and because MTCA is an applicable or relevant and appropriate requirement (ARAR) under CERCLA.

Carcinogenic PAH	TEF (Unitless)
Benzo(a)pyrene	1
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenz(a,h)anthracene	1
Indeno(1,2,3cd)pyrene	0.1

As described below in Section 4.4, the ecological receptor in direct contact with sediment that will be used to develop screening levels is the benthic invertebrate community. The Washington State Sediment Management Standards (SMS) provide sediment quality standards for the protection of benthic invertebrates for two PAH indicator chemical groups, low molecular weight PAHs (LPAH) and high molecular weight PAHs (HPAH). Total LPAH is calculated as the sum of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. Total HPAH is calculated as the sum of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

4 Sampling of Intertidal Beach Area

This section addresses the sampling and analysis work to be performed within the intertidal beach sediments adjacent to the former Gas Works. Data needs, sampling strategy, and proposed data interpretation steps are described consistent with AOC requirements and EPA expectations defined in project meetings and teleconferences.

4.1 Data Needs

Despite the presence of previous sampling data (see Figure 2), additional sample collection and analysis is required to define current contaminant concentrations within the intertidal beach sediments. The previously collected data are not adequate for this purpose given the following limitations:

- Data quality: Some of the existing data have QA/QC limitations, including missing QA/QC documentation and/or elevated detection limits. These limitations prevent use of these data for removal evaluation decision-making.
- Inconsistent coverage: Previous sampling efforts were biased toward the 2010 TCRA area. Data coverage in other beach areas is insufficient to complete the removal evaluation.
- Changes following the removal evaluation: The previous sampling data were collected prior to the implementation of the 2010 TCRA. This data may not be representative of current conditions due to the beneficial impacts of the TCRA.

Current sediment sampling data are required to address the following information needs:

- Characterize current PAH concentrations within the intertidal beach sediments adjacent to the former Gas Works.
- Determine whether current exposure conditions at the Site pose an imminent and substantial threat to human health or the environment that requires a removal action before completion of the RI/FS.

4.2 Sampling and Analysis Approach

Sediment sampling within the intertidal beach areas will include collection and analysis of 30 surface sediment samples from the locations shown in Figure 4.

Each sample will be collected at low tide using hand tools. Surface samples will be collected from the 0- to 4-inch depth interval. Five equal-volume aliquots will be collected at each sample location to create a single composite sample. One aliquot will be collected at the target location and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass. The purpose of compositing five individual aliquots from a single sampling location is to average potential small-scale heterogeneity in the physical substrate and chemical contaminant concentrations at the sample location. The compositing approach

provides a more representative average exposure concentration for a given location than could be obtained from a single grab sample.

Sediments will be collected with decontaminated stainless steel trowels into decontaminated stainless steel bowls, homogenized, and placed into pre-labeled sample containers. Horizontal positioning at each sample location will be determined using a handheld differential global positioning system receiver (DGPS). Additional sampling details are provided in the FSP (Appendix A). Laboratory sampling and analysis details and QA/QC procedures are defined in the QAPP (Appendix B).

During sampling, additional surface or subsurface sediment samples may be collected for archiving and/or for contingent chemical analysis under the following conditions:

- Additional Surface Sample Locations: If surface sediments with potential hydrocarbon sheen or odor are identified, additional local station composite samples of surface sediment may be collected and archived from these locations.
- Subsurface Sampling: If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. If hydrocarbon sheen or odor is noted in more than one station subsample aliquot location, the subsurface aliquots containing the sheen or odor will be composited and archived.

If contingent surface or subsurface sediment samples are collected and archived as described above, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed, these will be analyzed using the same analysis methods used for analysis of the 30 planned surface sediment samples

4.3 Preliminary Screening of Human Health Risks

A baseline human health risk assessment (HHRA) will be performed as part of the RI/FS. However, this analysis will not be available to support the removal evaluation.

To support the removal evaluation, a preliminary health risk evaluation will be conducted for recreational beach users potentially exposed to the intertidal beach sediments adjacent to the former Gas Works. This preliminary analysis is intended for limited use as a screening step to assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the RI/FS. The preliminary screening evaluation is detailed in Appendix D of this Work Plan.

The preliminary screening of human health risks will be focused on potential health risks associated with cPAH compounds in sediments. This evaluation will be conducted in coordination with EPA, considering potential child and young adult exposures (i.e., individuals from birth to 30 years of age) under a recreational beach use scenario. The preliminary screening of human health risks will focus on potential risks associated with dermal contact, incidental ingestion, and inhalation of cPAH compounds in beach sediments. These compounds can be elevated in residuals associated with manufactured gas plant operations. They can also be present in petroleum hydrocarbons, combustion byproducts, treated wood structures and stormwater.

The screening-level risk evaluation will be performed as a supporting piece of information during the removal evaluation of intertidal beach sediments adjacent to the Gas Works. This evaluation is intended for limited use during the removal evaluation to help assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the Remedial Investigation/Feasibility Study (RI/FS). A baseline human health risk assessment (HHRA) and ecological risk assessment will be performed during the RI/FS, and the HHRA may supersede the screening-level risk evaluation.

The screening-level risk evaluation is presented in Appendix D, and is based on standardized equations combining site-specific and EPA default exposure information assumptions with current EPA toxicity data. In support of EPA Superfund cleanup projects, EPA has developed the Regional Screening Levels (RSL) of Chemical Contaminants at Superfund Sites. While the published RSLs are generic, they may be recalculated using site-specific data. To aid in the development of site-specific screening levels at Superfund sites, EPA has provided a web-based RSL calculator. The "Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website provides the calculator, a user's guide, links to EPA guidance, and answers to frequently asked questions regarding the use of screening levels[1]. All computations for the preliminary recreational beach user screening evaluation were done using the RSL calculator and are provided in Appendix D.

The EPA recreational soil/sediment exposure was used for the current analysis. All assumptions provided with EPA default values were used. Conservative site-specific exposure frequency (days/year) and event time (hours/event) were used as described below.

Beach play exposure frequency values have been evaluated recently by EPA at other marine sediment sites with similar accessibility and characteristics, including at the Lower Duwamish Waterway (LDW) Superfund Site. The beach play exposure analysis for the LDW Site was summarized in the final HHRA performed during the RI/FS study process (Windward 2007), and used an exposure frequency of 65 days/year. This is more conservative than the exposure frequency used by the Washington Department of Ecology (Ecology 2012) in its generic beach play scenario (41 days/year) for developing cleanup levels at State-lead cleanup sites.

The preliminary recreational beach user scenario to be used at the Site will use an exposure frequency of 65 days per year. This exposure frequency represents the 95th percentile for children from birth to 6 years of age who engage in playing and digging in the sand adjacent to the water and is based on a King County survey of established parks (Lake Union, Lake Washington, and Lake Sammamish) with sandy beaches (Parametrix 2003). These King County park areas are likely to have higher visitation rates than the beach adjacent to the Bremerton Gas Works Site located on the Port Washington Narrows.

The event time for the assumed recreational beach user scenario is 6 hours per event. This value is conservative for a tidally-inundated beach area. This value is applied to the

[1] EPA 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

estimate of inhalation exposure. For the purpose of developing the preliminary beach user exposure screening evaluation, this value was assumed to be 6 hours per visit. Because cPAH compounds have very low volatility, the estimated exposure is very low and the contribution to risk is approximately four orders of magnitude lower than for soil ingestion or dermal contact. Regardless, the preliminary beach user scenario is based on all three exposure pathways, inhalation of soil vapor, and soil ingestion and dermal contact, consistent with the RSL calculation methods.

The preliminary recreational beach user scenario results in a protective total cPAH TEQ concentration of 8 mg/kg at the 10^{-4} risk level and 0.08 mg/kg at the 10^{-6} risk level. The details of this calculation are provided in Appendix D, and Table D-3 provides the input and output values from the EPA RSL calculator.

For the Removal Evaluation Report, surface sediment analytical data will be summarized in tables and presented on figures depicting station sample concentrations of total cPAH TEQ results. The evaluation of the risk screening results will be performed in coordination with EPA.

4.4 Preliminary Screening for Potential Benthic Impacts

Potential risks associated with direct contact exposure to sediment by the benthic invertebrate community will also be evaluated during the removal evaluation. Washington's SMS regulations contain promulgated criteria for the protection of benthic communities. The chemical-specific criteria contained within the SMS are Applicable or Relevant and Appropriate Requirements (ARARs) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and will be considered as part of the RI/FS at the Site. There are no corresponding chemical-specific federal ARARs that apply to the protection of marine benthic communities. The SMS are not intended for direct application to the Site during the removal evaluation, but will provide a useful point of reference for evaluating the likelihood that existing sediment quality may impact benthic communities in the beach area.

The SMS criteria for PAH contamination includes two groups of PAH compounds known as HPAH and LPAH. PAHs are non-polar organic compounds and preferentially bind with organic carbon (OC). Normalization of sediment PAH data to TOC is a standard practice because the bioavailability of PAHs in sediment is controlled by OC content. Therefore Ecology has promulgated PAH standards based on OC normalized data. Normalizing PAH data by dividing by the fraction of OC is appropriate when TOC concentrations are between 0.5 percent and 5 percent, the typical range of TOC for marine sediments (Ecology 2012). Outside of this range, the SMS standards are applied on a dry weight basis. For sediments between 0.5 percent and 5 percent, the OC normalized SMS for HPAH and LPAH are 980 mg/kg-OC and 370 mg/kg-OC, respectively. For sediments outside of the TOC range for normalization, the dry weight SMS standards for HPAH and LPAH are 12 mg/kg and 5.2 mg/kg, respectively.

For the evaluation of potential risk to the benthic community, the individual sample data will be compared to the SMS numeric criteria. For samples within the TOC range of 0.5 percent to 5 percent, the comparison will be made comparing TOC-normalized data and SMS criteria. For samples with less than 0.5 percent TOC or greater than 5 percent TOC,

the comparison will be made comparing dry weight data and SMS criteria. Results will be expressed as multiples of the SMS criteria.

5 Inspection of Former Drainage and Piping System

The 2010 TCRA involved removing and plugging a portion of the Pipe buried in the intertidal area along Port Washington Narrows (as described in detail in Section 2.3 and shown in Figure 2). Based on observations made during the TCRA and a review of the sewer record drawings, the Pipe appears to have been a former sewer overflow pipe. The Pipe and the associated drainage system (including catch basins, manholes, and connecting pipes) are shown on the City of Bremerton sewer cards provided in Appendix C. Locations of former and current drainage and piping system components at the Site were georeferenced from the City of Bremerton file information and are shown on Figure 3.

The sewer record drawings show the Pipe extending from a manhole located on the Sesko Property (Manhole "A") to the Port Washington Narrows. An effluent pipe from Manhole "A" is labeled as abandoned. Influent pipes to Manhole "A" noted on the drawings include the following:

- A 12-inch-diameter overflow pipe coming from a manhole (Manhole "D") located to the southwest of Manhole "A." The two influent pipes to Manhole "D" are noted as abandoned.
- A 10-inch-diameter overflow pipe coming from a manhole (Manhole "E") located 22 feet east-northeast of Manhole "A." The pipes entering and exiting Manhole "E" are noted as abandoned, and Manhole "E" is noted as plugged and filled with concrete.
- A 6-inch-diameter inlet pipe coming from the northwest. The full length of the 6-inch pipe is not shown, and its source and status are unknown. We are not aware of any current structures, catch basins, or other potential active connections to the sewer system northwest of Manhole "A." The Gas Works plant building was formerly located in this direction.
- A "drain" line extending from two areas south of Manhole "A": a catch basin located near Manhole "D," and a former gasoline tank containment area located on the Sesko Property. The former gasoline tank containment area is unrelated to the former Gas Works. The status of the drain line is not known.

During the TCRA, a manhole cover was observed in the approximate location where Manhole "A" is indicated on the drawings. Discussions with a contractor of Natasha Sesko and field observations indicate that the manhole had been filled with debris.

Based on the available data, it is unclear whether all of the influent lines entering Manhole "A" have been plugged or removed. If stormwater is entering Manhole "A," then it may enter the Pipe; however, no stormwater discharge is likely because the end of the Pipe was plugged during the TCRA. The removal evaluation will assess whether abandonment of Manhole "A" is necessary to prevent stormwater from entering the Pipe and mobilizing contamination, if any, present within the remaining Pipe.

Based on the sewer record drawings, Manhole “A” is approximately 16 feet deep. To further evaluate the potential need for a removal action to address the manhole, the following activities will be performed during the removal evaluation:

- Field survey to locate potential influent sources to Manhole “A”, including: 1) an inspection for the origin of the 6-inch-diameter influent pipe entering the manhole from the northwest, and 2) an inspection to locate and assess the condition of the drain lines and associated catch basin to the south of the manhole.
- Review of surface topography and conditions around the manhole to evaluate the potential for stormwater to enter the manhole.

6 Bluff Inspection and Contingent Sampling

Inspection and contingent sampling will be conducted along the boundary between the upland area of the Site (the “bluff”) and the beach to evaluate whether there is an exposed contaminant migration pathway from the upland area to the sediment and/or surface water of Port Washington Narrows through either the erosion of bluff soil or direct discharge of hydrocarbon product.

The bluff inspection area will extend west to east from approximately the Thompson Avenue right-of-way to the Pennsylvania Avenue right-of-way as shown in Figure 5. The inspection will include the soils at the base of the bluff.

The bluff inspection will consist of the following:

- Observing exposed soils in the lower bluff area.
- Inspect and document any evidence of hydrocarbon staining, hydrocarbon odors in conjunction with a PID or FID, or seeps containing potential hydrocarbon sheen or product.
- Collect and archive samples of bluff soil where observed to contain hydrocarbon staining, sheen or odors.
- Collect and archive samples of liquid seeps (if feasible), where observed to contain potential hydrocarbon sheen or product.
- If contingent soil or seep liquid samples are collected and archived, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned surface sediment samples.

7 Project Reporting and Schedule

This section describes the project schedule and reporting, consistent with AOC requirements.

7.1 Data Management and Reporting

Two types of data will be generated for this project: field data and laboratory data. Procedures for transmitting and reporting each type of data are described below.

- Field Data: Field measurements and observations will be recorded in logbooks or on appropriate field forms. The field team members should review the field data for completeness or errors daily before submitting the forms to the Task Manager. Field data forms, including groundwater sampling forms and boring logs, will be reviewed daily by the Task Manager. The Site logbook, daily reports, and copies of field data forms will be maintained by Anchor QEA and/or Aspect as required by the AOC.
- Laboratory Data: The laboratory data reports will be archived electronically. The electronic data deliverable will be uploaded into the project database. All data entered into the database will be compared to hard copy laboratory data and/or electronic laboratory submittals and to data validation reports to ensure the correct data have been entered before use and archiving.

Consistent with the AOC, a Removal Evaluation Report will be submitted to EPA following completion of the removal evaluation. The Removal Evaluation Report shall include the following:

- Locations, lab reports and summary of results of sample collection and analysis.
- Quality assurance review of analytical data.
- Conceptual site model for area sampled.
- Evaluation of Potential Removal Actions: To the extent conditions are identified during the removal evaluation indicating contaminant migration pathways at the Site pose an imminent and substantial endangerment to public health or welfare or the environment that should be addressed before completion of the RI/FS, then the Removal Evaluation Report shall include a description of one or more potential removal actions that could be conducted to mitigate this risk. This description shall include a summary of the migration pathways requiring control, the data available describing such pathways, and the specific actions recommended to control such pathways. Any proposed removal action shall, to the extent practicable, be consistent with the RI/FS, and shall be consistent with and facilitate final remediation of the Site. Proposed removal actions approved by EPA shall be performed under the AOC.
- The Removal Evaluation Report shall be based on information and data available at the time the report is submitted to EPA.

7.2 Schedule

Field sampling will be performed as soon as practicable after EPA approval of this Work Plan (including the FSP and the QAPP). If practicable, and depending on the schedule for EPA review and comment, field sampling will be performed during the daytime low tides of summer 2013. The proposed sampling dates will be confirmed with EPA after receipt of EPA review comments and/or approval of this Work Plan.

All removal evaluation activities will comply with the schedule defined in the AOC and SOW, unless an alternative schedule is approved by EPA. These activities as defined in the SOW include, but are not limited to, development of the final Removal Evaluation Work Plan and development of the draft and final Removal Evaluation Report.

8 References

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Washington State Department of Ecology. 2012. Draft Sediment Cleanup Users Manual II, Guidance for Implementing the Sediment Management Standards, Chapter 173-204 WAC. August 2012. Publication no. 12-09-057

Windward. 2007. Lower Duwamish Waterway Remedial Investigation, Appendix B, Baseline Human Health Risk Assessment, Final. November 12.

TABLES

Table 1
Project Personnel and Subcontractors

Name	Organization	Project Title	Project Role	Mailing Address	Email Address	Office Phone	Cell Phone
Representatives							
Kalle Godel	Cascade Natural Gas		Site representative and Cascade Project Coordinator	400 N 4th Street, Bismark, North Dakota 58501	Kalle.Godel@mdu.com	(701) 222-7657	(701) 471-0927
Consultants							
Jeremy Porter	Aspect Consulting	Project Manager	Aspect project manager	401 2nd Avenue South, #201 Seattle, Washington 98104	jporter@aspectconsulting.com	(206) 838-5835	(206) 790-2129
Carla Brock	Aspect Consulting	Task Manager - Upland Investigation	Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met.	401 2nd Avenue South, #201 Seattle, Washington 98104	cbrock@aspectconsulting.com	(206) 838-6593	(425) 269-7255
Mark Larsen	Anchor QEA	Project Manager	Anchor QEA project manager	1119 Pacific Avenue, Suite 1600 Tacoma, Washington 98402	mlarsen@anchoroqea.com	(206) 903-3359	(206) 310-2263
Ed Berschinski	Anchor QEA	Project Technical Advisor	Anchor QEA technical advisor regarding removal evaluation	720 Olive Way, Suite 1900 Seattle, Washington 98101	eberschiniski@anchorqea.com	(206) 903-3315	(206) 819-6099
David Templeton	Anchor QEA	Project Health and Safety Manager	Anchor QEA health and safety manager	720 Olive Way, Suite 1900 Seattle, Washington 98101	dtempleton@anchorqea.com	(206) 903-3312	(206) 910-4279
Dan Hennessy	Anchor QEA	Task Manager - Sediment Investigation	Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met.	1605 Cornwall Avenue Bellingham, Washington 98225-4427	dhennessy@anchorqea.com	(360) 733-4311	(206) 491-0610
Nathan Soccorsy	Anchor QEA	Field Safety Officer/Coordinator	Reports to the Task Manager. Ensures all project health and safety requirements are followed; coordinates and participates in the field sampling activities; coordinates sample deliveries to lab; coordinates sampling activities with Site owner and subcontractors; report to the Task Manager any deviations from the project plans.	720 Olive Way, Suite 1900 Seattle, Washington 98101	nsoccorsy@anchorqea.com	(206) 903-3385	(480) 272-2805
Delaney Peterson	Anchor QEA	Project QA Manager	Coordinates with laboratory to ensure that SQAPP requirements are followed and that laboratory QA objectives are met.	720 Olive Way, Suite 1900 Seattle, Washington 98101	dpeterson@anchorqea.com	(206) 903-3396	(206) 919-2845
Laurel Menoche	Anchor QEA	Project Data Manager	Ensures that analytical data is incorporated into Site database with appropriate qualifiers following validation	720 Olive Way, Suite 1900 Seattle, Washington 98101	lmenoche@anchorqea.com	(206) 903-3372	
Environmental Protection Agency (EPA)							
William Ryan	EPA	EPA Remedial Project Manager	Overall project management	1200 6th Ave Suite 900 ECL-113 Seattle, Washington 98101	ryan.william@epa.gov	(206) 553-8561	
Kathy Parker	EPA	EPA On Scene Coordinator	Coordinate with EPA RPM on topic related to Removal Evaluation and implementation of early actions at the Site	1200 6th Ave Suite 900 ECL-116 Seattle, Washington 98101	parker.kathy@epa.gov	(206) 553-0062	(206) 321-3796
Ginna Grepo-Grove	EPA	EPA Region 10 QA Manager	RI/FS technical support QA/QC issues	1200 6th Ave Suite 900 OEA-95 Seattle, Washington 98101	Grepo-Grove.Gina@epamail.epa.gov	(206) 553-1632	
Subcontractors							
Cheronne Oreiro	Analytical Resources, Inc.	Laboratory Manager	Soil and sediment analysis	4611 South 134th Place , Suite 100 Tukwila, Washington 98168	Cheronneo@arilabs.com	(206) 695-6214	

Table 2
Proposed Removal Evaluation Surface Sediment Explorations

Station ID	Sample Collection Method	Depth Interval	Media	Sampling DQO[2]	Analytical Chemistry	Coordinates[3]	
						Northing (Y)	Easting (X)
Removal Evaluation Intertidal Beach Surface Sediment Sampling [1]							
BGW-RE-SG-01	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216322.04	1193634.86
BGW-RE-SG-02	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216356.85	1193634.86
BGW-RE-SG-03	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216388.50	1193635.20
BGW-RE-SG-04	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216308.24	1193734.86
BGW-RE-SG-05	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216343.50	1193734.86
BGW-RE-SG-06	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216379.86	1193734.86
BGW-RE-SG-07	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216304.94	1193834.86
BGW-RE-SG-08	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216330.55	1193834.86
BGW-RE-SG-09	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216357.04	1193834.86
BGW-RE-SG-10	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216293.40	1193912.72
BGW-RE-SG-11	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216323.54	1193918.27
BGW-RE-SG-12	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216279.67	1193934.86
BGW-RE-SG-13	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216312.36	1193945.00
BGW-RE-SG-14	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216244.75	1193934.86
BGW-RE-SG-15	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216281.23	1193957.16
BGW-RE-SG-16	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216307.60	1193965.51
BGW-RE-SG-17	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216227.43	1193953.99
BGW-RE-SG-18	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216200.00	1193967.25
BGW-RE-SG-19	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216218.60	1193979.11
BGW-RE-SG-20	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216285.77	1194021.95

Table 2
Proposed Removal Evaluation Surface Sediment Explorations

Station ID	Sample Collection Method	Depth Interval	Media	Sampling DQO[2]	Analytical Chemistry	Coordinates[3]	
						Northing (Y)	Easting (X)
BGW-RE-SG-21	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216198.47	1194007.68
BGW-RE-SG-22	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216230.19	1194027.96
BGW-RE-SG-23	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216286.01	1194041.83
BGW-RE-SG-24	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216203.04	1194034.86
BGW-RE-SG-25	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216235.69	1194050.42
BGW-RE-SG-26	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216275.79	1194064.71
BGW-RE-SG-27	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216234.33	1194080.61
BGW-RE-SG-28	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216201.65	1194134.94
BGW-RE-SG-29	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216225.63	1194134.94
BGW-RE-SG-30	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216248.75	1194135.08
BGW-RE-SG-XX (Field duplicate 1)	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess sample variability and the nature and extent of surface contamination	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-SG-XX (Field duplicate 2)	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess sample variability and the nature and extent of surface contamination	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-SG-RB	Rinse blank	N/A	Distilled water	Assess equipment decontamination procedures	SIM-PAH	N/A	N/A

Notes
1: If hydrocarbon sheen or odor is observed in during bulk sediment sampling, an additional opportunistic sample from the 4-12 inch interval will be collected and archived. The decision to analyze the opportunistic sample will be made in consultation with EPA.
2: Each station sample will consist of five equal volume aliquots. One aliquot will be collected at the target location and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass.
3: Washington State Plane North, NAD 83, US feet.
DQO - Data Quality Objective
SIM PAH - Selective Ion Monitoring Polycyclic Aromatic Hydrocarbon. High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC - Total Organic Carbon
BGW - Bremerton Gas Works
RE - Removal Evaluation
SG - Sediment Grab
TBD - To be determined
N/A - Not applicable

Table 3
Removal Evaluation Contingent Bluff Soil or Seep Liquid Samples

Sample ID	Sample Collection Method	Depth Interval	Media	Sampling DQO	Analytical Chemistry	Coordinates[1]	
						Northing (Y)	Easting (X)
Contingent Soil or Seep Liquid Sampling							
BGW-RE-BS-01	Hand collection with stainless steel trowel	TBD	Soil	Assess nature of contamination from bluff soil	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-BS-02	Direct collection	N/A	Liquid	Assess nature of contamination from seep liquid	Archive	TBD	TBD
BGW-RE-BS-XX (Field duplicate)	Hand collection with stainless steel trowel	TBD	Soil	Assess sample variability and nature of contamination from bluff soil	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-BS-RB	Rinse blank	N/A	Distilled water	Assess equipment decontamination procedures	SIM-PAH	N/A	N/A

Notes
1: Washington State Plane North, NAD 83, US feet.
DQO - Data Quality Objective
SIM PAH - Selective Ion Monitoring Polycyclic Aromatic Hydrocarbon. High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC - Total Organic Carbon
BGW - Bremerton Gas Works
RE - Removal Evaluation
BS - Bluff Sample
TBD - To be determined
N/A - Not applicable

FIGURES

NOTE:
If a paper copy is required, this figure is best printed in color.

N

0 750 1,500
Feet

1:18,000

Former Gas Works Location and Vicinity Removal Evaluation Work Plan

Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO. 1

AO GIS Path: Q:\Jobs\100719-01_Bremerton MGP\Maps\2013_06\Vicinity_Map_Work_Plan_and_SQAPP (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/7/2013 || User: ckiblinger || Print Date: 6/7/2013

NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Extent of Organo-Clay Mat[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Approximate Monitoring Well Location (Not Surveyed)
- Surveyed Monitoring Well Location
- Current Stormwater Structures
- On-site Drainage Feature
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Historical Structures
- Existing Buildings
- Former Gas Works Location
- Parcel Boundaries[3]

N

0 75 150
Feet
1:900

Historical and Current Site Features Removal Evaluation Work Plan

Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: dhennessy

FIGURE NO. 2

AO GIS Path: Q:\Jobs\1007\19-01_Bremerton_MGP\Maps\2013_08\Historical and Current Site Features (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/12/2013 || User: dhennessy || Print Date: 6/12/2013

PORT WASHINGTON NARROWS

-10
-5
0
5
10
15
20
25
30
35
40
45
50
-25
-20
-15

Former end of pipe

Former 12" concrete pipe (location based on field GPS during removal)[1]

Farthest upgradient pipe (located in field)

12" concrete pipe (location from record drawings)

Sewer Overflow

McConkey Property

Sesko Property

MH "A"

MH "E"

MH "D"

Tank Containment Areas

N

0 50 100
Feet
1:600

LEGEND

- Storm Manhole
- Catch Basin
- Pipe Plug Location[1]
- Sewer Manhole
- Abandoned Sanitary Sewer Manhole
- Outfall
- Removed Storm Sewer
- Storm Sewer
- Sanitary Sewer
- Abandoned Sewer
- Former Gas Works Property Boundary
- Surveyed 5-Foot Topographic and BathymetricElevation Contours (MLLW vertical datum)
- Tax Parcel Boundary (based on Kitsap County GIS)

Notes:
1) See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January 2011 - Locations are approximate.
2) If a paper copy is required, this figure is best printed in color.

Location of Former Drainage & Piping System

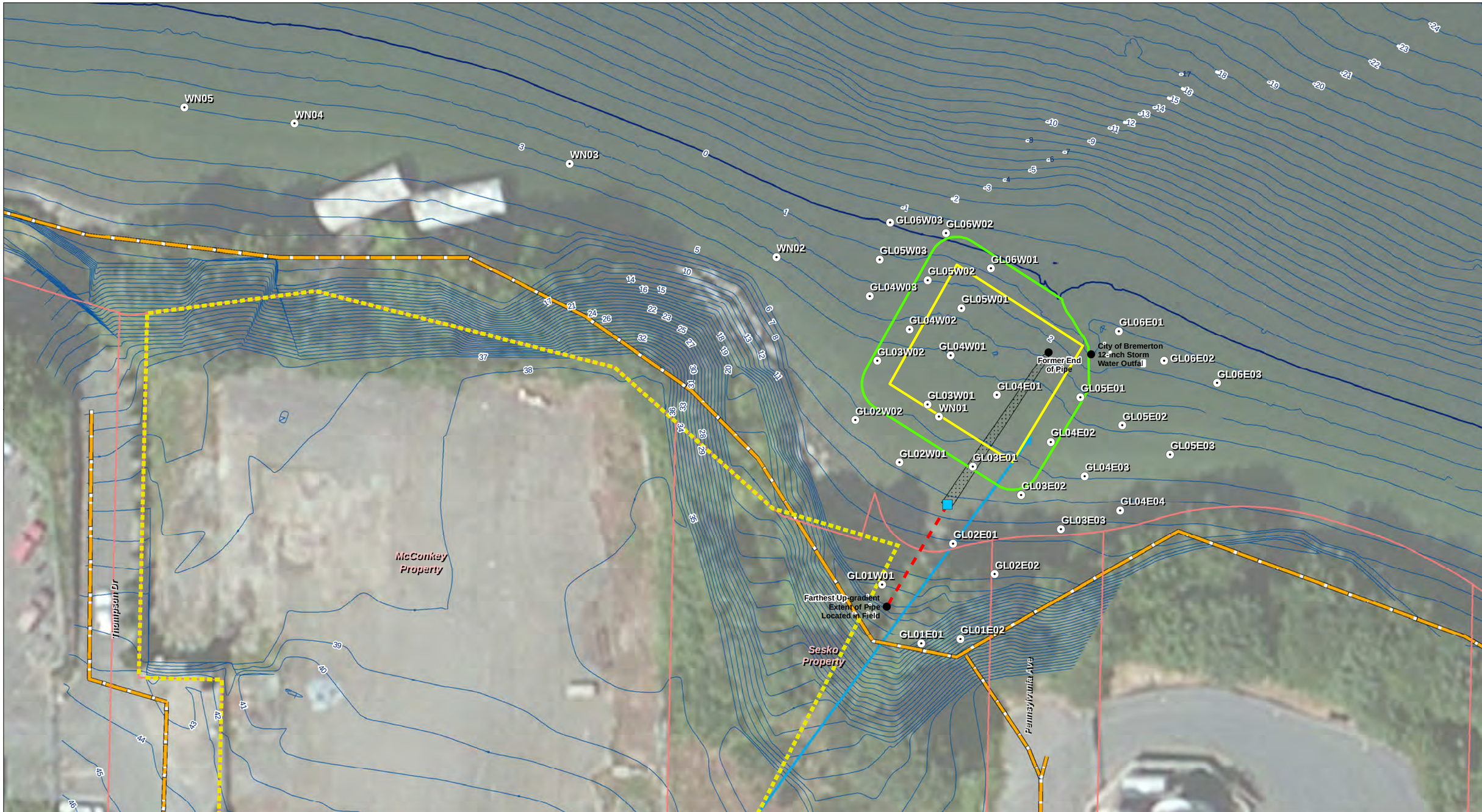
Removal Evaluation Work Plan
Bremerton Gas Works Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ASPECT
DRAWN BY: EAH / PPW

FIGURE NO. 3

GIS Path: T:\projects_8\Bremerton_MGP\DeliveredMay2013\Removal Evaluation Work Plan\FormerDrainageandPiping.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/12/2013 || User: ehealy || Print Date: 6/12/2013



- Historical Data
- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Extent of Organo-Clay Mat[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Former Gas Works Location
- Parcel Boundaries[3]

NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

N

0 25 50
Feet
1:400

Historical Sampling Locations Removal Evaluation Work Plan

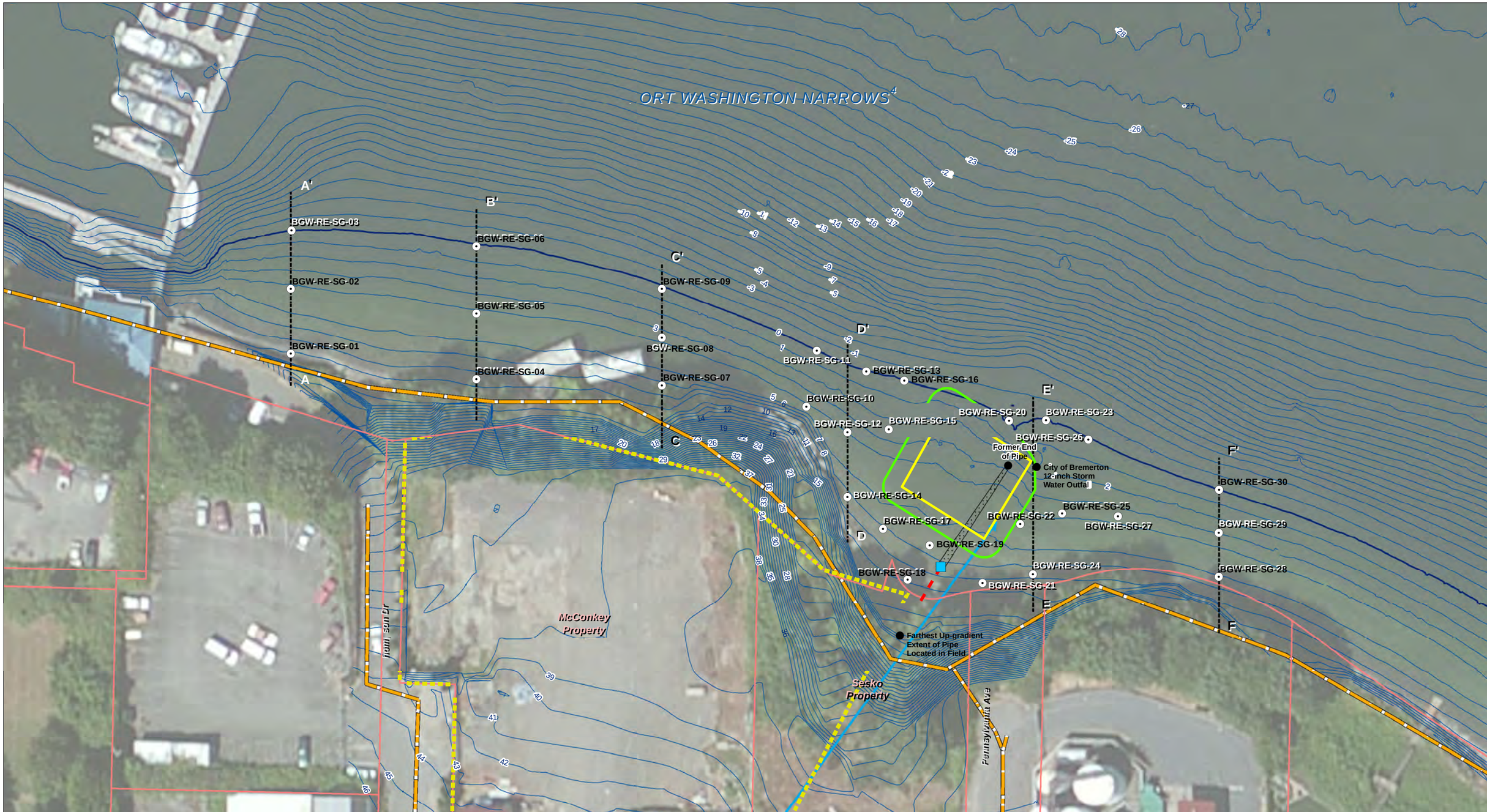
Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: dhennessy

FIGURE NO. 4

AO GIS Path: Q:\Jobs\1007\19-01_Bremerton_MGP\Maps\2013_08\Historical Sampling Locations (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/7/2013 || User: dhennessy || Print Date: 6/11/2013



- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Extent of Organo-Clay Mat[2]
- Proposed Sampling Locations
- 100-Foot Transects
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Former Gas Works Location
- Parcel Boundaries[3]

NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

N

0 50 100
Feet
1:600

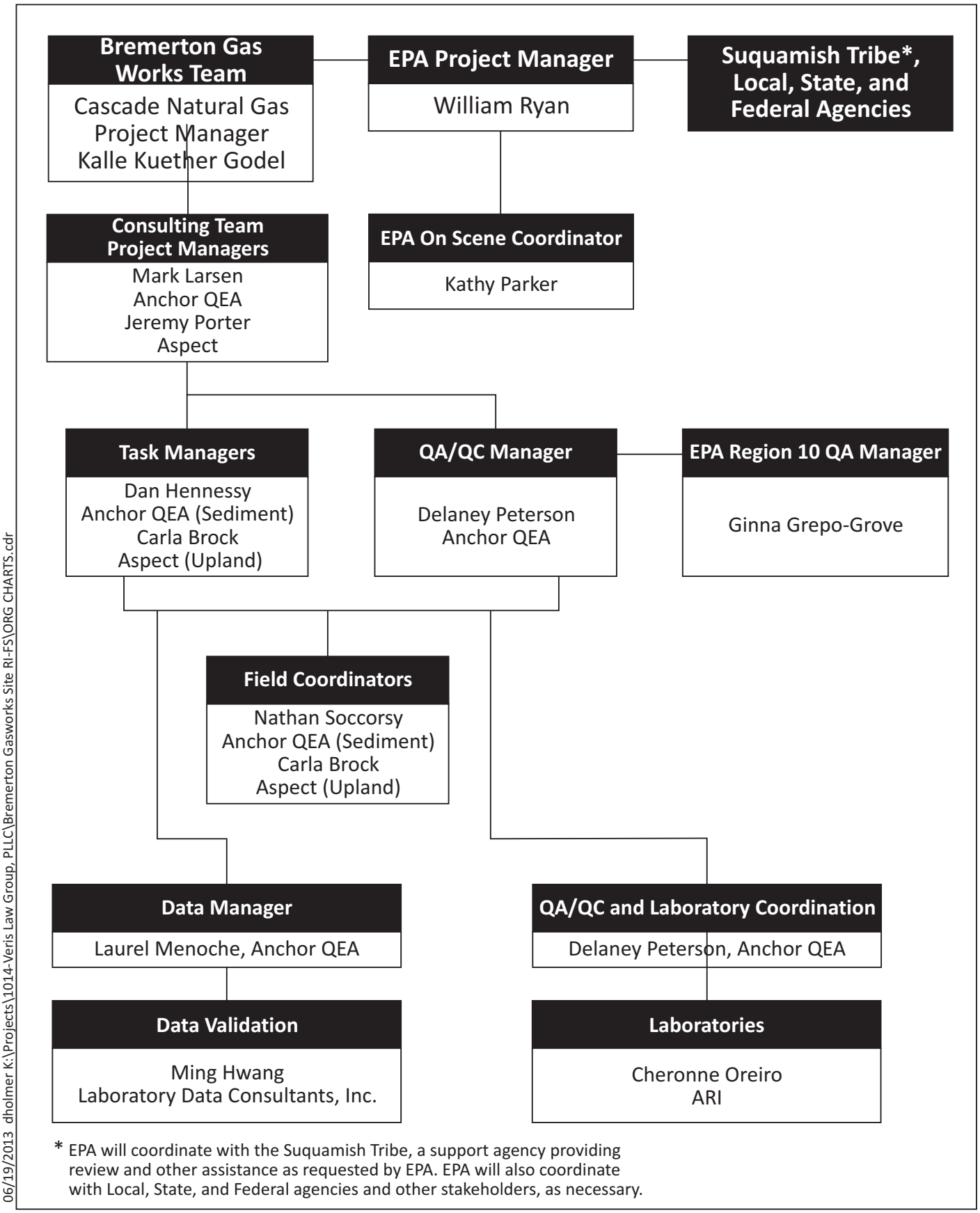
Removal Evaluation Intertidal Sampling Locations
Removal Evaluation Work Plan
Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: dhennessy

FIGURE NO.
5

AO GIS Path: Q:\Jobs\1007\19-01_Bremerton_MGP\Maps\2013_08\Removal Evaluation Intertidal Sampling Locations_Aspect_Template.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/7/2013 || User: dhennessy || Print Date: 6/11/2013



ANCHOR QEA

Figure 6
Project Organization
Bremerton Gasworks Site RI/FS

APPENDIX A
FIELD SAMPLING PLAN

APPENDIX A
FIELD SAMPLING PLAN
FINAL REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Prepared by

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

APPENDIX A
FIELD SAMPLING PLAN
FINAL REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC & Anchor QEA, LLC

Approvals:

Project Manager Jeremy Porter, Aspect	Date
Project Manager Mark Larsen, Anchor QEA	Date
EPA Remedial Project Manager William Ryan, EPA	Date
EPA Project On Scene Coordinator Kathy Parker, EPA	Date
EPA Region 10 QA Manager Ginna Grepo-Grove, EPA	Date

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Acronyms

AOC	Administrative Settlement Agreement and Order on Consent
ARI	Analytical Resources, Inc.
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DNAPL	dense non-aqueous phase liquid
DQOs	data quality objectives
EPA	U.S. Environmental Protection Agency
FC	field coordinator
FID	Flame Ionization Detector
FM	Field Manager
FSDS	field sampling data sheet
FSP	Field Sampling Plan
Gas Works	Former Bremerton gas works facility
HARN	High Accuracy Reference Network
IDW	investigation derived waste
MS/MSD	matrix spike/matrix spike duplicate
µg/L	microgram per liter
NAD	North American Datum
NAVD 88	North America Vertical Datum 1988
NELAP	National Environmental Laboratories Accreditation Program
PAH	polycyclic aromatic hydrocarbons
PID	Photoionization Detector
PM	project manager
PSEP	Puget Sound Estuary Program
PPE	personnel protective equipment

QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SOW	Statement of Work

1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gas Works Site (Site), Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013. Figure A-1 shows the location of the former Bremerton Gas Works facility (Gas Works).

The first task required under the AOC is the completion of a removal evaluation. This Field Sampling Plan (FSP) is Appendix A to the Removal Evaluation Work Plan (Work Plan). The field sampling described in this FSP includes collection and chemical analysis of sediment samples from the intertidal beach area adjacent to the Site. As described in the Work Plan, a Time Critical Removal Action (TCRA) was performed in a portion of this area during 2010 in order to control the release of hydrocarbon sheen from a historical drain pipe. The sediment data collected during the current effort will be used to assess current conditions in the beach area, and to determine whether releases or threatened releases from the Site present an imminent and substantial endangerment to public health or welfare or the environment which warrants performance of a removal action before completion of the RI/FS and selection of a final remedy. Field sampling will also include completion of an inspection of existing drainage system components at the former Gas Works location, and an inspection of conditions along the bluff between the former Gas Works and the intertidal beach area.

Appendix B of the Work Plan specifies the Quality Assurance Project Plan (QAPP). Compliance with the FSP and QAPP will ensure that sample collection and analytical activities result in data meeting project data quality objectives (DQOs). The FSP and QAPP address the three DQOs developed in the Work Plan and the methods for planning and meeting those objectives. These three DQOs are as follows:

- Collect the information necessary to evaluate whether current surface sediment contamination (0 to 4 inch depth interval) within the intertidal beach area adjacent to the former Gas Works poses a substantial and imminent threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. Intertidal beach area sampling activities were specified in the AOC. The extent of polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) in surface sediment within the beach area between the high tide line and the mean lower low water (MLLW) line will be characterized as specified in the AOC. These data will be used to estimate potential Site-related risks to beach users (evaluated using a child-exposure beach play scenario) and to benthic ecological receptors. If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. Anchor QEA will lead this field task.
- Inspect the former drainage and piping system connected to the 12-inch pipe addressed by the TCRA by surveying and locating potential influent sources to

Manhole "A." These data will be used to identify potential ongoing or threatened contaminant migration pathways to the beach. Aspect will lead this field task.

- Inspect the area between the bluff and the high tide line for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the beach. If potential hydrocarbon seeps are indicated by visual observation of hydrocarbon staining, sheen, or odor, soil samples will be collected and archived. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned surface sediment samples, as described in Section 3 of this FSP. Aspect will lead this field task.

This FSP also provides the basis for planning field activities, and establishes specific quality assurance requirements, which are presented in the QAPP. This FSP is organized into the following sections:

- Section 2 – Project Management and Responsibilities
- Section 3 – Sediment Sample Collection, Processing and Handling Procedures
- Section 4 – Drainage System Inspection
- Section 5 – Bluff Inspection and Sampling
- Section 6 - Chemical Testing
- Section 7 – Field Sampling Schedule
- Section 8 – References
- Attachment A-1 – Field Forms
- Attachment A-2 – Removal Evaluation Investigation and Sampling Training Checklist

2 Project Management and Responsibilities

This section describes the overall project management strategy for implementing and reporting of the field activities. Section 3.1 of the QAPP identifies key project management personnel and their roles and responsibilities.

As described in the QAPP, the project managers (PMs) for Anchor QEA and Aspect will be responsible for overall project coordination, including production of all project deliverables and administrative coordination to assure timely and successful completion of the project.

The Anchor QEA or Aspect field coordinator (FC) will be responsible for day-to-day technical and quality assurance/quality control (QA/QC) oversight for their respective tasks. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratory for chemical analyses. The FC will be assisted by additional personnel at Anchor QEA, as necessary. The data and QA/QC managers will be responsible for coordination and oversight of data validation and data management, and will report to the PMs.

The designated laboratory will be qualified and experienced in the analysis of environmental samples. As described in the QAPP, the laboratory manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical analyses, and laboratory report preparation for this project. The analytical laboratory will be responsible for the following:

- Performing the methods outlined in the QAPP and attachments, including those methods referenced for each analytical procedure.
- Following documentation, custody, and sample logbook procedures.
- Meeting all reporting and QA/QC requirements.
- Delivering electronic data files and deliverables as specified in the QAPP and attachments.
- Meeting turnaround times for deliverables as described in QAPP and attachments.
- Allowing EPA and the QA/QC manager to perform laboratory and data audits.
- Providing certified, pre-cleaned sample containers.

Table A-1 provides the names and contact information for project personnel and subcontractors.

3 Sediment Sample Collection, Processing, and Handling Procedures

The following sections describe the sediment sample collection, processing, and handling procedures to be followed during the removal evaluation. Sample locations are shown in Figure A-2. The QAPP details the quality assurance/quality control protocols to be followed during these activities.

3.1 Surface Sediment Sample Collection Procedures

Surface sediment samples will be collected at low tide at each of the locations defined in Figure A-2 and Table A-3. These sampling locations are consistent with the requirements of the AOC, and with EPA expectations as discussed during previous project teleconferences.

Surface sediments (0 to 4 inch sampling depth) will be collected from each of the 30 sampling locations. Each sample will represent a localized station composite of five equal volume aliquots. One aliquot will be collected at the target location and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass. Sediments will be collected with decontaminated stainless steel trowels into decontaminated stainless steel bowls, homogenized, and placed into sample containers as listed in Table A-2.

During sampling, additional surface or subsurface sediment samples may be collected for archiving and/or for contingent chemical analysis under the following conditions:

- Additional Surface Sample Locations: If surface sediments with potential hydrocarbon sheen or odor are identified, additional local station composite samples of surface sediment may be collected and archived from these locations.
- Subsurface Sampling: If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. Subsurface samples will be collected from discrete locations where hydrocarbon sheen or odor is noted. If hydrocarbon sheen or odor are noted in more than one sample aliquot location, the subsurface aliquots containing the sheen or odor will be composited.

If contingent surface or subsurface sediment samples are collected and archived as described above, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed, these will be analyzed using the same analysis methods used for analysis of the 30 planned surface sediment samples (Figure A-2).

3.2 Horizontal Positioning for Sediment Sampling

Horizontal positioning at each sample location will be determined using a differential global positioning system (DGPS) with a handheld GPS unit. Horizontal geographical coordinates will be in the North American Datum (NAD) 83, Washington State Plane, North Zone and use international feet.

3.3 Field Quality Assurance/Quality Control Samples

Field QA/QC field duplicate and rinse blank samples will be collected and used to evaluate the variability resulting from sample handling and the efficiency of field decontamination procedures. All field QA/QC samples will be documented in the Site logbook and on the field forms (Section 3.5).

3.3.1 Field Duplicates

Field duplicates are used to assess homogenization techniques. The field duplicates will be prepared by dividing aliquots of the field sample homogenate into two distinct samples for analysis at the laboratory: the field sample and a duplicate. The duplicate samples will be processed in exactly the same way as the field samples and will be submitted to the laboratory as blind duplicates. Duplicates will be collected at a rate of one per 20 field samples collected for analysis and analyzed for the same parameters as the field samples. Field duplicate sample identification is described in Section 3.4.1.

3.3.2 Rinse Blanks

Rinse blank samples will be collected to evaluate the efficiency of field decontamination procedures. One rinse blank will be collected for each type of sampling technique utilized. The rinse blank will consist of rinsing homogenization equipment after sample collection and decontamination with distilled water and collecting the rinsate for analysis. The rinse blank samples will be collected at a rate of one per sampling event and will be analyzed for PAHs. The rinse blank sample identification schematic is described in Section 3.4.1.

3.4 Station and Sample Identification for Sediment Sampling

Each sediment sample will be assigned a unique alphanumeric identifier according to the method described below. The identifiers facilitate sample tracking by incorporating identifying information.

The alphanumeric identifiers will be assigned in the following manner for sediments:

- The first three characters identify the sample location by the project descriptor: BGW for Bremerton Gas Works.
- The next two characters identify the sampling event: RE for Removal Evaluation.
- The next 2 characters identify the sampling matrix: SG for Sediment Grab.
- The next two characters identify the sample station: -01 = Station 01.
- The next six characters identify the collection date: -YYMMDD.

For example, sample number BGW-RE-SG-01-100101 indicates a Removal Evaluation sediment grab sample obtained from Station 01 on January 01, 2010. The representative depths for each sampling interval will be defined in the field logs and provided in the chemical analytical results tables.

The field QA QC samples will be assigned a unique alphanumeric identifier according to the method described below:

- The first seven characters will be BGW-RE-SG.
- The rinsate blank samples will be followed with a -RB followed by the date in YYMMDD format.
- The field duplicate will be followed with –XXSE-A-YYMMDD (sediments) or –XXSO-A-YYMMDD (soils) where XX is the station number plus 50, A is the sampling interval, and YYMMDD is the sampling date.

For example, sample number BGW-RE-SG-RB-100105 and BGW-RE-SG-51SE-A-100105 represent a rinsate blank (field blank) collected on January 5, 2010 and a homogenization duplicate sediment sample collected from station 01 interval A on January 5, 2010, respectively.

When necessary, extra sample volume collected for matrix spike/matrix spike duplicate (MS/MSD) analysis will be identified with the same designation as the sample. This may be the case when sample material for additional analyses, as determined in consultation with EPA, are needed.

3.5 Field Documentation

A complete record of all field activities will be maintained including the following:

- Documentation of all field activities on appropriate field forms, including:
  - Daily Log
  - Tailgate Health and Safety Form
  - Incident Report
- Documentation of all samples collected for analysis, including :
  - Surface Sediment Collection Log
  - Chain-of-custody

The FC or a designee will maintain the field forms. All on-Site activities, including health and safety entries and field observations will be documented on the Daily Log Form. All entries will be made in indelible ink. The Daily Log is intended to provide sufficient data and observations to enable readers to reconstruct events that occurred during sample collection. The Daily Log will include clear information concerning any modifications to the details and procedures identified in this FSP. The tailgate Health and Safety Form is intended to document start-of-day health and safety orientation

meetings. The incident report form is intended to document any health and safety reportable incidences. Surface sediment collection forms will be completed for each sampling station.

Field data sheets will be maintained as samples are collected, and will be referenced to the sample station location map. The following information will be included in the Surface Sediment Collection Log forms:

- Date and time of collection of each sample.
- Names person(s) collecting and logging the sample.
- Sample matrix description.
- Observations made during sample collection including: weather conditions, complications, and any other details associated with the sampling effort.
- Sample station number.
- Any deviation from the approved FSP.

Chain-of-custody forms will be updated as sample jars are filled and labeled at each station.

3.6 Sample Handling

This section describes the sample handling and storage, sample containers, decontamination procedures, chain-of-custody forms, and sample transport for all sample collection activities.

3.6.1 General Sample Handling and Storage

The guidelines for sample handling and storage for collected field and QA/QC samples are provided in Table A-2. Sample collection and homogenization equipment, containers, and any other items that may come into contact with sample material must meet high standards of cleanliness. All equipment used during sample collection will be made of glass, stainless steel, or polytetrafluoroethylene (PTFE), and will be decontaminated prior to each day's use and between sampling or homogenization events.

All working surfaces and instruments will be thoroughly decontaminated following the protocols in Section 3.6.3, and covered with aluminum foil to minimize outside contamination between sample collection events. Disposable gloves will be discarded after processing each station and replaced prior to handling decontaminated equipment or work surfaces. Collected samples will be stored in coolers with ice prior to delivery to the laboratory.

3.6.2 Sample Containers

All sample containers received from the analytical lab will be pre-cleaned and certified. Required sample container types are listed in Table A-2. Prior to filling, each container will be clearly labeled with the name of the project, sample number, type of analysis, date, time, and initials of the person preparing the sample.

3.6.3 Field Equipment Decontamination

To prevent sample cross contamination, sampling and processing equipment in contact with the samples will undergo the following decontamination procedures prior to and between collection activities in accordance with EPA protocols (EPA 2001). Between sample collection activities, all sample collection and homgenization equipment that will come in contact with the sample will be decontaminated prior to use by the following procedure:

- Rinse with Site or potable water and wash with scrub brush until free of sediment.
- Wash with phosphate-free detergent (e.g., Alconox®).
- Visually inspect the equipment and repeat the scrub and rinse step, if necessary.
- Rinse with potable water.
- Rinse with deionized water three times.

3.6.4 Sample Transport and Chain-of-Custody Procedures

All containerized sediment samples will be delivered to the designated analytical laboratories daily by hand or by courier after preparation is completed. Specific sample shipping procedures will be as follows:

- Individual sample containers will be placed in sealable plastic bags, packed to prevent breakage and transported in a cooler.
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage.
- Ice will be placed in the cooler to maintain a storage temperature of approximately 4 degrees Celsius (°C).
- Chain-of-custody forms will be enclosed in a plastic bag and placed in the cooler.
- If couriered or shipped, the cooler lids will be secured by wrapping the coolers in strapping tape and chain of custody seals will be placed on cooler lids

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample containers will sign the chain-of-custody forms. Upon receipt, the laboratory receiver will record the temperature and condition of the samples and cross-check the sample inventory with the chain-of-custody forms. Chain-of-custody forms will be used internally in the lab to track sample handling and final disposition.

4 Drainage System Inspection

A field survey will be conducted to evaluate the potential for stormwater to enter the drainage system leading to the pipe that was plugged during the November 2010 TCRA. As described in the Work Plan, the plugged pipe may be connected to a manhole located on the Sesko Property that is filled with debris. Sewer records indicate some of the pipes leading to that manhole have been abandoned, but the status of two of those pipes is unknown.

The Drainage System Inspection will include the following:

- Remove debris from the top of the manhole if possible using hand equipment, to further inspect the interior of the manhole and potential inlets. All work will be conducted from the surface and no entry will be made into the manholes.
- Inspect surface topography and ground surface conditions around the manhole, including identification of potential surface water drainage pathways, to evaluate the potential for stormwater to flow into the manhole during rain events.
- Perform field reconnaissance in the area located to the northwest of Manhole “A” to evaluate for the presence of any catch basins. Any catch basins that are located will be surveyed using a field GPS and inspected to estimate pipe alignments.
- Perform field reconnaissance in the area located to the south of Manhole “A”, including the former tank farm located on the Sesko Property, to evaluate the presence of catch basins or other drainage pipe inlets that may lead to Manhole “A.”

If any piping is identified that may connect to Manhole “A”, a private utility locating service will be contacted to identify the location and depth of pipe and, if possible, perform a TV camera inspection to evaluate condition and contents.

5 Bluff Inspection and Contingent Sampling

Inspection and contingent sampling will be conducted along the boundary between the upland properties ("the bluff") and the beach to evaluate whether there is an exposed contaminant migration pathway from the upland area to the sediment and/or surface water of Port Washington Narrows through either the erosion of bluff soil or direct discharge of hydrocarbon product.

The bluff inspection area will extend west to east from approximately the Thompson Avenue right-of-way to the Pennsylvania Avenue right-of-way. The inspection will include the soils at the base of the bluff. A photoionization detector (PID) or flame ionization detector (FID) will also be used to help detect the presence of hydrocarbon vapors.

The bluff inspection will consist of the following:

- Observing exposed soils in the lower bluff area.
- Inspect and document any evidence of hydrocarbon staining, hydrocarbon odors, or seeps containing potential hydrocarbon sheen or product.
- Collect and archive samples of bluff soil where observed to contain hydrocarbon staining, sheen, or odors.
- Collected and archive samples of liquid seeps (if feasible) where observed to contain potential hydrocarbon sheen or product.
- If contingent soil or seep liquid samples are collected and archived, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned surface sediment samples as described in Section 3.1. Table A-4 provides a summary of contingent bluff soil or seep liquid samples

Each opportunistic bluff sample will be assigned a unique alphanumeric identifier according to the method described below. The identifiers facilitate sample tracking by incorporating identifying information. The alphanumeric identifiers will be assigned in the manner below.

The alphanumeric identifiers will be assigned in the following manner for sediments:

- The first three characters identify the sample location by the project descriptor: BGW for Bremerton Gas Works.
- The next two characters identify the sampling event: RE for Removal Evaluation.
- The next 2 characters identify the sampling matrix: BS for Bluff Sample.
    - The next two characters identify the sample station: -01 = Station 01.

- The next six characters identify the collection date: -YYMMDD.

Opportunistic sample locations will be determined by DGPS and coordinates recorded on the field sampling forms.

6 Chemical Testing

Sediment and soil chemical and physical testing will be conducted at Analytical Resources, Inc. (ARI) located in Tukwila, Washington. ARI is accredited under the National Environmental Laboratories Accreditation Program (NELAP). All chemical and physical testing will adhere to SW-846 QA/QC procedures and analysis protocols (EPA 1986) or follow the appropriate Standard Method or PSEP protocols. If more current analytical methods are available, the laboratory may use them.

All sample analyses will be conducted in accordance with EPA-approved methods and the QAPP. Key elements of the QAPP relevant to field sample collection and analysis include the following:

- Prior to analysis, all samples will be maintained according to the appropriate holding times and temperatures for each analysis as outlined in the QAPP.
- Field personnel are responsible for providing the rinseate blanks and field duplicates defined in this FSP.
- Proposed analytes, analytical methods, and target reporting limits for the chemical testing are defined in the QAPP.
- The analytical laboratories will prepare a detailed report in accordance with the QAPP. Prior to the chemical analysis of the samples, the laboratories will calculate method detection limits (MDLs) for each analyte of interest, where applicable. Quantitation limits (QLs) typically correspond to the lowest level of calibration and are three to ten times higher than MDLs. QLs will be below the values specified in the QAPP if technically feasible and detected results will be reported down to the MDLs. Results between the MDLs and QLs will be flagged as estimated by the laboratory.
- Method reporting limits will be below the values specified in the QAPP, if technically feasible. These reporting limits may not be achieved in the event that constituent concentrations are elevated or if there are matrix interferences. If specified reporting limits are not achieved, possible corrective actions will be discussed with the laboratory and with EPA. If analytical methodology modifications are to be used to address raised reporting limits, these will be presented to EPA for review and approval prior to implementation.

7 Field Sampling Schedule

Field sampling will be performed as soon as practicable after EPA approval of the Work Plan, including this FSP and the attached QAPP. If practicable, and depending on the schedule for EPA review and comment, field sampling will be performed during the daytime low tides of summer 2013. The proposed sampling dates will be confirmed with EPA after receipt of EPA review comments and/or approval of the Work Plan, FSP, and QAPP.

All removal evaluation activities will comply with the schedule defined in the AOC and SOW, unless an alternative schedule is approved by EPA. These activities as defined in the SOW include, but are not limited to, development of the final Removal Evaluation Work Plan and development of the final Removal Evaluation Report.

8 References

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition. EPA SW-846, 1986.

EPA. 2001. Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA/823/B-01-022, October 2001.

TABLES

Table A-1
Project Personnel and Subcontractors

Name	Organization	Project Title	Project Role	Mailing Address	Email Address	Office Phone	Cell Phone
Representatives							
Kalle Godel	Cascade Natural Gas		Site representative	400 N 4th Street, Bismark, North Dakota 58501	Kalle.Godel@mdu.com	(701) 222-7657	(701) 471-0927
Consultants							
Jeremy Porter	Aspect Consulting	Project Manager	Aspect project manager	401 2nd Avenue South, #201 Seattle, Washington 98104	jporter@aspectconsulting.com	(206) 838-5835	(206) 790-2129
Carla Brock	Aspect Consulting	Task Manager - Upland Investigation	Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met.	401 2nd Avenue South, #201 Seattle, Washington 98104	cbrock@aspectconsulting.com	(206) 838-6593	(425) 269-7255
Mark Larsen	Anchor QEA	Project Manager	Anchor QEA project manager	1119 Pacific Avenue, Suite 1600 Tacoma, Washington 98402	mlarsen@anchoroqea.com	(206) 903-3359	(206) 310-2263
Ed Berschinski	Anchor QEA	Project Technical Advisor	Anchor QEA technical advisor regarding removal evaluation	720 Olive Way, Suite 1900 Seattle, Washington 98101	eberschiniski@anchorqea.com	(206) 903-3315	(206) 819-6099
David Templeton	Anchor QEA	Project Health and Safety Manager	Anchor QEA health and safety manager	720 Olive Way, Suite 1900 Seattle, Washington 98101	dtempleton@anchorqea.com	(206) 903-3312	(206) 910-4279
Dan Hennessy	Anchor QEA	Task Manager - Sediment Investigation	Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met.	1605 Cornwall Avenue Bellingham, Washington 98225-4427	dhennessy@anchorqea.com	(360) 733-4311	(206) 491-0610
Nathan Soccorsy	Anchor QEA	Field Safety Officer/Coordinator	Reports to the Task Manager. Ensures all project health and safety requirements are followed; coordinates and participates in the field sampling activities; coordinates sample deliveries to lab; coordinates sampling activities with site owner and subcontractors; report to the Task Manager any deviations from the project plans.	720 Olive Way, Suite 1900 Seattle, Washington 98101	nsoccorsy@anchorqea.com	(206) 903-3385	(480) 272-2805
Delaney Peterson	Anchor QEA	Project QA Manager	Coordinates with laboratory to ensure that SQAPP requirements are followed and that laboratory QA objectives are met.	720 Olive Way, Suite 1900 Seattle, Washington 98101	dpeterson@anchorqea.com	(206) 903-3396	(206) 919-2845
Laurel Menoche	Anchor QEA	Project Data Manager	Ensures that anaytical data is incorporated into site dabase with appropriate qualifiers following validation	720 Olive Way, Suite 1900 Seattle, Washington 98101	lmenoche@anchorqea.com	(206) 903-3372	
Environmental Protection Agency (EPA)							
William Ryan	EPA	EPA Remedial Project Manager	Overall project management	1200 6th Ave Suite 900 ECL-113 Seattle, Washington 98101	ryan.william@epa.gov	(206) 553-8561	
Kathy Parker	EPA	EPA On Scene Coordinator	Coordinate with EPA RPM on topic realated to Removal Evaluation and implementation of early actions at the Site	1200 6th Ave Suite 900 ECL-116 Seattle, Washington 98101	parker.kathy@epa.gov	(206) 553-0062	(206) 321-3796
Ginna Grepo-Grove	EPA	EPA Region 10 QA Manager	RI/FS technical support QA/QC issues	1200 6th Ave Suite 900 OEA-95 Seattle, Washington 98101	Grepo-Grove.Gina@epamail.epa.gov	(206) 553-1632	
Subcontractors							
Cheronne Oreiro	Analytical Resources, Inc.	Laboratory Manager	Soil and sediment analysis	4611 South 134th Place , Suite 100 Tukwila, Washington 98168	Cheronneo@arilabs.com	(206) 695-6214	

Table A-2
Container Size, Holding Time, and Preservation for Physical/Chemical Analyses

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Polycyclic aromatic hydrocarbons	100 g	8-oz glass	14 days until extraction	Cool/4° C
			1 year until extraction	Freeze -20° C
			40 days after extraction	Cool/4° C
Total solids	25 g	4-oz glass	14 days	Cool/4° C
			6 months	Freeze -20° C
Total organic carbon	25 g		14 days	Cool/4° C
			6 months	Freeze -20° C

Notes:
C = Celsius
g = gram
oz = ounce

Table A-3
Proposed Removal Evaluation Surface Sediment Explorations

Station ID	Sample Collection Method	Depth Interval	Media	Sampling DQO[2]	Analytical Chemistry	Coordinates[3]	
						Northing (Y)	Easting (X)
Removal Evaluation Intertidal Beach Surface Sediment Sampling [1]							
BGW-RE-SG-01	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216322.04	1193634.86
BGW-RE-SG-02	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216356.85	1193634.86
BGW-RE-SG-03	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216388.50	1193635.20
BGW-RE-SG-04	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216308.24	1193734.86
BGW-RE-SG-05	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216343.50	1193734.86
BGW-RE-SG-06	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216379.86	1193734.86
BGW-RE-SG-07	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216304.94	1193834.86
BGW-RE-SG-08	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216330.55	1193834.86
BGW-RE-SG-09	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216357.04	1193834.86
BGW-RE-SG-10	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216293.40	1193912.72
BGW-RE-SG-11	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216323.54	1193918.27
BGW-RE-SG-12	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216279.67	1193934.86
BGW-RE-SG-13	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216312.36	1193945.00
BGW-RE-SG-14	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216244.75	1193934.86
BGW-RE-SG-15	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216281.23	1193957.16
BGW-RE-SG-16	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216307.60	1193965.51
BGW-RE-SG-17	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216227.43	1193953.99
BGW-RE-SG-18	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216200.00	1193967.25
BGW-RE-SG-19	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216218.60	1193979.11
BGW-RE-SG-20	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216285.77	1194021.95
BGW-RE-SG-21	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216198.47	1194007.68
BGW-RE-SG-22	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216230.19	1194027.96
BGW-RE-SG-23	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216286.01	1194041.83
BGW-RE-SG-24	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216203.04	1194034.86
BGW-RE-SG-25	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216235.69	1194050.42
BGW-RE-SG-26	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216275.79	1194064.71
BGW-RE-SG-27	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216234.33	1194080.61

Table A-3
Proposed Removal Evaluation Surface Sediment Explorations

Station ID	Sample Collection Method	Depth Interval	Media	Sampling DQO[2]	Analytical Chemistry	Coordinates[3]	
						Northing (Y)	Easting (X)
BGW-RE-SG-28	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216201.65	1194134.94
BGW-RE-SG-29	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216225.63	1194134.94
BGW-RE-SG-30	Hand collection with stainless steel trowel	0-4 in.	Bulk Sediment	Assess nature and extent of surface contamination	SIM-PAH, TOC, Archive	216248.75	1194135.08
BGW-RE-SG-XX (Field duplicate 1)	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess sample variability and the nature and extent of surface contamination	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-SG-XX (Field duplicate 2)	Hand collection with stainless steel trowel	0-4 in	Bulk Sediment	Assess sample variability and the nature and extent of surface contamination	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-SG-RB	Rinse blank	N/A	Distilled water	Assess equipment decontamination procedures	SIM-PAH	N/A	N/A

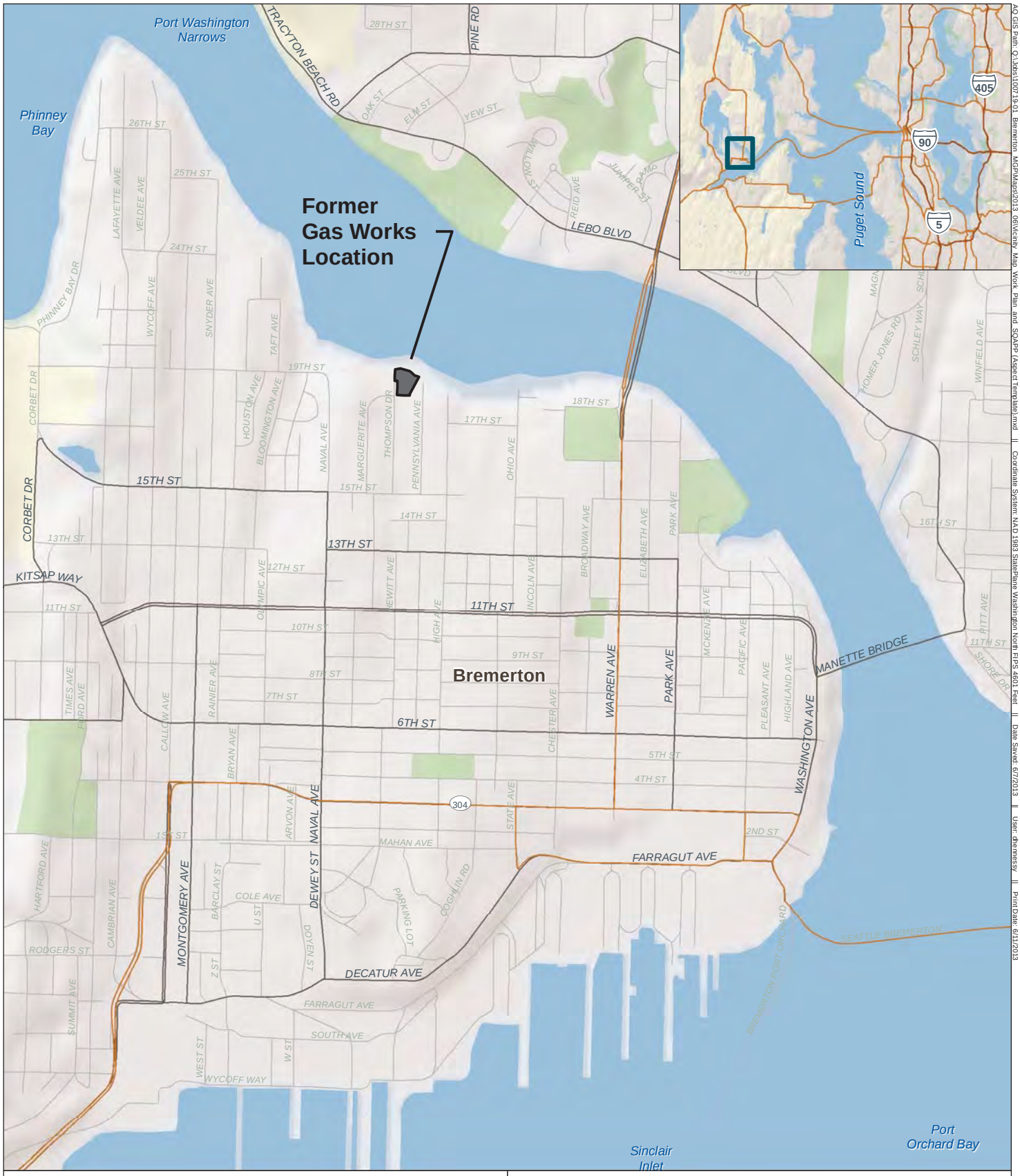
Notes
1 = If hydrocarbon sheen or odor is observed in during bulk sediment sampling, an additional opportunistic sample from the 4 to 12 inch interval will be collected and archived. The decision to analyze the opportunistic sample will be made in consultation with Environmental Protection Agency (EPA).
2 = Each station sample will consist of five equal volume aliquots. One aliquot will be collected at the target location, and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass.
3 = Washington State Plane North, North American Datum 83, U.S. feet
BGW = Bremerton Gas Works
DQO = data quality objective
in. = inch
RE = removal evaluation
SG = sediment grab
SIM PAH = selective ion monitoring polycyclic aromatic hydrocarbon (PAH). High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC = total organic carbon

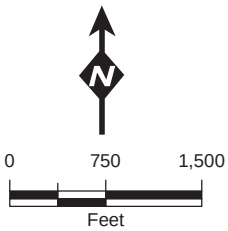
Table A-4
Removal Evaluation Contingent Bluff Soil or Seep Liquid Samples

Sample ID	Sample Collection Method	Depth Interval	Media	Sampling DQO	Analytical Chemistry	Coordinates[1]	
						Northing (Y)	Easting (X)
Contingent Soil or Seep Liquid Sampling							
BGW-RE-BS-01	Hand collection with stainless steel trowel	TBD	Soil	Assess nature of contamination from bluff soil	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-BS-02	Direct collection	N/A	Liquid	Assess nature of contamination from seep liquid	Archive	TBD	TBD
BGW-RE-BS-XX (Field duplicate)	Hand collection with stainless steel trowel	TBD	Soil	Assess sample variability and nature of contamination from bluff soil	SIM-PAH, TOC, Archive	TBD	TBD
BGW-RE-BS-RB	Rinse blank	N/A	Distilled water	Assess equipment decontamination procedures	SIM-PAH	N/A	N/A

Notes
1: Washington State Plane North, NAD 83, US feet.
DQO - Data Quality Objective
SIM PAH - Selective Ion Monitoring Polycyclic Aromatic Hydrocarbon. High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC - Total Organic Carbon
BGW - Bremerton Gas Works
RE - Removal Evaluation
BS - Bluff Sample
TBD - To be determined
N/A - Not applicable

FIGURES





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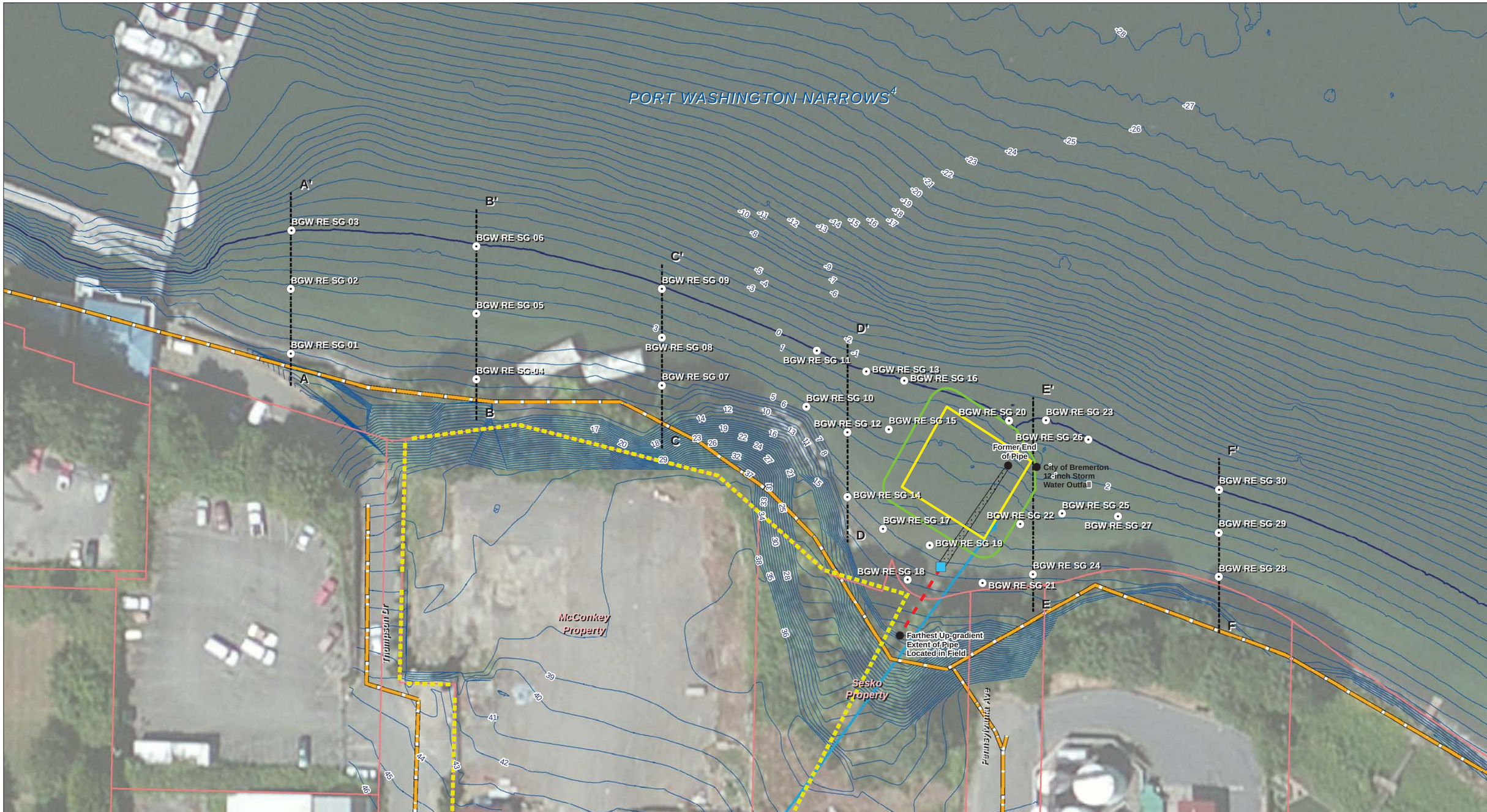
NOTE:
If a paper copy is required, this figure is best printed in color.

Former Gas Works Location and Vicinity Removal Evaluation Work Plan

Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING	ANCHOR QEA	FIRM: ANCHOR QEA / DRAWN BY: dhennessy	FIGURE NO. A-1

AG GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_06\Vicinity_Map_Work_Plan_and_SQAPP (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/7/2013 || User: dhennessy || Print Date: 6/11/2013



- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Extent of Organo-Clay Mat[2]
- Proposed Sampling Locations
- 100-Foot Transects
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Former Gas Works Location
- Parcel Boundaries[3]

NOTES:
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

N

0 50 100
Feet
1:600

Removal Evaluation Intertidal Sampling Locations
Removal Evaluation Work Plan
Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: dhennessy

FIGURE NO.
A-2

AO GIS Path: Q:\Jobs\1007\19-01_Bremerton_MGP\Maps\2013_06\Removal Evaluation Intertidal Sampling Locations (Aspect Template).mxd | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | Date Saved: 6/7/2013 | User: dhennessy | Print Date: 6/11/2013

ATTACHMENT A-1

Field Forms

Daily Log

Anchor QEA L.L.C.
720 Olive Way, Suite 1900
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

PROJECT NAME: Bremerton Gasworks **DATE:**

SITE ADDRESS: **PERSONNEL:**

WEATHER: **WIND FROM:**

N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
SUNNY		CLOUDY		RAIN		?				

TEMPERATURE: ° F . ° C
[Circle appropriate units]

TIME	COMMENTS
See Field Logs for detailed logging and sampling	
Equipment on site:	

Notes: Work performed, Phone calls made, Problems Issues/Resolutions, Visitors on site
Safety infractions, Important comments/instructions to contractors

Signature: _____

ANCHOR QEA

DATE: _____

PROJECT NAME: Bremerton Gasworks

PROJECT NO: 131014-01.01

DAILY SAFETY BRIEFING

PERSON CONDUCTING MEETING: _____ **HEALTH & SAFETY OFFICER:** _____ **PROJECT MANAGER:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/MSDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Other:
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking

WEATHER CONDITIONS: _____

DAILY WORK SCOPE: _____

SITE-SPECIFIC HAZARDS: _____

SAFETY COMMENTS: _____

ATTENDEES

PRINTED NAME	SIGNATURE

EMPLOYEE EXPOSURE/INJURY INCIDENT/SPILL REPORT

EMPLOYEE NAME: _____ **DATE:** _____

PROJECT NAME/NO: Bremerton Gasworks/131014-01.01 **TIME:** _____

TYPE OF OCCURRENCE: ☐ employee exposure ☐ injury incident ☐ spill

SITE NAME AND LOCATION: _____

SITE WEATHER (clear, rain, snow, etc.): _____

NATURE OF ILLNESS/INJURY: _____

SYMPTOMS: _____

ACTION TAKEN: ☐ rest ☐ first aid ☐ medical

TRANSPORTED BY: _____

WITNESSED BY: _____

HOSPITAL NAME: _____ **TREATMENT:** _____

DESCRIBE IN DETAIL HOW THIS EXPOSURE/INJURY INCIDENT/SPILL OCCURRED
(if a spill, list the name of the compounds, quantities, and method of clean-up/containment): _____

_____

_____

_____

_____

_____

WHAT WAS THE PERSON DOING AT THE TIME OF THE ACCIDENT/INCIDENT?: _____

_____

LIST PERSONAL PROTECTIVE EQUIPMENT WORN: _____

_____

WHAT IMMEDIATE ACTION WAS TAKEN TO PREVENT RECURRENCE?: _____

_____

Employee:

Printed Name	Signature	Date

Supervisor:

Printed Name	Signature	Date

Site Safety Representative:

Printed Name	Signature	Date

NOTE: Use additional page(s) if necessary.

Chain of Custody Record & Laboratory Analysis Request

Laboratory Number:

Date:

Project Name: Bremerton Gasworks

Project Number: 131014-01.01

Project Manager:

Phone Number:

Shipment Method:

Line	Field Sample ID	Collection Date/Time	Matrix	No. of Containers	Test Parameters																			Comments/Preservation
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								

Notes:

Relinquished By:	Company: Anchor QEA, LLC
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

Relinquished By:	Company:
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.

Surface Sediment Field Log

Job: Bremerton Gasworks	Station:
Job No: 131014-01.01	Date:
Field Staff:	Sample Method: Hand Collection
	Proposed Coordinates:

Tide Measurements | Horizontal Datum: | Easting:

Time: _____ | Northing:

Height: _____

Notes: Mudline Elevation (lower low water-large tides): calculated after sampling

Grab #	Time	Confirmed Coordinates (datum)		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		WGS 84 (N)	WGS 84 (E)			

Sample Description:

Sample Containers:

Analyses:

Bremerton Gasworks – Physical Description of Sediment Key

Visual Sediment Descriptions consist of the following:

MAJOR CONSTITUENT GROUP NAME. Moisture content, density/consistency, color, major constituent (%), minor constituents (%), plasticity. Amount and shape of minor constituents (e.g., wood, shells). Biota. Sheen, odor (as needed). Structure descriptions (as needed). Use parenthesis to denote interpretation (e.g., asphalt, glass).

Examples:

SILT with SAND (MH) Moist, soft, olive gray, 80% fines, 20% f-sand, medium plasticity, contains fine gravel and anthropogenics (brick and plastic fragments), sulfide odor.

CLAYEY GRAVEL with SAND (GC) Moist, dense, dark brown, 70% f-c gravel, 15% m-sand, 15% low plasticity fines, gravel is subrounded up to 3".

Sediment Description Terminology

MAJOR and minor Group Name			
Gravel	Sand	Silt	Clay
** For Group Name of Major Unit follow flow charts in ASTM D2488. Incorporate use of terms 'Lean, Sandy, Gravelly, Fat, Elastic'*			
** MAJOR is written in all CAPITAL LETTERS (i.e., SILTY SAND), If minor sand/gravel constituents >15% use 'with GRAVEL' or 'with SAND'*			

Moisture Content	
Dry	Little perceptible moisture (upland only), dusty or powdery
Wet	Visible free water
Moist	No visible water (most sediment)

Density/Consistency	
SILT or CLAY	
Consistency:	***Notes:***
Very soft	Soupy
Soft	Easily penetrated, just starting to be cohesive
Firm	Molded by figure pressure
Hard	Can indent and mold by finger pressure
Very Hard	modeling clay (rolls to a ball)

Color and Shading			
Example Colors:	Black	Browns (olive, yellow, red)	Grays (gray, olive brown)
Shades:	Light	Dark	Very Dark

Descriptors* – Sand and Gravel			
Grain size	Sand: fine, medium, coarse (no "vf" or "vc")	Gravel: fine (0.19-0.75") and coarse (0.75-3")	Cobbles: >3"
Grading	Well graded: many sizes	Poorly graded: homogenous	
Grain color	(black, white, grey, yellow, etc.)	*(*State percentage of fines, gravel, and sand either in text or in columns provided on log.)*	
Rounding	(subrounded, subangular, angular, rounded)		

Plasticity	
Non-plastic, low, medium, high	**For fine-grained soil, describe plasticity of the unit after grain size percentages (...80% fines, 20% sand, low plasticity)* **For coarse grained soil, describe the plasticity of the fines as part of the percentage description (…80% medium sand, 20% low plasticity fines)*

Other Minor Constituents: % volume		*(anthropogenics, etc.)*
Other Minor Constituents*:	Anthropogenics (aggregates, trash)	Organics (wood debris, fresh/decomposed)
Percent:	Call out volume in 5% increments	

Biota
Marsh grass, peat, worms, shells, etc.

Odor Descriptions* *(*use the following descriptors: none, slight, and strong)*		
Hydrocarbon-like	H_2S - like (Hydrogen sulfide - like)	Septic - like

Product	
Hydrocarbon Stained	Visible brown or black stains (fine grained)
Hydrocarbon Coated	Visible brown or black coating (coarse grained)
Hydrocarbon Wetted	Visible brown or black hydrocarbon wetting on soil. Hydrocarbon appears as a liquid and is not held by soil grains (pools)

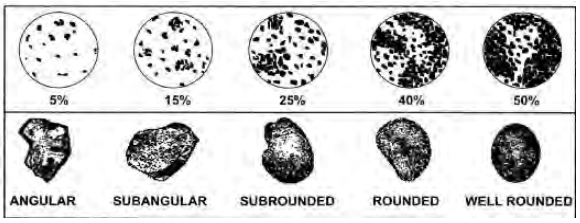
Sheen	
Describe sheen as necessary with percentages (5% increments)	**No odor or sheen observed unless noted*
Visual Description Terminology:	
Rainbow	Multicolored

Bremerton Gasworks – Physical Description of Sediment Key

Metallic	Metallic gray-colored
Florets	Semi-circular and flat (2-D)
Blebs	Semi-circular and spherical (3-D)
Structure and Other Sediment Descriptions	
Blocky	Cohesive soil that can be broken down into smaller lumps
Decomposed	Visible sign of decomposition or discoloration
Fresh	No visible sign of decomposition or discoloration
Gummy	Cohesive, pliable soil with high percentage of clay
Bed	Greater than 1/2" thick
Thin bed	Up to 1/2" thick
Laminated beds	Thin beds (<1/2" thick) lying between or alternating within a greater unit
Stratified beds	Beds (>1/2" thick) lying between or alternating within a greater unit
Layer	A bed or thin bed of anthropogenic material
Pockets	Semicircular to circular inclusion/deposit
Winnowed	Loss of material that occurred during coring
Anthropogenic	Debris originated from human activity

MAJOR DIVISONS			GROUP SYMBOL	GRAPHIC SYMBOL	TYPICAL DESCRIPTIONS
HIGHLY ORGANIC SOILS			PT		Peat, Humus and Other Highly Organic Soils
COARSE-GRAINED SOILS More than 50% retained on No. 200 (0.075 mm) sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 (4.75 mm) sieve	CLEAN GRAVELS Less than 5% fines	GW		Well-graded Gravels, Gravel-Sand Mixtures, < 5% Fines *
			GP		Poorly-graded Gravels, Gravel-Sand Mixtures, < 5% Fines *
		GRAVELS WITH FINES Greater than 12% fines	GM		Silty Gravels, Gravel-Sand-Silt Mixtures, > 12% Fines *
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures, > 12% Fines *
	SANDS More than 50% of coarse fraction passing No. 4 (4.75 mm) sieve	CLEAN SANDS Less than 5% fines	SW		Well-graded Sands, Gravelly Sands, < 5% Fines *
			SP		Poorly-graded Sands, Gravelly Sands, < 5% Fines *
		SANDS WITH FINES Greater than 12% fines	SM		Silty Sands, Sand-Silt Mixtures, > 12% Fines *
			SC		Clayey Sands, Sand-Clay Mixtures, > 12% Fines *
FINE-GRAINED SOILS 50% or more passes the No. 200 (0.075 mm) sieve	SILTS AND CLAYS Liquid Limit less than 50	INORGANIC	ML		Inorganic Silts and Very Fine Sands, Rock Flour, Silty Sands of Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
		ORGANIC	OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50	INORGANIC	MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils
			CH		Inorganic Clays of High Plasticity, Fat Clays
		ORGANIC	OH		Organic Clays of High Plasticity

*NOTE: The use of dual group symbols are required if percent fines are between 5 and 12% (e.g. GW-GC).



ATTACHMENT A-2

Removal Evaluation Investigation and Sampling Training Checklists

Attachment A-2.1
Removal Evaluation Investigation and Sampling Training Checklist
Intertidal Beach Sediment Sampling

Field Activity (Team Leads)	Task	Responsible Staff (to be completed during project kick-off)
Field Records (Nathan Soccorsy)		
	Daily log	
	Daily safety meeting form	
	Sample collection forms	
	COCs	
	Incident report forms	
Surface Sediment Collection and Processing (Nathan Soccorsy)		
	Location control (DGPS Operation)	
	5-point surface sediment collection	
	Subsurface sediment collection	
	Sediment description	
	Homogenization procedures	
	Sample containers	
	Sample labels	
	Decontamination Procedures	
	Chain-of-custody procedures	
	Sample packing procedures	
	Sample storage	
	Sample transport	

My signature below certifies that I have been trained on and understand the procedures outlined in this training checklist.

Date	Name (print)	Signature

Project manager certification that project staff have received task-appropriate training

Date	Name (print)	Signature
	Mark Larsen, Anchor QEA	

Attachment A-2.2
Removal Evaluation Investigation and Sampling Training Checklist
Bluff Inspection and Contingent Sampling

Field Activity (Team Leads)	Task	Responsible Staff (to be completed during project kick-off)
Field Records (Carla Brock)		
	Daily log	
	Daily safety meeting form	
	Sample collection forms	
	COCs	
	Incident report forms	
Inspection and Contingent Soil/Seep Liquid Collection and Processing (Carla Brock)		
	Location control (DGPS Operation)	
	PID/FID Operation	
	Soil sample collection	
	Seep sample collection	
	Homogenization procedures	
	Sample containers	
	Sample labels	
	Decontamination Procedures	
	Chain-of-custody procedures	
	Sample packing procedures	
	Sample storage	
	Sample transport	

My signature below certifies that I have been trained on and understand the procedures outlined in this training checklist.

Date	Name (print)	Signature

Project manager certification that project staff have received task-appropriate training

Date	Name (print)	Signature
	Jeremy Porter, Aspect	

Attachment A-2.3
Removal Evaluation Investigation and Sampling Training Checklist
Inspection of Former Drainage and Piping System

Field Activity (Team Leads)	Task	Responsible Staff (to be completed during project kick-off)
Field Records (Carla Brock)		
	Daily log	
	Daily safety meeting form	
	Incident report forms	
Inspection (Carla Brock)		
	Location control (DGPS Operation)	

My signature below certifies that I have been trained on and understand the procedures outlined in this training checklist.

Date	Name (print)	Signature

Project manager certification that project staff have received task-appropriate training

Date	Name (print)	Signature
	Jeremy Porter, Aspect	

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN
FINAL REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Prepared by

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

FINAL REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC and Anchor QEA, LLC

Approvals:

Aspect Project Manager Jeremy Porter, Aspect	Date
Anchor QEA Project Manager Mark Larsen, Anchor QEA	Date
EPA Remedial Project Manager William Ryan, EPA	Date
EPA Project On Scene Coordinator Kathy Parker, EPA	Date
EPA Region 10 QA Manager Ginna Grepo-Grove, EPA	Date

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Acronyms

AOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing and Materials
CCB	continuing calibration blanks
CCV	Continuing calibration verifications
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemicals of concern
DQOs	data quality objectives
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
FC	field coordinator
FID	Flame Ionization Detector
FSP	Field Sampling Plan
HASP	Health and Safety Plan
ICV	initial calibration verification
PM	project manager
LDC	Laboratory Data Consultants
MDL	method detection limit
µg/L	micrograms per liter
MNR	monitored natural recovery
MS/MSD	matrix spike/matrix spike duplicate
NAD	North American Datum
NAVD 88	North America Vertical Datum 1988
NELAP	National Environmental Laboratories Accreditation Program
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration

PID	Photoionization Detector
PQL	practical quantitation limit
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SRM	Standard Reference Material
TOC	total organic carbon

1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gasworks Site (Site), Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013.

This Quality Assurance Project Plan (QAPP) supports the Removal Evaluation Work Plan (Work Plan) which is required as the first task under the AOC. This QAPP presents detailed descriptions of the quality assurance/quality control (QA/QC) tasks to be performed during sampling and analysis activities supporting the removal evaluation activities.

The field sampling for the removal evaluation includes collection and chemical analysis of sediment samples from the intertidal beach area adjacent to the Site. As described in the Work Plan, a Time Critical Removal Action (TCRA) was performed in a portion of this area during 2010 in order to control the release of hydrocarbon sheen from a historical drain pipe. The sediment data collected during the current effort will be used to assess current conditions in the beach area, and to determine whether releases or threatened releases from the Site present an imminent and substantial endangerment to public health or welfare, or the environment which warrants performance of a removal action before completion of the RI/FS and selection of a final remedy. Detailed sampling and analysis methods are described in Appendix A of the Work Plan (Field Sampling and Analysis Plan [FSP]).

This QAPP was prepared in accordance with EPA *Requirements for Quality Assurance Project Plans* (EPA 2001) and EPA *Guidance on Quality Assurance Project Plans* (EPA 2002a). Analytical QA/QC procedures were also developed based on the analytical protocols and QA guidance of:

- EPA's Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition (EPA 1986).
- Guidance on Environmental Data Verification and Validation (EPA 2002b).
- Quality Assurance/Quality Control Guidance for Removal Activities (EPA 1990).
- Contract Laboratory Program National Functional Guidelines for Data Review (EPA 2004, 2008).

EPA's guidance specifies the four following groups of information that must be included in a QAPP: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability. Each group comprises several QAPP elements. EPA's guidance provides a suggested outline for the QAPP elements. However, the guidance indicates that certain elements may not be applicable to a given project, and that the elements need not be presented in the order presented in the guidance.

The remainder of this QAPP is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Overview of Data Generation and Acquisition
- Section 4 – Assessments and Response Actions
- Section 5 – Data Validation and Usability
- Section 6 – References

2 Project Management

This section identifies key project personnel and their roles.

2.1 Project Organization

Responsibilities of the team members, as well as laboratory project manager, are described in this section. The following paragraphs define their functional responsibilities.

The regional project manager (RPM) is **William Ryan** of EPA. The primary role of the RPM is to ensure compliance with the EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. EPA is the lead agency for this work.

The EPA on-scene coordinator (OSC) is **Kathy Parker**. The EPA OSC will be responsible for overseeing the removal evaluation. The EPA QA manager is **Ginna Grepo-Grove**. The QA manager is responsible for the QAPP review and approval and for providing QA oversight during sampling and analysis activities in support of the removal evaluation.

Cascade Natural Gas Corporation (Cascade) is the Respondent. **Kalle Kuether Godel** is the Cascade representative. The Anchor QEA and Aspect project managers (PMs) are **Mark Larsen** and **Jeremy Porter,** respectively. The project leads will act as the direct line of communication between Anchor QEA and Aspect, and the PMs are responsible for implementing activities described in this QAPP. **Dan Hennessy** and **Carla Brock** of Anchor QEA and Aspect, respectively, will be the task managers assisting the PMs. The project and task managers will be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The project and task managers will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this QAPP. Resolution of project concerns or conflicts related to technical matters will also be the responsibility of the project managers.

The Anchor QEA field coordinator (FC) will be **Nathan Soccorsy**. The FC will be responsible for day-to-day technical and QA/QC oversight. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratory for chemical and physical analyses.

The Anchor QEA Site Safety and Health Officer is **David Templeton.** The Site Safety and Health Officer will be responsible for managing on-Site health and safety activities and will provide support to the project manager and field coordinator on health and safety issues.

Delaney Peterson will serve as the Anchor QEA QA/QC manager. The QA/QC manager will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the

analytical laboratory, ensuring data quality, overseeing data validation, and supervising project QA coordination.

Laurel Menoche will serve as the Anchor QEA data manager. The data manager will compile field observations and analytical data from the laboratory into a database, review the data for completeness and consistency, append the database with qualifiers assigned by the data validator, and ensure that the data obtained is in a format suitable for inclusion in the appropriate databases and delivery to EPA.

Samples collected by Anchor QEA and Aspect will be analyzed at Analytical Resources, Inc. (ARI), located in Tukwila, Washington. ARI is accredited under the National Environmental Laboratories Accreditation Program (NELAP). All chemical testing will adhere to SW-846 QA/QC procedures and analysis protocols (EPA 1986) or follow the appropriate ASTM International (ASTM) or Standard Method protocols. If more current analytical methods are available, the laboratory may use them.

Cheronne Oreiro will serve as the laboratory project manager at ARI. The laboratory project manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical analyses, and laboratory report preparation for this project. The laboratory manager will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analyses.

The analytical testing laboratory will be responsible for the following:

- Perform the methods described in this QAPP, including those methods referenced for each analytical procedure.
- Follow documentation, custody, and sample logbook procedures.
- Meet all reporting and QA/QC requirements.
- Deliver electronic data files as specified in this QAPP.
- Meet turnaround times for deliverables as described in this QAPP.
- Allow EPA and the QA/QC contractor to perform laboratory and data audits.

The Data Validator project manager will be Ming Hwang of Laboratory Data Consultants (LDC), and she will serve as the primary contact to perform all applicable data validation.

2.2 Distribution List

All group leaders and technical advisors will receive copies of this QAPP and any approved revisions.

This list identifies all individuals to receive one copy of the approved QAPP. Contact information is provided in Table 1 of the Work Plan:

- EPA Remedial Project Manager – William Ryan
- EPA On-Scene Coordinator – Kathy Parker
- Cascade Natural Gas Representative – Kalle Kuether Godel

- EPA Region QA Manager – Ginna Grepo-Grove
- Aspect Project Manager – Jeremy Porter
- Aspect Task Manager – Carla Brock
- Anchor QEA Project Manager – Mark Larsen
- Anchor QEA Task Manager – Dan Hennessy
- Anchor QEA QA/QC Manager – Delaney Peterson
- Anchor QEA Field Coordinator – Nathan Soccorsy

The following Laboratory Managers will receive one copy of the approved QAPP and FSP (Attachment A to the Work Plan):

- ARI – Cheronne Oreiro
- LDC – Ming Hwang (Data validation)

3 Project and Task Description

The objectives of the sampling and description of work and measurements to be performed are described in the following sections.

3.1 Objectives

As described in the Work Plan, a TCRA was performed by Cascade in 2010 to address hydrocarbon sheen in sediments in the vicinity of a historical drain pipe located at the beach adjacent to the former Gas Works. The TCRA was conducted under the oversight of the U.S. Coast Guard (USCG) and EPA, in coordination with the Washington Department of Ecology (Ecology), the Washington Department of Natural Resources (DNR), and the Kitsap County Health Department (KCHD).

Under EPA and USCG oversight, Cascade implemented a TCRA including completion of the following activities:

- Investigation of the location and orientation of the abandoned Pipe.
- Permanent plugging of the Pipe as close as practicable to the shoreline.
- Removal of all portions of the Pipe from the new plug to the terminus of the Pipe.
- Backfilling of the excavation created by removal of the Pipe with clean beach material.
- Placement of an Organo-Clay mat over impacted sediments near the terminus of the Pipe that had been observed to generate sheen with only minimal disturbance.
- Continued maintenance of a containment system and field observations and inspections to confirm the situation remains stable (no sheen).

The TCRA was successfully completed between November 5 and November 8, 2010. The results of the removal action were documented in a Completion Report (Anchor QEA 2011). Post-completion inspections of the removal action area have been performed on behalf of Cascade between 2010 and 2013. These inspections have been conducted pursuant to the TCRA Work Plan (Anchor QEA and Aspect 2010). Results of monitoring have shown that the removal action has contained the hydrocarbon sheen, and the temporary cap has been colonized by surface algae.

As required by the AOC, a removal evaluation will be performed prior to initiation of the RI/FS. The removal evaluation is intended to assess whether releases or threatened releases of contamination at the Site present an imminent and substantial endangerment to public health or welfare or the environment that warrants performance of an additional removal action before completion of the RI/FS and selection of a final remedy. Per the AOC, the primary objective of the removal evaluation is to assess whether contaminant migration pathways at the Site pose an imminent and substantial threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. If so, the removal evaluation will also:

- Identify one or more removal actions that may be conducted to effectively control any such migration pathways.

- Determine whether the boundaries of the identified removal action(s) can be defined as discrete from the larger investigation of the nature and extent of contamination at the Site.
- Propose boundaries for the identified removal action(s).
- Document available information regarding the presence of Site-associated contaminants and any non-aqueous phase liquids (NAPL) in soil, groundwater, or sediments within the proposed boundaries of the identified removal action(s).
- Describe the recommended methods for completing the identified removal action(s).
- Describe how implementation of the identified removal action(s) will be consistent with and facilitate final remediation of the Site.

The three data quality objectives (DQOs) of the removal evaluation are as follows:

- Collect the information necessary to evaluate whether current surface sediment contamination (0 to 4 inch depth interval) within the intertidal beach area adjacent to the former Gas Works poses an imminent and substantial threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. Intertidal beach area sampling activities were specified in the AOC. The extent of polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) in surface sediment within the beach area between the high tide line and the mean lower low water (MLLW) line will be characterized as specified in the AOC. These data will be used to estimate potential Site-related risks to beach users (evaluated using a child-exposure beach play scenario) and to benthic ecological receptors. If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. Detailed field collection methods are provided in the FSP. Anchor QEA will lead this field task.
- Inspect the former drainage and piping system connected to the 12-inch pipe addressed by the TCRA by surveying and locating potential influent sources to the drainage and piping system. These data will be used to identify potential ongoing or threatened migration pathways of contamination to the beach. Aspect will lead this field task.
- Inspect the area between the bluff and the high tide line for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the beach. If potential hydrocarbon seeps are indicated by visual observation of hydrocarbon staining, sheen, or odor, opportunistic soil samples will be collected and archived. The locations and properties of these archived opportunistic samples will be reviewed with EPA. Where directed by EPA, these opportunistic samples will be subjected to chemical analysis. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned

surface sediment samples, as described in the FSP. Aspect will lead this field task.

3.2 Description of Work and Measurements to be Performed

The FSP describes in detail the data collection needs associated with the three removal evaluation DQOs including: sampling station locations, equipment to be used, location control, sample nomenclature, sampling intervals and analyses, and sampling protocols that will be followed.

4 Data Quality Objectives and Criteria

The primary analytical DQO for this project is to ensure that the data collected are of known and acceptable quality so that the project objectives described can be achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (also known as the "PARCC" parameters). Definitions of these parameters and the applicable QC procedures are included in this section. Applicable quantitative goals for these data quality parameters are listed or referenced in Table B-1.

4.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and in laboratory analysis. ASTM recognizes two levels of precision: repeatability: 1) the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions and reproducibility; and 2) the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material (ASTM 2002).

In the laboratory, "within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of blind field duplicates for chemistry samples at a frequency of 5 percent of samples analyzed. Field chemistry duplicate precision will be screened against a RPD of 50 percent for sediment samples. However, no data will be qualified based solely on field homogenization duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\text{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

RPD	=	relative percent difference
C1	=	larger of the two observed values
C2	=	smaller of the two observed values

4.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, spiked project samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative laboratory control sample, and matrix spike recovery performance criteria outlined in Table B-1. Surrogate spike recoveries will be evaluated against laboratory control limits and internal standard recoveries will be evaluated against method criteria. Accuracy can be expressed as a percentage of the true or reference value, or as a percentage of the spiked concentration. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/Csa$$

Where:

%R	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
Csa	=	actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in the FSP (Appendix A of the Work Plan).

4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the sampling program, the list of analytes has been identified to provide a comprehensive assessment of the known and potential contaminants at the Site.

4.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this program, comparability of data will be established

through the use of standard analytical methodologies and reporting formats, and of common traceable calibration and reference materials.

4.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{\text{(Number of acceptable data points) x 100}}{\text{(Total number of data points)}}$$

The DQO for completeness for all components of this project is 95 percent. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

4.6 Sensitivity

Sensitivity is measured by the achievable laboratory detection and reporting limits. The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Laboratory reporting limits (RLs) are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Detected results will be reported to the MDL level and non-detected results will be reported to the RL due to the 50 percent false negative rate assumed at the MDL level. Results between the MDL and the RL will be qualified “J” to indicate they are estimated.

The sample-specific MDL and RL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the reporting limit (e.g., dilution factor, percent moisture, sample mass). In the event that the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., reporting limits less than criteria are achieved), EPA will be contacted to discuss an acceptable resolution.

5 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field crews are trained in standardized sample collection requirements so that the samples collected and subsequent data generated are consistent with project requirements. All field crew are fully trained in the operation of equipment, collection and processing of surface sediments, decontamination protocols, visual inspections, and sample transport and chain-of-custody procedures. All field staff are required to read the Work Plan, FSP, and QAPP prior to beginning field work. All field staff are also required to participate in a field project kick-off meeting to review field tasks and to verify that staff understand and are trained for the site-specific field tasks. Training requirements for field tasks for the removal evaluation will be documented on the Field Training Documentation Forms (FSP Attachment A-2). Upon completion of project training and competency certification, the Anchor QEA and Aspect project managers will sign-off on this form to document the qualifications and training of the field crew.

The Occupational Safety and Health Administration (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health (29 CFR 1910.120). All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

6 Documentation and Records

This project will require central project files to be maintained at the Anchor QEA office conducting the work. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks, but must provide such files to the central project files upon completion of each task. A project-specific index of file contents is to be kept with the project files. Hard copy documents will be kept on file at Anchor QEA or at a document storage facility throughout the duration of the project, and all electronic data will be maintained in the database at Anchor QEA.

Deviations from the QAPP or FSP will be discussed with the project leads prior to implementation. Project leads will contact the on-Site EPA representative to discuss the deviation and proposed path forward. Upon approval of a path forward, the project leads will give notice to proceed to the FC. All deviations will be documented in all associated field forms and the logbook.

6.1 Field Records

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on field forms. Example field forms are provided in the FSP (Appendix A of the Work Plan). All field activities will be recorded on forms specific to the collection activity and will be maintained by the FCs. Field forms will be the main source of field documentation for all field activities. The on-Site field representative will record on the field log form information pertinent to the investigation program. The sampling documentation will contain information about each sample collected, and will include at a minimum the following information:

- Project name.
- Field personnel on Site.
- Weather conditions.
- Field observations.
- Maps and/or drawings.
- Date and time sample collected.
- Sampling method and description of activities.
- Identification or serial numbers of instruments or equipment used.
- Deviations from the QAPP.
- Conferences associated with field sampling activities.

Entries for each day will begin on a new form. The person recording information must enter the date and time and initial each entry. Additional specific field reporting

requirements and checklists for each study are defined in the FSP. In general, sufficient information will be recorded during sample collection so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field forms and field logbook will be on water-resistant, durable paper for adverse field conditions. Notes will be taken in indelible waterproof blue or black ink. Errors will be corrected by crossing out with a single line, dating, and initialing. Each form will be marked with the project name, number, and date. The field forms will be scanned into Anchor QEA's project file directory upon completion of the sampling event.

6.2 Analytical and Chemistry Records and Deliverables

Analytical data records will be retained by the laboratories and Anchor QEA. For all analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of all raw data. Laboratory analytical reports will be provided to Anchor QEA in PDF format and the Electronic Data Deliverable (EDD) will be provided in the Anchor QEA EQuIS 5 format. The analytical laboratory will be required to report the following:

- Project Narrative. This summary, in the form of a cover letter, will discuss any problems encountered during any aspect of analyses. This summary should discuss but should not be limited to QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered—actual or perceived—and their resolutions will be documented in as much detail as appropriate.
- Chain-of-custody Records. Legible copies of the chain-of-custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.
- Sample Results. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code.
  - Sample matrix.
  - Date of sample preparation.
  - Date and time of analysis.
  - Weight and/or volume used for preparation/analysis.
  - Final dilution volumes or concentration factor for the analysis.
  - Identification of the instrument used for analysis.

- Method detection limits and method reporting limits accounting for sample-specific factors (e.g., dilution, total solids).
- Analytical results with reporting units identified.
- Data qualifiers and their definitions.

- QA/QC Summaries. Results of the laboratory QA/QC procedures will be summarized for each analytical event. Each QA/QC sample analysis will be documented with the same information required for the sample results (see previous bullet point). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
  - Internal standard area summaries.
  - Method blank results.
  - Surrogate spike recoveries.
  - Matrix spike/matrix spike duplicate recoveries and RPD values.
  - Matrix duplicate RPD values.
  - Laboratory control sample/laboratory control sample duplicate recoveries.
- Calibration Data Summary. This summary will report the concentrations of the initial calibration and daily calibration standards, and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be documented.
- Original Data. Legible copies of the original data generated by the laboratory will include:
  - Sample preparation, identification of preparation method used, and cleanup logs.
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis.
  - Calculation worksheets for inorganic analyses.
  - Reconstructed ion chromatograms for all sample, standard, blank, calibration, spike, replicate, and reference material results.
  - Original printouts of full scan chromatograms and quantitation reports for all gas chromatography (GC) and/or GC/mass spectrometry (MS) sample, standard, blank, calibration, spike, replicate, and reference material results.
  - Enhanced and unenhanced spectra of detected compounds with associated best-match spectra for each sample.

All instrument data shall be fully restorable at the laboratory from electronic backup. Laboratories will be required to maintain all records relevant to project analyses for a

minimum of seven years. Data validation reports will be maintained in the central project files with the analytical data reports.

6.3 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the department lead, the laboratory project manager, and/or the QA/QC managers. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable error.

6.4 Removal Evaluation Reporting

A Removal Evaluation Report will be submitted following completion of the sampling and analysis activities. This report will be prepared by Anchor QEA and Aspect. Data collected during the removal evaluation will also be included in the RI/FS Scoping document and RI/FS Work Plan. The Removal Evaluation Report shall include the following, as applicable:

- Description of the sampling and analysis activities conducted.
- Schedule under which such activities were conducted.
- Description and supporting analytical data for known hazardous substances remaining on-Site after completion of the TCRA.
- Locations, lab reports, and summary of results of sample collection and analyses.
- Data validation reports of analytical data.
- Description of the management of investigation-derived wastes.

7 Overview of Data Generation and Acquisition

All sample collection will be conducted following standard procedures. In general, all sampling procedures will comply with EPA protocols or other approved sample collection standards established for the Site.

7.1 Sampling Rationale

The investigation and sampling rationale for the three DQOs of the removal evaluation are described in the Work Plan. Analytical sampling will be conducted as part of the intertidal beach sampling activities, and potentially may be conducted during the bluff inspection. The extent of sampling to be performed is specific to the removal evaluation, and is intended to fill specific data gaps defined by EPA. Analytical sampling will not be conducted for the inspection of the former drainage and piping system.

The extent of surface sediment sampling within the intertidal beach area is consistent with the requirements of the AOC. That sampling is intended to provide information on current surface sediment quality in the intertidal beach area adjacent to the former Gas Works. This information will be used to support a screening level risk evaluation for recreational beach users as requested by EPA. Thirty sample stations will be located in the vicinity of the 2010 TCRA and the beach area adjacent to the former Gas Works. Opportunistic subsurface sediment samples will be collected in the event that subsurface hydrocarbon sheen or visible product is noted during the collection of the surface sediment samples.

The bluff inspection and contingent sampling will be used to assess the potential presence of heavily impacted soils or hydrocarbon seeps along the bluff between the former Gas Works and the intertidal beach area. As described in the Work Plan, analytical sampling will be conducted if hydrocarbon stains or odors, or visual hydrocarbon seeps are noted during the bluff inspection.

7.2 Sampling Methods

The sampling methods for the two DQOs with specified or contingent analytical sampling are described the FSP. As described in the FSP, the surface sediment sampling in the intertidal beach area will be conducted using local station composites. Each surface sediment sample submitted for testing will consist of five equal aliquots of sediment, one collected from the target location and four collected each approximately 3 feet from the target location at the approximate four points of the compass. If surface sediments with potential hydrocarbon sheen or odor are identified, additional local station composite samples of surface sediment may be collected and archived from these locations.

In the event that opportunistic subsurface sediment samples are collected from the proposed beach surface sediment locations, these will be collected as discrete samples. However, if hydrocarbon sheen or product is noted in multiple points within a local station composite, then the discrete subsurface samples from that location station exhibiting hydrocarbon sheen or product will be composited.

During the bluff inspection, if potential hydrocarbon seeps are indicated by visual observation of hydrocarbon staining, sheen, or odor, soil or seep liquid samples will be collected and archived. A photoionization detector (PID) or flame ionization detector (FID) will also be used to help detect the presence of hydrocarbon vapors. Any samples collected during the bluff inspection will consist of discrete samples as described in the FSP.

All prescribed or opportunistic sediment samples will be collected with decontaminated stainless steel trowels into decontaminated stainless steel bowls, homogenized, and placed into sample containers as listed in Table A-2 of the FSP. Potential opportunistic bluff soil/seep samples will be collected using the same sampling techniques.

7.3 Sample Handling and Custody

The sample handling and custody procedures are described in the FSP. All containerized sediment samples will be delivered to the designated analytical laboratories daily by hand or by courier after preparation is completed. Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample containers will sign the chain-of-custody forms. Upon receipt, the laboratory receiver will record the temperature and condition of the samples and cross-check the sample inventory with the chain-of-custody forms. Chain-of-custody forms will be used internally in the lab to track sample handling and final disposition.

7.4 Analytical Methods

This section summarizes the target chemical and physical analyses for the various media sampled. All sample analyses will be conducted in accordance with EPA-approved methods and this QAPP. Chemical testing will be conducted at the selected analytical laboratory. The selected analytical laboratory is accredited under NELAP. Prior to analysis, all samples will be maintained according to the appropriate holding times and storage temperatures for each analysis. Table B-2 presents the proposed analytes, the analytical methods to be used, and the targeted reporting limits. All surface sediment samples will be analyzed for TOC and SIM PAHs. An archive sample from each station will be kept in frozen storage for possible future analyses, should any be determined necessary.

The laboratory will establish method detection limits for each analyte of interest, where applicable prior to sample analyses. Method reporting limits will be below the values specified in Table B-2, if technically feasible. The method reporting limits listed in Table B-2 are the laboratory's established and lowest achievable reporting limits for PAH analysis. The PAH reporting limits are sufficient to support the preliminary evaluation of exposure risk to recreational beach users (see Appendix D). These reporting limits may not be achieved in the event that constituent concentrations are elevated or if there are matrix interferences. If specified reporting limits are not achieved, possible corrective actions will be discussed with the laboratory and with EPA. If analytical methodology modifications are to be used to address raised reporting limits, these will be presented to EPA for review and approval prior to implementation.

In completing chemical analyses for this project, the contract laboratory is expected to meet the following minimum requirements:

- Adhere to the analytical methods outlined in this QAPP.
- Deliver scanned and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in the QAPP including data quality objectives, laboratory QC requirements, and performance evaluation testing requirements.
- Notify the project QA/QC manager of any QAPP QA/QC deviations when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

7.5 Quality Assurance/Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for EPA SW-846 (1986), the EPA Contract Laboratory Program (EPA 2004, 2008), and other cited methods.

7.5.1 Field Quality Control

Anchor QEA personnel will identify and label sample containers in a consistent manner to ensure that field samples are traceable and that labels provide all information necessary for the laboratory to conduct required analyses properly. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

7.5.1.1 Sample Containers

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided.

7.5.1.2 Sample Identification and Labels

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identification
- Date and time of sample collection

- Preservative type (if applicable)
- Analysis to be performed

Samples will be uniquely identified with a sample identification that at a minimum specifies sample number, sample location, and type of sample. Specific sample ID schemes are provided in the FSP.

7.5.1.3 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for collecting and handling of samples. Adherence to these procedures will be complemented by periodic and routine equipment inspection.

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA samples includes equipment rinsate blanks and field duplicates. Rinsate blanks will be collected at a rate of one per collection event for SIM PAH analysis. Field duplicate samples will be collected at a frequency of one per 20 samples collected. Any field QA sample result that significantly exceeds the acceptance criteria will be evaluated by the QA/QC manager to determine if field procedure modifications should be considered. These exceedances will also be narrated in the Data Report. Sample data will not be qualified based solely on field QA results.

Field QA samples will also include the collection of enough sample mass to ensure that the laboratory has sufficient amounts to run the program-required analytical QA/QC (matrix spike/matrix spike duplicate [MS/MSD]) samples for analyses as specified in Table B-3. For sediment and soil samples, enough mass will be collected to run MS/MSD on any sample. The samples designated for QA/QC analyses will be clearly marked on the chain-of-custody.

All field QA samples will be documented on the field forms and verified by the QA/QC manager or designee.

7.5.2 Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table B-1 summarizes the data quality objectives for precision, accuracy, and completeness and Table B-3 lists the frequency of analysis for laboratory QA/QC samples.

Results of the QC samples from each analytical batch will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

7.5.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. An initial calibration verification (ICV) will be analyzed following each initial calibration and must meet method criteria prior to analysis of samples. Continuing calibration verifications (CCV) will be performed daily prior to any sample analysis to track instrument performance. The frequency of CCV analyses varies with methods. For GC/MS methods, one will be analyzed every 12 hours. For inorganic methods, one will be analyzed for every 10 field samples analyzed or at the beginning and end of the analytical run, whichever is more frequent. If the continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks (CCB) provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or following continuing calibration verification of the instrument for each type of applicable analysis.

7.5.2.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

7.5.2.3 Matrix Spike and Matrix Spike Duplicates

Analysis of MS samples provides information on the preparation efficiency of the method on the sample matrix. By performing duplicate MS analyses, information on the precision of the method is also provided. The frequency of analysis for matrix spike and matrix spike duplicate samples is provided in Table B-3.

7.5.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the method reporting limit of any single target analyte/compound. If a laboratory method blank exceeds this criterion for any analyte/compound, and the concentration of the analyte/compound in any of the associated samples is less than five times the concentration found in the blank (10 times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced. Any affected samples will be re-prepared and reanalyzed as necessary. The frequency of analysis for method blank samples is provided in Table B-3.

7.5.2.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-

dependent spiked sample prepared along with the samples and any other required laboratory QC samples. The laboratory control sample will provide information on the accuracy of the analytical process, and when analyzed in duplicate, will provide precision information as well. The frequency of analysis for laboratory control samples is provided in Table B-3.

7.5.2.6 Standard Reference Materials

Standard reference materials are substances of the same or similar matrix to the project samples and contain a known concentration of target analyte(s). These materials are prepared and analyzed in the same manner as routine samples and in the same preparation and analytical batch. The recovery of the target analyte(s) provide information on interferences caused by the sample matrix. National Institute of Standards and Materials (NIST) standard reference material (SRM) 1941b for organics in marine sediment will be analyzed for SIM PAHs and TOC. The frequency of analysis for standard reference material samples is provided in Table B-3.

7.5.2.7 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. QC sample frequencies will be compared to the criteria in Table B-3.

7.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

7.6.1 Field Instruments/Equipment

Anchor QEA maintains inventories of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The FCs will be responsible for the preparation, documentation, and implementation of the preventative maintenance. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FCs will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field.

7.6.2 Laboratory Instruments/Equipment

The laboratories selected will maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratories selected will have a preventative maintenance program, as detailed in their QA Plans, organized to maintain proper instrument and equipment performance, and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The QA/QC managers will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The QA/QC managers will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times. Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. A laboratory QA/QC manager or designee shall be responsible for verifying compliance.

7.7 Instrument Calibration

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

7.7.1 Laboratory Instrument/Equipment Calibration

As part of their QC program, the chemistry laboratories selected will perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibrations procedures and frequencies are discussed in the laboratory standard operating procedures (SOPs) and the analytical methods.

The laboratory QA/QC manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the National Institute of Standards and

Technology (NIST). Chemical reference standards shall be NIST Standard Reference Materials (SRMs) or vendor certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Plan for each instrument or analytical method in use. All calibrations shall be preserved on electronic media.

7.8 Inspection/Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FCs. All primary chemical standards and standard solutions used in this project either in the field or laboratory will be traceable to documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

7.9 Laboratory Data Management

ARI will provide data to the Anchor QEA data manager in the EQuIS electronic data deliverable format as well as in PDF form. Electronically provided laboratory data will be loaded into the database and verified against the laboratory data report. The laboratory data will undergo Stage 3 (EPA 2009) manual validation. Stage 4 validation may be performed on a portion of the data if considered necessary. Qualifiers, if assigned, will be entered manually. The accuracy of manually entered data will be verified by a second party. Data tables and reports will be exported from EQuIS to Microsoft Excel tables.

7.10 Field Data Management

Field data sheets will be checked for completeness and accuracy by the FCs prior to delivery to the data managers. All data generated in the field will be documented on hard copy and provided to the office data managers, who are responsible for the data's entry into the database. All manually entered data will be verified by a second party. Field documentation will be filed in the Anchor QEA central project file of the office generating the data after data entry and checking are complete.

8 Assessments and Response Actions

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

8.1 Compliance Assessments

Laboratory and field performance audits consist of on-Site reviews of QA systems and equipment for sampling, calibration, and measurement.

Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA/QC managers upon request. The laboratory is required to have written procedures addressing internal QA/QC; these procedures have been submitted and will be reviewed by the project QA/QC managers to ensure compliance with the QAPP. The laboratory must ensure that personnel engaged in analysis tasks have appropriate training. The laboratory will, as part of the audit process, provide for consultant's review of written details of any and all method modifications planned. Laboratory non-conformances will be documented and submitted to the QA/QC managers for review. All non-conformances will be discussed in the final data report.

The database manager will work with the FC and the project leads to correct any questionable or incomplete data. All corrections to field forms will be signed and dated by the personnel making the change.

Field data will be verified by the database manager. These tasks include:

- Post-processed differential correction of GPS coordinates.
- Sample parameter review (e.g., depth, sample name, sample matrix, unit).
- Field QC assignment (e.g., duplicates assigned to parent, equipment blanks assigned to samples).

8.2 Response and Corrective Actions

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or nonconformance to protocols identified in this document.

8.2.1 Field Activities

The FCs will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC managers will be responsible for resolving situations identified by the FCs that may result in noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

8.2.2 Laboratory

The laboratory is required to comply with their SOPs. The laboratory managers will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The laboratory managers will be notified immediately if any QC sample result exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analyses. The laboratory managers will document the corrective action taken in writing. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalyses, and/or re-extraction) will be submitted with the data package in the form of a cover letter.

8.3 Reports to Management

Quality assurance reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC managers.

Progress reports will be prepared by the FCs following each sampling event. The QA/QC managers will also prepare progress reports after the sampling is completed and samples have been submitted for analyses, when information is received from the laboratory, and when analyses are complete. The status of the samples and analyses will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event. These reports will be delivered electronically to the Anchor QEA project lead.

9 Data Validation and Usability

This section describes the processes that will be used to review project data quality.

9.1 Data Review, Validation, and Verification

The removal evaluation data will undergo EPA Stage 2B validation. Some of the data may undergo EPA Stage 4 validation, if considered necessary. During the validation process, analytical data will be evaluated for QAPP, method, and laboratory quality control compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

9.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FCs and laboratory managers; review by the data managers for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into Anchor QEA's EQuIS database. Verification of the electronic data with the laboratory reports will be performed by a data manager or designee. All manually entered data and all manually assigned qualifiers will be verified. Any errors found will be corrected.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts and/or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the laboratory managers to determine whether corrective action is needed and to determine the impact on the reporting schedule.

The Anchor QEA QA/QC manager or designee will be responsible for checking data packages for completeness immediately upon receipt from the laboratory. This will ensure that data and QA/QC information requested are present. Data quality will be assessed by a reviewer using the current National Functional Guidelines for data review (EPA 1999, 2004, 2008) and Guidance on Environmental Data Verification and Validation (EPA 2002b) by considering the following:

- Holding times
- Initial calibrations

- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- MS/MSD samples
- Standard reference materials
- Overall conformance with project DQOs

The data will be validated in accordance with the project specific DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on their SOPs. Data validation will be performed by the Anchor QEA QA/QC manager, designee, or by a third party data validator. The data validation will be summarized in a validation report to be included with the Removal Evaluation Report. Any data qualifiers added as part of validation will be input into the Equis database.

9.3 Reconciliation with User Requirements

The QA/QC manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA/QC manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors, and will suggest corrective action. It is expected that the problem would be corrected by revision of techniques or replacement of supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/QC manager will recommend appropriate modifications. Any revisions will require approval by EPA. If matrix interference is suspected to have caused the exceedance, adequate lab documentation must be presented to demonstrate that instrument performance and/or laboratory technique did not bias the result. In cases where the DQOs have been exceeded and corrective actions did not resolve the outlier, data will be qualified per National Functional Guidelines (EPA 1999, 2004, 2008). In these instances, the usability of the data will be determined by the extent of the exceedance.

10 References

American Society for Testing and Materials (ASTM). 2000. Standard test methods for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates, E1706-00. ASTM International

ASTM. 2002. Standard Practices for Use of the Term Precision and Bias in ASTM Test Methods, 177-90a. ASTM International.

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EPA. 2002b. Guidance on Environmental Data Verification and Data Validation (QA/G-8). EPA/240/R-02/004, November 2002.

EPA. 2004. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA540-R-04-004. October 2004.

EPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process (QA/G-4). February 2006.

EPA. 2008. Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. U.S. Environmental Protection Agency, Office of Emergency Response. EPA 540/R-99/008. October 2008.

EPA. 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. USEPA 540-R-08-005. January.

TABLES

Table B-1
Project Data Quality Objectives

Parameter	Precision	Accuracy[1]	Method Blank	Completeness
Total solids	± 20% RPD	NA	NA	95%
Total organic carbon	± 20% RPD	75-125% R	≤ PQL[a]	95%
Polycyclic aromatic hydrocarbons	± 35% RPD	50-150% R	≤ PQL[a]	95%

Notes:
1 = Applies to MS/MSD and LCS/LCSD recoveries
a = When the sample concentration is < 5x the method blank concentration
LCS/LCSD = laboratory control sample/laboratory control sample duplicate
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
PQL = practical quantitation limit
R = recovery
RPD = relative percent difference

Table B-2
Parameters for Analysis, Methods, and Quantitation Limits

Parameter	Recommended Analytical Method	Quantitation Limits
Conventional parameters (%)		
Total solids	SM 2540B	0.1
Total organic carbon	PSEP	0.1
Polycyclic aromatic hydrocarbons (µg/kg dry weight)		
1-Methylnaphthalene	8270D-SIM	0.5
2-Methylnaphthalene	8270D-SIM	0.5
Acenaphthene	8270D-SIM	0.5
Acenaphthylene	8270D-SIM	0.5
Anthracene	8270D-SIM	0.5
Benz(a)anthracene	8270D-SIM	0.5
Benzo(a)pyrene	8270D-SIM	0.5
Benzo(b)fluoranthene	8270D-SIM	0.5
Benzo(g,h,i)perylene	8270D-SIM	0.5
Benzo(j)fluoranthene	8270D-SIM	0.5
Benzo(k)fluoranthene	8270D-SIM	0.5
Chrysene	8270D-SIM	0.5
Dibenzo[a,h]anthracene	8270D-SIM	0.5
Dibenzofuran	8270D-SIM	0.5
Fluoranthene	8270D-SIM	0.5
Fluorene	8270D-SIM	0.5
Indeno(1,2,3-c,d)pyrene	8270D-SIM	0.5
Naphthalene	8270D-SIM	0.6
Phenanthrene	8270D-SIM	0.5
Pyrene	8270D-SIM	0.5

Notes:

µg/kg = micrograms per kilogram

PSEP = Puget Sound Estuary Program

SIM = selective ion monitoring

Table B-3
Laboratory Quality Control Sample Analysis Frequency

Analysis Type	Initial Calibration	Ongoing Calibration	Standard Reference Material[d]	Replicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes	Laboratory Control Samples
Total solids	Daily[a]	NA	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total organic carbon	Daily or each batch[b]	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	Each batch	NA	1 per 20 samples
Polycyclic aromatic hydrocarbons	As needed [c]	Every 12 hours	1 per 20 samples	NA	1 per 20 samples	1 per 20 samples	Each batch	Every sample	1 per 20 samples

Notes:

a = Calibration and certification of drying ovens and weighing scales are conducted bi-annually.

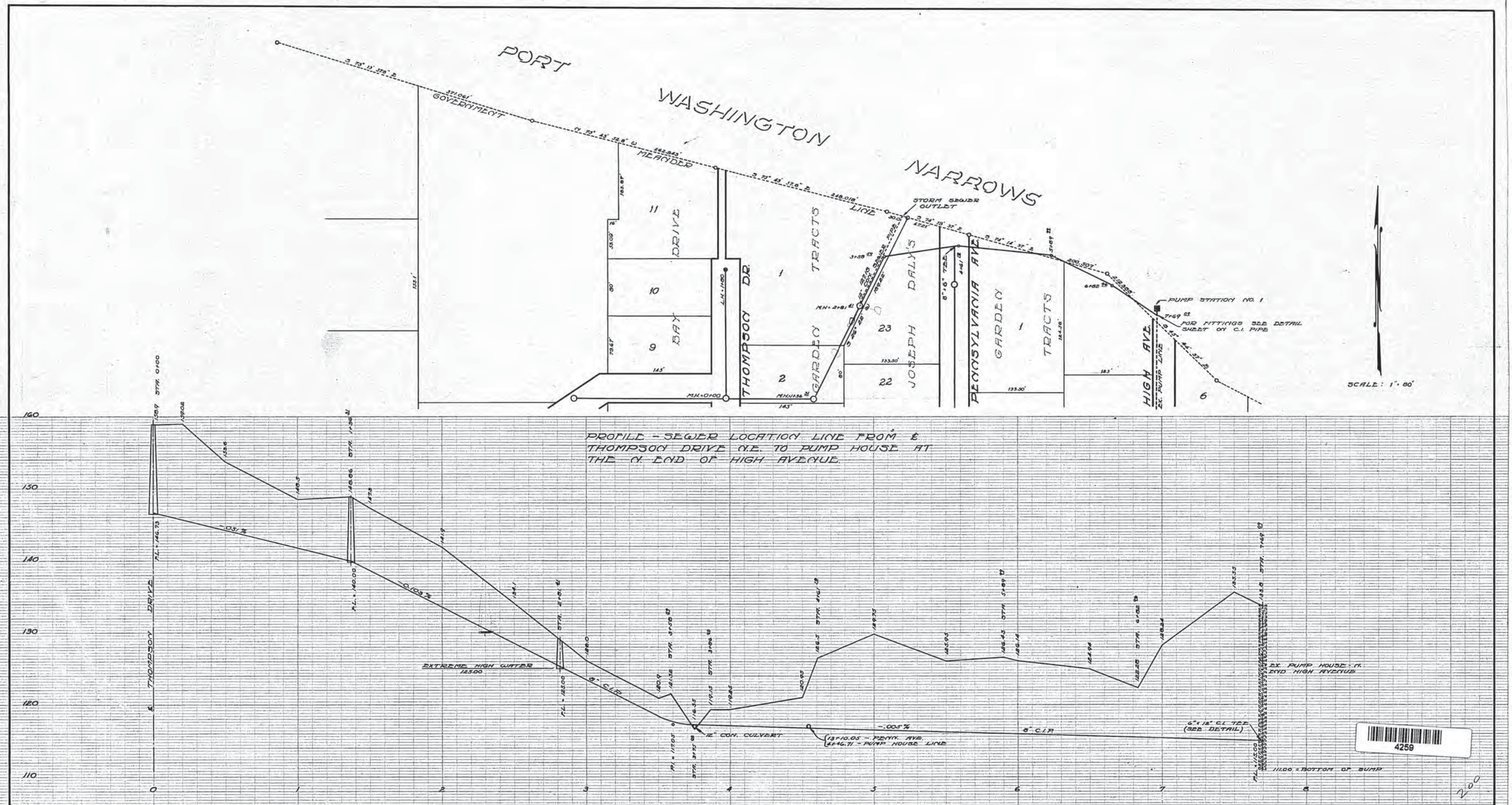
b = Initial calibration verification and calibration blank must be analyzed at the beginning of each batch.

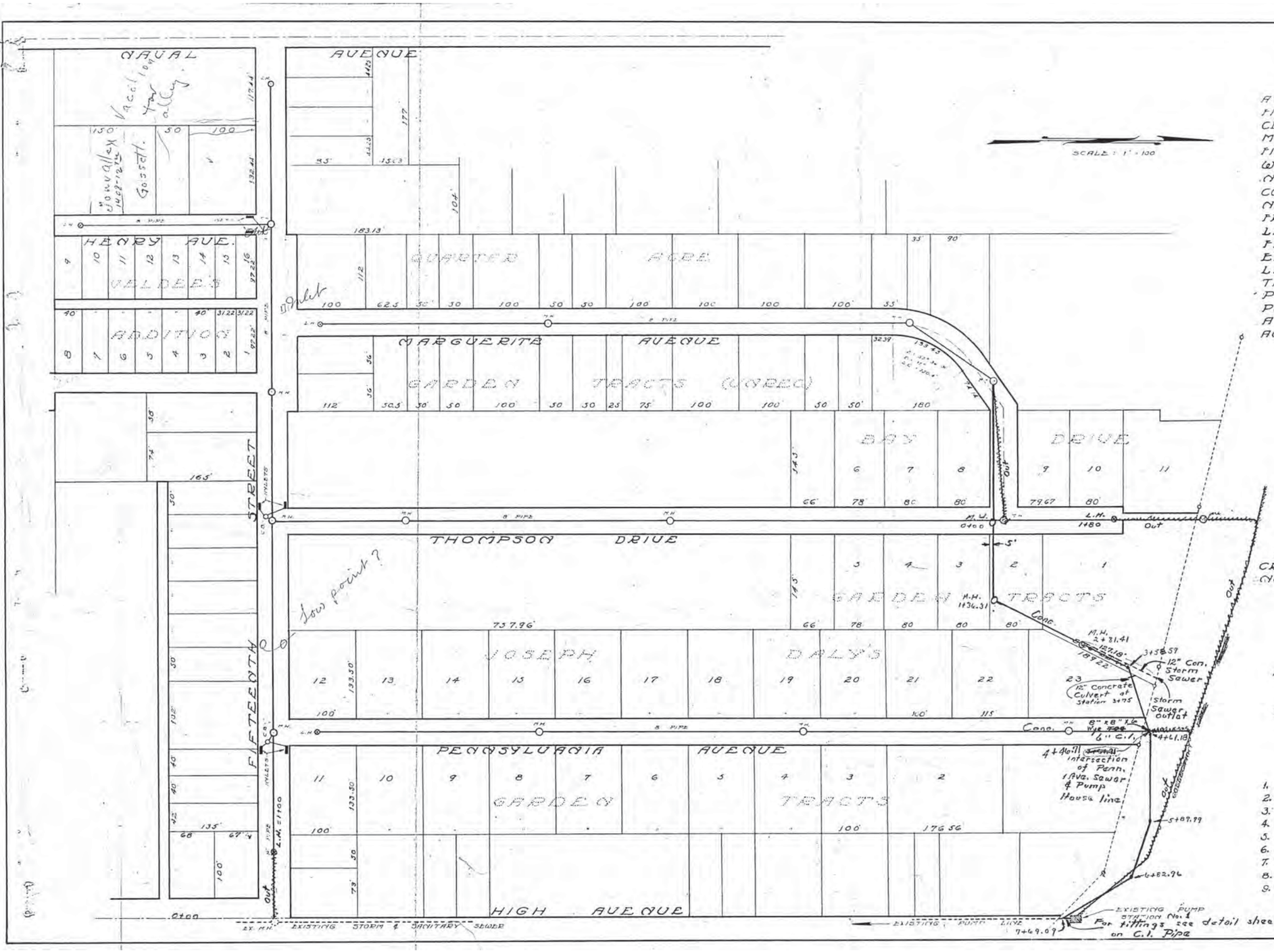
c = Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new calibration is performed.

d = When a Standard Reference Material is available

NA = not applicable

APPENDIX C
RECORD DRAWINGS


PORT
WASHINGTON
NARROWS
GOVERNMENT
MEANDER
LINE
STORM SEWER OUTLET
THOMPSON DR.
BAY DRIVE
GARDEN TRACTS
JOSEPH DALY'S
PENNSYLVANIA AVE.
GARDEN TRACTS
HIGH AVE.
PUMP STATION NO. 1
FOR FITTINGS SEE DETAIL SHEET ON C.I. PIPE
SCALE: 1" = 80'
PROFILE - SEWER LOCATION LINE FROM ℄ THOMPSON DRIVE N.E. TO PUMP HOUSE AT THE N. END OF HIGH AVENUE.
EXTREME HIGH WATER
12" CON. CULVERT
8" C.I.P.
6"x12" C.I. TEE (SEE DETAIL)
EX. PUMP HOUSE - N. END HIGH AVENUE
111.00 = BOTTOM OF SUMP
4258



PLAN

FOR THE IMPROVEMENT OF HENRY AVENUE FROM A POINT 265 SOUTH OF FIFTEENTH STREET NORTH TO THE CENTER LINE OF FIFTEENTH STREET; MARGUERITE AVENUE NORTH FROM FIFTEENTH STREET TO ITS INTERSECTION WITH THOMPSON DRIVE, THOMPSON DRIVE NORTH FROM FIFTEENTH STREET TO A COLLECTION LINE ALONG PORT WASHINGTON NARROWS; PENNSYLVANIA AVENUE NORTH FROM FIFTEENTH STREET TO A COLLECTION LINE ALONG PORT WASHINGTON NARROWS FIFTEENTH STREET FROM NAVAL AVENUE EAST TO HIGH AVENUE, COLLECTION LINE FROM THE NORTH END OF THOMPSON DRIVE SOUTHEASTERLY ALONG PORT WASHINGTON NARROWS TO THE PUMP AT THE NORTH END OF HIGH AVENUE, BY A SYSTEM OF STORM AND SANITARY SEWERS.

CERTIFICATION

AUTHORIZED BY ORDINANCE NO. CREATING LOCAL IMPROVEMENT DISTRICT NO. APPROVED THIS DAY OF 1939.

MAYOR

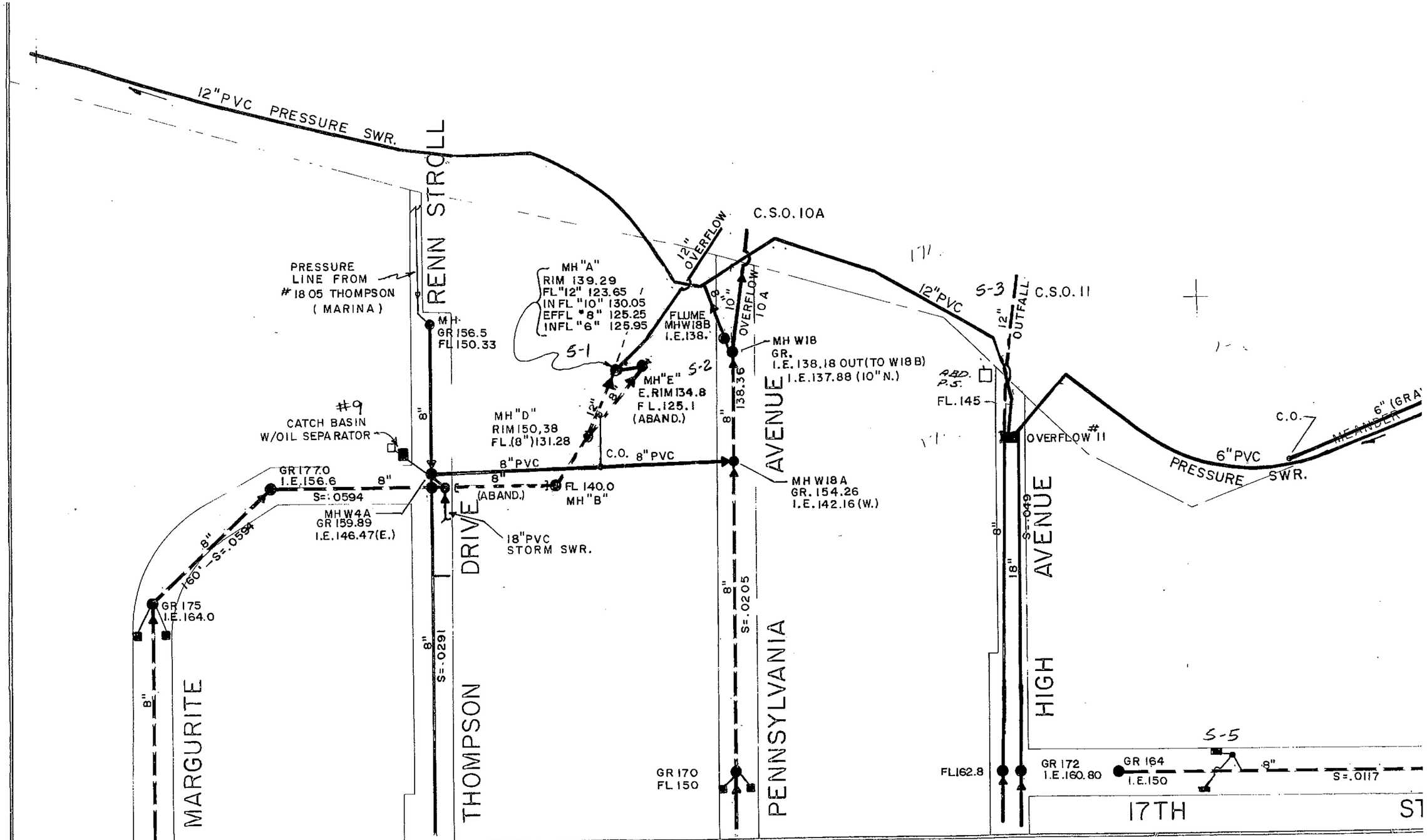
ATTEST: CITY CLERK

APPROVED: CITY ENGINEER

QUANTITIES

1.	FIXED ESTIMATE	ACTUAL COST
2.	CLEARING & GRUBBING	LUMP SUM
3.	8" PIPE — INCLUDING 6"x8" WYES	3640 FEET
4.	6" PIPE	480 FEET
5.	MANHOLES	14
6.	LAMPHOLES	4
7.	CATCH BASINS	3
8.	INLETS	6
9.	8" C.I.P.	630 FEET

4263



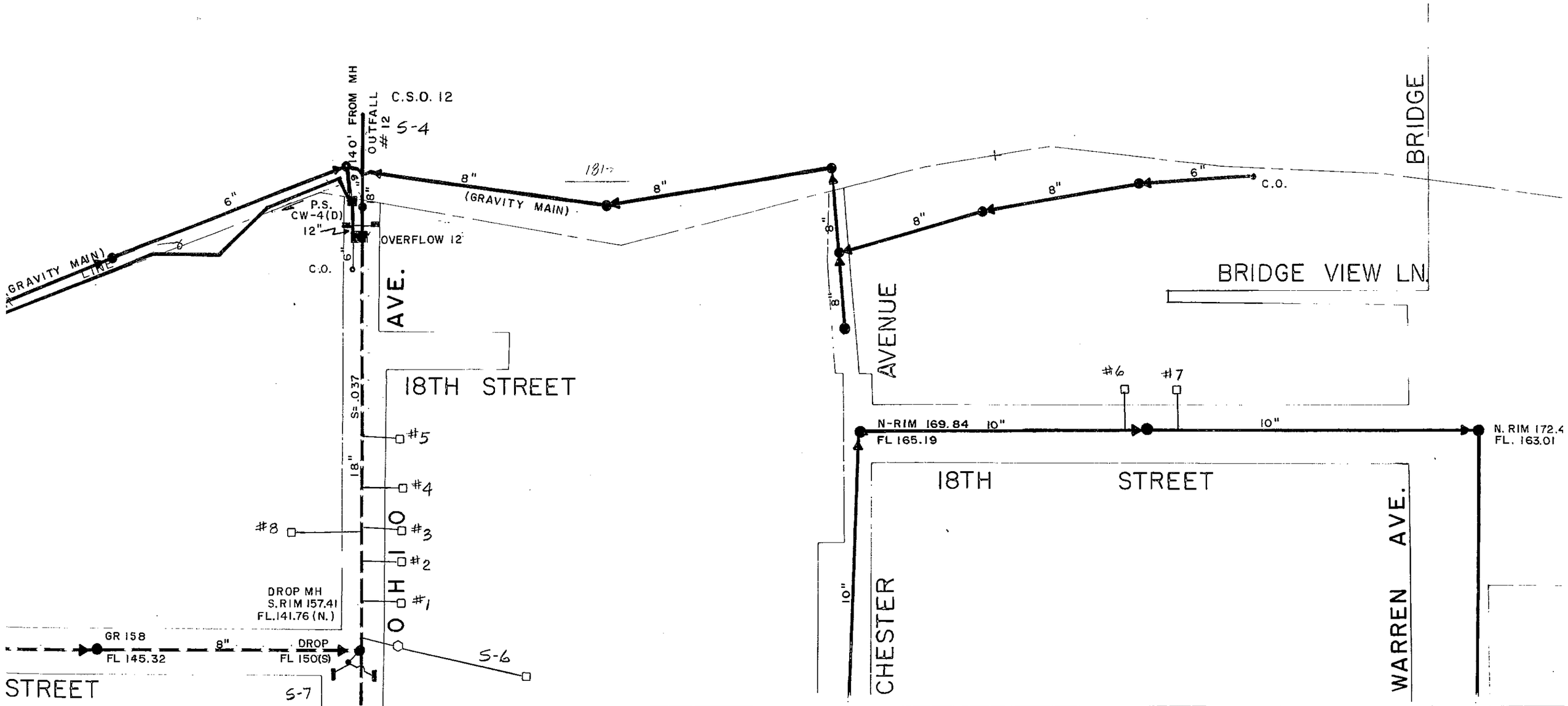
DATE	BY	REVISION	APPD.
4-6-92	AEL	ADD SAN./STORM CONN.	CB
1-6-89	AEL	RE-DRAW 8", 10" & 12" PRESSURE SWRS.	
1-6-89	AEL	COMB. STORM/SAN. SWRS.	

REFERENCES
- C.B. FIELD NOTES
- CONTR. C6 (CH_2M HILL DWG.) CONTR. C10
- ENG. DEPT SWR. CARDS

ENGINEERING DEPARTMENT

CITY of BREMERTON

THIS MAP IS NOT INTENDED TO REPRESENT THE PRECISE LOCATION OR THE EXTENT OF BREMERTON MUNICIPAL UTILITIES PRESENT OR FUTURE FACILITIES



SANITARY SEWER SYSTEM

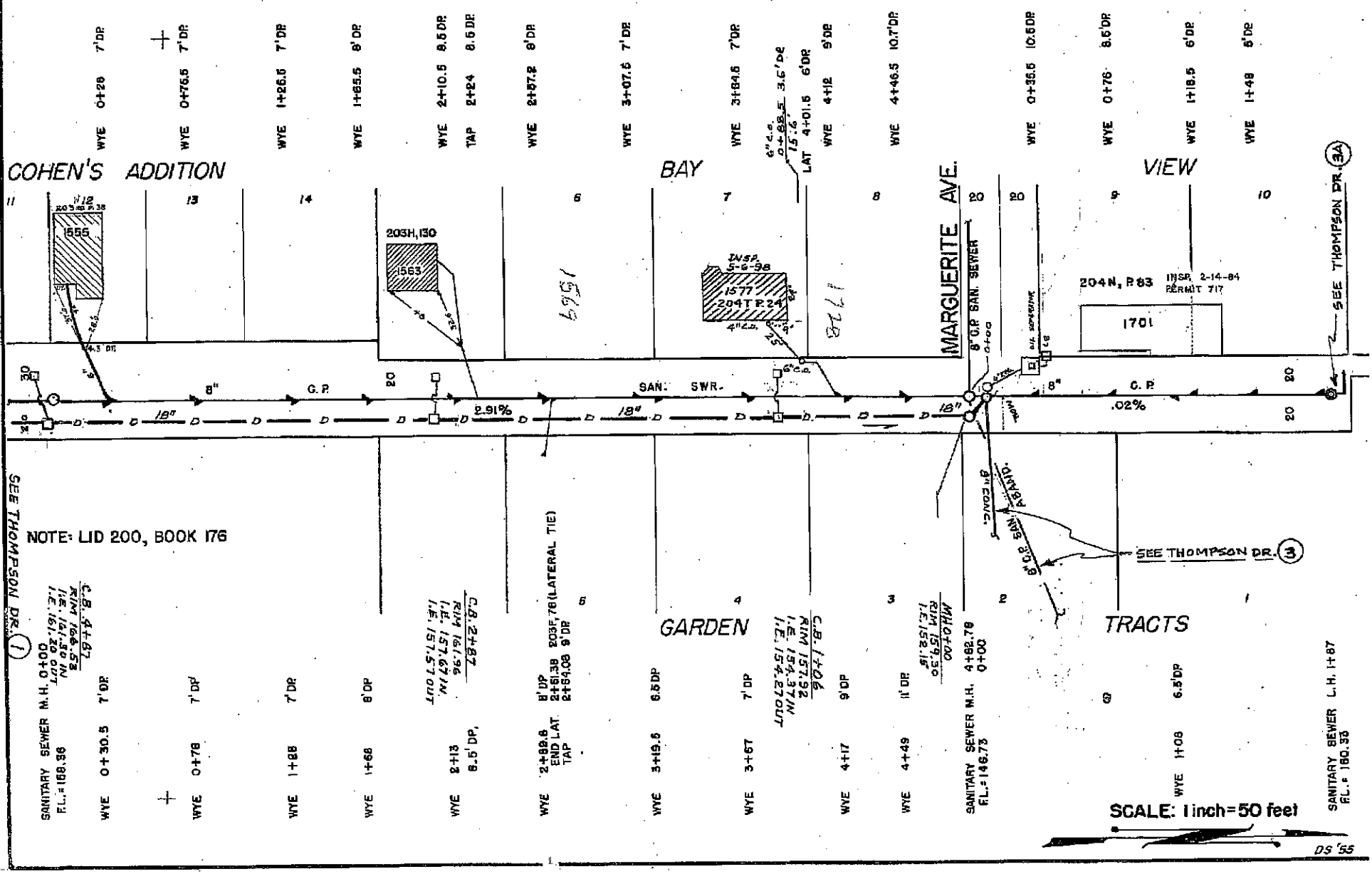
1" = 100'	
DATE	
FILE NO.	

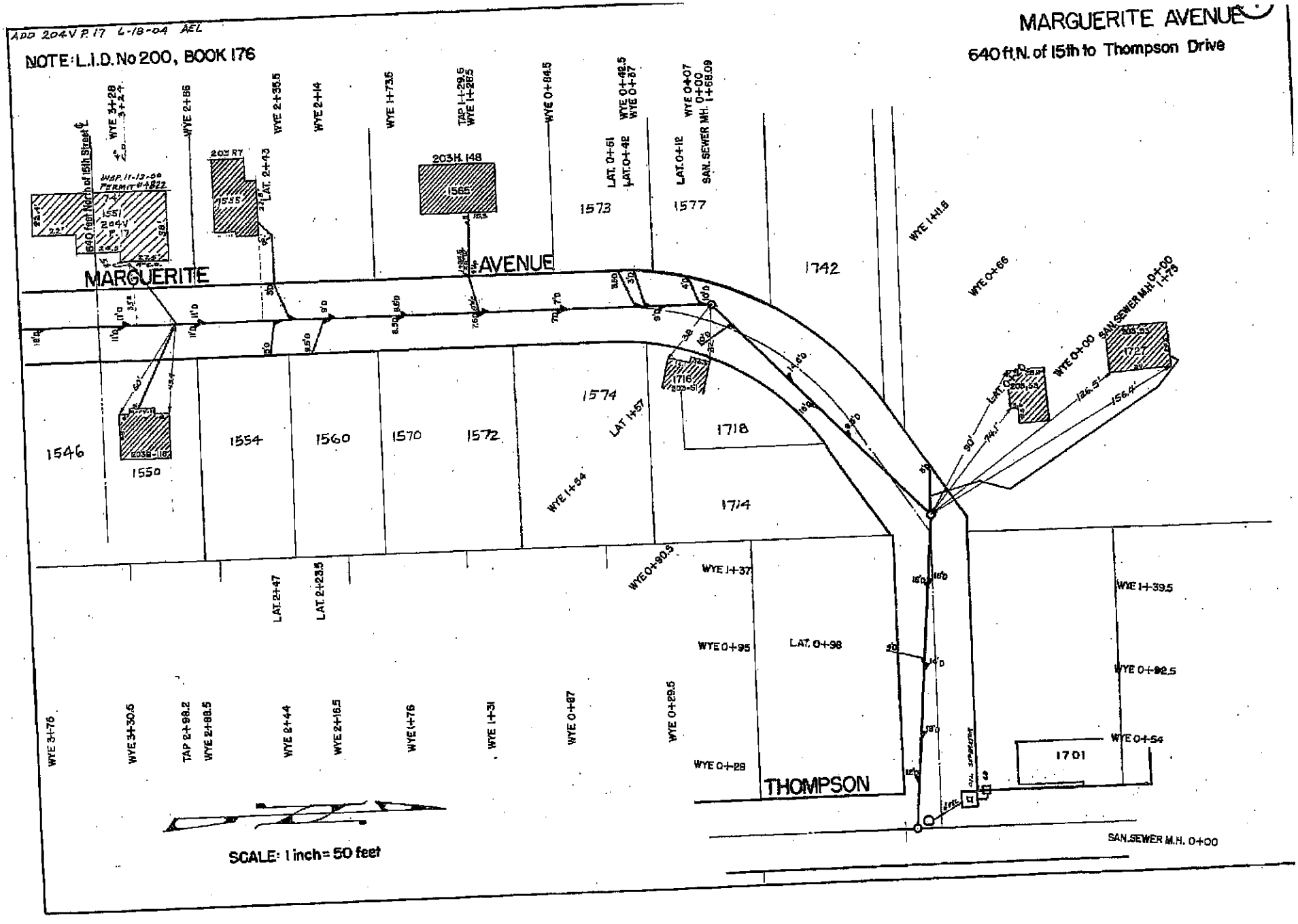
206
112 ✚
105

REVISION BLOCK		
DATE	REASON	INIT
2-25-92	STORM SWR. (18")	AEL
4-20-94	ADD 204T P. 24	AEL

THOMPSON DRIVE
M.H. 600' NORTH OF 15th STREET
NORTH TO END

(2)

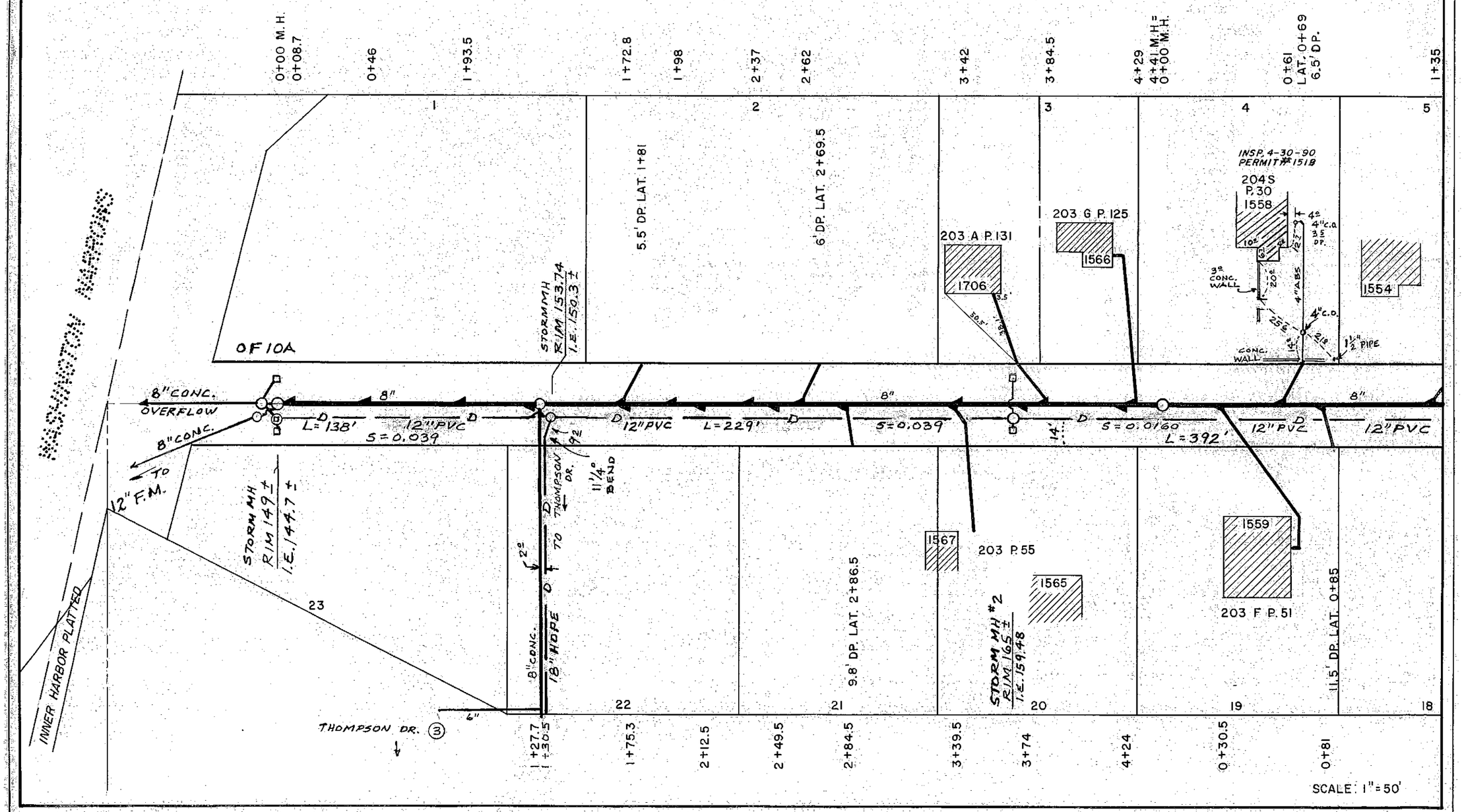


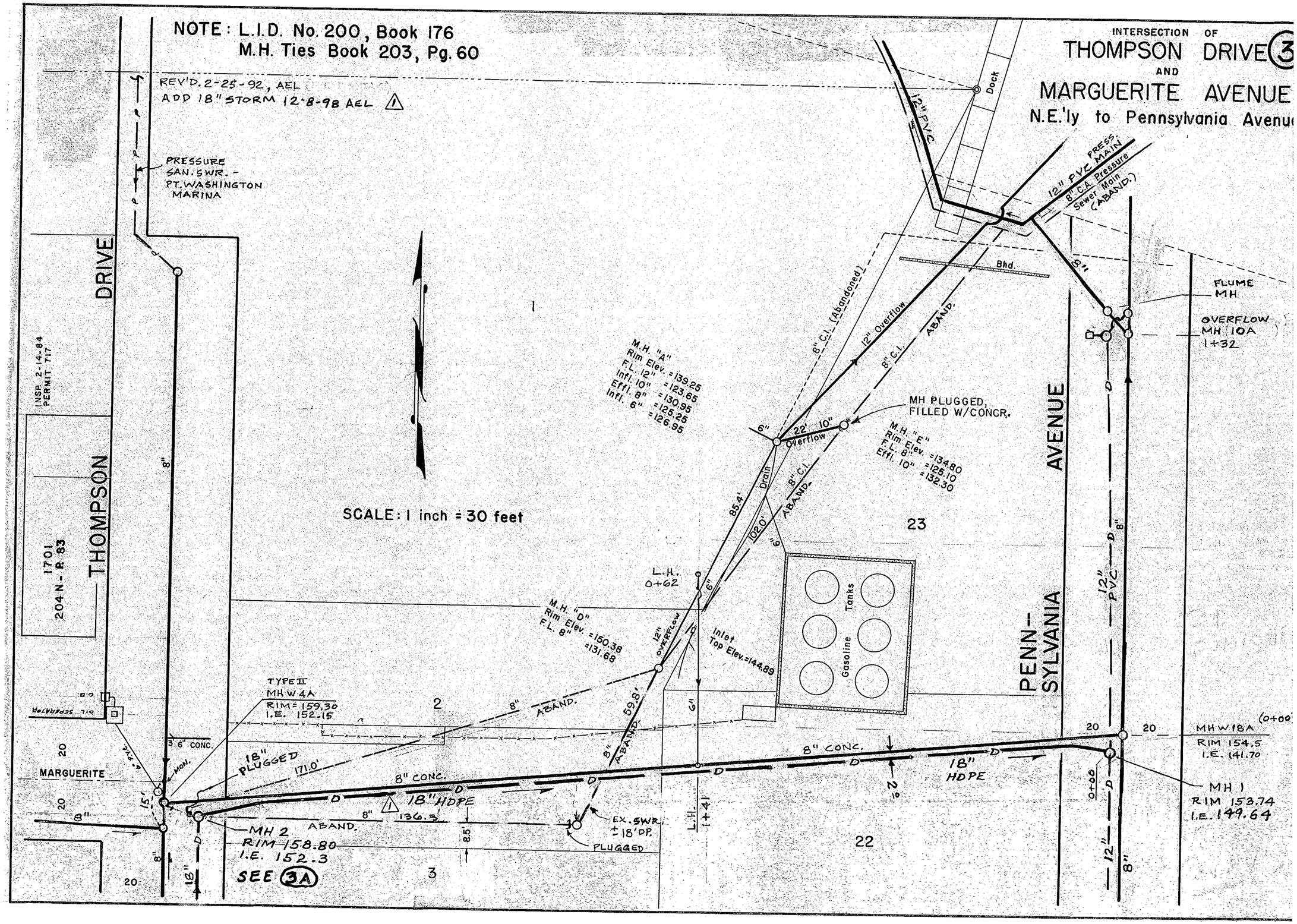

ADD 204V P.17 6-18-04 AEL
NOTE: L.I.D. No 200, BOOK 176
MARGUERITE AVENUE
640 ft.N. of 15th to Thompson Drive
MARGUERITE
AVENUE
THOMPSON
640 feet North of 15th Street
INSP. 11-13-00 PERMIT #4822
1546
1550
1554
1560
1570
1572
1574
1573
1577
1565
1555
1551
1742
1718
1714
1716
1727
1701
WYE 3+28
3+24
WYE 2+86
WYE 2+35.5
WYE 2+14
WYE 1+73.5
TAP 1+29.5
WYE 1+28.5
WYE 0+84.5
LAT. 0+51
LAT. 0+42
WYE 0+42.5
WYE 0+37
LAT. 0+12
WYE 0+07
SAN. SEWER MH. 0+00
1+68.09
WYE 1+41.5
WYE 0+66
WYE 0+00
SAN. SEWER M.H. 0+00
1+73
LAT. 2+43
LAT. 1+57
WYE 1+54
LAT. 2+47
LAT. 2+23.5
WYE 0+90.5
WYE 1+37
WYE 0+95
LAT. 0+98
WYE 1+39.5
WYE 0+92.5
WYE 0+54
WYE 0+29
WYE 3+76
WYE 3+30.5
TAP 2+98.2
WYE 2+88.5
WYE 2+44
WYE 2+16.5
WYE 1+76
WYE 1+31
WYE 0+87
WYE 0+29.5
SAN. SEWER M.H. 0+00
SCALE: 1 inch = 50 feet

REVISION BLOCK		
DATE	REASON	INIT.
5-2-90	NEW CONST.	AEL
12-8-98	12" STORM #1536 N'LY.	AEL

PENNSYLVANIA AVE.

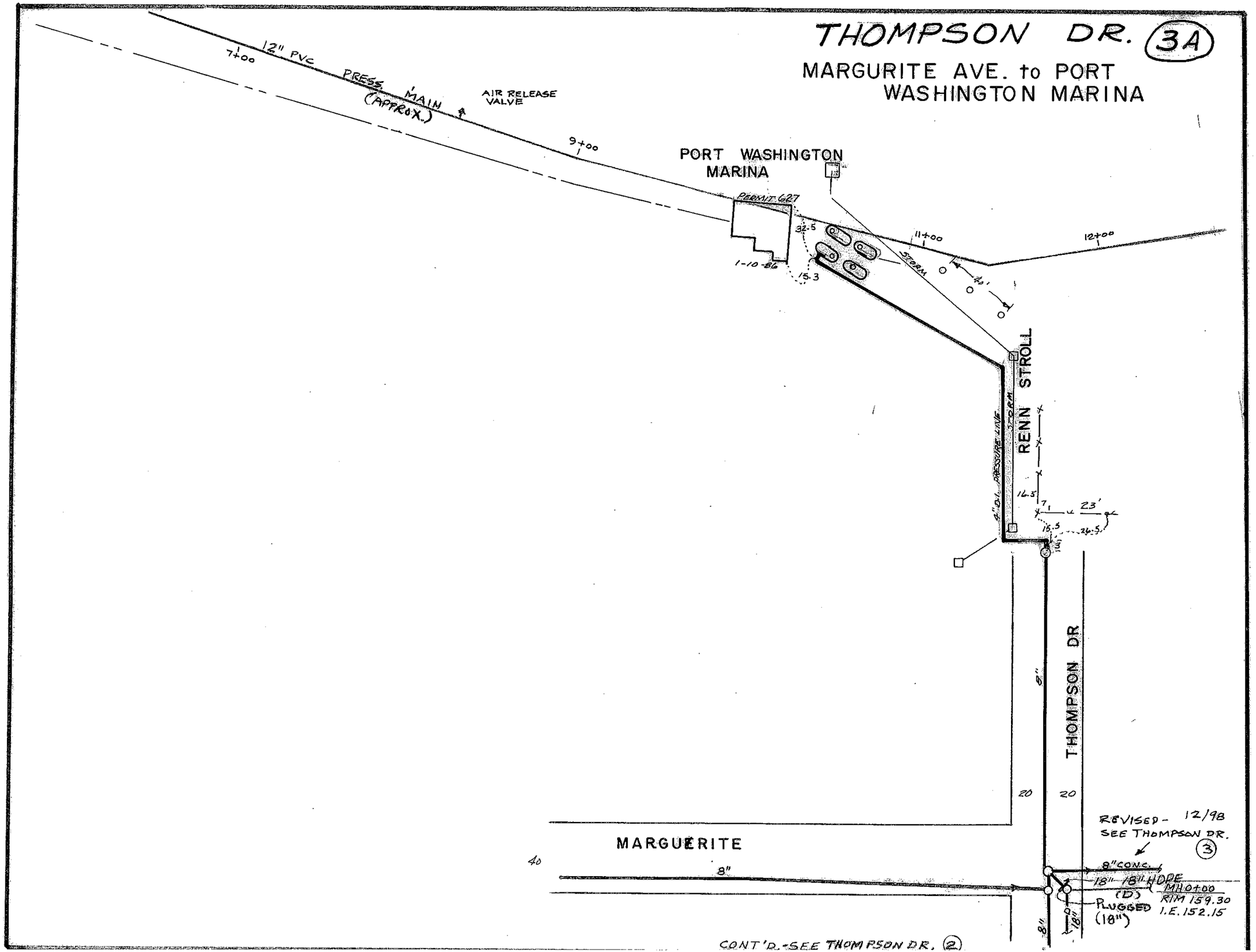
WASHINGTON NARROWS SOUTH (5)




NOTE: L.I.D. No. 200, Book 176
M.H. Ties Book 203, Pg. 60
REV'D. 2-25-92, AEL
ADD 18" STORM 12-8-98 AEL
INTERSECTION OF
THOMPSON DRIVE
AND
MARGUERITE AVENUE
N.E.'ly to Pennsylvania Avenue
PRESSURE SAN. SWR. - PT. WASHINGTON MARINA
THOMPSON DRIVE
INSP. 2-14-84 PERMIT 717
1701
204 N - R 83
SCALE: 1 inch = 30 feet
Dock
12" PVC
12" PVC PRESS. MAIN
8" C.A. Pressure Sewer Main (ABAND.)
Bhd.
FLUME MH
OVERFLOW MH 10A 1+32
M.H. "A"
Rim Elev. = 139.25
F.L. 12" = 123.65
Infl. 10" = 130.95
Effl. 8" = 125.25
Infl. 6" = 126.95
8" C.I. (Abandoned)
12" Overflow
8" C.I. ABAND.
MH PLUGGED, FILLED W/CONCR.
M.H. "E"
Rim Elev. = 134.80
F.L. 8" = 125.10
Effl. 10" = 132.30
22' 10" Overflow
6"
Drain
8" C.I. ABAND.
85.4'
102.0'
6"
23
L.H. 0+62
M.H. "D"
Rim Elev. = 150.38
F.L. 8" = 131.68
12" Overflow
Inlet Top Elev. = 144.89
Tanks
Gasoline
PENN-SYLVANIA
AVENUE
12" PVC
8"
TYPE II MH W4A
RIM = 159.30
I.E. 152.15
2
8" ABAND.
59.8'
8" ABAND.
6"
Oil Separator
3' 6" CONC.
MARGUERITE
20
8"
15'
Mon.
18" PLUGGED
171.0'
8" CONC.
18" HDPE
136.3
8"
ABAND.
8.5'
MH 2
RIM 158.80
I.E. 152.3
SEE 3A
3
18"
EX. SWR. ± 18' DP.
PLUGGED
L.H. 1+41
22
8" CONC.
18" HDPE
2%
20
MH W18A (0+00)
RIM 154.5
I.E. 141.70
0+00
MH 1
RIM 153.74
I.E. 149.64
12"
8"

THOMPSON DR. (3A)

MARGURITE AVE. to PORT WASHINGTON MARINA



HIGH AVE.
17TH ST. TO N. END OF SEWER

6

REVISION BLOCK		
DATE	REASON	INIT.
3-25-76	PER FIELD INSP	G.P.C.
3-20-90	STORM SWR. *	AEL

HARIPAR LEEDS MASS SPH 8642

*SEE HEWITT AVE. STORM SWR. SEPARATION (1984)

M.H. = 4+90.02 FROM NEXT M.H. SOUTH

WYE -0+76 | TAP -0+53 | WYE -0+20 | 0+00 | LAT. WYE 7.5'C. 0+69 0+91 | TAP 7.5'C. 1+16.6 | WYE 7.5'C. 1+44 | LAT. WYE 12'C. 2+02.5 2+04.5 | WYE 17'C. 2+83.02 | WYE 14'C. 3+38.02 | M.H. 3+55.02 0+00 | EL. -108.00 1+77.05

71-5 | 71-6 | 71-7 | 71-8 | 71-9 | 72-2 | 72-1

N.P.# INSP 8-27-57 203 K P.1 — 1559 — LAT. -0+78 — LAT. -0+20 — 1561 — 1701 — N.P.# INSP 7-8-57 203 J 84 — 1707 — 1709 — PERMIT #0388 INSP 7-28-75 — 1721 204F P54 — 1725 — 1731

SANITARY — CUB

4" PVC — 2+10.52 9S — 179°15' — ABAND. PUMP STA. — 12" — D.F. 11

5.5'C. 7.5'C. WALL — 8" SAN. — 6" PRESSURE (Abandoned) — (18" STORM) — 12" OUTFALL

42" S=0.0165 — 42" — S=0.0170 — 42" 12" — 12" — 42" — S=0.0935 OUTFALL

HIGH AVE.

1552 — V. WYE -0+91.5 — LAT. -1+15 — LAT. -1+40 — 1556 — 203 C P.16 INSP 9-13-50 N.P.# — V. WYE -0+43 — WYE -0+19 — 5 — 2 OMARVILLE

17TH ST.

0+25 — 0+55 — 0+67 — 25 — 1704 — 1708 — 1710 — 1712 — 6 — 1 — 1+72 — 2+27 — 2+84.5 — 3+47

N.P.# INSP 1-16-69 — 203P P.38 — 1722 — 4' GATE VALVE EXPOSED — EXPOSED C.O. — CHECK VANE 2.5 DP — END OF EXISTING LAT. 16 DP — 6" PVC PRESSURE SWR. — 6" PVC

MH 18+11 I.E. 153.61 — MH 18+70 I.E. 116.08 IN I.E. 114.99 OUT

MH 13+26 I.E. 166.35 IN I.E. 162.19 OUT — MH 13+80 I.E. 161.30 IN I.E. 160.94 OUT

-1+34 — -1+10 — 0+63 WYE 7.5'C. — 1+26 WYE 7'C. — 1+74 WYE 9'C. — 3+41 LAT. — 3+49.02 WYE 14'C.

NOTE: 73 FT. OF 42" RCP FROM MH 18+11 TO MH 18+70

SCALE - 1 INCH = 50 FEET

203G 27 Aug 8 Vit

APPENDIX D PRELIMINARY SCREENING EVALUATION FOR RECREATIONAL BEACH USER SCENARIO

APPENDIX D
PRELIMINARY SCREENING EVALUATION FOR RECREATIONAL BEACH USER SCENARIO REMOVAL EVALUATION WORK PLAN

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01

June 2013

Prepared by

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

APPENDIX D
PRELIMINARY SCREENING EVALUATION FOR RECREATIONAL BEACH USER SCENARIO

REMOVAL EVALUATION WORK PLAN

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC and Anchor QEA, LLC

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1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a Remedial Investigation and Feasibility Study (RI/FS) at the Bremerton Gas Works Site (Site) in Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) as executed with EPA May 1, 2013.

Prior to execution of the AOC, a Time Critical Removal Action (TCRA) was completed to address sheen and odor observed on the adjacent Washington Narrows beach and associated with discharges from a combined sewer overflow (CSO) adjacent to and sharing historical drainage connections to the former gas works (Anchor QEA 2011).

Submittal of the Removal Evaluation Work Plan (Work Plan) to address potential imminent and substantial threats to human health, welfare, or the environment is the first task under the AOC. The Work Plan presents detailed descriptions of the data collection tasks to be performed to complete the removal evaluation. The Work Plan includes a detailed Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The AOC scope of work (SOW) requires a removal evaluation that includes the collection of 30 surface sediment samples and analysis of polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) as information to help determine whether an additional removal action is warranted. These sediment data will be used to conduct a preliminary screening evaluation of potential Site-related risks using a recreational beach user scenario.

This appendix to the Work Plan describes the preliminary screening of potential human health risks to recreational beach users that will be used to support the removal evaluation. The screening-level risk evaluation will be performed as a supporting piece of information during the removal evaluation of intertidal beach sediments adjacent to the former gas works. This evaluation is intended for limited use during the removal evaluation to help assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the RI/FS. A baseline human health risk assessment (HHRA) and ecological risk assessment will be performed during the RI/FS, and that HHRA may supersede the screening level risk evaluation.

The preliminary screening of human health risks will focus on potential risks associated with dermal contact, incidental ingestion, and inhalation of carcinogenic polycyclic aromatic hydrocarbon (cPAH) compounds in beach sediments. These compounds can be elevated in residuals associated with manufactured gas plant operations. They can also be present in petroleum hydrocarbons, combustion byproducts, treated wood structures, and stormwater.

Section 2 of this appendix describes the methods and exposure assumptions used as the basis of the preliminary beach recreation scenario. Section 3 describes the data evaluation approach and qualitatively identifies associated uncertainties. Section 4 provides the references.

2 Methods and Assumptions

The preliminary recreational beach user scenario presented in this appendix is a risk-based evaluation derived from standardized equations combining site-specific and EPA default exposure information assumptions with current EPA toxicity data. In support of the EPA Superfund cleanup projects, EPA has developed the Regional Screening Levels (RSL) of Chemical Contaminants at Superfund Sites. While the published RSLs are generic, they may be recalculated using site-specific data. To aid in the development of site-specific screening levels at Superfund sites, EPA has provided a web-based RSL calculator. The "Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website provides the calculator, a user's guide, links to EPA guidance, and answers to frequently asked questions regarding the use of RSLs[1]. All computations for the preliminary recreational beach user screening evaluation were done using the RSL calculator.

The following section describes the exposure parameters that are used in the RSL calculator and that can be applied as default values or adjusted using site-specific information. The EPA recreational soil/sediment exposure was used for the current analysis. All assumptions provided with EPA default values were used. Conservative site-specific exposure frequency (days/year) and event time (hours/event) were used as described below

2.1 Default RSL Calculator Parameters

The RSL calculator default age-dependent exposure parameters and values are summarized in Table D-1. The total exposure duration for the beach use scenario was 30 years, applied using early life stage adjustments to account for mutagenic effects of benzo(a)pyrene (EPA 2011). Body weight, skin surface area, skin adherence factors, and soil ingestion rates are based on RSL calculator default values for the residential soil scenario and were not modified. While the RSL inputs are updated periodically, the current RSLs are based on default exposure parameters and factors that represent reasonable maximum exposure (RME) conditions for long-term/chronic exposures and that are based on the methods outlined in EPA's Risk Assessment Guidance for Superfund, Part B Manual (1991) and Soil Screening Guidance documents (1996 and 2002). In 2011, EPA updated the Exposure Factors Handbook (EFH; EPA 2011) but the newer parameters have not yet been incorporated into the RSLs. Updating the exposure parameters based on the newer EFH is beyond the scope of this screening evaluation. During the RI/FS, the HHRA will apply current EPA guidance, including the EFH, to develop a site-specific conceptual exposure model and determine appropriate exposure parameters.

[1] EPA 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

Table D-1
RSL Calculator Default Age-dependent Exposure Parameters and Values

Age Class	Body Wt (kg)	Skin Surface Area (cm^2)	Skin Adherence Factor (mg/cm^2)	Soil Ingestion Rate (mg/day)	Exposure Duration (years)	Mutagenic Adjustment (unitless)
0-2	15	2800	0.2	200	2	10
2-6	15	2800	0.2	200	4	3
6-16	70	5700	0.07	100	10	3
16-30	70	5700	0.07	100	14	1

2.2 Site-Specific Parameters

Beach play exposure frequency values have been evaluated recently by EPA at other marine sediment sites with similar accessibility and characteristics, including at the Lower Duwamish Waterway (LDW) Superfund Site. The beach play exposure analysis for the LDW Site was summarized in the final HHRA performed during the RI/FS study process (Windward 2007), and used an exposure frequency of 65 days/year. This is more conservative than the exposure frequency used by the Washington Department of Ecology (Ecology 2012) in its generic beach play scenario (41 days/year) for developing cleanup levels at State-lead cleanup sites.

The preliminary recreational beach user risk scenario to be used at the Site will use an exposure frequency of 65 days per year. This exposure frequency represents the 95th percentile for children from birth to 6 years of age who engage in playing and digging in the sand adjacent to the water and is based on a King County survey of established parks (Lake Union, Lake Washington, and Lake Sammamish) with sandy beaches (Parametrix 2003). These King County park areas are likely to have higher visitation rates than the beach adjacent to the Site.

The event time for the assumed recreational beach user scenario is 6 hours per event. This value is conservative for a tidally-inundated beach area. This value is applied to the estimate of inhalation exposure. For the purpose of developing the preliminary beach user screening evaluation, this value was assumed to be 6 hours per visit. Because cPAH compounds have very low volatility, the estimated exposure is very low and the contribution to risk is approximately four orders of magnitude lower than for soil ingestion or dermal contact. Regardless, the preliminary beach user scenario is based on all three exposure pathways: inhalation of soil vapor, soil ingestion, and dermal contact, consistent with the RSL calculation methods.

3 Data Evaluation and Uncertainty

The following sections describe the preliminary beach user screening evaluation and identify potential sources of uncertainty. A formal uncertainty evaluation will be completed as part of the baseline risk assessment that will be completed during the RI/FS process.

3.1 Preliminary Recreational Beach User Screening Evaluation

The preliminary recreational beach user scenario results in a protective total cPAH Toxic Equivalency Quotient (TEQ) concentration of 8 milligrams per kilogram (mg/kg) at the 10^{-4} risk level and 0.08 mg/kg at the 10^{-6} risk level (Table D-3). The use of this value in the screening of surface sediment samples collected under the Work Plan will be conducted in coordination with EPA.

3.2 Screening Evaluation Uncertainty

Uncertainties in the screening evaluation may include those associated with the default RSL calculator values as well as the assumed site-specific exposure frequency and event duration. Regarding the RSL calculator default values, EPA has issued new guidance updating the current scientific basis of exposure (Exposure Factors Handbook; EPA 2011). This new guidance has not yet been incorporated into the RSL calculator. Because this screening evaluation is being conducted in advance of the RI/FS and has a limited purpose in informing the removal evaluation, establishing site-specific exposure assumptions for parameters like body weight, skin surface area and skin adherence factors were determined to be beyond the scope of this work. The current EFH and other risk assessment requirements and guidance will be addressed fully in the risk assessment work plan, which will be prepared in coordination with EPA as part of the RI/FS process

The preliminary recreational beach user scenario assumed an exposure frequency of 65 days based on a regional survey of park beaches, as described above in Section 2.2. For reference, Ecology (2012) has also developed a beach play scenario for use in evaluating human health risk under the Washington Sediment Management Standards (SMS). The exposure frequency for the SMS beach play scenario is 41 days, based on the assumption that beach visits occur 3 days per week during school vacation, and 1 day per week for 5 weeks from mid-September to the end of October.

As described in Section 2.2, the assumption of 65 daily visits per year is likely to be conservative because the beach adjacent to the Site lack the amenities found at the King County parks (i.e., rest rooms, picnic tables, lawn, parking area). As such, the Ecology (2012) value of 41 daily visits per year may be a more reasonable estimate for an area like the Washington Narrows beach adjacent to the Site. A complete evaluation of relevant recreational beach user exposure frequencies and associated uncertainty will be completed during the risk assessment.

3.3 Exposure Data Uncertainty

Uncertainty around the exposure to total cPAHs TEQ in beach sediments can take two forms, in the calculation of the total cPAH TEQ and in the estimation of exposure to recreational beach users. These two forms of uncertainty will be evaluated in the risk assessment conducted during the RI/FS process and are outside of the scope of the Work Plan.

3.3.1 Total cPAH TEQ Calculation

The differences in the way the sample total cPAH TEQ is calculated may over or underestimate the true potency of the benzo(a)pyrene equivalent concentration. The total cPAH concentration is computed with individual cPAH weighted according to their benzo(a)pyrene toxicity equivalency factor (TEF). The total cPAH TEQ is the weighted sum of the individual compounds (Table D-2). As additional toxicity data have been developed by researchers, TEFs have been updated in the scientific literature (e.g., EPA 1993, Collins et al. 1998, CalEPA 2002). Promulgated TEFs under the Washington Model Toxics Control Act (MTCA) may be changed depending on programmatic updates (e, g., MTCA 2001 and MTCA 2007).

Table D-2
Summary of cPAH Toxicity Equivalency Factors

Compound	EPA (1993)/EPA RSL Calculator	CalEPA (2002)/ MTCA 2007
Benzo(a)pyrene	1	1
Benz(a)anthracene	0.1	0.1
Benzo(b)fluoranthene	0.1	0.1
Benzo(k)fluoranthene	0.01	0.1
Chrysene	0.001	0.01
Dibenz(a,h)anthracene	1	0.1
Indeno(1,2,3-c,d)pyrene	0.1	0.1

For the removal evaluation, the TEFs from EPA (1993) *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* will be applied to calculate sample total cPAH TEQ concentrations. The EPA RSL webpage users guide (November 2012) references the EPA (1993) TEFs for comparison to RSLs. As an additional point of comparison, the TEFs promulgated under the current MTCA rule (2007) will be applied to calculate cPAH TEQ values used in exposure estimates. The MTCA cPAH TEQ values will be calculated because they represent a more current evaluation of cPAH potency and because MTCA is an applicable or relevant and appropriate requirement (ARAR) under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). To better understand the uncertainty associated with censored data, sample total cPAH TEQ concentrations will be calculated in two ways, with undetected compounds set equal to zero or equal to one-half.

3.3.2 Recreational Beach User Exposure Concentrations

For the Removal Evaluation Report, surface sediment analytical data will be summarized in tables and presented on figures depicting station sample concentrations of total cPAH TEQ results. The evaluation of the risk screening results will be performed in coordination with EPA.

4 References

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Windward, 2007. Lower Duwamish Waterway, Final Remedial Investigation, Baseline Human Health Risk Assessment.

TABLE D-3
WEBSITE OUTPUT FILE: EPA REGIONAL SCREENING LEVEL RISK CALCULATOR INPUTS AND RESULTS FOR RECREATIONAL BEACH USER SCENARIO

Site-specific

Recreator Equation Inputs for Soil

Variable	Value
TR (target cancer risk) unitless	1.0E-6
SA_{recsc} (skin surface area - child) cm^2/day	2800
SA_{recsa} (skin surface area - adult) cm^2/day	5700
SA_{0-2} (skin surface area - mutagenic) cm^2/day	2800
SA_{2-6} (skin surface area - mutagenic) cm^2/day	2800
SA_{6-16} (skin surface area - mutagenic) cm^2/day	5700
SA_{16-30} (skin surface area - mutagenic) cm^2/day	5700
SA_{recsa} (skin surface area - adult) cm^2/day	5700
THQ (target hazard quotient) unitless	1
LT (lifetime - recreator) year	70
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7428.571
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	23452
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	31819.048
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	93955.333
EF_{0-2} (exposure frequency) day/year	65
EF_{2-6} (exposure frequency) day/year	65
EF_{6-16} (exposure frequency) day/year	65
EF_{16-30} (exposure frequency) day/year	65
EF_{recsc} (exposure frequency - child) day/year	65
EF_{recsa} (exposure frequency - adult) day/year	65
EF_{recsa} (exposure frequency - adult) day/year	65
EF_{recs} (exposure frequency - recreator) day/year	65
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-30} (soil intake rate) mg/day	100
IRS_{recsc} (soil intake rate - child) mg/day	200

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Site-specific

Recreator Equation Inputs for Soil

Variable	Value
IRS_{recsa} (soil intake rate - adult) mg/day	100
IRS_{recsa} (soil intake rate - adult) mg/day	100
ED_{0-2} (exposure duration) year	2
ED_{2-6} (exposure duration) year	4
ED_{6-16} (exposure duration) year	10
ED_{16-30} (exposure duration) year	14
ED_{recsc} (exposure duration - child) year	6
ED_{recsa} (exposure duration - adult) year	24
ED_{recsa} (exposure duration - adult) year	24
ED_{recs} (exposure duration - recreator) year	30
ET_{0-2} (exposure time) hr/day	6
ET_{2-6} (exposure time) hr/day	6
ET_{6-16} (exposure time) hr/day	6
ET_{16-30} (exposure time) hr/day	6
ET_{recsc} (exposure time - child) hr/day	6
ET_{recsa} (exposure time - adult) hr/day	6
ET_{recsa} (exposure time - adult) hr/day	6
ET_{recs} (exposure time - recreator) hr/day	6
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	70
BW_{16-30} (body weight) kg	70
BW_{recsc} (body weight - child) kg	15
BW_{recsa} (body weight - adult) kg	70
BW_{recsa} (body weight - adult) kg	70
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07

Site-specific

Recreator Equation Inputs for Soil

Variable	Value
AF_{recsc} (skin adherence factor - child) mg/cm^2	0.2
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
City (Climate Zone) PEF Selection	Default
A_s (acres) PEF Selection	0.5
Q/C_{wp} (g/m^2-s per kg/m^3) PEF Selection	93.77
PEF (particulate emission factor) m^3/kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependant on U_m/U_t) unitless	0.194
City (Climate Zone) VF Selection	Default
A_s (acres) VF Selection	0.5
Q/C_{wp} (g/m^2-s per kg/m^3) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ_b (dry soil bulk density) g/cm^3	1.5
ρ_s (soil particle density) g/cm^3	2.65
θ_w (water-filled soil porosity) L_{water}/L_{soil}	0.15
T (exposure interval) s	9.5e8
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845

Site-specific

Recreator Screening Levels (RSL) for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,
Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),
Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA	Volatilization Factor (m^3/kg)
Benzo[a]pyrene	50-32-8	Yes	No	7.30E+00	I	1.10E-03	C	-		-		1	0.13	1	-

Chemical	Soil Saturation Concentration (mg/kg)	Particulate Emission Factor (m^3/kg)	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL (Child) HQ=1 (mg/kg)	Dermal SL (Child) HQ=1 (mg/kg)	Inhalation SL (Child) HQ=1 (mg/kg)	Noncarcinogenic SL (Child) HI=1 (mg/kg)
Benzo[a]pyrene	-	1.36E+09	1.10E-01	2.87E-01	2.56E+04	7.95E-02	-	-	-	-

Chemical	Ingestion SL (Adult) HQ=1 (mg/kg)	Dermal SL (Adult) HQ=1 (mg/kg)	Inhalation SL (Adult) HQ=1 (mg/kg)	Noncarcinogenic SL (Adult) HI=1 (mg/kg)	Screening Level (mg/kg)
Benzo[a]pyrene	-	-	-	-	7.95E-02 ca

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APPENDIX B
FINAL QUALITY ASSURANCE PROJECT PLAN ADDENDUM

FINAL QUALITY ASSURANCE PROJECT PLAN ADDENDUM

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
December 2013

Prepared by

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FINAL QUALITY ASSURANCE PROJECT PLAN ADDENDUM

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
December 2013

Aspect Consulting, LLC & Anchor QEA, LLC

Approvals:

Project Manager Jeremy Porter, Aspect	December 3, 2013 Date
Project Manager Mark Larsen, Anchor QEA	December 3, 2013 Date
EPA Remedial Project Manager William Ryan, EPA	Date
EPA Project On Scene Coordinator Kathy Parker, EPA	Date

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1 Field Forms

Acronyms

°C	degrees Celsius
AOC	Administrative Settlement Agreement and Order on Consent
ARI	Analytical Resources, Inc.
ASTM	ASTM International
Cascade	Cascade Natural Gas Corporation
CCB	continuing calibration blanks
CCV	continuing calibration verifications
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain-of-custody
DQO	data quality objective
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FC	Field Coordinator
FSP	Field Sampling Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICV	initial calibration verification
LDC	Laboratory Data Consultants
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Materials
OSC	On-scene Coordinator
OSHA	Occupational Safety and Health Administration
PID	photo-ionization detector
PM	Project Manager

QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SIM	Select Ion Monitoring
Site	Bremerton Gas Works Site
SOP	standard operating procedure
SRM	Standard reference materials
TCRA	Time Critical Removal Action
VOC	Volatile organic compound
Work Plan	Removal Evaluation Work Plan

1 Distribution List

All group leaders and technical advisors will receive copies of this Quality Assurance Project Plan (QAPP) and any approved revisions.

This list identifies all individuals to receive one copy of the approved QAPP:

- U.S. Environmental Protection Agency (EPA) Remedial Project Manager – William Ryan
- EPA Project On-site Coordinator – Kathy Parker
- EPA Region Quality Assurance (QA) Manager – Ginna Grepo-Grove
- Cascade Project Manager – Kalle Kuether Godel
- Anchor QEA Project Manager – Mark Larsen
- Anchor QEA Task Manager – Dan Hennessey
- Anchor QEA Field Coordinator – Nik Bacher
- Anchor QEA Health and Safety Officer – Nathan Soccorsy
- Anchor QEA QA Manager – Delaney Peterson
- Analytical Resources, Inc. (ARI) Laboratory Project Manager – Cheronne Oreiro

2 Document Organization

Responsibilities of the team members, as well as laboratory project manager, are described in the following paragraphs. Because the individuals listed below may change over time, this QAPP refers to these individuals alternately as "designee." The following paragraphs define their functional responsibilities.

2.1 Management

The Regional Project Manager (RPM) is **William Ryan** of EPA. The primary role of the RPM is to ensure compliance with the EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. EPA is the lead agency for this work.

The EPA On-scene Coordinator (OSC) is **Kathy Parker**. The EPA OSC will be responsible for overseeing the removal evaluation. The EPA QA manager is **Ginna Grepo-Grove**. The QA manager is responsible for the QAPP review and approval and for providing QA oversight during sampling and analysis activities in support of the removal evaluation.

Cascade Natural Gas Corporation (Cascade) is the Respondent. **Kalle Kuether Godel** is the Cascade representative. The Anchor QEA project manager (PM) is **Mark Larsen**. The PM is responsible for implementing activities described in this QAPP. **Dan Hennessy** of Anchor QEA will be the task manager assisting the PM. The project and task managers will be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The project and task managers will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this QAPP. Resolution of project concerns or conflicts related to technical matters will also be the responsibility of the project managers.

2.2 Field Coordinator

The Anchor QEA field coordinator (FC) will be Nik Bacher. The FC will be responsible for day-to-day technical and QA/ Quality Control (QC) oversight. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratory for chemical and physical analyses.

2.3 Site Health and Safety Officer

The Anchor QEA Site Safety and Health Officer is **Nathan Soccorsy**. The Site Safety and Health Officer will be responsible for managing on-Site health and safety activities and will provide support to the project manager and field coordinator on health and safety issues.

2.4 Quality Assurance/Quality Control Manager

Delaney Peterson will serve as the Anchor QEA QA Manager. The QA Manager will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratory, ensuring data quality, overseeing data validation, and supervising project QA coordination.

2.5 Data Manager

Laurel Menoche will serve as the Anchor QEA Data Manager. The data manager will compile field observations and analytical data from the laboratory into a database, review the data for completeness and consistency, append the database with qualifiers assigned by the data validator, and ensure that the data obtained is in a format suitable for inclusion in the appropriate databases and delivery to EPA.

2.6 Laboratory Project Manager and Data Validation Manager

Cheronne Oreiro will serve as the laboratory project manager at ARI. The laboratory project manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical analyses, and laboratory report preparation for this project. The laboratory manager will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analyses.

The analytical testing laboratory will be responsible for the following:

- Perform the methods described in this QAPP, including those methods referenced for each analytical procedure.
- Follow documentation, custody, and sample logbook procedures.
- Meet all reporting and QA/QC requirements.
- Deliver electronic data files as specified in this QAPP.
- Meet turnaround times for deliverables as described in this QAPP.
- Allow EPA and the QA/QC contractor to perform laboratory and data audits.

The Data Validation project manager will be **Ming Hwang** of Laboratory Data Consultants (LDC), and she will serve as the primary contact to perform all applicable third-party data validation.

3 Problem Definition/Background

Cascade is conducting an evaluation to assess whether a removal action is warranted at the Bremerton Gas Works Site (Site), Bremerton, Washington (Figure 1). The work is being conducted under the direction of the EPA under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013.

This QAPP Addendum presents detailed descriptions of the tasks to be performed during subsurface sampling and analysis as part of the Removal Evaluation. Surface sediment samples were collected per the Removal Evaluation Work Plan in July 2013 (Work Plan; Aspect and Anchor QEA 2013). Results from the initial sample collection and analyses indicated that subsurface sample collection is necessary to develop the preliminary conceptual site model as discussed in Section 2.3 of the Statement of Work (SOW). The collection of additional subsurface data addresses data gaps associated with the following:

1. Defining the nature and extent of hydrocarbon sheen and associated cPAH contamination in subsurface sediments in SG-04/SG-05 area.
2. Provide subsurface sediment stratigraphy in the SG-04/SG-05 area to support development of a conceptual site model

This QAPP Addendum was prepared in accordance with EPA Requirements for Quality Assurance Project Plans (EPA 2001) and EPA Guidance on Quality Assurance Project Plans (EPA 2002a). Analytical QA/QC procedures were also developed based on the analytical protocols and QA guidance of:

- EPA's *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition* (EPA 1986).
- *Guidance on Environmental Data Verification and Validation* (EPA 2002b).
- *Quality Assurance/Quality Control Guidance for Removal Activities* (EPA 1990).
- *Contract Laboratory Program National Functional Guidelines for Data Review* (EPA 1999, 2004, 2008).

4 Project Task/Description

This QAPP Addendum details the collection of up to eight subsurface sediment samples from borings advanced using Geoprobe® technology at the locations shown on Figure 2. Subsurface sediment will be collected during low tide to a target depth of 15 feet or refusal. The results of the borings will be used to address data gaps defined in Section 3.

The recovered subsurface sediment will be characterized for lithology and processed into samples, with up to four sample intervals submitted for analysis per location. Samples will be collected into decontaminated stainless steel bowls using stainless steel spoons, homogenized, and placed into pre-labeled sample containers unless specified otherwise (i.e., volatile organic compound [VOC] collection). Collection of subsurface sediment touching the sidewalls of the sampler will be avoided.

Contingent subsurface sediment samples collected and archived will be discussed with EPA. Some of these archived samples may be subjected to chemical analyses if directed by EPA.

5 Data Quality Objectives and criteria

Data Quality Objectives (DQOs) provide a qualitative and quantitative framework and series of planning steps based on the scientific method around which data collection programs can be designed. The use of DQOs ensures that:

- The objectives of the investigation are clearly defined (see Section 3)
- The type, quantity, and quality of environmental data used in decision making are appropriate for their intended application
- Acceptable levels of decision error and performance goals are specified, such that the quantity and quality of data needed to support management decisions are provided

5.1 Measurement Quality Objectives for Chemical Data

The primary analytical DQO for this project is to ensure that the data collected are of known and acceptable quality so that the project objectives described can be achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, completeness, and sensitivity. Definitions of these parameters and the applicable QC procedures are included in this section. Quantitative goals for each analytical parameter are listed in Table 1. Project-specific control limits will be used to assess analytical performance with regard to precision and accuracy and are outlined in Table 2. Data representativeness will be addressed by the sample quantities and locations. Data comparability will be achieved through the use of standard EPA-approved methods. Data completeness will be assessed at the conclusion of analytical activities.

The six parameters of QC indicators are:

- Precision
- Accuracy
- Representativeness
- Comparability
- Completeness
- Sensitivity

Each parameter is defined below. Specific QA objectives for sample collection and analyses are set forth in other sections of this QAPP as referenced below.

5.2 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and in laboratory analysis. ASTM International (ASTM) recognizes two levels

of precision: repeatability: 1) the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions and reproducibility; and 2) the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material (ASTM 2002).

In the laboratory, "within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of blind field duplicates for chemistry samples at a frequency of 5 percent of samples analyzed. Field chemistry duplicate precision will be screened against a RPD of 50 percent for sediment samples. However, no data will be qualified based solely on field homogenization duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\text{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

RPD	=	relative percent difference
C1	=	larger of the two observed values
C2	=	smaller of the two observed values

5.3 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, spiked project samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative laboratory control sample, and matrix spike recovery performance criteria outlined in Table B-1. Surrogate spike recoveries will be evaluated against laboratory control limits and internal standard recoveries will be evaluated against method criteria. Accuracy can be expressed as a percentage of the true or reference value, or as a percentage of the spiked concentration. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/Csa$$

Where:

%R	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
Csa	=	actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in the Field Sampling Plan (FSP; Appendix A of the Work Plan).

5.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the sampling program, the list of analytes has been identified to provide a comprehensive assessment of the known and potential contaminants at the Site.

5.5 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats, and of common traceable calibration and reference materials.

5.6 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{\text{(Number of acceptable data points)} \times 100}{\text{(Total number of data points)}}$$

The DQO for completeness for all components of this project is 95 percent. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

5.7 Sensitivity

Sensitivity is measured by the achievable laboratory detection and reporting limits. The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Laboratory reporting limits (RLs) are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Detected results will be reported to the MDL level and non-detected results will be reported to the RL due to the 50 percent false negative rate assumed at the MDL level. Results between the MDL and the RL will be qualified "J" to indicate they are estimated.

The sample-specific MDL and RL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the reporting limit (e.g., dilution factor, percent moisture, sample mass). In the event that the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., reporting limits less than criteria are achieved), EPA will be contacted to discuss an acceptable resolution.

6 Special Training/Certification

For sample collection tasks, it is important that field crews are trained in standardized sample collection requirements so that the samples collected and subsequent data generated are consistent with project requirements. All field crew are fully trained in the operation of equipment, collection and processing of subsurface sediments, decontamination protocols, visual inspections, and sample transport and chain-of-custody procedures. All field staff are required to read this QAPP prior to beginning field work. All field staff are also required to participate in a field project kick-off meeting to review project goals and to verify that staff understand and are trained for the site-specific field tasks that will be conducted to achieve the goals. Training requirements for field tasks for the removal evaluation will be documented on the Field Training Documentation Form (Attachment A). Upon completion of project training and competency certification, the Anchor QEA project manager will sign-off on this form to document the qualifications and training of the field crew.

The Occupational Safety and Health Administration (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health (29 CFR 1910.120). All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and annual 8-hour refresher courses to meet the OSHA regulations.

7 Documents and Records

Two types of data will be generated for this project: field data and laboratory data. Procedures for transmitting and reporting each type of data are described below.

- **Field Data**: Field measurements and observations will be recorded in logbooks or on appropriate field forms. The field team members should review the field data for completeness or errors daily before submitting the forms to the Task Manager. Field data forms will be reviewed daily by the Task Manager. The Site logbook, daily reports, and copies of field data forms will be maintained by Anchor QEA as required by the AOC.
- **Laboratory Data**: The laboratory data reports will be stored electronically and will be maintained by Anchor QEA as required by the AOC. The electronic data deliverables will be uploaded into the project database. All data entered into the database will be compared to hard copy laboratory data and/or electronic laboratory submittals and to data validation reports to ensure the correct results have been entered before use.

The laboratory will be required, where applicable, to provide the following in a laboratory report:

- **Project Narrative**. This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate.
- **Chain of Custody Records**. Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- **Sample Results**. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample extraction
  - Date and time of analysis
  - Weight and/or volume used for analysis
  - Final dilution volumes or concentration factor for the sample
  - Identification of the instrument used for analysis
  - Method detection limits
  - Method reporting limits

- Analytical results with reporting units identified
- Data qualifiers and their definitions

- **QC Summaries.** This section will contain the results of the laboratory QC procedures. Each QC sample analysis will be documented with the same information required for the sample results (see above). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
  - Calibration Data Summary. This summary will report the concentrations of the initial calibration and daily calibration standards, and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, r-value, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be documented.
  - Internal Standard Area Summary. The area counts of internal standard areas will be reported and compared to method criteria.
  - Method Blank Analysis. The method blank analyses associated with each sample and the concentrations of all compounds of interest will be reported.
  - Surrogate Spike Recovery. This will include all surrogate spike recovery data for organic compounds. The names of all compounds added, percent recoveries, and range of acceptable recoveries will be listed.
  - Matrix Spike Recovery. All matrix spike recovery data for all applicable analyses will be reported. The names and concentrations of all compounds added, percent recoveries, and range of acceptable recoveries will be listed. The RPD for all matrix spike duplicate analyses will be included.
  - Matrix Duplicate. RPD values for all matrix duplicate analyses will be reported.
  - Laboratory Control Sample. All laboratory control sample recovery data will be reported. The names and concentrations of all compounds added, percent recoveries, and range of acceptable recoveries will be listed. The RPD for all laboratory control sample duplicate analyses will be included.
  - Relative Retention Time. The relative retention times of each analyte detected in the samples for both primary and confirmational analyses will be reported.
  - Original Data. Legible copies of the original data generated by the laboratory will include:
    - Sample extraction, preparation, and cleanup logs
    - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
    - Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials

- Spectra of detected compounds with associated best-match spectra for each sample
- Printouts and quantitation reports for each instrument used, including reports for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
- Original data quantification reports for each sample
- Original data for blanks and samples not reported

All data from this project will be stored electronically in Anchor QEA's project files. In addition to the laboratory report including all elements outlined above in pdf format, the laboratory will also provide results in Anchor QEA's custom EQUiS four-file format

8 Sampling Process Design

Subsurface sediment will be collected and analyzed from eight stations, respectively, as shown on Figure 2, to develop the conceptual site model. Final sampling locations may be adjusted in the field based on drill rig access. Subsurface sampling methods are discussed in more detail below in Section 9.

9 Sampling Methods

This section describes decontamination procedures, sediment sample collection methods, and sample containers, preservation, and hold times. Subsurface sediment collection will be performed by direct-push Geoprobe® methodology. Sample containers, hold times, and preservation requirements are listed in Table 3.

9.1 Field Equipment Decontamination

To prevent sample cross contamination, sampling and processing equipment in contact with the samples will undergo the following decontamination procedures prior to and between collection activities in accordance with EPA protocols (EPA 2001). Between sample collection activities, all sample collection and homogenization equipment that will come in contact with the sample will be decontaminated prior to use by the following procedure:

- Rinse with Site or potable water and wash with scrub brush until free of sediment.
- Wash with phosphate-free detergent (e.g., Alconox®).
- Visually inspect the equipment and repeat the scrub and rinse step, if necessary.
- Rinse with potable water.
- Rinse with distilled water.
- Cover decontaminated equipment with aluminum foil.

9.2 Subsurface Sediment Collection

Eight direct-push borings will be advanced along two transects perpendicular to the shoreline in order to define the vertical and horizontal extent of potential contamination in the sediment (Figure 2). The transects will be spaced approximately 25 feet apart and sample locations will be spaced approximately 25 feet apart within each transect. Final sampling locations will be determined in the field based on drill rig access.

Subsurface sediment borings will be collected using a limited access Geoprobe® drill rig. Sediment samples from the borings will be collected continuously in 5-foot intervals, beginning at the ground surface and extending to a maximum depth of 15 feet, or refusal. Up to three borings will be pushed if refusal is encountered before moving on to the next sampling location. The lithology will be logged by the field staff for each boring in accordance with ASTM International Method D 2488, including soil descriptions, field screening results, and other relevant details (e.g., staining, debris, odors, etc.). Subsurface sediments will be field screened with a photo-ionization detector (PID) to evaluate the presence of VOCs. Select sediment samples will be submitted for VOC analysis per the requirements set forth in this QAPP.

The field sampling procedures are described in the section below. Field sampling data will be recorded and documented on field forms in Attachment A. The one-call utility location service and a private utility location service will be contacted to confirm the

locations of subsurface utilities before any drilling activities are performed. In addition, the City of Bremerton will be contacted in order to locate the sanitary sewer running along the shoreline in the investigation area.

The subsurface sediment borings will be advanced using 3-inch-diameter steel casing from a limited access Geoprobe® rig extending from the surface to a maximum of 15 feet or refusal. The 3-inch-diameter steel casing will be lined with a disposable acetate sleeve that will be removed and opened to reveal each 5-foot maximum sample interval. The intervals pushed by the Geoprobe® rig may be less than 5 feet based on subsurface conditions encountered, and will be advanced in such a way as to maximize sample recovery. Boring locations may be adjusted within an approximately 5-foot radius of the target location based on locations of utilities or other access conditions. Coarse gravel and cobbles will be removed from the sample interval prior to sample collection. Up to 4 samples from each boring will be collected based on lithological changes or observed hydrocarbon impact. In the event no apparent lithological change or hydrocarbon impact is observed, then samples will be collected every 3 feet to the bottom of the boring.

Subsurface sediment samples will be collected from the borings for potential laboratory analysis. The samples will be collected and handled in accordance with the following procedures:

- Subsurface sediment samples will be collected directly from the Geoprobe® sampler using stainless steel sampling tools. Non-dedicated and non-disposable sampling equipment will be decontaminated between uses, as outlined in Section 9.1.
- Subsurface sediment borings will be digitally photographed, with respective boring identification and sample location markers visible in the photos.
- The following information at a minimum will be logged by the field geologist: sample depth, Unified Soil Classification System description, soil moisture, occurrence of groundwater, physical indications of potential contamination (e.g., odor, staining), and field-screening results obtained using a photoionization detector.
- The sediment sample will be transferred to a decontaminated stainless steel bowl, homogenized to a uniform color and consistency, and placed into laboratory-supplied sample containers. Care will be taken not to handle the seal or inside cap of the container when the sample is placed into the containers. Sample aliquots collected for VOC analyses by EPA method 5035A if possible, or will be transferred directly into sample containers and the containers will be filled to eliminate headspace.
- The sample containers will be labeled with the media, date and time collected, sample identification and number, project name, project number, and sampler's initials.
- The sample will be logged on a Chain-of-custody form and placed into a cooler at approximately 4 degrees Celsius (C) for transport to the laboratory under chain-of-custody protocols.

- QA/QC samples will be collected at the designated frequency identified in Section 12.1.2.
- Disposable sampling and health and safety supplies and equipment will be discarded in an appropriate waste dumpster and handled and disposed using the procedures identified in Section 11.
- The sample location will be determined to sub-meter accuracy using a differential global positioning system and using a measuring tape or other measuring device relative to a landmark.

9.3 Station and Sample Identification for Sediment Sampling

Each sediment sample will be assigned a unique alphanumeric identifier according to the method described below. The identifiers facilitate sample tracking by incorporating identifying information.

The alphanumeric identifiers will be assigned in the following manner for boring sediments. The surface sediment identification scheme is described in the FSP.

- The first three characters identify the sample location by the project descriptor: BGW for Bremerton Gas Works.
- The next two characters identify the sampling event: RE for Removal Evaluation.
- The next two characters identify the sampling matrix: GP for Geoprobe®.
- The next two characters identify the sample station: -01 = Station 01.
- For the subsurface sediment samples, the next six characters identify the sample depth in inches: 012-024 = 12 to 24 inches.
- The next six characters identify the collection date: -YYMMDD.

For example, sample number BGW-RE-GP-01-012-024-100101 indicates a Removal Evaluation sediment boring sample from 12 to 24 inches in depth obtained from Station 01 on January 01, 2010. The representative depths for each sampling interval will be defined in the field logs and provided in the chemical analytical results tables.

The field QA QC samples will be assigned a unique alphanumeric identifier according to the method described below:

- The first seven characters will be BGW-RE-GP.
- The rinsate blank samples will be followed with a -RB followed by the date in YYMMDD format. For example, sample number BGW-RE-GP-RB-100105 represents a rinsate blank collected on January 5, 2010
- The field duplicate will be identified by adding 50 to the station number. For example, the duplicate of BGW-RE-GP-01-012-024-100101will be BGW-RE-GP-51-012-024-100101

When necessary, extra sample volume collected for matrix spike/matrix spike duplicate (MS/MSD) analysis will be identified with the same designation as the sample. This may

be the case when sample material for additional analyses, as determined in consultation with EPA, are needed.

9.4 Sample Containers, Preservation, and Holding Time Requirements

Certified pre-cleaned sample containers provided by the contract analytical laboratory will be used for all samples. Sample containers, holding times, and preservation requirements are listed in Table 3.

10 Sample Handling and Custody

All containerized sediment samples will be delivered to the designated analytical laboratories daily by hand or by courier after preparation is completed. Specific sample shipping procedures will be as follows:

- Individual sample containers will be placed in sealable plastic bags, packed to prevent breakage and transported in a cooler.
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage.
- Ice will be placed in the cooler to maintain a storage temperature of approximately 4 degrees C.
- Chain-of-custody forms will be enclosed in a plastic bag and placed in the cooler.
- If couriered or shipped, the cooler lids will be secured with packing or strapping tape and custody seals will be placed over cooler openings

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample containers will sign the COC forms. Upon receipt, the laboratory receiver will record the temperature and condition of the samples and cross-check the sample inventory with the chain-of-custody forms. COC forms will be used internally in the lab to track sample handling and final disposition.

11 Analytical Methods

This section summarizes the target chemical and physical analyses. All sample analyses will be conducted in accordance with EPA-approved methods and this QAPP. Chemical testing will be conducted at the selected National Environmental Laboratory Accreditation Program- (NELAP-) accredited analytical laboratory. Prior to analyses, all samples will be maintained according to the appropriate holding times and storage temperatures for each analysis. Table 1 presents the proposed analytes, the analytical methods to be used, and the targeted reporting limits. All subsurface sediment samples will be analyzed for total organic carbon (TOC) and SIM polycyclic aromatic hydrocarbons (PAHs) and a subset of samples will be analyzed for VOCs. Samples will be screened for benzene using a PID and approximately ten samples will be chosen for VOC analyses. An archive sample from each interval will be kept in frozen storage for possible future analyses, should any be determined necessary and if there is sufficient sample mass remaining.

The laboratory will establish method detection limits for each analyte of interest, where applicable, prior to sample analyses. Method reporting limits will be below the values specified in Table 1, if technically feasible. These reporting limits may not be achieved in the event that constituent concentrations are elevated or if there are matrix interferences. If specified reporting limits are not achieved, possible corrective actions will be discussed with the laboratory and with EPA. If analytical methodology modifications are to be used to address elevated reporting limits, these will be presented to EPA for review and approval prior to implementation.

In completing chemical analyses for this project, the contract laboratory is expected to meet the following minimum requirements:

- Adhere to the analytical methods outlined in this QAPP.
- Deliver scanned and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in the QAPP including data quality objectives, laboratory QC requirements, and performance evaluation testing requirements.
- Notify the project QA manager of any QAPP QA/QC deviations when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

12 Quality Assurance/Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for EPA SW-846 (1986), the EPA Contract Laboratory Program (EPA 1999, 2004, 2008), and other cited methods.

12.1 Field Quality Control

Anchor QEA personnel will identify and label sample containers in a consistent manner to ensure that field samples are traceable and that labels provide all information necessary for the laboratory to conduct required analyses properly. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

12.1.1 Sample Containers

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided.

12.1.2 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for collecting and handling of samples. Adherence to these procedures will be complemented by periodic and routine equipment inspection.

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA samples includes equipment rinsate blanks and field duplicates. Rinsate blanks will be collected at a rate of one per collection event for SIM PAH analysis. Field duplicate samples will be collected at a frequency of one per 20 samples collected. Any field QA sample result that significantly exceeds the acceptance criteria will be evaluated by the QA manager to determine if field procedure modifications should be considered. These exceedances will also be narrated in the Data Report. Sample data will not be qualified based solely on field QA results.

Field QA samples will also include the collection of enough sample mass to ensure that the laboratory has sufficient amounts to run the program-required analytical QA/QC samples for analyses as specified in Table 4. For sediment and soil samples, enough mass will be collected to run MS/MSD on any sample. The samples designated for QA/QC analyses will be clearly marked on the COC form.

All field QA samples will be documented on the field forms and verified by the QA manager or designee.

12.2 Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates,

matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table 2 summarizes the DQOs for precision, accuracy, and completeness and Table 4 lists the frequency of analysis for laboratory QA/QC samples.

Results of the QC samples from each analytical batch will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits have been exceeded in the sample group, the QA manager will be contacted immediately, and corrective action will be initiated prior to processing a subsequent group of samples.

12.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. An initial calibration verification (ICV) will be analyzed following each initial calibration and must meet method criteria prior to analysis of samples. Continuing calibration verifications (CCV) will be performed daily prior to any sample analysis to track instrument performance. The frequency of CCV analyses varies with methods. For GC/MS methods, one will be analyzed every 12 hours. For inorganic methods, one will be analyzed for every ten field samples analyzed or at the beginning and end of the analytical run, whichever is more frequent. If the continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks (CCB) provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or following continuing calibration verification of the instrument for each type of applicable analysis.

12.2.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

12.2.3 Matrix Spike and Matrix Spike Duplicates

Analysis of MS samples provides information on the preparation efficiency of the method on the sample matrix. By performing duplicate MS analyses, information on the precision of the method is also provided. The frequency of analysis for matrix spike and matrix spike duplicate samples is provided in Table 4.

12.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the method reporting limit of any single target analyte/compound. If a laboratory method blank exceeds this criterion for any analyte/compound, and the concentration of the analyte/compound in any of the associated samples is less than five times the

concentration found in the blank (ten times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced. Any affected samples will be re-prepared and reanalyzed as necessary. The frequency of analysis for method blank samples is provided in Table 4.

12.2.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared along with the samples and any other required laboratory QC samples. The laboratory control sample will provide information on the accuracy of the analytical process, and when analyzed in duplicate, will provide precision information as well. The frequency of analysis for laboratory control samples is provided in Table 4.

12.2.6 Standard Reference Materials

Standard reference materials are substances of the same or similar matrix to the project samples and contain a known concentration of target analyte(s). These materials are prepared and analyzed in the same manner as routine samples and in the same preparation and analytical batch. The recovery of the target analyte(s) provide information on interferences caused by the sample matrix. National Institute of Standards and Materials (NIST) standard reference material (SRM) 1941b for organics in marine sediment will be analyzed for SIM PAHs and TOC. The frequency of analysis for standard reference material samples is provided in Table 4.

12.2.7 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. QC sample frequencies will be compared to the criteria in Table 4.

13 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

13.1 Field Instruments/Equipment

Anchor QEA maintains inventories of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The FCs will be responsible for the preparation, documentation, and implementation of the preventative maintenance. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FCs will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field.

13.2 Laboratory Instruments/Equipment

The laboratory will maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratory will have a preventative maintenance program, as detailed in their QA Plan, organized to maintain proper instrument and equipment performance, and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The QA Manager will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The QA Manager will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times. Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and

recorded by the responsible individual. A laboratory QA Manager or designee shall be responsible for verifying compliance.

14 Instrument/Equipment Calibration Procedures and Frequency

As part of their QC program, the chemistry laboratories selected will perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibrations procedures and frequencies are discussed in the laboratory standard operating procedures (SOPs) and the analytical methods.

The laboratory QA manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the NIST. Chemical reference standards shall be NIST SRMs or vendor certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Plan for each instrument or analytical method in use. All calibrations shall be preserved on electronic media.

15 Inspection/Acceptance of Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sample bottles, will be conducted by the FC. All primary chemical standards and standard solutions used in this project either in the field or laboratory will be traceable to documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

16 Non-Direct Measurements

Additional information may be obtained from the Washington State Department of Ecology, Cascade, or EPA. If such information is needed, the party providing the information will be asked to provide any information on data limitations. This information will be maintained with the project files.

17 Data Management

All data will undergo two levels of QA/QC evaluation: one at the laboratory and one by a qualified data validator. Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory's QA manual. QC data resulting from methods and procedures described in this document will also be reported.

17.1 Sample Management

All laboratory analytical batches will be assigned a unique number and tracking identifier at the laboratory. All data reports will include this tracking number. The laboratory will use a laboratory information management system to track all samples throughout the analytical process.

17.2 Data Reporting

Analytical chemistry results will be provided by the laboratory in digital and electronic deliverable formats. The data packages will be reviewed to ensure that the correct analyses were performed for each sample submitted and that all of the analyses requested on the COC form were performed in accordance with the analytical methods and this QAPP. If discrepancies are noted, the Project QA Manager will be notified and will promptly follow up with the laboratory to resolve any issues.

Following completion of data validation, the digital files will be used to generate the appropriate report tables. Electronic data deliverables (EDDs) will be supplied by the laboratory in Anchor QEA's custom EQuIS electronic format. Laboratory data, which is electronically provided and loaded into the database, will undergo a check against the laboratory data deliverable. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. All manually entered data will be verified by a second party. Data tables and reports are exported from EQuIS to Microsoft Excel tables as needed.

17.3 Data Management Procedures

A record of all field documentation and analytical and QA/QC results, will be maintained to ensure the validity of the data. To effectively execute such documentation, carefully constructed sample tracking and data management procedures will be used throughout the sampling program.

Sample tracking will begin with the completion of COC forms. Copies of all completed COC forms will be maintained in the project files. The laboratory shall verify receipt of the samples electronically within 48 hours of sample receipt.

When analytical data are received from the laboratory, the Project QA Manager will review the incoming analytical data packages and compare the information to the COCs to confirm that the correct analyses were performed for each sample, and that results

were received for all samples submitted for analyses. Any discrepancies noted will be promptly followed up by the Project QA Manager.

17.4 Archival/Retention Requirements

Archival sediment samples will be stored in the dark at -18 ± 10 °C for possible additional analyses or reanalyses. Archive sample aliquots will be retained for one year after the collection date. The laboratory will notify the Project QA Manager prior to disposing of any samples.

18 Assessments and Response Actions

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

18.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement.

Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA manager upon request. The laboratory is required to have written procedures addressing internal QA/QC; these procedures have been submitted and will be reviewed by the project QA manager to ensure compliance with the QAPP. The laboratory must ensure that personnel engaged in analysis tasks have appropriate training. The laboratory will, as part of the audit process, provide for consultant's review of written details of any and all method modifications planned. Laboratory non-conformances will be documented and submitted to the QA manager for review. All non-conformances will be discussed in the final data report.

The database manager will work with the FC and the project leads to correct any questionable or incomplete data. All corrections to field forms will be signed and dated by the personnel making the change.

Field data will be verified by the database manager. These tasks include:

- Post-processed differential correction of GPS coordinates.
- Sample parameter review (e.g., depth, sample name, sample matrix, unit).
- Field QC assignment (e.g., duplicates assigned to parent, equipment blanks assigned to samples).

18.2 Response and Corrective Actions

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or nonconformance to protocols identified in this document.

18.2.1 Field Activities

The FCs will be responsible for correcting equipment malfunctions during the field sampling effort. The Project QA Manager will be responsible for resolving situations identified by the FCs that may result in noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

18.2.2 Laboratory

The laboratory is required to comply with their SOPs. The laboratory manager will be responsible for ensuring that appropriate corrective actions are initiated as required for

conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The laboratory manager will be notified immediately if any QC sample result exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analyses. The laboratory manager will document the corrective action taken in writing. A narrative describing the anomaly, the steps taken to identify and correct the anomaly and the treatment of the relevant sample batch (i.e., recalculation, reanalyses, and/or re-extraction) will be submitted with the data package in the form of a cover letter.

18.3 Reports to Management

Quality assurance reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA Manager.

Progress reports will be prepared by the FCs following each sampling event. The QA manager will also prepare progress reports after the sampling is completed and samples have been submitted for analyses, when information is received from the laboratory, and when analyses are complete. The status of the samples and analyses will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event. These reports will be delivered electronically to the Anchor QEA project lead.

19 Data Review, Validation, and Verification

The removal evaluation data will undergo EPA Stage 2B validation. Some of the data may undergo EPA Stage 4 validation, if considered necessary. During the validation process, analytical data will be evaluated for QAPP, method, and laboratory quality control compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

20 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FCs and laboratory managers; review by the data managers for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into Anchor QEA's EQuIS database. Verification of the electronic data with the laboratory reports will be performed by a data manager or designee. All manually entered data and all manually assigned qualifiers will be verified. Any errors found will be corrected.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts and/or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the laboratory managers to determine whether corrective action is needed and to determine the impact on the reporting schedule.

The Anchor QEA QA manager or designee will be responsible for checking data packages for completeness immediately upon receipt from the laboratory. This will ensure that data and QA/QC information requested are present. Data quality will be assessed by a reviewer using the current National Functional Guidelines for data review (EPA 1999, 2004, 2008) and *Guidance on Environmental Data Verification and Validation* (EPA 2002b) by considering the following:

- Holding times
- Initial calibrations
- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- MS/MSD samples
- Standard reference materials

- Overall conformance with project DQOs

The data will be validated in accordance with the project specific DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on their SOPs. Data validation will be performed by the Anchor QEA QA manager, designee, or by a third party data validator. The data validation will be summarized in a validation report to be included with the Removal Evaluation Report. Any data qualifiers added as part of validation will be input into the EQuIS database.

20.1 Reconciliation with User Requirements

The QA manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors, and will suggest corrective action. It is expected that the problem would be corrected by revision of techniques or replacement of supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA manager will recommend appropriate modifications. Any revisions will require approval by EPA. If matrix interference is suspected to have caused the exceedance, adequate lab documentation must be presented to demonstrate that instrument performance and/or laboratory technique did not bias the result. In cases where the DQOs have been exceeded and corrective actions did not resolve the outlier, data will be qualified per National Functional Guidelines (EPA 1999, 2004, 2008). In these instances, the usability of the data will be determined by the extent of the exceedance.

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EPA, 1999. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. U.S. Environmental Protection Agency, Office of Emergency Response. EPA 540/R-99/008. October.

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EPA, 2004. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI). EPA 540-R-04-004. October 2004.

EPA, 2008. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. EPA 540-R-08-01. June.

TABLES

Table 1
Parameters for Analysis, Methods, and Quantitation Limits

Parameter	Recommended Analytical Method	Quantitation Limits
Conventional parameters (%)		
Total solids	SM 2540B	0.1
Total organic carbon	PSEP	0.1
Polycyclic aromatic hydrocarbons (µg/kg dry weight)		
1-Methylnaphthalene	8270D-SIM	0.5
2-Methylnaphthalene	8270D-SIM	0.5
Acenaphthene	8270D-SIM	0.5
Acenaphthylene	8270D-SIM	0.5
Anthracene	8270D-SIM	0.5
Benz(a)anthracene	8270D-SIM	0.5
Benzo(a)pyrene	8270D-SIM	0.5
Benzo(b)fluoranthene	8270D-SIM	0.5
Benzo(g,h,i)perylene	8270D-SIM	0.5
Benzo(j)fluoranthene	8270D-SIM	0.5
Benzo(k)fluoranthene	8270D-SIM	0.5
Chrysene	8270D-SIM	0.5
Dibenzo[a,h]anthracene	8270D-SIM	0.5
Dibenzofuran	8270D-SIM	0.5
Fluoranthene	8270D-SIM	0.5
Fluorene	8270D-SIM	0.5
Indeno(1,2,3-c,d)pyrene	8270D-SIM	0.5
Naphthalene	8270D-SIM	0.6
Phenanthrene	8270D-SIM	0.5
Pyrene	8270D-SIM	0.5
Volatile Organics in Sediment (µg/kg dry weight)		
1,1,1-Trichloroethane	8260C	1.0
1,1,2,2-Tetrachloroethane	8260C	1.0
1,1,2-Trichloroethane	8260C	1.0
1,1-Dichloroethene	8260C	1.0
1,1-Dichloroethane	8260C	1.0
1,2,3-Trichlorobenzene	8260C	5.0
1,2,4-Trichlorobenzene	8260C	5.0
1,2-Dibromo-3-chloropropane	8260C	5.0
1,2-Dibromoethane	8260C	1.0
1,2-Dichlorobenzene	8260C	1.0
1,2-Dichloroethane	8260C	1.0
1,2-Dichloropropane	8260C	1.0
1,3-Dichlorobenzene	8260C	1.0
1,4-Dichlorobenzene	8260C	1.0
2-Butanone	8260C	5.0
2-Hexanone	8260C	5.0
4-Methyl-2-pentanone	8260C	5.0

Table 1
Parameters for Analysis, Methods, and Quantitation Limits

Parameter	Recommended Analytical Method	Quantitation Limits
Acetone	8260C	5.0
Benzene	8260C	1.0
Bromochloromethane	8260C	1.0
Bromodichloromethane	8260C	1.0
Bromoform	8260C	1.0
Bromomethane	8260C	1.0
Carbon disulfide	8260C	1.0
Carbon tetrachloride	8260C	1.0
Chlorobenzene	8260C	1.0
Chloroethane	8260C	1.0
Chloroform	8260C	1.0
Chloromethane	8260C	1.0
cis-1,2-Dichloroethene	8260C	1.0
cis-1,3-Dichloropropene	8260C	1.0
Dibromochloromethane	8260C	1.0
Dichlorodifluoromethane	8260C	1.0
Ethylbenzene	8260C	1.0
Isopropylbenzene	8260C	1.0
Methyl tert-Butyl Ether	8260C	1.0
Methylene chloride	8260C	2.0
Styrene	8260C	1.0
Tetrachloroethene	8260C	1.0
Toluene	8260C	1.0
trans-1,2-Dichloroethene	8260C	1.0
trans-1,3-Dichloropropene	8260C	1.0
Trichloroethene	8260C	1.0
Trichlorofluoromethane	8260C	1.0
Vinyl chloride	8260C	1.0
m,p-Xylene	8260C	1.0
o-Xylene	8260C	1.0

Note:

µg/kg = micrograms per kilogram

% = percent

Table 2
Project Data Quality Objectives

Parameter	Precision	Accuracy[a]	Method Blank	Completeness
Total solids	± 20% RPD	NA	NA	95%
Total organic carbon	± 20% RPD	75-125% R	≤ PQL[b]	95%
Polycyclic aromatic hydrocarbons	± 35% RPD	50-150% R	≤ PQL[b]	95%
Volatile organic compounds	± 35% RPD	50-150% R	≤ PQL[b]	95%

Notes:

[a] Applies to MS/MSD and LCS/LCSD recoveries

[b] When the sample concentration is < 5x the method blank concentration

LCS/LCSD = laboratory control sample/laboratory control sample duplicate

MS/MSD = matrix spike/matrix spike duplicate

NA = not applicable

PQL = practical quantitation limit

R = recovery

RPD = relative percent difference

Table 3
Container Size, Holding Time, and Preservation

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Polycyclic aromatic hydrocarbons	100 g	8-oz glass	14 days until extraction	Cool/4° C
			1 year until extraction	Freeze -20° C
			40 days after extraction	Cool/4° C
Volatile organic compounds	25 g	2-oz glass; no headspace	14 days	Cool/4° C
Total solids	25 g	4-oz glass	14 days	Cool/4° C
			6 months	Freeze -20° C
Total organic carbon	25 g		14 days	Cool/4° C
			6 months	Freeze -20° C

Notes:
° C = degrees Celsius
g = gram
oz = ounce

Table 4
Laboratory Quality Control Sample Analysis Frequency

Analysis Type	Initial Calibration	Ongoing Calibration	Standard Reference Material[d]	Replicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes	Laboratory Control Samples
Total solids	Daily[a]	NA	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total organic carbon	Daily or each batch[b]	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	Each batch	NA	1 per 20 samples
Polycyclic aromatic hydrocarbons	As needed [c]	Every 12 hours	1 per 20 samples	NA	1 per 20 samples	1 per 20 samples	Each batch	Every sample	1 per 20 samples
Volatile organic compounds	As needed [c]	Every 12 hours	1 per 20 samples	NA	1 per 20 samples	1 per 20 samples	Each batch	Every sample	1 per 20 samples

Notes:

[a] Calibration and certification of drying ovens and weighing scales are conducted bi-annually.

[b] Initial calibration verification and calibration blank must be analyzed at the beginning of each batch.

[c] Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new calibration is performed.

[d] When a Standard Reference Material is available

NA = not applicable

FIGURES

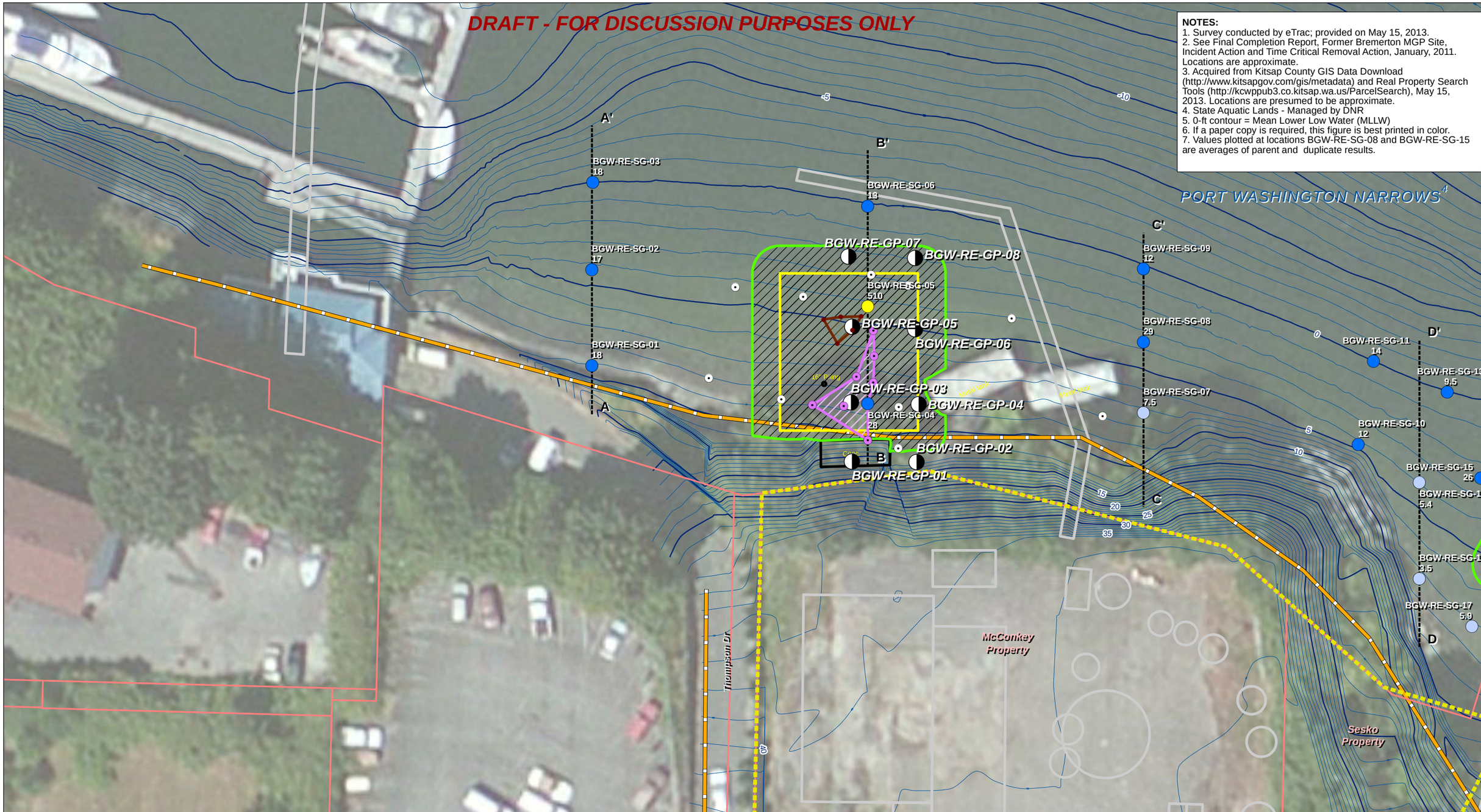
NOTE:
If a paper copy is required, this figure is best printed in color.

Former Gas Works Location and Vicinity

QAPP Addendum
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING	ANCHOR QEA	FIRM: ANCHOR QEA DRAWN BY: ckiblinger	FIGURE NO. 1

AO GIS Path: Q:\Jobs\100719-01_Bremerton MGP\Maps\2013_08\Vicinity_Map_Work_Plan_and_SQAPP (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 8/8/2013 || User: ckiblinger || Print Date: 8/13/2013



Subsurface Sediment Sample
Test Plots with no Observed Sheen
Test Plots with Observed Sheen
Hydrocarbon-like Solid Observations

Surface Sediment cPAH mg/kg TEQ[7]
- 0.047 - 0.08
- 0.081 - 0.8
- 0.81 - 8
- 8.1 - 80
- 81 - 510

Area of Observed Hydrocarbon-like Sheen
Solid Hydrocarbon-like Material
Historic Structures
Former Gas Works Location
Approximate Proposed Reactive Core Mat Cover
Approximate Proposed Reactive Core Mat

100-Foot Transects
Sanitary Sewer
Bathymetry/Topography Contours (MLLW ft)[1]
Cover of Organo-Clay Mat (10-inch minus rock)[2]
Parcel Boundaries[3]

N

0 25 50
Feet
1:402

Geoprobe Locations
QAPP Addendum
Bremerton Gas Works
Bremerton, Washington

Aspect CONSULTING
ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: ckiblinger

FIGURE NO.
2

AO GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_08\Proposed Geoprobe Locations.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 8/13/2013 || User: ckiblinger || Print Date: 8/13/2013

ATTACHMENT A

Field Forms

Sediment Core Collection Log

Job:
Station ID:
Job No:
Attempt No.
Field Staff:
Date:
Contractor:
Logged By:
Vertical Datum:
Horizontal Datum:

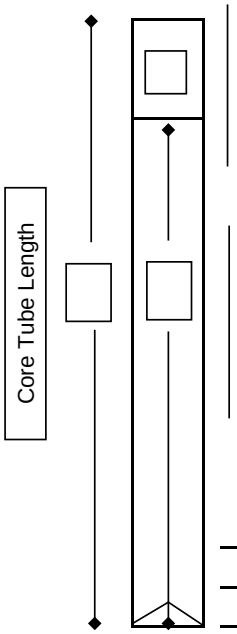
Field Collection Coordinates:
Lat/Northing:
Long/Easting:

A. Water Depth
DTM Depth Sounder:
DTM Lead Line:

B. Water Level Measurements
Time:
Height:
Source:

C. Mudline Elevation

Recovery Measurements (prior to cuts)



Core Collection Recovery Details:
Core Accepted: Yes / No
Core Tube Length:
Drive Penetration:
Headspace Measurement:
Recovery Measurement:
Recovery Percentage:
Total Length of Core To Process:

Drive Notes:

Sections To Process:
A:
B:
C:
D:

Core Field Observations and Description:

Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

ANCHOR QEA

DATE: _____

PROJECT NAME: Bremerton Gasworks

PROJECT NO: 131014-01.01

DAILY SAFETY BRIEFING

PERSON CONDUCTING MEETING: _____ **HEALTH & SAFETY OFFICER:** _____ **PROJECT MANAGER:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/MSDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Other:
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking

WEATHER CONDITIONS: _____

DAILY WORK SCOPE: _____

SITE-SPECIFIC HAZARDS: _____

SAFETY COMMENTS: _____

ATTENDEES

PRINTED NAME	SIGNATURE

Sediment Core Processing Log

ANCHOR QEA

Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Mudmole ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed

Recovered Length (ft)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (ft)	PID	Sample	Summary Sketch

Chain of Custody Record & Laboratory Analysis Request

Laboratory Number:

Date:

Project Name: Bremerton Gasworks

Project Number: 131014-01.01

Project Manager:

Phone Number:

Shipment Method:

Line	Field Sample ID	Collection Date/Time	Matrix	No. of Containers	Test Parameters																			Comments/Preservation
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								

Notes:

Relinquished By:	Company: Anchor QEA, LLC
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

Relinquished By:	Company:
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.

APPENDIX C
WASTE CHARACTERIZATION DATA SUMMARY

Table A-1
Waste Characterization Summary Table

Task		2013 Removal Evaluation	2013 Removal Evaluation
Location ID		**SHC-081913**	**Briquette**
Sample ID		**SHC-081913**	**Briquette**
Sample Date		**08/19/2013**	**09/03/2013**
Sample Depth		**0 - 4 in**	**NA**
Sample Type		**N**	**N**
Matrix	**Method**	**Solid**	**Soild**
Conventional Parameters (pct)			
Total organic carbon	Plumb 1981	--	**77.9**
Total solids	SM2540B	--	**83.99**
Semivolatile Organics (mg/kg)			
Dibenzofuran	SW8270DSIM	**150**	**85**
Volatile Organic Compounds (µg/kg)			
Benzene	SW8270DSIM	0.51 U	--
Toluene	SW8270DSIM	**51**	--
Ethylbenzene	SW8270DSIM	**1500**	--
m,p-Xylene	SW8270DSIM	**160**	--
o-Xylene	SW8270DSIM	**620**	--
Polycyclic Aromatic Hydrocarbons (mg/kg)			
1-Methylnaphthalene	SW8270DSIM	**660**	**450**
2-Methylnaphthalene	SW8270DSIM	**71 J**	**54**
Acenaphthene	SW8270DSIM	**630**	**350**
Acenaphthylene	SW8270DSIM	**1200**	**190**
Anthracene	SW8270DSIM	**1400**	**1100**
Benzo(a)anthracene	SW8270DSIM	**1000**	**1100**
Benzo(a)pyrene	SW8270DSIM	**1100**	**1500**
Benzo(b)fluoranthene	SW8270DSIM	--	**770**
Benzo(g,h,i)perylene	SW8270DSIM	**600**	**1200**
Benzo(j)fluoranthene	SW8270DSIM	--	**430**
Benzo(k)fluoranthene	SW8270DSIM	--	**510**
Total Benzofluoranthenes (b,j,k) (U = 0)		**1300**	--
Chrysene	SW8270DSIM	**1100**	**1400**
Dibenzo(a,h)anthracene	SW8270DSIM	**120**	**130**
Fluoranthene	SW8270DSIM	**3500**	**4500**
Fluorene	SW8270DSIM	**500**	**570**
Indeno(1,2,3-c,d)pyrene	SW8270DSIM	**450**	**910**
Naphthalene	SW8270DSIM	**630**	**910**
Phenanthrene	SW8270DSIM	**5500**	**6000**
Pyrene	SW8270DSIM	**4500**	**5400**
Total HPAH (SMS) (U = 0)		**13670**	**17080**
Total LPAH (SMS) (U = 0)		**9860**	**9120**
Total cPAH Toxic Equivalency (mg/kg)			
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)		**1528**	**1856**
Total cPAH TEQ (EPA 1993) (U = 1/2)		**1509**	**1915**

Table A-1
Waste Characterization Summary Table

Task	Method	2013 Removal Evaluation	2013 Removal Evaluation
Location ID		**SHC-081913**	**Briquette**
Sample ID		**SHC-081913**	**Briquette**
Sample Date		**08/19/2013**	**09/03/2013**
Sample Depth		**0 - 4 in**	**NA**
Sample Type		**N**	**N**
Matrix		**Solid**	**Soild**
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		**1528**	**1856**
Total cPAH TEQ (EPA 1993) (U = 0)		**1509**	**1915**

Notes:

-- = not analyzed

µg/kg = micrograms per kilogram

cPAH = carcinogenic polycyclic aromatic hydrocarbon

HPAH = high molecular weight polycyclic aromatic hydrocarbon (sum of Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3,-c,d)pyrene, Dibenzo(a,h)anthracene, and Benzo(g,h,i)perylene)

LPAH = low molecular weight polycyclic aromatic hydrocarbon (Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene)

mg/kg = milligrams per kilogram

NA = not applicable

pct = percent

TEQ = toxic equivalency

U = compound analyzed, but not detected above detection limit

bold = compound detected above detection limit

Analytical Resources, Incorporated
Analytical Chemists and Consultants

September 16, 2013

Nathan Soccorsy
Anchor QEA
720 Olive Way, Suite 1900
Seattle, WA 98101

RE: Client Project: Bremerton Gas Works, 131014-01.01
ARI Job No.: XE09

Dear Nathan:

Please find enclosed the Chain of Custody records (COCs), sample receipt documentation, and the final data package for samples from the project referenced above.

Sample receipt and details of these analyses are discussed in the Case Narrative.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Cheronne Oreiro
Project Manager
(206) 695-6214
cheronneo@arilabs.com
www.arilabs.com

cc: eFile: XE09

Enclosures

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request XEOY

Laboratory Number:

Date: September 6, 2013
Project Name: Bremerton Gas Works
Project Number: 131014-01.01
Project Manager: Soccorsy / Fields
Phone Number: 206-287-9130
Shipment Method: Courier pick up

ANCHOR QEA

Line	Field Sample ID	Collection Date/Time	Matrix	No. of Containers	Test Parameters: PAH	Test Parameters: TOC	Comments/Preservation
1	BGW-RE-HA-01-6.5	9/3/2013 14:30	Soil	2	X	X	
2	Briquette	9/3/2013 14:30	Soil	2	X	X	
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Notes: 1 week TAT requested

Relinquished By:	Company: Anchor QEA, LLC	Received By:	Company:
Cindy Fields	9/6/13 12:19	Rich Hudson	9/6/13 16:40
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time
Relinquished By:	Company:	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: XE09
Client: Anchor QEA
Project Event: 131014-01.01
Project Name: Bremerton Gas Works

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	BGW-RE-HA-01-6.5	XE09A	13-18800	Solid	09/04/13 14:30	09/06/13 16:40
2.	Briquette	XE09B	13-18801	Solid	09/04/13 14:30	09/06/13 16:40

XE09 . 00010

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U Indicates that the target analyte was not detected at the reported concentration

* Duplicate RPD is not within established control limits

B Reported value is less than the CRDL but ≥ the Reporting Limit

N Matrix Spike recovery not within established control limits

NA Not Applicable, analyte not spiked

H The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible

L Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U Indicates that the target analyte was not detected at the reported concentration

* Flagged value is not within established control limits

B Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.

J Estimated concentration when the value is less than ARI's established reporting limits

D The spiked compound was not detected due to sample extract dilution

E Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

Q Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.

F Samples were frozen prior to particle size determination

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: Briquette
SAMPLE

Lab Sample ID: XE09B
LIMS ID: 13-18801
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 16:04
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 0.90 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 3.00
Percent Moisture: 11.1 %

CAS Number	Analyte	DL	LOQ	Result	
91-20-3	Naphthalene	880	1,700	380,000	ES
91-57-6	2-Methylnaphthalene	510	1,700	54,000	
90-12-0	1-Methylnaphthalene	570	1,700	340,000	ES
208-96-8	Acenaphthylene	420	1,700	190,000	E
83-32-9	Acenaphthene	440	1,700	250,000	E
86-73-7	Fluorene	430	1,700	360,000	ES
85-01-8	Phenanthrene	660	1,700	620,000	ES
120-12-7	Anthracene	490	1,700	380,000	ES
206-44-0	Fluoranthene	590	1,700	690,000	ES
129-00-0	Pyrene	740	1,700	730,000	ES
56-55-3	Benzo(a)anthracene	530	1,700	560,000	ES
218-01-9	Chrysene	630	1,700	580,000	ES
205-99-2	Benzo(b)fluoranthene	630	1,700	450,000	ES
207-08-9	Benzo(k)fluoranthene	680	1,700	310,000	E
50-32-8	Benzo(a)pyrene	580	1,700	660,000	ES
193-39-5	Indeno(1,2,3-cd)pyrene	1200	1,700	440,000	ES
53-70-3	Dibenz(a,h)anthracene	790	1,700	130,000	
191-24-2	Benzo(g,h,i)perylene	1000	1,700	720,000	ES
132-64-9	Dibenzofuran	500	1,700	85,000	
TOTBFA	Total Benzofluoranthenes	620	1,700	1,000,000	ES
205-82-3	Benzo(j)fluoranthene	660	1,700	280,000	E

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	80.0%
d10-2-Methylnaphthalene	65.0%
d14-Dibenzo(a,h)anthracen	280%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: Briquette
DILUTION

Lab Sample ID: XE09B
LIMS ID: 13-18801
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 20:47
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 0.90 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 150
Percent Moisture: 11.1 %

CAS Number	Analyte	DL	LOQ	Result	
91-20-3	Naphthalene	44000	83,000	910,000	
91-57-6	2-Methylnaphthalene	25000	83,000	49,000	J
90-12-0	1-Methylnaphthalene	28000	83,000	450,000	
208-96-8	Acenaphthylene	21000	83,000	190,000	
83-32-9	Acenaphthene	22000	83,000	350,000	
86-73-7	Fluorene	22000	83,000	570,000	
85-01-8	Phenanthrene	33000	83,000	6,000,000	
120-12-7	Anthracene	24000	83,000	1,100,000	
206-44-0	Fluoranthene	30000	83,000	4,500,000	
129-00-0	Pyrene	37000	83,000	5,400,000	
56-55-3	Benzo(a)anthracene	27000	83,000	1,100,000	
218-01-9	Chrysene	31000	83,000	1,400,000	
205-99-2	Benzo(b)fluoranthene	32000	83,000	770,000	
207-08-9	Benzo(k)fluoranthene	34000	83,000	510,000	
50-32-8	Benzo(a)pyrene	29000	83,000	1,500,000	
193-39-5	Indeno(1,2,3-cd)pyrene	58000	83,000	910,000	
53-70-3	Dibenz(a,h)anthracene	40000	83,000	460,000	
191-24-2	Benzo(g,h,i)perylene	51000	83,000	1,200,000	
132-64-9	Dibenzofuran	25000	83,000	110,000	
TOTBFA	Total Benzofluoranthenes	31000	83,000	1,700,000	
205-82-3	Benzo(j)fluoranthene	33000	83,000	430,000	

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	D
d10-2-Methylnaphthalene	D
d14-Dibenzo(a,h)anthracen	D

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: Briquette DUPLICATE

Lab Sample ID: XE09B
LIMS ID: 13-18801
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works 131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 18:52
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 0.93 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 3.00
Percent Moisture: 11.1 %

CAS Number	Analyte	DL	LOQ	Result		RPD
91-20-3	Naphthalene	850	1,600	390,000	ES	2.6%
91-57-6	2-Methylnaphthalene	490	1,600	50,000		7.7%
90-12-0	1-Methylnaphthalene	550	1,600	340,000	ES	0.0%
208-96-8	Acenaphthylene	410	1,600	170,000	E	11.1%
83-32-9	Acenaphthene	430	1,600	260,000	E	3.9%
86-73-7	Fluorene	420	1,600	360,000	ES	0.0%
85-01-8	Phenanthrene	640	1,600	660,000	ES	6.2%
120-12-7	Anthracene	470	1,600	420,000	ES	10.0%
206-44-0	Fluoranthene	570	1,600	730,000	ES	5.6%
129-00-0	Pyrene	720	1,600	780,000	ES	6.6%
56-55-3	Benzo(a)anthracene	520	1,600	580,000	ES	3.5%
218-01-9	Chrysene	610	1,600	600,000	ES	3.4%
205-99-2	Benzo(b)fluoranthene	610	1,600	440,000	ES	2.2%
207-08-9	Benzo(k)fluoranthene	660	1,600	300,000	E	3.3%
50-32-8	Benzo(a)pyrene	560	1,600	680,000	ES	3.0%
193-39-5	Indeno(1,2,3-cd)pyrene	1100	1,600	430,000	ES	2.3%
53-70-3	Dibenz(a,h)anthracene	770	1,600	120,000		8.0%
191-24-2	Benzo(g,h,i)perylene	980	1,600	700,000	ES	2.8%
132-64-9	Dibenzofuran	490	1,600	81,000		4.8%
TOTBFA	Total Benzofluoranthenes	600	1,600	1,000,000	ES	0.0%
205-82-3	Benzo(j)fluoranthene	640	1,600	270,000	E	3.6%

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	70.0%
d10-2-Methylnaphthalene	60.0%
d14-Dibenzo(a,h)anthracen	280%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: Briquette
DUPLICATE DILUTION

Lab Sample ID: XE09B
LIMS ID: 13-18801
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 21:16
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 0.93 g-dry-wt
Final Extract Volume: 5.0 mL
Dilution Factor: 150
Percent Moisture: 11.1 %

CAS Number	Analyte	DL	LOQ	Result	RPD
91-20-3	Naphthalene	42000	81,000	960,000	5.3%
91-57-6	2-Methylnaphthalene	25000	81,000	44,000 J	10.8%
90-12-0	1-Methylnaphthalene	28000	81,000	410,000	9.3%
208-96-8	Acenaphthylene	20000	81,000	140,000	30.3%
83-32-9	Acenaphthene	21000	81,000	340,000	2.9%
86-73-7	Fluorene	21000	81,000	480,000	17.1%
85-01-8	Phenanthrene	32000	81,000	5,400,000	10.5%
120-12-7	Anthracene	24000	81,000	960,000	13.6%
206-44-0	Fluoranthene	29000	81,000	3,900,000	14.3%
129-00-0	Pyrene	36000	81,000	5,000,000	7.7%
56-55-3	Benzo(a)anthracene	26000	81,000	910,000	18.9%
218-01-9	Chrysene	30000	81,000	1,300,000	7.4%
205-99-2	Benzo(b)fluoranthene	31000	81,000	720,000	6.7%
207-08-9	Benzo(k)fluoranthene	33000	81,000	400,000	24.2%
50-32-8	Benzo(a)pyrene	28000	81,000	1,200,000	22.2%
193-39-5	Indeno(1,2,3-cd)pyrene	56000	81,000	770,000	16.7%
53-70-3	Dibenz(a,h)anthracene	38000	81,000	440,000	4.4%
191-24-2	Benzo(g,h,i)perylene	49000	81,000	1,000,000	18.2%
132-64-9	Dibenzofuran	24000	81,000	97,000	12.6%
TOTBFA	Total Benzofluoranthenes	30000	81,000	1,500,000	12.5%
205-82-3	Benzo(j)fluoranthene	32000	81,000	350,000	20.5%

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	D
d10-2-Methylnaphthalene	D
d14-Dibenzo(a,h)anthracen	D

FORM I

ANALYTICAL RESOURCES INCORPORATED

SIM SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Solid

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01

Client ID	FLND10	MNP	DBA	TOT OUT
MB-090913	151%	92.7%	108%	0
LCS-090913	85.0%	67.0%	83.7%	0
SRM SRM 1941B	54.0%	41.3%	55.7%	0
BGW-RE-HA-01-6.5	53.5%	62.0%	30.0%	0
BGW-RE-HA-01-6.5 DL2	D	D	D	0
BGW-RE-HA-01-6.5 MS	D	D	D	0
BGW-RE-HA-01-6.5 MSD	D	D	D	0
Briquette	80.0%	65.0%	280%*	1
Briquette DL	D	D	D	0
Briquette DUP DL	D	D	D	0
Briquette DUP	70.0%	60.0%	280%*	1

	LCS/MB LIMITS	QC LIMITS
(FLND10) = d10-Fluoranthene	(30-160)	(30-160)
(MNP) = d10-2-Methylnaphthalene	(35-100)	(34-100)
(DBA) = d14-Dibenzo(a,h)anthracene	(37-120)	(10-117)

Prep Method: SW3546
Log Number Range: 13-18800 to 13-18801

FORM-II SIM SW8270

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D-SIM GC/MS

Sample ID: BGW-RE-HA-01-6.5
MATRIX SPIKE

Lab Sample ID: XE09A
LIMS ID: 13-18800
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
Event: 131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted MS/MSD: 09/09/13

Date Analyzed MS: 09/10/13 17:55
MSD: 09/10/13 18:23
Instrument/Analyst MS: NT4/JZ
MSD: NT4/JZ

Sample Amount MS: 3.61 g-dry-wt
MSD: 3.63 g-dry-wt
Final Extract Volume MS: 0.50 mL
MSD: 0.50 mL
Dilution Factor MS: 30.0
MSD: 30.0

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Naphthalene	13000 ES	37400	831	NA	28700	826	NA	26.3%
2-Methylnaphthalene	7100 E	10500	831	NA	7830	826	NA	29.1%
1-Methylnaphthalene	3700	5270	831	NA	4160	826	NA	23.5%
Acenaphthylene	2500	3550	831	126%	3860	826	165%	8.4%
Acenaphthene	110	769	831	79.3%	769	826	79.8%	0.0%
Fluorene	590	1250	831	79.4%	1140	826	66.6%	9.2%
Phenanthrene	13000 ES	51300 E	831	NA	43400 E	826	NA	16.7%
Anthracene	2300	3770	831	177%	3400	826	133%	10.3%
Fluoranthene	12000 ES	34200	831	NA	36400	826	NA	6.2%
Pyrene	8600 ES	19600	831	NA	29500	826	NA	40.3%
Benzo(a)anthracene	2400	3660	831	152%	5130	826	331%	33.4%
Chrysene	6500 E	9560	831	NA	10900	826	NA	13.1%
Benzo(b)fluoranthene	2500	4000	831	181%	5270	826	335%	27.4%
Benzo(k)fluoranthene	880	1350	831	56.6%	2360	826	179%	54.4%
Benzo(a)pyrene	750	1570	831	98.7%	2110	826	165%	29.3%
Indeno(1,2,3-cd)pyrene	470	2100	831	196%	2310	826	223%	9.5%
Dibenz(a,h)anthracene	250	2130	831	226%	2150	826	230%	0.9%
Benzo(g,h,i)perylene	510	839	831	39.6%	1380	826	105%	48.8%
Dibenzofuran	2600	3530	831	112%	3040	826	53.3%	14.9%
Total Benzofluoranthenes	4200	6630	2490	97.6%	9450	2480	212%	35.1%
Benzo(j)fluoranthene	860	1280	831	50.5%	1820	826	116%	34.8%

Reported in µg/kg (ppb)

NA-No recovery due to high concentration (> 4X) of analyte in original sample, calculated negative recovery, or undetected spike.
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: BGW-RE-HA-01-6.5
MATRIX SPIKE

Lab Sample ID: XE09A
LIMS ID: 13-18800
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 17:55
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 3.61 g-dry-wt
Final Extract Volume: 0.50 mL
Dilution Factor: 30.0
Percent Moisture: 27.9 %

CAS Number	Analyte	DL	LOQ	Result
91-20-3	Naphthalene	220	420	---
91-57-6	2-Methylnaphthalene	130	420	---
90-12-0	1-Methylnaphthalene	140	420	---
208-96-8	Acenaphthylene	100	420	---
83-32-9	Acenaphthene	110	420	---
86-73-7	Fluorene	110	420	---
85-01-8	Phenanthrene	160	420	---
120-12-7	Anthracene	120	420	---
206-44-0	Fluoranthene	150	420	---
129-00-0	Pyrene	180	420	---
56-55-3	Benzo(a)anthracene	130	420	---
218-01-9	Chrysene	160	420	---
205-99-2	Benzo(b)fluoranthene	160	420	---
207-08-9	Benzo(k)fluoranthene	170	420	---
50-32-8	Benzo(a)pyrene	150	420	---
193-39-5	Indeno(1,2,3-cd)pyrene	290	420	---
53-70-3	Dibenz(a,h)anthracene	200	420	---
191-24-2	Benzo(g,h,i)perylene	250	420	---
132-64-9	Dibenzofuran	130	420	---
TOTBFA	Total Benzofluoranthenes	150	420	---
205-82-3	Benzo(j)fluoranthene	160	420	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	D
d10-2-Methylnaphthalene	D
d14-Dibenzo(a,h)anthracen	D

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: BGW-RE-HA-01-6.5
MATRIX SPIKE DUP

Lab Sample ID: XE09A
LIMS ID: 13-18800
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01
Date Sampled: 09/04/13
Date Received: 09/06/13

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 18:23
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 3.63 g-dry-wt
Final Extract Volume: 0.50 mL
Dilution Factor: 30.0
Percent Moisture: 27.9 %

CAS Number	Analyte	DL	LOQ	Result
91-20-3	Naphthalene	220	410	---
91-57-6	2-Methylnaphthalene	130	410	---
90-12-0	1-Methylnaphthalene	140	410	---
208-96-8	Acenaphthylene	100	410	---
83-32-9	Acenaphthene	110	410	---
86-73-7	Fluorene	110	410	---
85-01-8	Phenanthrene	160	410	---
120-12-7	Anthracene	120	410	---
206-44-0	Fluoranthene	150	410	---
129-00-0	Pyrene	180	410	---
56-55-3	Benzo(a)anthracene	130	410	---
218-01-9	Chrysene	160	410	---
205-99-2	Benzo(b)fluoranthene	160	410	---
207-08-9	Benzo(k)fluoranthene	170	410	---
50-32-8	Benzo(a)pyrene	140	410	---
193-39-5	Indeno(1,2,3-cd)pyrene	290	410	---
53-70-3	Dibenz(a,h)anthracene	200	410	---
191-24-2	Benzo(g,h,i)perylene	250	410	---
132-64-9	Dibenzofuran	120	410	---
TOTBFA	Total Benzofluoranthenes	150	410	---
205-82-3	Benzo(j)fluoranthene	160	410	---

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	D
d10-2-Methylnaphthalene	D
d14-Dibenzo(a,h)anthracen	D

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SIM SW8270D-SIM GC/MS
Extraction Method: SW3546

Sample ID: SRM 1941B 090913
STANDARD REFERENCE

Lab Sample ID: SRM-090913
LIMS ID: 13-18800
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
131014-01.01
Date Sampled: NA
Date Received: NA

Date Extracted: 09/09/13
Date Analyzed: 09/10/13 13:21
Instrument/Analyst: NT4/JZ
GPC Cleanup: No

Sample Amount: 4.89 g-dry-wt
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Percent Moisture: 2.4%

CAS Number	Analyte	DL	LOQ	Result
91-20-3	Naphthalene	5.4	10	370
91-57-6	2-Methylnaphthalene	3.1	10	120
90-12-0	1-Methylnaphthalene	3.5	10	66
208-96-8	Acenaphthylene	2.6	10	35
83-32-9	Acenaphthene	2.7	10	15
86-73-7	Fluorene	2.6	10	36
85-01-8	Phenanthrene	4.0	10	210
120-12-7	Anthracene	3.0	10	110
206-44-0	Fluoranthene	3.6	10	310
129-00-0	Pyrene	4.5	10	300
56-55-3	Benzo(a)anthracene	3.3	10	180
218-01-9	Chrysene	3.8	10	200
205-99-2	Benzo(b)fluoranthene	3.9	10	220
207-08-9	Benzo(k)fluoranthene	4.2	10	120
50-32-8	Benzo(a)pyrene	3.6	10	140
193-39-5	Indeno(1,2,3-cd)pyrene	7.1	10	130
53-70-3	Dibenz(a,h)anthracene	4.9	10	74
191-24-2	Benzo(g,h,i)perylene	6.2	10	140
132-64-9	Dibenzofuran	3.1	10	46
TOTBFA	Total Benzofluoranthenes	3.8	10	440
205-82-3	Benzo(j)fluoranthene	4.0	10	100

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	54.0%
d10-2-Methylnaphthalene	41.3%
d14-Dibenzo(a,h)anthracen	55.7%

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D-SIM GC/MS

ANALYTICAL RESOURCES INCORPORATED

Sample ID: LCS-090913
LAB CONTROL SAMPLE

Lab Sample ID: LCS-090913
LIMS ID: 13-18800
Matrix: Solid
Data Release Authorized:
Reported: 09/13/13

QC Report No: XE09-Anchor QEA
Project: Bremerton Gas Works
Event: 131014-01.01
Date Sampled: NA
Date Received: NA

Date Extracted: 09/09/13
Date Analyzed LCS: 09/10/13 14:49
Instrument/Analyst LCS: NT4/JZ

Sample Amount LCS: 10.00 g-dry-wt
Final Extract Volume LCS: 0.50 mL
Dilution Factor LCS: 1.00

Analyte	LCS	Spike Added	Recovery
Naphthalene	140	300	46.7%
2-Methylnaphthalene	111	300	37.0%
1-Methylnaphthalene	110	300	36.7%
Acenaphthylene	119	300	39.7%
Acenaphthene	112	300	37.3%
Fluorene	120	300	40.0%
Phenanthrene	120	300	40.0%
Anthracene	134	300	44.7%
Fluoranthene	137	300	45.7%
Pyrene	145	300	48.3%
Benzo(a)anthracene	144	300	48.0%
Chrysene	130	300	43.3%
Benzo(b)fluoranthene	133	300	44.3%
Benzo(k)fluoranthene	165	300	55.0%
Benzo(a)pyrene	142	300	47.3%
Indeno(1,2,3-cd)pyrene	130	300	43.3%
Dibenz(a,h)anthracene	128	300	42.7%
Benzo(g,h,i)perylene	139	300	46.3%
Dibenzofuran	113	300	37.7%
Total Benzofluoranthenes	437	900	48.6%
Benzo(j)fluoranthene	139	300	46.3%

Reported in µg/kg (ppb)

SIM Semivolatile Surrogate Recovery

d10-Fluoranthene	85.0%
d10-2-Methylnaphthalene	67.0%
d14-Dibenzo(a,h)anthracen	83.7%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

30 August 2013

Jeremy Porter
Aspect Consulting
401 Second Avenue South, Suite 201
Seattle, WA 98104

RE: Bremerton Gas Works
ARI Job: XB73

Dear Jeremy:

Please find enclosed the original chain of custody (COC) record and the final results for the sample from the project referenced above. Analytical Resources, Inc. accepted one solid sample in good condition on August 20, 2013. The sample was analyzed for BETX and PAHs as requested.

No analytical complications were noted.

An electronic copy of this data package and all associated raw data will be kept on file at ARI. If you have questions or require additional information, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Mark D. Harris
Project Manager
206/695-6210
markh@arilabs.com

Enclosures

cc: file XB73

MDH/mdh

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: XB 93	Turn-around Requested: STD.	Page: 1 of 1	
ARI Client Company: ASPECT CONSULTING	Phone: 206.328.7443	Date: 8.19.13	Ice Present?
Client Contact: JEREMY PORTER		No. of Coolers:	Cooler Temps:
Client Project Name: BREMERTON GAS WORKS			
Client Project #: 080239	Samplers: C. BROCK		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	BTEX	PAHs							Notes/Comments
SHC-081913	8.19.13	1300	SOLID	1	X	X							

Analysis Requested

Comments/Special Instructions	Relinquished by:	Received by:	Relinquished by:	Received by:
	(Signature) Carla E. Brock	(Signature)	(Signature)	(Signature)
	Printed Name: Carla E. Brock	Printed Name: Rick Hudson	Printed Name:	Printed Name:
	Company: Aspect Consulting	Company: ARI	Company:	Company:
	Date & Time:	Date & Time: 8/20/13 1400	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Aspect

COC No(s): _____ NA

Assigned ARI Job No: XB73

Project Name: Bremerton Gasworks

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Tracking No: _____ NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO
Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)	5.4	~~NA~~ RU

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID#: 122412224

Cooler Accepted by: _____ Date: 8/20/13 Time: 1400

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: _____			
Was sufficient ice used (if appropriate)?	NA	YES	NO
Were all bottles sealed in individual plastic bags?		YES	NO
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		YES	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI	NA		

Was Sample Split by ARI : NA YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by: TS Date: 8-21-13 Time: 734

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:

Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

XB73 : 00003

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: XB73
Client: Aspect Consulting
Project Event: 080239
Project Name: Bremerton Gas Works

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	SHC-081913	XB73A	13-17338	Solid	08/19/13 13:00	08/20/13 14:00

XB73:0000H

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U — Indicates that the target analyte was not detected at the reported concentration

* — Duplicate RPD is not within established control limits

B — Reported value is less than the CRDL but ≥ the Reporting Limit

N — Matrix Spike recovery not within established control limits

NA — Not Applicable, analyte not spiked

H — The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible

L — Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U — Indicates that the target analyte was not detected at the reported concentration

* — Flagged value is not within established control limits

B — Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.

J — Estimated concentration when the value is less than ARI's established reporting limits

D — The spiked compound was not detected due to sample extract dilution

E — Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

Q — Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
NA	The flagged analyte was not analyzed for
NR	Spiked compound recovery is not reported due to chromatographic interference
NS	The flagged analyte was not spiked into the sample
M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
EMPC	Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference
X	Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**
Z	Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod

Sample ID: SHC-081913
SAMPLE

Lab Sample ID: XB73A
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/27/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works
Event: 080239
Date Sampled: 08/19/13
Date Received: 08/20/13

Date Analyzed: 08/22/13 16:40
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 49 mg-dry-wt
Percent Moisture: 26.2%

CAS Number	Analyte	RL	Result
71-43-2	Benzene	51	< 51 U
108-88-3	**Toluene**	**51**	**51**
100-41-4	**Ethylbenzene**	**51**	**1,500**
179601-23-1	**m,p-Xylene**	**100**	**160**
95-47-6	**o-Xylene**	**51**	**620**

BETX Surrogate Recovery

Trifluorotoluene	98.3%
Bromobenzene	84.6%

BETX values reported in µg/kg (ppb)

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod

Sample ID: MB-082213
METHOD BLANK

Lab Sample ID: MB-082213
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/27/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works
Event: 080239
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/22/13 13:37
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result
71-43-2	Benzene	25	< 25 U
108-88-3	Toluene	25	< 25 U
100-41-4	Ethylbenzene	25	< 25 U
179601-23-1	m,p-Xylene	50	< 50 U
95-47-6	o-Xylene	25	< 25 U

BETX Surrogate Recovery

Trifluorotoluene	94.8%
Bromobenzene	95.1%

BETX values reported in µg/kg (ppb)

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod

Sample ID: LCS-082213
LAB CONTROL SAMPLE

Lab Sample ID: LCS-082213
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/27/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works
Event: 080239
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/22/13 12:39
LCSD: 08/22/13 13:08
Instrument/Analyst LCS: PID1/JLW
LCSD: PID1/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Benzene	89.0	105	84.8%	91.5	105	87.1%	2.8%
Toluene	1650	1740	94.8%	1660	1740	95.4%	0.6%
Ethylbenzene	839	870	96.4%	834	870	95.9%	0.6%
m,p-Xylene	2980	3140	94.9%	2970	3140	94.6%	0.3%
o-Xylene	1620	1730	93.6%	1630	1730	94.2%	0.6%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	104%	104%
Bromobenzene	97.0%	99.5%

ANALYTICAL RESOURCES INCORPORATED

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XB73
Matrix: Solid

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works
Event: 080239

Client ID	TFT	BBZ	TOT OUT
MB-082213	94.8%	95.1%	0
LCS-082213	104%	97.0%	0
LCSD-082213	104%	99.5%	0
SHC-081913	98.3%	84.6%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-17338 to 13-17338

FORM II BETX

XB73:00014

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS

Sample ID: SHC-081913
SAMPLE

Lab Sample ID: XB73A
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/29/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works 080239
Date Sampled: 08/19/13
Date Received: 08/20/13

Date Extracted: 08/22/13
Date Analyzed: 08/29/13 11:33
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes
Alumina: No
Silica Gel: No

Sample Amount: 1.52 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 50.0
Percent Moisture: 26.2%

CAS Number	Analyte	RL	Result	
91-20-3	Naphthalene	33,000	630,000	
91-57-6	2-Methylnaphthalene	33,000	76,000	
90-12-0	1-Methylnaphthalene	33,000	690,000	
208-96-8	Acenaphthylene	33,000	1,100,000	
83-32-9	Acenaphthene	33,000	650,000	
86-73-7	Fluorene	33,000	500,000	
85-01-8	Phenanthrene	33,000	4,000,000	ES
120-12-7	Anthracene	33,000	1,300,000	
206-44-0	Fluoranthene	33,000	2,800,000	E
129-00-0	Pyrene	33,000	3,600,000	ES
56-55-3	Benzo(a)anthracene	33,000	1,100,000	
218-01-9	Chrysene	33,000	1,100,000	
50-32-8	Benzo(a)pyrene	33,000	1,200,000	
193-39-5	Indeno(1,2,3-cd)pyrene	33,000	520,000	
53-70-3	Dibenz(a,h)anthracene	33,000	140,000	
191-24-2	Benzo(g,h,i)perylene	33,000	730,000	
132-64-9	Dibenzofuran	33,000	150,000	
TOTBFA	Total Benzofluoranthenes	33,000	1,400,000	

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d14-p-Terphenyl	92.0%
2-Fluorobiphenyl	84.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS

Sample ID: SHC-081913
DILUTION

Lab Sample ID: XB73A
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/29/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works 080239
Date Sampled: 08/19/13
Date Received: 08/20/13

Date Extracted: 08/22/13
Date Analyzed: 08/29/13 12:07
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes
Alumina: No
Silica Gel: No

Sample Amount: 1.52 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 150
Percent Moisture: 26.2%

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	99,000	630,000
91-57-6	2-Methylnaphthalene	99,000	71,000 J
90-12-0	1-Methylnaphthalene	99,000	660,000
208-96-8	Acenaphthylene	99,000	1,200,000 0.012
83-32-9	Acenaphthene	99,000	630,000
86-73-7	Fluorene	99,000	500,000
85-01-8	Phenanthrene	99,000	5,500,000
120-12-7	Anthracene	99,000	1,400,000
206-44-0	Fluoranthene	99,000	3,500,000
129-00-0	Pyrene	99,000	4,500,000
56-55-3	Benzo(a)anthracene	99,000	1,000,000
218-01-9	Chrysene	99,000	1,100,000
50-32-8	Benzo(a)pyrene	99,000	1,100,000
193-39-5	Indeno(1,2,3-cd)pyrene	99,000	450,000
53-70-3	Dibenz(a,h)anthracene	99,000	120,000
191-24-2	Benzo(g,h,i)perylene	99,000	600,000
132-64-9	Dibenzofuran	99,000	150,000
TOTBFA	Total Benzofluoranthenes	99,000	1,300,000

Reported in µg/kg (ppb)

2.2 g

Semivolatile Surrogate Recovery

d14-p-Terphenyl	D
2-Fluorobiphenyl	D

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS

Sample ID: MB-082213
METHOD BLANK

Lab Sample ID: MB-082213
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/29/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works 080239
Date Sampled: NA
Date Received: NA

Date Extracted: 08/22/13
Date Analyzed: 08/28/13 16:23
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes
Alumina: No
Silica Gel: No

Sample Amount: 7.50 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA

CAS Number	Analyte	RL	Result
91-20-3	Naphthalene	67	< 67 U
91-57-6	2-Methylnaphthalene	67	< 67 U
90-12-0	1-Methylnaphthalene	67	< 67 U
208-96-8	Acenaphthylene	67	< 67 U
83-32-9	Acenaphthene	67	< 67 U
86-73-7	Fluorene	67	< 67 U
85-01-8	Phenanthrene	67	< 67 U
120-12-7	Anthracene	67	< 67 U
206-44-0	Fluoranthene	67	< 67 U
129-00-0	Pyrene	67	< 67 U
56-55-3	Benzo(a)anthracene	67	< 67 U
218-01-9	Chrysene	67	< 67 U
50-32-8	Benzo(a)pyrene	67	< 67 U
193-39-5	Indeno(1,2,3-cd)pyrene	67	< 67 U
53-70-3	Dibenz(a,h)anthracene	67	< 67 U
191-24-2	Benzo(g,h,i)perylene	67	< 67 U
132-64-9	Dibenzofuran	67	< 67 U
TOTBFA	Total Benzofluoranthenes	67	< 67 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery	
d14-p-Terphenyl	77.2%
2-Fluorobiphenyl	60.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PNAs by SW8270D GC/MS

Sample ID: LCS-082213
LAB CONTROL

Lab Sample ID: LCS-082213
LIMS ID: 13-17338
Matrix: Solid
Data Release Authorized:
Reported: 08/29/13

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works 080239
Date Sampled: NA
Date Received: 08/20/13

Date Extracted: 08/22/13
Date Analyzed: 08/28/13 16:57
Instrument/Analyst: NT6/JZ
GPC Cleanup: Yes
Silica Gel Cleanup: No

Sample Amount: 7.50 g-dry-wt
Final Extract Volume: 0.50 mL
Dilution Factor: 1.00
Alumina Cleanup: No

Analyte	Lab Control	Spike Added	Recovery
Naphthalene	943	1670	56.5%
2-Methylnaphthalene	933	1670	55.9%
1-Methylnaphthalene	1080	1670	64.7%
Acenaphthylene	983	1670	58.9%
Acenaphthene	971	1670	58.1%
Fluorene	1100	1670	65.9%
Phenanthrene	1120	1670	67.1%
Anthracene	1140	1670	68.3%
Fluoranthene	1230	1670	73.7%
Pyrene	1200	1670	71.9%
Benzo(a)anthracene	1220	1670	73.1%
Chrysene	1220	1670	73.1%
Benzo(a)pyrene	1190	1670	71.3%
Indeno(1,2,3-cd)pyrene	1200	1670	71.9%
Dibenz(a,h)anthracene	1210	1670	72.5%
Benzo(g,h,i)perylene	1200	1670	71.9%
Dibenzofuran	1110	1670	66.5%
Total Benzofluoranthenes	2460	3330	73.9%

Semivolatile Surrogate Recovery

d14-p-Terphenyl	76.4%
2-Fluorobiphenyl	58.0%

Results reported in µg/kg

FORM III

ANALYTICAL RESOURCES INCORPORATED

SW8270 PNA SURROGATE RECOVERY SUMMARY

Matrix: Solid

QC Report No: XB73-Aspect Consulting
Project: Bremerton Gas Works
080239

Client ID	TER	FBP	TOT OUT
MB-082213	77.2%	60.8%	0
LCS-082213	76.4%	58.0%	0
SHC-081913	92.0%	84.0%	0
SHC-081913 DL	D	D	0

	LCS/MB LIMITS	QC LIMITS
(TER) = d14-p-Terphenyl	(30-160)	(30-160)
(FBP) = 2-Fluorobiphenyl	(30-160)	(30-160)

Prep Method: SW3546
Log Number Range: 13-17338 to 13-17338

FORM-II SW8270 PNA

XB73:00016

APPENDIX D
FIELD FORMS AND BORING LOGS

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-01
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 0935
Northing:
Height:

Tidal elevations estimated based on bathymetry

Notes: No aliquot taken from location closest to bank due to large amount of rock and shell and no sediment present.

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	0935			Y	4	

Sample Description: SANDY GRAVEL, well-graded (GW), moist, brown, grey, and black. 50% gravel, 30% sand, 20% shell hash.

Sample Containers: 1x 16 oz, 1x 8 oz, 1x 4 oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-02
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DO
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1440
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1440			Y	4	

Sample Description: Surface - Barnacle-covered COBBLE and GRAVEL, well-sorted (GW).
0-2cm - SANDY GRAVEL, well-sorted (GW). ~ 70% gravel, 20% sand, 10% shell, brown, moist.
2-4cm - GRAVELLY SAND, well-sorted (SW), ~~damp~~, moist, black. 85% sand, 10% gravel, 5% shell
4-10cm - color changes to grey & brown
8-10cm - CLAY, firm, light grey, damp - location closest to water only.

Sample Containers:
1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG03
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1215
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1215			Y		

Sample Description: GRAVELLY SAND, poorly graded (SP). wet, dark grey. 80% sand, 20% gravelly. Surface covered in shell hash and gravel. Trace worms.

Sample Containers: 1x 16oz, 1x 8oz, 1x 4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG04
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1020
Northing:
Height:

Tidal elevations estimated based on bathymetry

Notes: Subsurface aliquots composited from 4 of 5 collection locations. No aliquot taken from location furthest from waters edge. BGW-RE-SG04B

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1020			Y	4	Center location - @ 1cm - Moderate HC-like odor.
	1030				4-12	

Sample Description: 0-1cm - SHELLY SAND, well-graded (SW). Moist, brown. 60% Sand, 30% Shell, 10% gravel
1-10cm: SAND, well-graded (SW) with gravel, cobble, and shell. 70% Sand, 15% gravel, 10% shell, 5% cobble.
10cm-1ft. Fine-grain SAND, poorly graded (SP), wet, grey. Moderate to strong HC odor. Trace to moderate rainbow and metallic sheen.

Sample Containers: 2x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks | Station: BGW-RE-SG05
Job No: 131014-01.01 | Date: 7/8/13
Field Staff: CF, DP | Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1005 | Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1005			Y		

Sample Description: 0-3cm - SHELLY SAND, well-graded (SW). Moist, multi-colored. 50% sand, 30% shell, 20% gravel.
3-10cm - GRAVELLY SAND, well graded (SW). wet, brown. 80% sand, 20% gravel. Slightly small crabs on surface.

Sample Containers: 1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-06
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1200
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1200			Y		

Sample Description: GRAVELLY SAND, well-graded (SW). Moist, grey with black mottling. 75% sand, 20% gravel, 5% shell. Trace snails.

Sample Containers: 1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-07
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1420
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1420			Y	4	

Sample Description: GRAVEL on surface.
Surface-10cm: GRAVELLY SAND (SW), well-graded, damp, grey and brown. Moderate coal and coal-like pieces scattered in and around seds. Moderate algae on surface. 80% sand, 15% gravel, 5% shell.

Sample Containers: 1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-SG08
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1400
Northing:
Height:

Tidal elevations estimated based on bathymetry

Notes: Duplicate collected at 14:10 - BGW-RE-SG58-130708 (2 jars)

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1400			Y	4	

Sample Description: GRAVELLY SAND, well-graded (SW). Damp. Black and brown. 70% sand, 30% gravel. Slight layer of shell on surface with slight dried algae.
0-2 cm - brown, 2-10cm - black.
Trace coal & coke-like pieces.

Sample Containers: 1x16oz, 2x8oz, 2x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG09
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1140
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1140			Y		

Sample Description: 0-2 cm - Shell hash
2-10 cm - GRAVELLY SAND, well-graded, wet, grey and brown. 80% Sand, 10% gravel.

Sample Containers: 1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-10
Job No: 131014-01.01
Date: July 8 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 0953 first aliquot
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	0953			Y ~~0-4~~ DPH	0-4	No odor ~10% algae on rocks

Sample Description:

SAND w/ 10% gravel ~~50~~ DPH 5% shell hash
Brown in top 1 inch then gray color
Some rust-colored sand
~10% cobble on surface
Well graded Moist, soft

Sample Containers: 3 jars as noted below

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG11
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1230
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1230			Y	4	

Sample Description: GRAVELLY SAND, well graded (SW). Wet, brown and grey. 80% Sand, 15% gravel, 5% Shell hash. Moderate algae on surface.

Sample Containers: 1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-12
Job No: 131014-01.01
Date: July 8, 2015
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1006 first aliquot
Northing:

Height:

Tidal elevations estimated based on bathymetry

Notes:

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1006			Y	0-4	No odor ~10% Algae on surface

Sample Description:

SAND w/ coarse gravel ~10% gravel, 5% shell hash
Brown color with some gray lenses
Some dark gray lenses ~~Poorly~~ SP-SW graded - well
No odor
Grades from coarse surface to finer sand
w/ trace silt
Moist, soft

Sample Containers: 5 jars as noted below

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG13
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1245
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1245			Y	4	

Sample Description: GRAVELLY SAND, well graded (SW), wet, brown and grey. 85% sand, 10% gravel, 5% shell hash. Water and moderate algae on surface.

Sample Containers: 1 x 16oz, 1 x 8oz, 1 x 4oz.

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-14
Job No: 131014-01.01
Date: July 8, 2013
Field Staff:
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1018 | Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1018			Y	0-4	No odor Some Fucus on station

Sample Description:

SAND w/15% gravel w/o 10% cobble on surface
chunks of rust & 15% shell hash
Brown color, Well Graded
Moist. Soft
Some Fucus on station

Sample Containers: 3 as noted below:

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-15
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 10:47 ~~Dup at 1052~~ DPH
Northing:

Height:

Tidal elevations estimated based on bathymetry

Notes: Very minor hydrocarbon odor in SE alloqvot
PID recorded zero throughout

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			DPH Minor HC
1	10:47				0-4	~~No~~ odor in SW Alloqvot
Dup	10:52				0-4	SG-65
Arch	10 47				4-10	SG-15-B From SE corner

Sample Description:

G #1 Surface covered with gravel + cobble - covered w/ barnacles
SAND w/ 10-15 % silt - Darker lenses @ 3 inches
Moist. Soft DPH - Slight odor - Well graded

Arch #B SAND w trace silt Brown color
Moist. Soft No Odor Poorly graded

Sample Containers: 4 jars as noted below

Analyses: TOC, PAH-SIM, Archive +B Archive at 4-10
4oz 8oz 16oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG16
Job No: 131014-01.01
Date: 7/8/13
Field Staff: CF, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1300
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1300			Y	4	

Sample Description: 0-1 cm - Shell hash
1-10cm - GRAVELLY SAND, well graded (SW), wet, brown with slight black mottling. 90% Sand, 10% Gravel, trace shell. Some anthropogenic-like material (iron slag & pipe, decomposed) on surface. Moderate algae on surface.

Sample Containers: 1x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-17
Job No: 131014-01.01
Date:
Field Staff:
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1500
Northing:
Height:

Tidal elevations estimated based on bathymetry

Notes: Subsurface Sample collected from 4 of 5 locations, not collected from western location.

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1500			Y	4	
2	1510			Y	4-9	Archive

Sample Description: GRAVEL and COBBLES on surface (GW)
Surface - 8cm: SANDY GRAVEL, well-sorted (GW), damp, brown. 70% sand, 30% gravel.
8-16cm - Color changes to black. Moderate HC odor noted in 4 of 5 collection locations, not in west location.
Black layer ~2-4cm thick. Color changes back to brown to ~22cm.

Sample Containers:
2x16oz, 1x8oz, 1x4oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-18
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1453
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1453			Y	0.4	No Odor

Sample Description: Surface mostly gravel w/ Fucus on larger cobble
Brown Med/Coarse SAND. Moist. Soft
Gravel about 20% gravel
Well graded

Sample Containers: 3 jars as noted below

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-19
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gellingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1500 | Northing:

Height:

Tidal elevations estimated based on bathymetry

Notes: Slight hydrocarbon odor

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1)	1500				0-4	center HC. odor NW, SW, NE, SE all slight odor
B)	1515				4-8	HC odor - moderate Very hard w/ Gravel

Sample Description: Surface large cobble with barnacles, some open mud patches ~ 30% of surface of ~~s~~ stations

1) Olive Brown surface Dark gray Med ~~SAND~~ w/ silt 20% gravel. Moist. Firm

B) Dark Gray / Black Coarse ~~SAND~~ med w/ 30% Gravel w/ cobble Very Firm. Moist well Graded

Sample Containers: 4 Jars as noted below:

Analyses: TOC, PAH-SIM, Archive + B- Archive
4oz 8oz 16oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG 20
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Collingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1254
Northing:

Height:

Tidal elevations estimated based on bathymetry

Notes: Slight hydrocarbon odor

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1254			Y	0-4	Center HC odor All corners HC odor
B	1305			Y	4-8	Very slight HC odor

Sample Description:

#1 Edge of cape. Surface covered w/ cobble + barnacles shell hash
Olive on surface dark gray SAND 15% gravel
Moist. Soft Well graded

#B ~~Dark~~ PH Olive gray med/coarse SAND w/ 10% grav. Moist. Soft
Well graded - water filled holes

Sample Containers:
3 + 1 archive of B- interval

Analyses: TOC, PAH-SIM, Archive + B-archive
~~8oz~~ 8oz 16oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-21
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1445
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1445			Y	0-4	No Odor

Sample Description: Surface covered w/ pea gravel (<5% cobble.
Brown Med/Coarse SAND Moist, Soft
15% gravel Well Graded

Sample Containers: 3 jars as noted below:

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-22
Job No: 131014-01.01
Date: 7/8/2013
Field Staff: DG - DH
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 11:15
Northing:

Height:

Tidal elevations estimated based on bathymetry

Notes: Center, NW, SE, NE Slight Hydrocarbon odor
Archive all 4 allequots

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	11:15			Y	0-~~10~~ 4 DPH	
B	11:20			~~Y~~	~~0~~-10	SG-22-B

Sample Description:

G1 COARSE SAND w/ Gravel ~15%
Dark gray in 1-2 inches of top interval w/
slight H.C. odor moist, soft well graded

B COARSE SAND w/ Gravel ~15%
slight H.C. odor moist, soft well graded
Dark gray lenses 5-6 then brown 6-10"

Sample Containers: ~~B~~ As noted Below

Analyses: TOC, PAH-SIM, Archive + B archive
4oz 8oz 16oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-23
Job No: 131014-01.01
Date:
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1220
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1220			Y	0-~~4~~	Slight flic. odor in all alloquots
B	1225			Y	4-12	Very slight HC odor

Sample Description: Cobble surface w/ barnacles

#1 Dark gray SAND (coarse) 5% gravel well sorted few shells moist - non plastic

B Dark Gray SAND (coarse) trace gravel Moist soft well sorted water filled hole

Sample Containers: 3 + 1 Archive of B interval

Analyses: TOC, PAH-SIM, Archive + B-interval Archive
4oz 8oz 16oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-24
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1435
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1435			Y	0-4	No Odor

Sample Description: Surface covered in large gravel + pea gravel ~ 5-10% shell hash. Fucus on rocks
Olive brown Med/Coarse SAND. Moist. ~~Firm~~ DPH Soft
Well graded. 15% gravel. 10% shell hash

Sample Containers: 3 jars as noted below

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-25
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1403 | Northing:

Height:

Tidal elevations estimated based on bathymetry

Notes: Slight hydrocarbon odor

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1403			Y	0-4	center - slight HC odor NW, SW, NE, SE all slight HC odor
B	1404			Y	4-12	Very slight HC odor

Sample Description: Surface mostly shell hash w/ some barnicle covered cobble. Surface ~~SAND~~ olive with

1) SAND Dark gray at 0.5-2 inches associated w/ H.C. odor then Olive SAND. 10-15% gravel Moist. Soft

B) ~~Dark~~ Dark Gray Med./Coarse SAND. 10% gravel Olive Moist. Soft

Sample Containers:

4 jars as noted below

Analyses: TOC, PAH-SIM, Archive + B interval

4oz. 8oz 16oz. 16oz.

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-26
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1204 | Northing:

Height:

~~Tidal elevations estimated based on bathymetry~~ 8.4

Notes: Hydrocarbon Odor - center - dark gray
No other points had odor

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1204			Y	0-4	Slight H.C. odor on center pt.
B	1214			Y	4-12	Center only had slight odor No sheen
						SG-26-B

Sample Description: Few cobbles on surface - mostly sand and shell hash
G1 Dark gray SAND ~5% gravel
moist, soft -
B Dark gray SAND ~~Moist~~ wet, very soft
wet because hole filled in w/ water

Sample Containers: 4 As Noted Below:

Analyses: TOC, PAH-SIM, Archive + Archive B interval
1/2 oz. 8 oz. 16 oz. 16 oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-27
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1354
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1354			Y	0-4	No Odor

Sample Description:
Barnacle covered cobble and shell hash on surf
Brown moist ~~Medium~~ SAND
~ 5-10% shell hash ~ 10% gravel
Moist. Soft.

Sample Containers: 3 jars as noted below

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-28
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1424
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1424			Y	0-4	No Odor

Sample Description: Surface barnacle covered cobble + gravel. Fucus seaweed.
Brown Med/Coarse SAND 10-15% gravel
Small area rust colored sand
Well graded

Sample Containers: 3 as noted below:

Analyses: TOC, PAH-SIM, Archive
1/oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-29
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1348
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1348			Y	0-4	No Odor

Sample Description: Gravel + Cobble on surface
Brown Med SAND w/ ~ 5% shell hash
Moist Soft ~ 10% gravel - Well graded

Sample Containers: 3 8ozs as noted below

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: SG-3C
Job No: 131014-01.01
Date: July 8, 2013
Field Staff: Gillingham / Hennessy
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1115
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1115			Y	0-4	No odor

Sample Description:
cobble on surface w/ barnacles + clamshells
coarse SAND with ~10% gravel
olive brown surface w/ dark gray 0.5-1.5 in.
then brown gray to 4 in
Soft. Moist. Well graded

Sample Containers: 3 jars as noted below.

Analyses: TOC, PAH-SIM, Archive
4oz 8oz 16oz

ANCHOR QEA

DATE: 8/7/13

PROJECT NAME: Bremerton Gasworks

PROJECT NO: 131014-01.01

DAILY SAFETY BRIEFING

PERSON CONDUCTING MEETING: D. Peterson

HEALTH & SAFETY OFFICER: D. Templeton

PROJECT MANAGER: M. Larsen

TOPICS COVERED:

- [x] Emergency Procedures and Evacuation Route
- [x] Directions to Hospital
- [x] HASP Review and Location
- [x] Safety Equipment Location
- [ ] Proper Safety Equipment Use
- [ ] Employee Right-to-Know/MSDS Location
- [ ] Fire Extinguisher Location
- [x] Eye Wash Station Location
- [ ] Buddy System
- [x] Self and Coworker Monitoring
- [ ] Lines of Authority
- [x] Communication
- [ ] Site Security
- [ ] Vessel Safety Protocols
- [x] Work Zones
- [ ] Vehicle Safety and Driving/Road Conditions
- [ ] Equipment Safety and Operation
- [ ] Proper Use of PPE
- [x] Decontamination Procedures
- [ ] Other:
- [x] Lifting Techniques
- [x] Slips, Trips, and Falls
- [ ] Hazard Exposure Routes
- [x] Heat and Cold Stress
- [ ] Overhead and Underfoot Hazards
- [ ] Chemical Hazards
- [ ] Flammable Hazards
- [ ] Biological Hazards
- [x] Eating/Drinking/Smoking

WEATHER CONDITIONS: Sunny, warm

DAILY WORK SCOPE: Beach grab sampling

SITE-SPECIFIC HAZARDS: Contaminated seds, hot weather

SAFETY COMMENTS: Drink water, take breaks

ATTENDEES

PRINTED NAME	SIGNATURE
Delaney Peterson	D. Peterson
Nik Bacher	Nik Bacher
PAUL CYRWETH	[illegible]
Kathy Parker	Kathy Parker
Nathan Socury	[illegible]

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-31
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1100 | Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1100			Y	4	

Sample Description: Layer of gravel on surface.
Sand w/ gravel: Brown, moist, f-m sand (85%), 15% gravel
Shell hash in hole closest to shoreline.

Sample Containers: 1x4oz, 1x8oz, 1x16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-32
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1200
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (In)	Comments
		Easting	Northing			
1	1200			Y	4	

Sample Description: Shell gravel, ~~and~~ rip-rap, and algae (ulva) on surface. 2cm shell hash on surface. Sand, gravel, and shell: Moist to wet, grey and white, 70% f-m sand, 25% shell, 5% gravel.

Sample Containers: 1x 4oz, 1x 8oz, 1x 16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-33
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1115 | Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1115			Y	4	

Sample Description: Algae on surface (fucus), gravel & cobble on surface
Sand and gravel with shell hash. Damp to wet, greyish-brown
70% f-m sand, 20% gravel, 10% shell hash

Sample Containers: 1x4oz, 1x8oz, 1x16 oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-34
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1130 | Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1130			Y	4	

Sample Description: Gravel & cobble on surface
Sand, gravel, and shell. Damp, brown, f-m sand (85%), 15% gravel, 5% shell hash.

Sample Containers: 1x 4oz, 1x 8oz, 1x 16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-35
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements | Horizontal Datum: NAD 83 Wa. SP North, U.S. ft | Easting:

Time: 1240
Northing:

Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1240			Y	4	

Sample Description: Shell hash on surface.
Damp, brown, f-m sand (85%), 15% gravel

Sample Containers: 1x 8oz, 1x4oz, 1x16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-3C
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1200
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1200			Y	4	

Sample Description: Gravel on surface.
Sand with gravel, 70% f-m sand, 20% gravel, 10% shell hash with scattered orange brick fragments. Dry to moist, grayish brown. Trace clams. Trace pieces of black coal-like material. 1" piece of wire in homogenized material.

Sample Containers: 1x4oz, 1x8oz, 1x16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-37
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1230
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1230			Y	4	

Sample Description: Sand with gravel: Damp, brown, f-m sand (85%), 15% gravel. Trace brick fragments. Algae on surface (mlva)

Sample Containers: 1x 4oz, 1x 8oz, 1x 16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-38
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1150
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
	1150			Y	4	

Sample Description: Gravel and shell hash on surface. Wet, brown and black, f-m sand (70%), 30% gravel. ~1/2" lens of black sand on surface in center hole and two holes along shore. Trace worms.

Duplicate collected: BGW-RE-SG-88

Sample Containers: Sample: 1x 4oz, 1x 8oz, 1x 16oz; dup: 1x 4oz, 1x 8oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-39
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1255
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1255			Y	4	

Sample Description: Sand with gravel and brick Wet, grayish brown. 90% f-m sand, 5% gravel, 5% brick fragments

Sample Containers: 1x4oz, 1x8oz, 1x16oz

Analyses: TOC, PAH-SIM, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-40
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1315
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1315			Y	4	

Sample Description: Gravelly shell hash on surface
Moist, grey, 85% f-m sand, 15% gravel.

Sample Containers: 1x 16oz

Analyses: ~~TOC, PAH-SIM,~~ Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-41
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1305
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1305			Y	4	

Sample Description: Gravel on surface.
Moist, dark grey, 75% f-m sand, 25% gravel

Sample Containers: 1x 16oz

Analyses: ~~TOC, PAH-SIM~~, Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-42
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1125
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1125					

Sample Description: Gravel & cobble on surface.
Sand and gravel: Damp, brown, ~~sand~~ grey, and black ~ 2" layer of black sand on surface. 85% Sand, 15% gravel. Trace shell hash (25%.)

Sample Containers: 1 x 16 oz

Analyses: ~~TOC, PAH-SIM,~~ Archive

ANCHOR QEA

Surface Sediment Field Log

Job: Bremerton Gasworks
Station: BGW-RE-SG-43
Job No: 131014-01.01
Date: 8/7/13
Field Staff: NB, DP
Sample Method: Hand Collection
Proposed Coordinates:

Tide Measurements
Horizontal Datum: NAD 83 Wa. SP North, U.S. ft
Easting:
Time: 1320
Northing:
Height:

Notes: Tidal elevations estimated based on bathymetry

Grab #	Time	Confirmed Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments
		Easting	Northing			
1	1320			Y	4	

Sample Description: Gravel on Surface.
Damp, brown and black, 85% f-m sand, 15% gravel.
Black lens, ~2" thick from surface in northern and ~~ea~~ western holes.

Sample Containers: 1 x 16 oz

Analyses: ~~TOC, PAH-SIM,~~ Archive

Sediment Core Log

BGW-RE-GP-01 / BGW-RE-HA-01

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **1.5**
Collection Date: **9/3/2013-9/4/2013**	Ground Elevation (ft): **18.5**	Field Recovery Length (ft): **1.2**
Contractor: **Cascade Drilling**	N/LAT:**216292.172856** E/LONG:**1193728.93267**	Process Date: **9/3/2013-9/4/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM/NB**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0–1.5		BGW-RE-GP-01-0-1.2-130903	PAH, TS/TOC		SILT (ML). Moist, dark brown, 100% fines. Contains organics (woody fibers). Dry, light brown, 80% fines, 20% fine to coarse gravel.	18.0
1.5–5.0		No Sample	No Sample		SILTY SAND (SM). Hard. Contains roots.	17.0
5.0–6.5		BGW-RE-HA-01-6.5	PAH, TS/TOC		Black sand (coal-like).	13.0
6.5–8					End of Core @ 6.5 ft.	12.0

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8

Elevation scale: 18.0, 17.0, 16.0, 15.0, 14.0, 13.0, 12.0, 11.0

I:\Projects\Port of Olympia\Budd Inlet Cleanup\Field_Data_2013_Event\Sed_Core_Data\Core Processing Logs\LogPlot\Data & T

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, WA 98101
206-287-9130

Notes: 1. 0-1.5' collected by Geoprobe on 9/3/2013, 1.5-6.5' collected by hand auger (HA) on 9/4/2013.
2. Attempt 2 of 2 (Geoprobe).

Calculated Recovery
Recovery Length/Penetration Depth:
80%

Sediment Core Log

BGW-RE-GP-02

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **4**
Collection Date: **9/3/2013**	Ground Elevation (ft): **11**	Field Recovery Length (ft): **3.5**
Contractor: **Cascade Drilling**	N/LAT**216292.78834** E/LONG:**1193748.64851**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0		BGW-RE-GP-02-0-1.2-130903 BGW-RE-GP-02-0.8-1.0-130903	PAH, TS/TOC, VOC	13.4	SILTY SAND WITH GRAVEL (SM). Moist, dark brown, 70% fine to medium sand, 15% fines, 15% fine gravel. Contains shell and brick fragments.	11.0
1					POORLY GRADED SAND WITH SILT (SP-SM). Grayish brown, 80% fine to medium sand, 10% fines, 10% fine gravel. 0.3 ft bed of black, viscous, HC-like material. Strong HC-like odor. Strong metallic sheen.	10.0
2		BGW-RE-GP-02-1.2-3.5-130903	PAH, TS/TOC, Archive		POORLY GRADED SAND (SP). Moist, brown, 95% fine to medium sand, 5% fines. Slight HC-like odor. Contains fine gravel. No odor	9.0
3						8.0
4					End of Core @ 4 ft.	7.0
5						6.0

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Notes: 1. Attempt 1 of 1.

Calculated Recovery
Recovery Length/Penetration Depth:
87.5%

Sediment Core Log

BGW-RE-GP-03

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **5.0**
Collection Date: **9/3/2013**	Ground Elevation (ft): **9.0**	Field Recovery Length (ft): **4.5**
Contractor: **Cascade Drilling**	N/LAT**216308.832272** E/LONG:**1193728.80997**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0					POORLY GRADED SAND (SP). Wet, dark gray, 100% fine sand. Strong HC-like odor. Contains shell fragments.	9.0
				18.9		
1		BGW-RE-GP-03-0-2-130903 BGW-RE-GP-03-0.7-1.2-130903	PAH, TS/TOC, VOC, Archive		0.8' bed of blackish brown HC-like material. Strong HC-like odor. Strong rainbow sheen.	8.0
2						7.0
					0.3' bed of blackish brown HC-like material. Strong HC-like odor. Strong rainbow sheen.	
				41.6		
3		BGW-RE-GP-03-2-3.5-130903 BGW-RE-GP-03-2.0-2.8-130903	PAH, TS/TOC, VOC, Archive		0.5' bed of blackish brown HC-like material. Strong HC-like odor. Strong rainbow sheen.	6.0
4					Gray. No odor.	5.0
		BGW-RE-GP-03-3.5-4.5-130903	PAH, TS/TOC		GRAVELLY CLAYEY SILT WITH SAND (ML/CL). Firm, moist, brown, 60% medium plasticity fines, 25% fine to coarse gravel, 15% medium sand. Gravel is subrounded. No odor.	
5					End of Core @ 5.0 feet.	4.0

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Notes: 1. Attempt 1 of 1.
2. Core collected in 2 sections.

Calculated Recovery
Recovery Length/Penetration Depth:
0-4': 87.5% 4-5': 100%

Sediment Core Log

BGW-RE-GP-04

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **4**
Collection Date: **9/3/2013**	Ground Elevation (ft): **8.48804664612**	Field Recovery Length (ft): **2.2**
Contractor: **Cascade Drilling**	N/LAT**216308.042247** E/LONG:**1193753.30598**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0					POORLY GRADED SAND WITH SILT (SP-SM). Moist, grayish brown, 80% fine to medium sand, 10% fines, 10% fine gravel. 90% fine to medium sand, 10% fines.	8.0
1		BGW-RE-GP-04-0-1.2-130903	PAH, TS/TOC, Archive		CLAYEY SILT (ML/CL). Moist, brown, hard, 90% medium plasticity fines, 10% fine sand.	7.0
2					GRAVELLY CLAYEY SILT WITH SAND (ML/CL). Firm, moist, brown, 50% medium plasticity fines, 30% fine to coarse gravel, 20% medium to coarse sand.	
3		BGW-RE-GP-04-1.2-2.2-130903	PAH, TS/TOC		POORLY GRADED SAND (SP). 95% medium to coarse sand, 5% fines.	6.0 5.0
4					End of Core @ 4 ft.	4.0
5						

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Notes: 1. Attempt 1 of 1.

Calculated Recovery
Recovery Length/Penetration Depth:
55%

Sediment Core Log

BGW-RE-GP-05

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **5.0**
Collection Date: **9/3/2013**	Ground Elevation (ft): **5.0**	Field Recovery Length (ft): **3.7**
Contractor: **Cascade Drilling**	N/LAT:**216336.173096** E/LONG:**1193729.28405**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM/NB**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0		BGW-RE-GP-05-0-1-130903 BGW-RE-GP-05-0.3-0.8-130903	PAH, TS/TOC, VOC	1.7	SILT SAND (SM). Moist, brownish gray, 75% fine to medium sand, 15% fines, 10% fine gravel. Contains shell fragments Dark gray. Slight HC-like odor.	5.0
1					POORLY GRADED SAND (SP). Moist, gray, 95% fine to medium sand, 5% fines. Trace HC-like odor.	4.0
2		BGW-RE-GP-05-1-2.7-130903	PAH, TS/TOC, Archive		POORLY GRADED SAND WITH GRAVEL (SP). 65% fine to medium sand, 30% fine to coarse gravel, 5% fines. Trace HC-like odor.	3.0
3					POORLY GRADED SAND (SP). 100% fine to medium sand. No odor.	2.0
4		BGW-RE-GP-05-2.7-3.7-130903	PAH, TS/TOC, Archive			1.0
5					End of Core @ 5 ft.	0.0

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Notes: 1. Attempt 1 of 1.
2. Core collected in 2 sections.

Calculated Recovery
Recovery Length/Penetration Depth:
0-4': 67.5% 4-5': 100%

Sediment Core Log

BGW-RE-GP-06

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **4**
Collection Date: **9/3/2013**	Ground Elevation (ft): **5.0**	Field Recovery Length (ft): **3.8**
Contractor: **Cascade Drilling**	N/LAT:**216335.224935** E/LONG:**1193752.04155**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM/NB**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0		No Sample	No Sample	0.1	SILTY SAND (SM). Wet, blackish gray, 80% fine sand, 20% non-plastic fines. Contains crushed brick fragments and black angular gravel pieces. Slight HC-like odor.	5.0
1		BGW-RE-GP-06-0.8-2.2-130903	PAH, TS/TOC		POORLY GRADED SAND WITH GRAVEL (SP). Wet, blackish gray, 65% fine to medium sand, 30% fine to coarse gravel, 5% fines. Slight HC-like odor.	4.0
2					Brownish gray. Gravel is predominantly fine.	3.0
3		BGW-RE-GP-06-2.2-3.8-130903	PAH, TS/TOC			2.0
4					End of Core @ 4 ft.	1.0
5						0.0

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Notes: 1. Attempt 1 of 1.

Calculated Recovery
Recovery Length/Penetration Depth:
95%

Sediment Core Log

BGW-RE-GP-07

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **5**
Collection Date: **9/3/2013**	Ground Elevation (ft): **2.4**	Field Recovery Length (ft): **4.3**
Contractor: **Cascade Drilling**	N/LAT:**216361.617599** E/LONG:**1193727.8618**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM/NB**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0					SILTY SAND (SM). Moist, 75% fine to medium sand, 20% non-plastic fines, 5% fine gravel. Contains black angular fragments up to 0.1'.	
					POORLY GRADED SAND WITH SILT (SP-SM). 80% fine to medium sand, 10% fines, 10% fine gravel.	2.0
1		BGW-RE-GP-07-0-1.8-130903	PAH, TS/TOC, Archive			
					Contains occasional coarse gravel and occasional pockets of reddish brown sand.	1.0
2					POORLY GRADED SAND (SP). Grayish brown, 100% fine to medium sand. Contains occasional fine gravel. Sand grains are white, gray, black, and orange.	0.0
3		BGW-RE-GP-07-1.8-4.3-130903	PAH, TS/TOC, Archive			-1.0
4						-2.0
5					End of Core @ 5 ft.	

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Notes: 1. Attempt 1 of 1.
2. Core collected in 2 sections.

Calculated Recovery
Recovery Length/Penetration Depth:
0-4': 86% 4-5': 100%

Sediment Core Log

BGW-RE-GP-08

Project: **Bremerton Gas Works Site**	Location: **Bremerton, WA**	Tube Length (ft): **4 ft. sections**
Project #: **131014-01.01**	Client: **Cascade Natural Gas Corporation**	Penetration Depth (ft): **5**
Collection Date: **9/3/2013**	Ground Elevation (ft): **2.3**	Field Recovery Length (ft): **3.7**
Contractor: **Cascade Drilling**	N/LAT:**216361.143519** E/LONG:**1193752.04155**	Process Date: **9/3/2013**
Drill Rig Type: **54 LT Limited Access Geoprobe**	Horiz. Datum: **NAD 83 N** Vert. Datum: **MLLW**	Process Method: **Cut tube**
Operator: **Frank Scott**	Method/Tube ID: **Geoprobe/1.5"**	Sample Quality: **Good** Logged By: **EM/NB**

In-Situ Depth (ft)	In-Situ Interval	Sample	Chemical Analysis	PID	Sediment Description Samples and Descriptions are in In-Situ Depths. Classification Scheme: USCS	Estimated In-situ Elevation (MLLW)
0					SILTY SAND (SM). Wet, dark gray, 80% fine to medium sand, 15% non-plastic fines, 5% fine gravel. Contains anthropogenics (red paint chip).	2.0
				0.1	Reddish brown. 75% fine to medium sand, 15% non-plastic fines, 10% fine gravel. Gravel content increases downcore.	
1		BGW-RE-GP-08-0-1.8-130903	PAH, TS/TOC, Archive			1.0
2						0.0
3					POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM). 75% medium to coarse sand, 15% fine gravel, 10% fines.	-1.0
4		BGW-RE-GP-08-1.8-3.7-130903	PAH, TS/TOC, Archive			-2.0
5					End of Core @ 5 ft.	-3.0

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Notes: 1. Attempt 1 of 1.
2. Core collected in 2 sections.

Calculated Recovery
Recovery Length/Penetration Depth:
0-4': 67.5% 4-5': 100%

APPENDIX E
ANALYTICAL CHEMISTRY DATA

APPENDIX F
DATA VALIDATION REPORTS

ANCHOR QEA

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DATA VALIDATION REVIEW REPORT – EPA STAGE 2B

Project:	Bremerton Gasworks
Project Number:	131014-01.01
Date:	July 22, 2013

This report summarizes the review of analytical results for 36 sediment samples, two field duplicates, and one rinse blank collected July 8, 2013. The samples were collected by Anchor QEA, LLC and submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. The samples were analyzed for the following analyses:

- Polycyclic Aromatic Hydrocarbons (PAHs) by United States Environmental Protection Agency (USEPA) method 8270D-SIM
- Total solids (TS) by Standard Method (SM) 2540B
- Total organic carbon (TOC) by Plumb, 1981

ARI sample data group (SDG) numbers WW72, WW73, and WX18 were reviewed in this report. IDs of the samples whose results were reviewed in this report are presented in Table 1.

Table 1
Samples Reviewed

Sample ID	Lab ID	Matrix	Analyses Requested
BGW-RE-SG-01-130708	WW72A	Sediment	PAHs, TOC, TS
BGW-RE-SG-02-130708	WW72B	Sediment	PAHs, TOC, TS
BGW-RE-SG-03-130708	WW72C	Sediment	PAHs, TOC, TS
BGW-RE-SG-04-130708	WW72D	Sediment	PAHs, TOC, TS
BGW-RE-SG-05-130708	WW72E	Sediment	PAHs, TOC, TS
BGW-RE-SG-06-130708	WW72F	Sediment	PAHs, TOC, TS
BGW-RE-SG-07-130708	WW72G	Sediment	PAHs, TOC, TS
BGW-RE-SG-08-130708	WW72H	Sediment	PAHs, TOC, TS
BGW-RE-SG-09-130708	WW72I	Sediment	PAHs, TOC, TS
BGW-RE-SG-10-130708	WW72J	Sediment	PAHs, TOC, TS
BGW-RE-SG-11-130708	WW72K	Sediment	PAHs, TOC, TS
BGW-RE-SG-12-130708	WW72L	Sediment	PAHs, TOC, TS
BGW-RE-SG-13-130708	WW72M	Sediment	PAHs, TOC, TS
BGW-RE-SG-14-130708	WW72N	Sediment	PAHs, TOC, TS
BGW-RE-SG-15-130708	WW72O	Sediment	PAHs, TOC, TS

Sample ID	Lab ID	Matrix	Analyses Requested
BGW-RE-SG-16-130708	WW73A	Sediment	PAHs, TOC, TS
BGW-RE-SG-17-130708	WW73B	Sediment	PAHs, TOC, TS
BGW-RE-SG-18-130708	WW73C	Sediment	PAHs, TOC, TS
BGW-RE-SG-19-130708	WW73D	Sediment	PAHs, TOC, TS
BGW-RE-SG-20-130708	WW73E	Sediment	PAHs, TOC, TS
BGW-RE-SG-21-130708	WW73F	Sediment	PAHs, TOC, TS
BGW-RE-SG-22-130708	WW73G	Sediment	PAHs, TOC, TS
BGW-RE-SG-23-130708	WW73H	Sediment	PAHs, TOC, TS
BGW-RE-SG-24-130708	WW73I	Sediment	PAHs, TOC, TS
BGW-RE-SG-25-130708	WW73J	Sediment	PAHs, TOC, TS
BGW-RE-SG-26-130708	WW73K	Sediment	PAHs, TOC, TS
BGW-RE-SG-27-130708	WW73L	Sediment	PAHs, TOC, TS
BGW-RE-SG-28-130708	WW73M	Sediment	PAHs, TOC, TS
BGW-RE-SG-29-130708	WW73N	Sediment	PAHs, TOC, TS
BGW-RE-SG-30-130708	WW73O	Sediment	PAHs, TOC, TS
BGW-RE-SG-65-130708	WW73P	Sediment	PAHs, TOC, TS
BGW-RE-SG-58-130708	WW73Q	Sediment	PAHs, TOC, TS
BGW-RE-SG-RB-130708	WW73R	Water	PAHs
BGW-RE-SG-04B-130708	WX18E	Sediment	PAHs, TOC, TS
BGW-RE-SG-15B-130708	WX18B	Sediment	PAHs, TOC, TS
BGW-RE-SG-17B-130708	WX18F	Sediment	PAHs, TOC, TS
BGW-RE-SG-19B-130708	WX18C	Sediment	PAHs, TOC, TS
BGW-RE-SG-22B-130708	WX18D	Sediment	PAHs, TOC, TS
BGW-RE-SG-25B-130708	WX18A	Sediment	PAHs, TOC, TS

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QA/QC) guidelines outlined in the analytical procedures and data quality objective sections of the Quality Assurance Project Plan (QAPP; Anchor QEA, 2013). Laboratory results were reviewed using the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganics Data Review* (USEPA 2004)
- *USEPA National Functional Guidelines for Organic Data Review* (USEPA 1999)
- *USEPA National Functional Guidelines for Superfund Organic Methods Data Review* (USEPA 2008)

And also by using laboratory and method QC criteria as stated in USEPA (1986; SW 846, Third Edition), *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January

1995; update III, December 1996; update IIIA, April 1998. Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody forms were signed by ARI at the time of sample receipt; the samples were received cold and in good condition.

Holding Times and Sample Preservation and Analytical Methods

Samples were appropriately preserved and analyzed within holding times.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes with the exceptions of eight analytes in one of the PAH method blanks associated with SDG WW73. All associated results were significantly greater than (>5x) the levels detected in the method blank so no data were qualified.

Field Quality Control

Rinse Blanks

One rinse blank was collected with one of these sample sets and analyzed for PAHs. Target analytes were below detection with the exceptions of the low-level detections of four analytes. Concentrations were significantly lower than those in the samples so results are not expected to be affected.

Field Duplicates

Two field duplicates were collected in association with these sample sets. Detected results are summarized in Table 2.

Table 2
Field Duplicate Summary

Analyte	BGW-RE-SG-08-130708	BGW-RE-SG-58-130708	RPD
1-Methylnaphthalene	790 µg/kg	4200 µg/kg	137%
2-Methylnaphthalene	2300 µg/kg	8700 µg/kg	116%
Acenaphthene	150 µg/kg	280 µg/kg	60%
Acenaphthylene	4500 µg/kg	7000 µg/kg	43%
Anthracene	3500 µg/kg	5200 µg/kg	39%

Analyte	BGW-RE-SG-08-130708	BGW-RE-SG-58-130708	RPD
Benzo(a)anthracene	23000 µg/kg	17000 µg/kg	30%
Benzo(a)pyrene	26000 µg/kg	16000 µg/kg	48%
Benzo(b)fluoranthene	18000 µg/kg	12000 µg/kg	40%
Benzo(g,h,i)perylene	21000 µg/kg	16000 µg/kg	27%
Benzo(j)fluoranthene	8700 µg/kg	6100 µg/kg	35%
Benzo(k)fluoranthene	7800 µg/kg	6100 µg/kg	24%
Chrysene	25000 µg/kg	22000 µg/kg	13%
Dibenz(a,h)anthracene	3200 µg/kg	2800 µg/kg	13%
Dibenzofuran	520 µg/kg	1100 µg/kg	72%
Fluoranthene	36000 µg/kg	32000 µg/kg	12%
Fluorene	1100 µg/kg	2000 µg/kg	58%
Indeno(1,2,3-cd)pyrene	14000 µg/kg	11000 µg/kg	24%
Naphthalene	3800 µg/kg	16000 µg/kg	123%
Phenanthrene	17000 µg/kg	27000 µg/kg	45%
Pyrene	47000 µg/kg	34000 µg/kg	32%
Total Organic Carbon	9.31 pct	4.98 pct	61%
Total Solids	78.02 pct	81.48 pct	4%

Analyte	BGW-RE-SG-15-130708	BGW-RE-SG-65-130708	RPD
1-Methylnaphthalene	3500 µg/kg	1600 µg/kg	75%
2-Methylnaphthalene	5500 µg/kg	2400 µg/kg	78%
Acenaphthene	960J µg/kg	540 µg/kg	56%
Acenaphthylene	6400 µg/kg	3000 µg/kg	72%
Anthracene	7400 µg/kg	4300 µg/kg	53%
Benzo(a)anthracene	23000 µg/kg	13000 µg/kg	56%
Benzo(a)pyrene	24000 µg/kg	14000 µg/kg	53%
Benzo(b)fluoranthene	16000 µg/kg	9500 µg/kg	51%
Benzo(g,h,i)perylene	20000 µg/kg	12000 µg/kg	50%
Benzo(j)fluoranthene	8300 µg/kg	5000 µg/kg	50%
Benzo(k)fluoranthene	8700 µg/kg	4700 µg/kg	60%
Chrysene	24000 µg/kg	16000 µg/kg	40%
Dibenz(a,h)anthracene	3600 µg/kg	1900 µg/kg	62%
Dibenzofuran	1200 µg/kg	840 µg/kg	35%
Fluoranthene	45000 µg/kg	29000 µg/kg	43%
Fluorene	3500 µg/kg	1400 µg/kg	86%
Indeno(1,2,3-cd)pyrene	14000 µg/kg	7900 µg/kg	56%
Naphthalene	7100 µg/kg	4400 µg/kg	47%
Phenanthrene	29000 µg/kg	14000 µg/kg	70%
Pyrene	64000 µg/kg	36000 µg/kg	56%
Total Organic Carbon	5.54 pct	3.93 pct	34%
Total Solids	69.85 pct	69.56 pct	0%

Concentrations at or near the reporting limit (RL) may have exaggerated relative percent difference (RPD) values. No data were qualified based on field duplicate results.

Instrument Performance Checks

Ion abundance criteria were met for GC/MS methods.

Initial Calibrations and Calibration Verifications

All initial calibrations and calibration verifications met method criteria.

Internal Standard and Surrogate Recoveries

All internal standard recoveries were within method control limits. All surrogate recoveries were within the laboratory control limits with the exception of d14-dibenzo(a,h)anthracene which recovered above the control limit in two samples in SDG WX18. Since the other two surrogates recovered within control limits, no data were qualified.

Laboratory Control Sample and Laboratory Control Sample Duplicate

Laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs) were analyzed at the required frequencies and resulted in recoveries and/or RPD values within control limits.

Matrix Spike and Matrix Spike Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) samples were analyzed at the required frequencies. Many recoveries in all MS/MSD analyses were not calculated because the sample concentrations were significantly greater than (>4x) the spike concentrations. Calculable recoveries and RPD values were within control limits with the following exceptions:

- SDG WW72 -
    - PAHs – 1-Methylnaphthalene, acenaphthylene, and fluorene recovered below the control limit in the MS and MSD analyzed on sample BGW-RE-SG-14-130708. The associated parent sample results have been qualified "J" to indicate a potentially low bias.
    - TOC – The MS performed on sample BGW-RE-SG-01-130708 recovered below the control limit. Associated sample results have been qualified "J" to indicate a potentially low bias.
- SDG WW73 PAHs –
    - Two analytes recovered below the control limit and in the MS analyzed on sample BGW-RE-SG-25-130708. Because the sample and MS results were above

the calibration range and could not be accurately quantitated, the associated results were not qualified. One analyte recovered above the control limit in the same MS and in the MSD and five analytes recovered above the control limit in the MSD. In addition, four MS/MSD RPD values were above the control limit. The associated parent sample results have been qualified "J" to indicate they are estimated.

  - Anthracene recovered above the control limit in the MS, benzo(k)fluoranthene recovered above the control limit in the MSD, and benzo(j)fluoranthene recovered above the control limit in the MS and MSD analyzed on sample BGW-RE-SG-21-130708.. Associated parent sample results have been qualified "J" to indicate a potentially high bias.

- WX18 PAHs – Three analytes recovered above and one below the control limit in the MS and two analytes recovered below the control limit in the MSD analyzed on sample BGW-RE-SG-22B-130708. The MS/MSD RPD value was above the control limit for all but three analytes. Two of these were not qualified because the sample and MSD and/or MS results were above the calibration range and could not be accurately quantified. The rest have been qualified "J" to indicate they are estimated.

See Table 3 for qualified data.

Standard Reference Material

Standard reference materials (SRMs) were analyzed at required frequencies and resulted in recoveries within project-required control limits with the exceptions of the low recoveries of benzo(a)pyrene, fluorene, and indeno(1,2,3-cd)pyrene in one of the SRMs analyzed in SDG WX18. Since the second SRM recovered within control limits, no data were qualified.

Laboratory Triplicates

Laboratory triplicates were analyzed at required frequencies and resulted in relative standard deviation (RSD) values within control limits with the exception of the triplicate analyses of sample BGW-RE-SG-01-130708. Associated sample results have been qualified "J" to indicate results are estimated. See Table 3 for qualified data.

Method Reporting Limits

Reporting limits were acceptable as reported. All values were reported using the laboratory reporting limits. Values were reported as undiluted, or when reported as diluted, the reporting limit accurately reflects the dilution factor.

Overall Assessment

As was determined by this evaluation, the laboratory followed the specified analytical methods and all requested sample analyses were completed. Accuracy was acceptable as demonstrated by the surrogate, SRM, LCS/LCSD, and MS/MSD recovery values, with the exceptions noted above. Precision was also acceptable as demonstrated by the laboratory triplicates, MS/MSD, and LCS/LCSD RSD/RPD values, with the exceptions noted above. Most data were acceptable as reported; all other data are acceptable as qualified. Table 3 summarizes the qualifiers applied to sample results reviewed in this report.

Data Qualifier Definitions

U Indicates the compound or analyte was analyzed for but not detected at or above the specified limit.

J Indicates an estimated value.

R Indicates data is rejected and unusable.

UJ Indicates the compound or analyte was analyzed for but not detected and the specified limit reported is estimated.

Table 3
Data Qualification Summary

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
BGW-RE-SG-01-130708	Conventionals	TOC	6.79 %	6.79J %	Low MS %R, high triplicate RSD
BGW-RE-SG-02-130708	Conventionals	TOC	1.61 %	1.61J %	Low MS %R, high triplicate RSD
BGW-RE-SG-03-130708	Conventionals	TOC	3.52 %	3.52J %	Low MS %R, high triplicate RSD
BGW-RE-SG-04-130708	Conventionals	TOC	5.15 %	5.15J %	Low MS %R, high triplicate RSD
BGW-RE-SG-05-130708	Conventionals	TOC	12.6 %	12.6J %	Low MS %R, high triplicate RSD

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
BGW-RE-SG-06-130708	Conventionals	TOC	3.66 %	3.66J %	Low MS %R, high triplicate RSD
BGW-RE-SG-07-130708	Conventionals	TOC	4.69 %	4.69J %	Low MS %R, high triplicate RSD
BGW-RE-SG-08-130708	Conventionals	TOC	9.31 %	9.31J %	Low MS %R, high triplicate RSD
BGW-RE-SG-09-130708	Conventionals	TOC	3.83 %	3.83J %	Low MS %R, high triplicate RSD
BGW-RE-SG-10-130708	Conventionals	TOC	2.89 %	2.89J %	Low MS %R, high triplicate RSD
BGW-RE-SG-11-130708	Conventionals	TOC	3.28 %	3.28J %	Low MS %R, high triplicate RSD
BGW-RE-SG-12-130708	Conventionals	TOC	2.34 %	2.34J %	Low MS %R, high triplicate RSD
BGW-RE-SG-13-130708	Conventionals	TOC	5.18 %	5.18J %	Low MS %R, high triplicate RSD
BGW-RE-SG-14-130708	Conventionals	TOC	1.59 %	1.59J %	Low MS %R, high triplicate RSD
	PAHs	1-Methylnaphthalene	180 µg/kg	180J µg/kg	Low MS/MSD %R
		Acenaphthylene	460 µg/kg	460J µg/kg	
		Fluorene	210 µg/kg	210J µg/kg	
BGW-RE-SG-15-130708	Conventionals	TOC	5.54 %	5.54J %	Low MS %R, high triplicate RSD
BGW-RE-SG-21-130708	PAHs	Anthracene	24 µg/kg	24J µg/kg	MS and/or MSD %R above control limit
		Benzo(j)fluoranthene	46 µg/kg	46J µg/kg	
		Benzo(k)fluoranthene	40 µg/kg	40J µg/kg	
BGW-RE-SG-25-130708	PAHs	1-Methylnaphthalene	81 µg/kg	81J µg/kg	MSD %R and RPD above control limits
		2-Methylnaphthalene	160 µg/kg	160J µg/kg	
		Acenaphthylene	350 µg/kg	350J µg/kg	
		Naphthalene	340 µg/kg	340J µg/kg	
		Anthracene	310 µg/kg	310J µg/kg	MSD %R above control limit
		Fluorene	100 µg/kg	100J µg/kg	MS/MSD %R above control limit
BGW-RE-SG-22B-130708	PAHs	Anthracene	1300 µg/kg	1300J µg/kg	MS/MSD %R and/or RPD outside of control limits
		Benzo(g,h,i)perylene	3800 µg/kg	3800J µg/kg	
		Indeno(1,2,3-c,d)pyrene	2600 µg/kg	2600J µg/kg	
		Benzo(j)fluoranthene	1700 µg/kg	1700J µg/kg	
		Benzo(b)fluoranthene	2900 µg/kg	2900J µg/kg	
		Benzo(k)fluoranthene	1700 µg/kg	1700J µg/kg	
		Acenaphthylene	1200 µg/kg	1200J µg/kg	
		Chrysene	5600 µg/kg	5600J µg/kg	
		Benzo(a)pyrene	4400 µg/kg	4400J µg/kg	
		Dibenzo(a,h)anthracene	670 µg/kg	670J µg/kg	
		Benzo(a)anthracene	5600 µg/kg	5600J µg/kg	

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
		Acenaphthene	170 µg/kg	170J µg/kg	
		Phenanthrene	4400 µg/kg	4400J µg/kg	
		Fluorene	540 µg/kg	540J µg/kg	
		1-Methylnaphthalene	300 µg/kg	300J µg/kg	
		Naphthalene	880 µg/kg	880J µg/kg	

%R = percent recovery

REFERENCES

Anchor QEA, 2013. Quality Assurance Project Plan, Final Removal Evaluation Work Plan, Appendix B. June.

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA 600/4 79-020.

USEPA. 1986. Test methods for Evaluating Solid Waste: Physical/Chemical Methods. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. EPA 530/SW-846.

USEPA. 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI). EPA 540-R-04-004. October.

USEPA. 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. USEPA 540/R-99/008. October.

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DATA VALIDATION REVIEW REPORT – EPA STAGE 2B

Project:	Bremerton Gasworks
Project Number:	131014-01.01
Date:	August 16, 2013

This report summarizes the review of analytical results for nine sediment samples, one field duplicate, and one rinse blank collected August 7, 2013. The samples were collected by Anchor QEA, LLC and submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. The samples were analyzed for the following analyses:

- Polycyclic aromatic hydrocarbons (PAHs) by United States Environmental Protection Agency (USEPA) method 8270D-SIM
- Total solids (TS) by Standard Method (SM) 2540B
- Total organic carbon (TOC) by Plumb, 1981

ARI sample data group (SDG) number WZ94 was reviewed in this report. Sample IDs of the results reviewed in this report are presented in Table 1.

Table 1
Samples Reviewed

Sample ID	Lab ID	Matrix	Analyses Requested
BGW-RE-SG-31-130807	WZ94A	Sediment	PAHs, TOC, TS
BGW-RE-SG-32-130807	WZ94B	Sediment	PAHs, TOC, TS
BGW-RE-SG-33-130807	WZ94C	Sediment	PAHs, TOC, TS
BGW-RE-SG-34-130807	WZ94D	Sediment	PAHs, TOC, TS
BGW-RE-SG-35-130807	WZ94E	Sediment	PAHs, TOC, TS
BGW-RE-SG-36-130807	WZ94F	Sediment	PAHs, TOC, TS
BGW-RE-SG-37-130807	WZ94G	Sediment	PAHs, TOC, TS
BGW-RE-SG-38-130807	WZ94H	Sediment	PAHs, TOC, TS
BGW-RE-SG-39-130807	WZ94I	Sediment	PAHs, TOC, TS
BGW-RE-SG-88-130807	WZ94J	Sediment	PAHs, TOC, TS
BGW-RE-SG-RB-130807	WZ94K	Sediment	PAHs, TOC, TS

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QA/QC) guidelines outlined in the analytical procedures and data

quality objective sections of the Quality Assurance Project Plan (QAPP; Anchor QEA, 2013). Laboratory results were reviewed using the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganics Data Review* (USEPA 2004)
- *USEPA National Functional Guidelines for Organic Data Review* (USEPA 1999)
- *USEPA National Functional Guidelines for Superfund Organic Methods Data Review* (USEPA 2008)

And also by using laboratory and method QC criteria as stated in USEPA (1986; SW 846, Third Edition), *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998. Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody forms were signed by ARI at the time of sample receipt; the samples were received cold and in good condition.

Holding Times and Sample Preservation and Analytical Methods

Samples were appropriately preserved and analyzed within holding times.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes with the exceptions of fluoranthene and pyrene in the PAH method blank. Associated sample results were significantly greater than (>5x) the levels detected in the method blank so no data were qualified.

Field Quality Control

Rinse Blanks

One rinse blank was collected with one of these sample sets and analyzed for PAHs. Target analytes were below detection with the exception of the low-level detections of naphthalene. The concentration was significantly lower than the sample concentrations so results are not expected to be affected.

Field Duplicates

One field duplicate was collected in association with this sample set. Detected results are summarized in Table 2.

Table 2
Field Duplicate Summary

Analyte	BGW-RE-SG-38-130807	BGW-RE-SG-88-130807	RPD
1-Methylnaphthalene	1200 µg/kg	2000 µg/kg	50%
2-Methylnaphthalene	1600 µg/kg	1700 µg/kg	6%
Acenaphthene	1500 µg/kg	3200 µg/kg	72%
Acenaphthylene	6800 µg/kg	8000 µg/kg	16%
Anthracene	6800 µg/kg	6200 µg/kg	9%
Benzo(a)anthracene	24000 µg/kg	20000 µg/kg	18%
Benzo(a)pyrene	26000 µg/kg	24000 µg/kg	8%
Benzo(b)fluoranthene	13000 µg/kg	13000 µg/kg	0%
Benzo(g,h,i)perylene	19000 µg/kg	16000 µg/kg	17%
Benzo(j)fluoranthene	7900 µg/kg	7600 µg/kg	4%
Benzo(k)fluoranthene	6600 µg/kg	6200 µg/kg	6%
Chrysene	23000 µg/kg	21000 µg/kg	9%
Dibenzo(a,h)anthracene	3400 µg/kg	1900 µg/kg	57%
Dibenzofuran	470 µg/kg	490 µg/kg	4%
Fluoranthene	49000 µg/kg	43000 µg/kg	13%
Fluorene	2400 µg/kg	1700 µg/kg	34%
Indeno(1,2,3-c,d)pyrene	13000 µg/kg	12000 µg/kg	8%
Naphthalene	3300 µg/kg	3600 µg/kg	9%
Phenanthrene	16000 µg/kg	15000 µg/kg	6%
Pyrene	55000 µg/kg	44000 µg/kg	22%
Total organic carbon	4.43 pct	4.6 pct	4%
Total solids	77.79 pct	85.41 pct	9%

Concentrations at or near the reporting limit (RL) may have exaggerated relative percent difference (RPD) values. No data were qualified based on field duplicate results.

Instrument Performance Checks

Ion abundance criteria were met for GC/MS methods.

Initial Calibrations and Calibration Verifications

All initial calibrations and calibration verifications met method criteria with the exception of benzo(g,h,i)perylene in the continuing calibration verification (CCV) associated with the rinse blank. The percent difference (%D) value for this analyte was below the control limit and the associated result has been qualified “UJ” to indicate a potentially low bias.

Internal Standard and Surrogate Recoveries

All internal standard recoveries were within method control limits and all surrogate recoveries were within the laboratory control limits.

Laboratory Control Sample and Laboratory Control Sample Duplicate

Laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs) were analyzed at the required frequencies and resulted in recoveries and/or RPD values within control limits.

Matrix Spike and Matrix Spike Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) samples were analyzed at the required frequencies. Many recoveries in all MS/MSD analyses were not calculated because the sample concentrations were significantly greater than (>4x) the spike concentrations. Calculable recoveries and RPD values were within control limits with the exception of the PAH analyses. Five analytes recovered below the control limit in the MS and ten analytes recovered below the control limit or did not recover in the MSD analyzed on sample BGW-RE-SG-31-130807. In addition, eight MS/MSD RPD values were above the control limit. The associated parent sample results have been qualified "J" to indicate a potentially low bias. See Table 3 for qualified data.

Standard Reference Material

Standard reference materials (SRMs) were analyzed at required frequencies and resulted in recoveries within project-required control limits with the exceptions of the low recoveries of acenaphthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene the PAH SRM. Associated sample results have been qualified "J" to indicate a potentially low bias.

Laboratory Triplicates

Laboratory triplicates were analyzed at required frequencies and resulted in relative standard deviation (RSD) values within control limits.

Method Reporting Limits

Reporting limits were acceptable as reported. All values were reported using the laboratory reporting limits. Values were reported as undiluted, or when reported as diluted, the reporting limit accurately reflects the dilution factor.

Overall Assessment

As was determined by this evaluation, the laboratory followed the specified analytical methods and all requested sample analyses were completed. Accuracy was acceptable as demonstrated by the surrogate, SRM, LCS/LCSD, and MS/MSD recovery values, with the exceptions noted above. Precision was also acceptable as demonstrated by the laboratory triplicates, MS/MSD, and LCS/LCSD RSD/RPD values. Most data were acceptable as reported; all other data are acceptable as qualified. Table 3 summarizes the qualifiers applied to sample results reviewed in this report.

Data Qualifier Definitions

U Indicates the compound or analyte was analyzed for but not detected at or above the specified limit.

J Indicates an estimated value.

R Indicates data is rejected and unusable.

UJ Indicates the compound or analyte was analyzed for but not detected and the specified limit reported is estimated.

Table 3
Data Qualification Summary

Sample	Parameter	Analyte	Reported	Qualified	Reason
BGW-RE-SG-31-130807	PAHs	1-Methylnaphthalene	47 µg/kg	47J µg/kg	MS/MSD %R and/or RPD outside of control limits
		2-Methylnaphthalene	120 µg/kg	120J µg/kg	
		Acenaphthylene	170 µg/kg	170J µg/kg	
		Anthracene	190 µg/kg	190J µg/kg	
		Benzo(b)fluoranthene	770 µg/kg	770J µg/kg	
		Benzo(j)fluoranthene	320 µg/kg	320J µg/kg	
		Benzo(k)fluoranthene	290 µg/kg	290J µg/kg	
		Dibenzo(a,h)anthracene	150 µg/kg	150J µg/kg	
		Fluorene	89 µg/kg	89J µg/kg	
		Naphthalene	200 µg/kg	200J µg/kg	

		Acenaphthene	24 µg/kg	24J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	1200 µg/kg	1200J µg/kg	
		Indeno(1,2,3-c,d)pyrene	840 µg/kg	840J µg/kg	
BGW-RE-SG-32-130807	PAHs	Acenaphthene	2100 µg/kg	2100J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	6400 µg/kg	6400J µg/kg	
		Indeno(1,2,3-c,d)pyrene	4900 µg/kg	4900J µg/kg	
BGW-RE-SG-33-130807	PAHs	Acenaphthene	1400 µg/kg	1400J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	39000 µg/kg	39000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	29000 µg/kg	29000J µg/kg	
BGW-RE-SG-34-130807	PAHs	Acenaphthene	730 µg/kg	730J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	25000 µg/kg	25000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	18000 µg/kg	18000J µg/kg	
BGW-RE-SG-35-130807	PAHs	Acenaphthene	3600 µg/kg	3600J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	17000 µg/kg	17000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	13000 µg/kg	13000J µg/kg	
BGW-RE-SG-36-130807	PAHs	Acenaphthene	230 µg/kg	230J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	34000 µg/kg	34000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	24000 µg/kg	24000J µg/kg	
BGW-RE-SG-37-130807	PAHs	Acenaphthene	380 µg/kg	380J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	20000 µg/kg	20000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	14000 µg/kg	14000J µg/kg	
BGW-RE-SG-38-130807	PAHs	Acenaphthene	1500 µg/kg	1500J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	19000 µg/kg	19000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	13000 µg/kg	13000J µg/kg	
BGW-RE-SG-39-130807	PAHs	Acenaphthene	580 µg/kg	580J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	10000 µg/kg	10000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	7400 µg/kg	7400J µg/kg	
BGW-RE-SG-88-130807	PAHs	Acenaphthene	3200 µg/kg	3200J µg/kg	SRM %R below control limit
		Benzo(g,h,i)perylene	16000 µg/kg	16000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	12000 µg/kg	12000J µg/kg	
BGW-RE-SG-RB-130807	PAHs	Benzo(g,h,i)perylene	0.01U µg/L	0.01UJ µg/L	CCV %D below control limit

%R = percent recovery

REFERENCES

Anchor QEA, 2013. Quality Assurance Project Plan, Final Removal Evaluation Work Plan, Appendix B. June.

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA 600/4 79-020.

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DATA VALIDATION REVIEW REPORT – EPA STAGE 2B

Project:	Bremerton Gasworks
Project Number:	131014-01.01
Date:	September 19, 2013

This report summarizes the review of analytical results for 2 soil samples, 21 sediment samples, two field duplicates, and one rinse blank collected September 3 and 4, 2013. The samples were collected by Anchor QEA, LLC and submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. The samples were analyzed for the following analyses:

- Polycyclic Aromatic Hydrocarbons (PAHs) by United States Environmental Protection Agency (USEPA) method 8270D-SIM
- Volatile organic compounds (VOCs) by USEPA method 8260C
- Total solids (TS) by Standard Method (SM) 2540B
- Total organic carbon (TOC) by Plumb, 1981

ARI sample data group (SDG) number XD36 and XE09 were reviewed in this report. Samples reviewed in this report are presented in Table 1.

Table 1
Samples Reviewed

Sample ID	Lab ID	Matrix	Analyses Requested
BGW-RE-GP-08-0-1.8	XD36A	Sediment	PAHs, TOC, TS
BGW-RE-GP-08-1.8-3.7	XD36B	Sediment	PAHs, TOC, TS
BGW-RE-GP-06-0.8-2.2	XD36C	Sediment	PAHs, TOC, TS
BGW-RE-GP-06-2.2-3.9	XD36D	Sediment	PAHs, TOC, TS
BGW-RE-GP-05-2.7-3.7	XD36E	Sediment	PAHs, TOC, TS
BGW-RE-GP-05-1.0-2.7	XD36F	Sediment	PAHs, TOC, TS
BGW-RE-GP-05-0-1.0	XD36G	Sediment	PAHs, TOC, TS
BGW-RE-GP-07-0-1.8	XD36H	Sediment	PAHs, TOC, TS
BGW-RE-GP-07-1.8-4.3	XD36I	Sediment	PAHs, TOC, TS
BGW-RE-GP-52-0-1.2	XD36J	Sediment	PAHs, TOC, TS
BGW-RE-GP-02-1.2-3.5	XD36K	Sediment	PAHs, TOC, TS
BGW-RE-GP-02-0-1.2	XD36L	Sediment	PAHs, TOC, TS
BGW-RE-GP-04-0-1.2	XD36M	Sediment	PAHs, TOC, TS
BGW-RE-GP-04-1.2-2.2	XD36N	Sediment	PAHs, TOC, TS

Sample ID	Lab ID	Matrix	Analyses Requested
BGW-RE-GP-03-3.5-4.5	XD36O	Sediment	PAHs, TOC, TS
BGW-RE-GP-03-2.0-3.5	XD36P	Sediment	PAHs, TOC, TS
BGW-RE-GP-53-2.0-3.5	XD36Q	Sediment	PAHs, TOC, TS
BGW-RE-GP-03-0-2.0	XD36R	Sediment	PAHs, TOC, TS
BGW-RE-GP-01-0-1.2	XD36S	Sediment	PAHs, TOC, TS
BGW-RE-GP-05-0.3-0.8	XD36T	Sediment	VOCs
BGW-RE-GP-02-0.8-1	XD36U	Sediment	VOCs
BGW-RE-GP-03-0.7-1.2	XD36V	Sediment	VOCs
BGW-RE-GP-03-2.0-2.8	XD36W	Sediment	VOCs
BGW-RE-GP-RB	XD36X	Water	PAHs
BGW-RE-HA-01-6-5	XE09A	Soil	PAHS, TOC, TS
Briquette	XE90A	Solid	PAHS, TOC, TS

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QA/QC) guidelines outlined in the analytical procedures and data quality objective sections of the Quality Assurance Project Plan (QAPP; Anchor QEA, 2013). Laboratory results were reviewed using the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganics Data Review* (USEPA 2004)
- *USEPA National Functional Guidelines for Organic Data Review* (USEPA 1999)
- *USEPA National Functional Guidelines for Superfund Organic Methods Data Review* (USEPA 2008)

And also by using laboratory and method QC criteria as stated in USEPA (1986; SW 846, Third Edition), *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998. Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody forms were signed by ARI at the time of sample receipt; the samples were received cold and in good condition, with the exception of both samples in SDG XE09. These samples were received at room temperature; PAH and TOC data have been qualified "J" to indicate a potentially low bias.

Holding Times and Sample Preservation and Analytical Methods

Samples were appropriately preserved and analyzed within holding times.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes with the exceptions of methylene chloride, which was found in the VOC method blank, and phenanthrene, which was found between the reporting limit (RL) and the method detection limit (MDL) in the aqueous PAH method blank. Sample results for methylene chloride that were not greater than five times the level in the blank were qualified as non-detects. Phenanthrene was not detected in the associated rinse blank sample so no data were qualified.

Field Quality Control

Rinse Blanks

One rinse blank was collected with one of these sample sets and analyzed for PAHs. Target analytes were below detection with the exceptions of the low-level detections of naphthalene, fluoranthene, and pyrene. Concentrations were significantly lower than those in the samples so results are not expected to be affected.

Field Duplicates

Two field duplicates were collected in association with these sample sets. Detected results are summarized in Table 2.

Table 2
Field Duplicate Summary

Analyte	BGW-RE-GP-02-0-1.2	BGW-RE-GP-52-0-1.2	RPD
Total Organic Carbon	3.69 pct	7.08 pct	63%
Total Solids	83.53 pct	84.25 pct	1%
1-Methylnaphthalene	140000 µg/kg	80000 µg/kg	55%
2-Methylnaphthalene	210000 µg/kg	150000 µg/kg	33%
Acenaphthene	13000 µg/kg	9300 µg/kg	33%
Acenaphthylene	160000 µg/kg	120000 µg/kg	29%
Anthracene	180000 µg/kg	140000 µg/kg	25%
Benzo(a)anthracene	210000 µg/kg	170000 µg/kg	21%
Benzo(a)pyrene	220000 µg/kg	160000 µg/kg	32%
Benzo(b)fluoranthene	86000 µg/kg	66000 µg/kg	26%
Benzo(g,h,i)perylene	150000 µg/kg	88000 µg/kg	52%

Analyte	BGW-RE-GP-02-0-1.2	BGW-RE-GP-52-0-1.2	RPD
Benzo(j)fluoranthene	49000 µg/kg	37000 µg/kg	28%
Benzo(k)fluoranthene	46000 µg/kg	39000 µg/kg	16%
Chrysene	200000 µg/kg	150000 µg/kg	29%
Dibenz(a,h)anthracene	22000 µg/kg	16000 µg/kg	32%
Dibenzofuran	16000 µg/kg	11000 µg/kg	37%
Fluoranthene	410000 µg/kg	340000 µg/kg	19%
Fluorene	150000 µg/kg	88000 µg/kg	52%
Indeno(1,2,3-cd)pyrene	72000 µg/kg	53000 µg/kg	30%
Naphthalene	49000 µg/kg	33000 µg/kg	39%
Phenanthrene	580000 µg/kg	380000 µg/kg	42%
Pyrene	680000 µg/kg	550000 µg/kg	21%
Total Benzofluoranthenes	180000 µg/kg	140000 µg/kg	25%

Analyte	BGW-RE-GP-03-2.0-3.5	BGW-RE-GP-53-2.0-3.5	RPD
Total Organic Carbon	3.87 pct	6.89 pct	56%
Total Solids	84.55 pct	84.37 pct	0%
1-Methylnaphthalene	900000 µg/kg	810000 µg/kg	11%
2-Methylnaphthalene	600000 µg/kg	530000 µg/kg	12%
Acenaphthene	76000 µg/kg	79000 µg/kg	4%
Acenaphthylene	840000 µg/kg	730000 µg/kg	14%
Anthracene	680000 µg/kg	430000 µg/kg	45%
Benzo(a)anthracene	280000 µg/kg	250000 µg/kg	11%
Benzo(a)pyrene	280000 µg/kg	240000 µg/kg	15%
Benzo(b)fluoranthene	110000 µg/kg	110000 µg/kg	0%
Benzo(g,h,i)perylene	150000 µg/kg	150000 µg/kg	0%
Benzo(j)fluoranthene	64000 µg/kg	63000 µg/kg	2%
Benzo(k)fluoranthene	59000 µg/kg	64000 µg/kg	8%
Chrysene	260000 µg/kg	220000 µg/kg	17%
Dibenz(a,h)anthracene	30000 µg/kg	27000 µg/kg	11%
Dibenzofuran	69000 µg/kg	68000 µg/kg	1%
Fluoranthene	770000 µg/kg	680000 µg/kg	12%
Fluorene	600000 µg/kg	510000 µg/kg	16%
Indeno(1,2,3-cd)pyrene	91000 µg/kg	89000 µg/kg	2%
Naphthalene	1700000 µg/kg	1500000 µg/kg	13%
Phenanthrene	1700000 µg/kg	1500000 µg/kg	13%
Pyrene	1200000 µg/kg	1100000 µg/kg	9%

Concentrations at or near the reporting limit (RL) may have exaggerated relative percent difference (RPD) values. No data were qualified based on field duplicate results.

Instrument Performance Checks

Ion abundance criteria were met for GC/MS methods.

Initial Calibrations and Calibration Verifications

All initial calibrations and calibration verifications met method criteria with the following exceptions:

- SDG XD36: The continuing calibration verification (CCV) percent difference (%D) values for bromoethane and iodomethane were above the control limit and the % D value for 2-chloroethylvinylether was below the control limit. Bromoethane and iodomethane were not detected in the samples so no data were qualified. 2-Chloroethylvinylether results were qualified "UJ" to indicate a potentially low bias.
- SDG XE09: The CCV response factor (RF) for benzo(a)anthracene was less than the minimum RF required by the method. Sample results were qualified "J" to indicate a potentially low bias.

See Table 3 for qualified data.

Internal Standard and Surrogate Recoveries

All internal standard recoveries were within method control limits. All surrogate recoveries were within the laboratory control limits with the exception of d14-dibenzo(a,h)anthracene, which was above the control limit in the BGW-RE-GP-03-O-2.0 and the Briquette samples. Since the other two surrogates recovered within control limits, no data were qualified.

Laboratory Control Sample and Laboratory Control Sample Duplicate

Laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs) were analyzed at the required frequencies and resulted in recoveries and/or RPD values within control limits with the following exceptions:

- SDG XD36 VOCs: 2-Chloroethylvinylether recovered below the control limit and iodomethane recovered above the control limit. 2-Chloroethylvinylether results were qualified "UJ" to indicate a potentially low bias. Iodomethane was not detected in any samples so no data were qualified.
- SDG XE09 PAHs: All analytes recovered below the control limit in the LCS with the exception of benzo(k)fluoranthene. Sample results were qualified "J" to indicate a potentially low bias.

See Table 3 for qualified data.

Matrix Spike and Matrix Spike Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) samples were analyzed at the required frequencies. Many recoveries in all MS/MSD analyses were not calculated because the sample concentrations were significantly greater than (>4x) the spike concentrations. Calculable recoveries and RPD values were within control limits with the following exceptions:

- SDG XD36 PAHs - The MS %R value and the MS/MSD RPD for 1-methylnaphthalene, and the MSD %R value for dibenz(a,h)anthracene were above the control limit in the MS/MSD performed on sample BGW-RE-GP-06-0.8-2. Parent sample results were qualified "J" to indicate a potentially high bias. The MS and/or MSD %R and RPD values for eleven analytes were out of control limits in the MS/MSD analyzed on sample BGW-RE-GP-04-0-1.2. However, the sample result for benzo(g,h,i)perylene, which was above the calibration range, could not be accurately quantified and was not qualified. Parent sample results for the other ten analytes were qualified "J" to indicate that they are estimated.
- SDG XE09 PAHs - The MS and/or MSD %R and RPD values for ten analytes were outside of control limits in the MS/MSD analyzed on sample BGW-RE-HA-01-6.5. Parent sample results were qualified "J" to indicate a potential high bias, or that they are estimated.

See Table 3 for qualified data.

Standard Reference Material

Standard reference materials (SRMs) were analyzed at required frequencies and resulted in recoveries within project-required control limits with the following exceptions:

- SDG XD36 PAHs: Dibenz(a,h)anthracene recovered above control limit in both of the SRMs. Detected results were qualified "J" to indicate a potentially high bias.
- SDG XE09 PAHs: Ten analytes recovered below the control limit. Results were qualified "J" to indicate a potentially low bias.

See Table 3 for qualified data.

Laboratory Replicates

Laboratory replicates were analyzed at required frequencies and resulted in relative standard deviation (RSD) values within control limits.

Method Reporting Limits

Reporting limits were acceptable as reported. All values were reported using the laboratory reporting limits. Values were reported as undiluted, or when reported as diluted, the reporting limit accurately reflects the dilution factor.

Overall Assessment

As was determined by this evaluation, the laboratory followed the specified analytical methods and all requested sample analyses were completed. Accuracy was acceptable as demonstrated by the surrogate, SRM, LCS/LCSD, and MS/MSD recovery values, with the exceptions noted above. Precision was also acceptable as demonstrated by the laboratory triplicates, MS/MSD, and LCS/LCSD RSD/RPD values, with the exceptions noted above. Most data were acceptable as reported; all other data are acceptable as qualified. Table 3 summarizes the qualifiers applied to sample results reviewed in this report.

Data Qualifier Definitions

U Indicates the compound or analyte was analyzed for but not detected at or above the specified limit.

J Indicates an estimated value.

R Indicates data is rejected and unusable.

UJ Indicates the compound or analyte was analyzed for but not detected and the specified limit reported is estimated.

Table 3
Data Qualification Summary

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
BGW-RE-GP-01-0-1.2	PAHs	Dibenzo(a,h)anthracene	350 µg/kg	350J µg/kg	High SRM %R
BGW-RE-GP-02-0.8-1	VOCs	2-Chloroethylvinyl ether	16000U µg/kg	16000UJ µg/kg	Low CCV %D, low LCS/LCSD %R
		Methylene chloride	18000 µg/kg	18000U µg/kg	Method blank contamination

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
BGW-RE-GP-02-0-1.2	PAHs	Dibenzo(a,h)anthracene	22000 µg/kg	22000J µg/kg	High SRM %R
BGW-RE-GP-02-1.2-3.5	PAHs	Dibenzo(a,h)anthracene	20 µg/kg	20J µg/kg	High SRM %R
BGW-RE-GP-03-0.7-1.2	VOCs	2-Chloroethylvinyl ether	390U µg/kg	390UJ µg/kg	Low CCV %D, low LCS/LCSD %R
		Dichloromethane (Methylene chloride)	160QB µg/kg	160U µg/kg	Method blank contamination
BGW-RE-GP-03-0-2.0	PAHs	Dibenzo(a,h)anthracene	7500 µg/kg	7500J µg/kg	High SRM %R
BGW-RE-GP-03-2.0-2.8	VOCs	2-Chloroethylvinyl ether	6700U µg/kg	6700UJ µg/kg	Low CCV %D, low LCS/LCSD %R
		Methylene chloride	6800 µg/kg	6800U µg/kg	Method blank contamination
BGW-RE-GP-03-2.0-3.5	PAHs	Dibenzo(a,h)anthracene	30000 µg/kg	30000J µg/kg	High SRM %R
BGW-RE-GP-03-3.5-4.5	PAHs	Dibenzo(a,h)anthracene	6.5 µg/kg	6.5J µg/kg	High SRM %R
BGW-RE-GP-04-0-1.2		Acenaphthylene	24 µg/kg	24J µg/kg	High MSD %R and MS/MSD RPD
		Anthracene	20 µg/kg	20J µg/kg	
		Benzo(b)fluoranthene	42 µg/kg	42J µg/kg	High MS/MSD %R and RPD
		Benzo(b,j,k)fluoranthene	82 µg/kg	82J µg/kg	High MSD %R and MS/MSD RPD
		Benzo(j)fluoranthene	22 µg/kg	22J µg/kg	High MSD %R and MS/MSD RPD
		Benzo(k)fluoranthene	19 µg/kg	19J µg/kg	
		Dibenzo(a,h)anthracene	11 µg/kg	11J µg/kg	High SRM %R, high MSD %R and MS/MSD RPD
		Dibenzofuran	21 µg/kg	21J µg/kg	Low MS %R, high MSD and MS/MSD RPD
		Fluorene	7.9 µg/kg	7.9J µg/kg	High MSD %R and MS/MSD RPD
		Indeno(1,2,3-c,d)pyrene	43 µg/kg	43J µg/kg	High MS/MSD %R and RPD
BGW-RE-GP-04-1.2-2.2	PAHs	Dibenzo(a,h)anthracene	12 µg/kg	12J µg/kg	High SRM %R
BGW-RE-GP-05-0.3-0.8	VOCs	2-Chloroethylvinyl ether	6.1U µg/kg	6.1UJ µg/kg	Low CCV %D, low LCS/LCSD %R
		Dichloromethane (Methylene chloride)	4.9QB µg/kg	4.9U µg/kg	Method blank contamination
BGW-RE-GP-05-0-1.0	PAHs	Dibenzo(a,h)anthracene	10000 µg/kg	10000J µg/kg	High SRM %R
BGW-RE-GP-05-1.0-2.7	PAHs	Dibenzo(a,h)anthracene	4.3 µg/kg	4.3J µg/kg	High SRM %R
BGW-RE-GP-05-2.7-3.7	PAHs	Dibenzo(a,h)anthracene	11 µg/kg	11J µg/kg	High SRM %R
BGW-RE-GP-	PAHs	1-Methylnaphthalene	6700	6700J	High MS %R and

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
06-0.8-2.2			µg/kg	µg/kg	MS/MSD RPD
		Dibenzo(a,h)anthracene	5700 µg/kg	5700J µg/kg	High SRM %R, high MSD %R
BGW-RE-GP-06-2.2-3.9	PAHs	Dibenzo(a,h)anthracene	0.3J µg/kg	0.3J µg/kg	High SRM %R
BGW-RE-GP-07-0-1.8	PAHs	Dibenzo(a,h)anthracene	88 µg/kg	88J µg/kg	High SRM %R
BGW-RE-GP-08-0-1.8	PAHs	Dibenzo(a,h)anthracene	26 µg/kg	26J µg/kg	High SRM %R
BGW-RE-GP-08-1.8-3.7	PAHs	Dibenzo(a,h)anthracene	0.2J µg/kg	0.2J µg/kg	High SRM %R
BGW-RE-GP-52-0-1.2	PAHs	Dibenzo(a,h)anthracene	16000 µg/kg	16000J µg/kg	High SRM %R
BGW-RE-GP-53-2.0-3.5	PAHs	Dibenzo(a,h)anthracene	27000 µg/kg	27000J µg/kg	High SRM %R
BGW-RE-HA-01-6.5	TOCs	Total organic carbon	68.5 pct	68.5J pct	Ambient cooler temperature
	TS	Total solids	73.54 pct	73.54J pct	Ambient cooler temperature
	PAHs	1-Methylnaphthalene	3700 µg/kg	3700J µg/kg	Ambient cooler temperature, low LCS %R
		2-Methylnaphthalene	9900 µg/kg	9900J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Acenaphthene	110 µg/kg	110J µg/kg	
		Acenaphthylene	2500 µg/kg	2500J µg/kg	Ambient cooler temperature, low LCS %R, high MSD %R
		Anthracene	2300 µg/kg	2300J µg/kg	Ambient cooler temperature, low LCS %R, high MS %R
		Benzo(a)anthracene	2400 µg/kg	2400J µg/kg	Ambient cooler temperature, low CCV RF, low LCS %R, high MS/MSD %R
		Benzo(a)pyrene	750 µg/kg	750J µg/kg	Ambient cooler temperature, low LCS %R, high MSD %R, low SRM %R
		Benzo(b)fluoranthene	2500 µg/kg	2500J µg/kg	Ambient cooler temperature, low LCS %R, high MS/MSD %R, low SRM %R
		Benzo(b,j,k)fluoranthenes	4200 µg/kg	4200J µg/kg	Ambient cooler temperature, low LCS %R, high MSD %R, high MS/MSD RPD

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
		Benzo(g,h,i)perylene	510 µg/kg	510J µg/kg	Ambient cooler temperature, low LCS %R, low MS %R, high MS/MSD RPD, low SRM %R
		Benzo(j)fluoranthene	860 µg/kg	860J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Benzo(k)fluoranthene	880 µg/kg	880J µg/kg	Ambient cooler temperature, high MSD %R, high MS/MSD RPD
		Chrysene	9600 µg/kg	9600J µg/kg	Ambient cooler temperature, low LCS %R
		Dibenzo(a,h)anthracene	250 µg/kg	250J µg/kg	Ambient cooler temperature, low LCS %R, high MS/MSD %R
		Dibenzofuran	2600 µg/kg	2600J µg/kg	Ambient cooler temperature, low LCS %R
		Fluoranthene	39000 µg/kg	39000J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Fluorene	590 µg/kg	590J µg/kg	
		Indeno(1,2,3-c,d)pyrene	470 µg/kg	470J µg/kg	Ambient cooler temperature, low LCS %R, high MS/MSD %R, low SRM %R
		Naphthalene	40000 µg/kg	40000J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Phenanthrene	76000 µg/kg	76000J µg/kg	Ambient cooler temperature, low LCS %R
		Pyrene	19000 µg/kg	19000J µg/kg	
BRIQUETTE	TOCs	Total organic carbon	77.9 pct	77.9J pct	Ambient cooler temperature
	TS	Total solids	83.99 pct	83.99J pct	Ambient cooler temperature
	PAHs	1-Methylnaphthalene	450000 µg/kg	450000J µg/kg	Ambient cooler temperature, low LCS %R
		2-Methylnaphthalene	54000 µg/kg	54000J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Acenaphthene	350000 µg/kg	350000J µg/kg	
		Acenaphthylene	190000 µg/kg	190000J µg/kg	Ambient cooler temperature, low LCS

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
		Anthracene	1100000 µg/kg	1100000J µg/kg	%R
		Benzo(a)anthracene	1100000 µg/kg	1100000J µg/kg	Ambient cooler temperature; low CCV RF, low LCS %R
		Benzo(a)pyrene	1500000 µg/kg	1500000J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Benzo(b)fluoranthene	770000 µg/kg	770000J µg/kg	
		Benzo(b,j,k)fluoranthenes	1700000 µg/kg	1700000J µg/kg	Ambient cooler temperature, low LCS %R
		Benzo(g,h,i)perylene	1200000 µg/kg	1200000J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Benzo(j)fluoranthene	430000 µg/kg	430000J µg/kg	
		Benzo(k)fluoranthene	510000 µg/kg	510000J µg/kg	Ambient cooler temperature
		Chrysene	1400000 µg/kg	1400000J µg/kg	Ambient cooler temperature, low LCS %R
		Dibenzo(a,h)anthracene	130000 µg/kg	130000J µg/kg	
		Dibenzofuran	85000 µg/kg	85000J µg/kg	
		Fluoranthene	4500000 µg/kg	4500000J µg/kg	Ambient cooler temperature, low LCS %R, low SRM %R
		Fluorene	570000 µg/kg	570000J µg/kg	
		Indeno(1,2,3-c,d)pyrene	910000 µg/kg	910000J µg/kg	
		Naphthalene	910000 µg/kg	910000J µg/kg	
		Phenanthrene	6000000 µg/kg	6000000J µg/kg	Ambient cooler temperature, low LCS %R
		Pyrene	5400000 µg/kg	5400000J µg/kg	

%R = percent recovery
CCV = continuing calibration verification
LCS = lab control sample
MS/MSD = matrix spike / matrix spike duplicate
RF = response factor
RPD = relative percent difference
SRM = standard reference material

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APPENDIX G
RISK SCREENING SUPPORTING INFORMATION

APPENDIX E
RISK SCREENING SUPPORTING INFORMATION
REMOVAL EVALUATION REPORT

Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
October 2013

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Aspect Consulting, LLC and Anchor QEA, LLC

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1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a Remedial Investigation and Feasibility Study (RI/FS) at the Bremerton Gas Works Site (Site) in Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) as executed with EPA May 1, 2013.

Prior to execution of the AOC, a Time Critical Removal Action (TCRA) was completed to address sheen and odor observed on the adjacent Washington Narrows beach and associated with discharges from a combined sewer overflow (CSO) adjacent to and sharing historical drainage connections to the former gas works (Anchor QEA 2011).

The Removal Evaluation Work Plan (Work Plan) was submitted, approved and executed to address potential imminent and substantial threats to human health, welfare, or the environment is the first task under the AOC. Sediment data collected as part of the Removal Evaluation was used to conduct a preliminary screening evaluation of potential Site-related risks using a recreational beach user scenario.

This appendix to the Removal Evaluation Report describes the preliminary screening of potential human health risks to recreational beach users that were used to support the removal evaluation. The screening-level risk evaluation were performed as a supporting piece of information during the removal evaluation of intertidal beach sediments adjacent to the former gas works. This evaluation is intended for limited use during the removal evaluation to help assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the RI/FS. A baseline human health risk assessment (HHRA) and ecological risk assessment were performed during the RI/FS, and that HHRA may supersede the screening level risk evaluation.

The preliminary screening of human health risks focused on potential risks associated with dermal contact, incidental ingestion, and inhalation of carcinogenic polycyclic aromatic hydrocarbon (cPAH) compounds in beach sediments. These compounds can be elevated in residuals associated with manufactured gas plant operations. They can also be present in petroleum hydrocarbons, combustion byproducts, treated wood structures, and stormwater.

Section 2 of this appendix describes the methods and exposure assumptions used as the basis of the preliminary beach recreation scenario. Section 3 describes the data evaluation approach and qualitatively identifies associated uncertainties. Section 4 provides the references.

2 Methods and Assumptions

The preliminary recreational beach user scenario presented in this appendix is a risk-based evaluation derived from standardized equations combining site-specific and EPA default exposure information assumptions with current EPA toxicity data. In support of the EPA Superfund cleanup projects, EPA has developed the Regional Screening Levels (RSL) of Chemical Contaminants at Superfund Sites. While the published RSLs are

generic, they may be recalculated using site-specific data. To aid in the development of site-specific screening levels at Superfund sites, EPA has provided a web-based RSL calculator. The "Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website provides the calculator, a user's guide, links to EPA guidance, and answers to frequently asked questions regarding the use of RSLs[1]. All computations for the preliminary recreational beach user screening evaluation were done using the RSL calculator.

The following section describes the exposure parameters that are used in the RSL calculator and that can be applied as default values or adjusted using site-specific information. The EPA recreational soil/sediment exposure was used for the current analysis. All assumptions provided with EPA default values were used. Conservative site-specific exposure frequency (days/year) and event time (hours/event) were used as described below

2.1 Default RSL Calculator Parameters

The RSL calculator default age-dependent exposure parameters and values are summarized in Table E-1. The total exposure duration for the beach use scenario was 30 years, applied using early life stage adjustments to account for mutagenic effects of benzo(a)pyrene (EPA 2011). Body weight, skin surface area, skin adherence factors, and soil ingestion rates are based on RSL calculator default values for the residential soil scenario and were not modified. While the RSL inputs are updated periodically, the current RSLs are based on default exposure parameters and factors that represent reasonable maximum exposure (RME) conditions for long-term/chronic exposures and that are based on the methods outlined in EPA's Risk Assessment Guidance for Superfund, Part B Manual (1991) and Soil Screening Guidance documents (1996 and 2002). In 2011, EPA updated the Exposure Factors Handbook (EFH; EPA 2011) but the newer parameters have not yet been incorporated into the RSLs. Updating the exposure parameters based on the newer EFH is beyond the scope of this screening evaluation. During the RI/FS, the HHRA applied current EPA guidance, including the EFH, to develop a site-specific conceptual exposure model and determine appropriate exposure parameters.

[1] EPA 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

Table E-1
RSL Calculator Default Age-dependent Exposure Parameters and Values

Age Class	Body Wt (kg)	Skin Surface Area (cm^2)	Skin Adherence Factor (mg/cm^2)	Soil Ingestion Rate (mg/day)	Exposure Duration (years)	Mutagenic Adjustment (unitless)
0-2	15	2800	0.2	200	2	10
2-6	15	2800	0.2	200	4	3
6-16	70	5700	0.07	100	10	3
16-30	70	5700	0.07	100	14	1

2.2 Site-Specific Parameters

Beach play exposure frequency values have been evaluated recently by EPA at other marine sediment sites with similar accessibility and characteristics, including at the Lower Duwamish Waterway (LDW) Superfund Site. The beach play exposure analysis for the LDW Site was summarized in the final HHRA performed during the RI/FS study process (Windward 2007), and used an exposure frequency of 65 days/year. This is more conservative than the exposure frequency used by the Washington Department of Ecology (Ecology 2012) in its generic beach play scenario (41 days/year) for developing cleanup levels at State-lead cleanup sites.

The preliminary recreational beach user risk scenario to be used at the Site used an exposure frequency of 65 days per year. This exposure frequency represents the 95th percentile for children from birth to 6 years of age who engage in playing and digging in the sand adjacent to the water and is based on a King County survey of established parks (Lake Union, Lake Washington, and Lake Sammamish) with sandy beaches (Parametrix 2003). These King County park areas are likely to have higher visitation rates than the beach adjacent to the Site.

The event time for the assumed recreational beach user scenario is 6 hours per event. This value is conservative for a tidally-inundated beach area. This value is applied to the estimate of inhalation exposure. For the purpose of developing the preliminary beach user screening evaluation, this value was assumed to be 6 hours per visit. Because cPAH compounds have very low volatility, the estimated exposure is very low and the contribution to risk is approximately four orders of magnitude lower than for soil ingestion or dermal contact. Regardless, the preliminary beach user scenario is based on all three exposure pathways: inhalation of soil vapor, soil ingestion, and dermal contact, consistent with the RSL calculation methods.

3 Data Evaluation and Uncertainty

The following sections describe the preliminary beach user screening evaluation and identify potential sources of uncertainty. A formal uncertainty evaluation werecompleted as part of the baseline risk assessment that were completed during the RI/FS process.

3.1 Preliminary Recreational Beach User Screening Evaluation

The preliminary recreational beach user scenario results in a protective total cPAH Toxic Equivalency Quotient (TEQ) concentration of 8 milligrams per kilogram (mg/kg) at the 10^{-4} risk level and 0.08 mg/kg at the 10^{-6} risk level (Table E-3). The use of this value in the screening of surface sediment samples collected under the Work Plan was conducted in coordination with EPA.

3.2 Screening Evaluation Uncertainty

Uncertainties in the screening evaluation may include those associated with the default RSL calculator values as well as the assumed site-specific exposure frequency and event duration. Regarding the RSL calculator default values, EPA has issued new guidance updating the current scientific basis of exposure (Exposure Factors Handbook; EPA 2011). This new guidance has not yet been incorporated into the RSL calculator. Because this screening evaluation is being conducted in advance of the RI/FS and has a limited purpose in informing the removal evaluation, establishing site-specific exposure assumptions for parameters like body weight, skin surface area and skin adherence factors were determined to be beyond the scope of this work. The current EFH and other risk assessment requirements and guidance were addressed fully in the risk assessment work plan, which were prepared in coordination with EPA as part of the RI/FS process

The preliminary recreational beach user scenario assumed an exposure frequency of 65 days based on a regional survey of park beaches, as described above in Section 2.2. For reference, Ecology (2012) has also developed a beach play scenario for use in evaluating human health risk under the Washington Sediment Management Standards (SMS). The exposure frequency for the SMS beach play scenario is 41 days, based on the assumption that beach visits occur 3 days per week during school vacation, and 1 day per week for 5 weeks from mid-September to the end of October.

As described in Section 2.2, the assumption of 65 daily visits per year is likely to be conservative because the beach adjacent to the Site lack the amenities found at the King County parks (i.e., rest rooms, picnic tables, lawn, parking area). As such, the Ecology (2012) value of 41 daily visits per year may be a more reasonable estimate for an area like the Washington Narrows beach adjacent to the Site. A complete evaluation of relevant recreational beach user exposure frequencies and associated uncertainty were completed during the risk assessment.

3.3 Exposure Data Uncertainty

Uncertainty around the exposure to total cPAHs TEQ in beach sediments can take two forms, in the calculation of the total cPAH TEQ and in the estimation of exposure to recreational beach users. These two forms of uncertainty were evaluated in the risk assessment conducted during the RI/FS process and are outside of the scope of the Work Plan.

3.3.1 Total cPAH TEQ Calculation

The differences in the way the sample total cPAH TEQ is calculated may over or underestimate the true potency of the benzo(a)pyrene equivalent concentration. The total cPAH concentration is computed with individual cPAH weighted according to their benzo(a)pyrene toxicity equivalency factor (TEF). The total cPAH TEQ is the weighted sum of the individual compounds (Table E-2). As additional toxicity data have been developed by researchers, TEFs have been updated in the scientific literature (e.g., EPA 1993, Collins et al. 1998, CalEPA 2002). Promulgated TEFs under the Washington Model Toxics Control Act (MTCA) may be changed depending on programmatic updates (e, g., MTCA 2001 and MTCA 2007).

Table E-2
Summary of cPAH Toxicity Equivalency Factors

Compound	EPA (1993)/EPA RSL Calculator	CalEPA (2002)/ MTCA 2007
Benzo(a)pyrene	1	1
Benz(a)anthracene	0.1	0.1
Benzo(b)fluoranthene	0.1	0.1
Benzo(k)fluoranthene	0.01	0.1
Chrysene	0.001	0.01
Dibenz(a,h)anthracene	1	0.1
Indeno(1,2,3-c,d)pyrene	0.1	0.1

For the removal evaluation, the TEFs from EPA (1993) *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* were applied to calculate sample total cPAH TEQ concentrations. The EPA RSL webpage users guide (November 2012) references the EPA (1993) TEFs for comparison to RSLs. As an additional point of comparison, the TEFs promulgated under the current MTCA rule (2007) were applied to calculate cPAH TEQ values used in exposure estimates. The MTCA cPAH TEQ values were calculated because they represent a more current evaluation of cPAH potency and because MTCA is an applicable or relevant and appropriate requirement (ARAR) under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). To better understand the uncertainty associated with censored data, sample total cPAH TEQ concentrations were calculated in two ways, with undetected compounds set equal to zero or equal to one-half.

3.3.2 Recreational Beach User Exposure Concentrations

For the Removal Evaluation Report, surface sediment analytical data were summarized in tables and presented on figures depicting station sample concentrations of total cPAH TEQ results. The evaluation of the risk screening results were performed in coordination with EPA.

4 References

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Windward, 2007. Lower Duwamish Waterway, Final Remedial Investigation, Baseline Human Health Risk Assessment.

TABLE E-3
WEBSITE OUTPUT FILE: EPA REGIONAL SCREENING LEVEL RISK CALCULATOR INPUTS AND RESULTS FOR RECREATIONAL BEACH USER SCENARIO

Site-specific

Recreator Equation Inputs for Soil

Variable	Value
TR (target cancer risk) unitless	1.0E-6
SA_{recsc} (skin surface area - child) cm^2/day	2800
SA_{recsa} (skin surface area - adult) cm^2/day	5700
SA_{0-2} (skin surface area - mutagenic) cm^2/day	2800
SA_{2-6} (skin surface area - mutagenic) cm^2/day	2800
SA_{6-16} (skin surface area - mutagenic) cm^2/day	5700
SA_{16-30} (skin surface area - mutagenic) cm^2/day	5700
SA_{recsa} (skin surface area - adult) cm^2/day	5700
THQ (target hazard quotient) unitless	1
LT (lifetime - recreator) year	70
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7428.571
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	23452
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	31819.048
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	93955.333
EF_{0-2} (exposure frequency) day/year	65
EF_{2-6} (exposure frequency) day/year	65
EF_{6-16} (exposure frequency) day/year	65
EF_{16-30} (exposure frequency) day/year	65
EF_{recsc} (exposure frequency - child) day/year	65
EF_{recsa} (exposure frequency - adult) day/year	65
EF_{recsa} (exposure frequency - adult) day/year	65
EF_{recs} (exposure frequency - recreator) day/year	65
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-30} (soil intake rate) mg/day	100
IRS_{recsc} (soil intake rate - child) mg/day	200

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Site-specific

Recreator Equation Inputs for Soil

Variable	Value
IRS_{recsa} (soil intake rate - adult) mg/day	100
IRS_{recsa} (soil intake rate - adult) mg/day	100
ED_{0-2} (exposure duration) year	2
ED_{2-6} (exposure duration) year	4
ED_{6-16} (exposure duration) year	10
ED_{16-30} (exposure duration) year	14
ED_{recsc} (exposure duration - child) year	6
ED_{recsa} (exposure duration - adult) year	24
ED_{recsa} (exposure duration - adult) year	24
ED_{recs} (exposure duration - recreator) year	30
ET_{0-2} (exposure time) hr/day	6
ET_{2-6} (exposure time) hr/day	6
ET_{6-16} (exposure time) hr/day	6
ET_{16-30} (exposure time) hr/day	6
ET_{recsc} (exposure time - child) hr/day	6
ET_{recsa} (exposure time - adult) hr/day	6
ET_{recsa} (exposure time - adult) hr/day	6
ET_{recs} (exposure time - recreator) hr/day	6
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	70
BW_{16-30} (body weight) kg	70
BW_{recsc} (body weight - child) kg	15
BW_{recsa} (body weight - adult) kg	70
BW_{recsa} (body weight - adult) kg	70
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07

Site-specific

Recreator Equation Inputs for Soil

Variable	Value
AF_{recsc} (skin adherence factor - child) mg/cm^2	0.2
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
City (Climate Zone) PEF Selection	Default
A_s (acres) PEF Selection	0.5
Q/C_{wp} (g/m^2-s per kg/m^3) PEF Selection	93.77
PEF (particulate emission factor) m^3/kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependant on U_m/U_t) unitless	0.194
City (Climate Zone) VF Selection	Default
A_s (acres) VF Selection	0.5
Q/C_{wp} (g/m^2-s per kg/m^3) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ_b (dry soil bulk density) g/cm^3	1.5
ρ_s (soil particle density) g/cm^3	2.65
θ_w (water-filled soil porosity) L_{water}/L_{soil}	0.15
T (exposure interval) s	9.5e8
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845

Site-specific

Recreator Screening Levels (RSL) for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,
Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),
Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA	Volatilization Factor (m^3/kg)
Benzo[a]pyrene	50-32-8	Yes	No	7.30E+00	I	1.10E-03	C	-		-		1	0.13	1	-

Chemical	Soil Saturation Concentration (mg/kg)	Particulate Emission Factor (m^3/kg)	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL (Child) HQ=1 (mg/kg)	Dermal SL (Child) HQ=1 (mg/kg)	Inhalation SL (Child) HQ=1 (mg/kg)	Noncarcinogenic SL (Child) HI=1 (mg/kg)
Benzo[a]pyrene	-	1.36E+09	1.10E-01	2.87E-01	2.56E+04	7.95E-02	-	-	-	-

Chemical	Ingestion SL (Adult) HQ=1 (mg/kg)	Dermal SL (Adult) HQ=1 (mg/kg)	Inhalation SL (Adult) HQ=1 (mg/kg)	Noncarcinogenic SL (Adult) HI=1 (mg/kg)	Screening Level (mg/kg)
Benzo[a]pyrene	-	-	-	-	7.95E-02 ca

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