FORMER CHIGNIK LAGOON CANNERY
SITE CHARACTERIZATION WORK PLAN
ADEC File No. 2532.38.004
Hazard ID #26488

Prepared for:

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Acronyms and Abbreviations

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
BMP	Best Management Practices
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
COC	Contaminants of Concern
DRO	Diesel Range Organics
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
FLB	Fluorescent Light Ballast
GPS	Global Positioning System
GRO	Gasoline Range Organics
PCB	Polychlorinated Biphenyl
PAH	Polycyclic Aromatic Hydrocarbons
PID	Photo-Ionization Detector
PPE	Personal Protective Equipment
ppm	Parts per Million
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RRO	Residual Range Organics
SOP	Standard Operating Procedure
TPECI	Travis/Peterson Environmental Consulting, Inc.
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons

VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbons

1.0 INTRODUCTION

On behalf of Wards Cove Packing Company, LLC, and its predecessor Wards Cove Packing Company, Inc. (collectively "Wards Cove"), Travis/Peterson Environmental Consulting, Inc. (TPECI) prepared this work plan. This work plan was developed in response to a June 12, 2017 Alaska Department of Environmental Conservation (ADEC) letter requesting that Wards Cove Packing Company, LLC characterize the extent of the soil and groundwater contamination on the property as well as address concerns regarding fuel pipelines, potential lead or PCB contamination, and conduct a fuel tank inventory. This work plan details the proposed site characterization investigation, sampling, screening, laboratory analysis, and reporting of petroleum-contaminated soil at the Chignik Lagoon Cannery facility near Chignik Lagoon, Alaska (the Site, a part of which is located on real property currently owned by Top Notching Holdings, LLC (the Property)). The Site location is shown in Figure 1.

TPECI developed this plan to meet the requirements of 18 AAC 75.325. The purpose of this work plan is to describe the methods and procedures through which action will be taken under regulatory oversight to identify and characterize soil and groundwater contaminant concentrations to numeric and practicable cleanup levels defined in 18 AAC 75.

2.0 OBJECTIVES

The objectives of this work plan are to:

- Acquire and summarize existing environmental data;
- Assess chemical hazards at the site;
- Identify field screening, sampling, and analytical methods;
- Identify the methods for contaminated material handling; and
- Identify the methods for managing investigation generated wastes.

These objectives will be met by presenting the following information:

- The site description and background;
- A method to inventory hazardous materials, including heating oil, associated with the site;
- A field screening and sampling plan for additional site investigation and characterization;
- The sample collection methods;
- Field quality control measures;
- Field documentation to be used;
- The analytical methods to be employed; and
- Conclusions and recommendations.

The objectives of the proposed work include the completion of the following tasks:

1. Determine the horizontal and vertical extents of contamination in soil, groundwater, and surface water at the Old Tank Farm. The locations of associated pipelines and surface water will also be assessed.

2. Determine the horizontal and vertical extents of contamination in soil, groundwater, and surface water at the New Tank Farm, in particular, the northeast corner containing the sump. The locations of associated pipelines and surface water will also be assessed.

3. Determine the nature and extent of contamination associated with all pipelines on site, the boat storage area (only in areas not located over water), and the fuel dock (only in areas not located over water).

4. Collect data to determine if site-specific alternative cleanup levels for soil may be developed for this property.

5. Provide ADEC with an inventory of onsite heating oil tanks. The inventory will include the total number of tanks, the volume of fuel in each tank, any visible spills associate with each tank, and if feasible, the type of fuel used or remaining in each tank. If there are additional tanks on the property not associated with heating oil or the two, primary tank farms, those tanks will also be included in the inventory.

6. A 2007 Brownsfield assessment documented the potential presence of polychlorinated biphenyls (PCBs) in fluorescent light fixtures in facility buildings and in electrical transformers at the generator shed. Site work will determine the presence of PCB-containing materials on the property.

7. A 2007 Brownsfield assessment documented the potential presence of lead-based paint in soils surrounding facility buildings. Site work will determine the extent of lead contamination (if any) on the property.

8. Site work will determine if floor drains or other conduits are present in the facility machine shop. If identified, additional characterization of drains may be necessary.

The extent and boundaries of the study are limited to the Wards Cove Packing Company, LLC property identified as U.S. Survey 2715. The focus of the proposed work is to address areas impacted by bulk fuel storage at the property. Additional work will focus on other potential environmental hazards. No work will be conducted on the adjacent property owned by Chignik Lagoon Native Corporation.

3.0 SITE DESCRIPTION AND BACKGROUND

The Property on which the former Chignik Lagoon Cannery sits is located across the lagoon from the village of Chignik Lagoon in the Lake and Peninsula Borough, Alaska (Figure 1 and 1A). The Property is U.S. Survey 2715 (USS 2715). The Property covers 15.5 acres.

The Property position is approximately 56.3145° North latitude, -158.6029° West longitude. The Parcel is located in Section 2, Township 45 South, Range 60 West, Seward Meridian, United States Geological Survey Chignik Quadrangle. The former Chignik Lagoon Cannery is listed in the ADEC Contaminated Sites Database under the ADEC file number 2532.38.004.

In 1968, CWC Fisheries, Inc. acquired title in the Property. CWC Fisheries was a joint venture between Wards Cove and Bumble Bee Seafoods (formerly known as Columbia River Packers Association and a subsidiary of Castle and Cooke, Inc.). CWC Fisheries leased the Property and the canning facility to an operator called Columbia Wards Fisheries, also a joint venture of Wards Cove and Bumble Bee Seafoods. In about 1983, Wards Cove acquired Bumble Bee's interest in the joint venture entities and operations, and by 1987 owned the Property. The fishing support operation was terminated in the 1990s.

The Property can be accessed by boat from the village of Chignik Lagoon and is situated on an unnamed creek (Figure 2). The creek bisects the Property and the cannery facility was built into the surrounding hillside. The topography of the Property consists of steep hillsides with structures set into the hillside. Significant excavation and grading occurred at the time of construction. The Property and surrounding area are densely vegetated.

The soils throughout the property, including beneath the tank farms, consisted of silty sands with discontinuous clay lenses. Small pockets of gravel and cobble were also observed in some areas.

The Property has numerous derelict buildings and other structures associated with the commercial cannery that operated for many years. The Property has been largely abandoned since commercial operations at the site ceased in the early 1990s.

In 2008, the Property was conveyed to Top Notch, a real property holding company affiliated with Wards Cove. The Property is currently not actively being supported for any development or use. Though the Property has a caretaker, significant vandalism has occurred causing damage to many of the buildings and structures on the property.

Two historic fuel tank farms are located on the property identified as the New Tank Farm and the Old Tank Farm. The tank farms are shown in Figure 2 in Appendix A. Both tank farms are located upgradient of nearby surface waters. The New Tank Farm is located approximately 140 feet from an unnamed creek on the property. The Old Tank Farm is approximately 255 feet from the unnamed creek and 155 feet from Chignik Lagoon. In 2016, these tank farms were demolished as part of an investigation and site remediation effort. This is further described in Sections 3.2.2 and 3.2.3 of this work plan.

The 2007 Brownfield Assessment *Limited Phase I Environmental Site Assessment* of the Chignik Lagoon Cannery conducted by Hart Crowser, Inc. had provided the ADEC with baseline information regarding the property and the site. However, Hart Crowser, Inc. did not have authorization to access the property, thus all information provided in the report was obtained through review of aerial imagery or by viewing the site via binoculars. No onsite inspection was conducted. As a result, the report contained significant speculation and inaccuracies that have followed the facility within ADEC files.

The Brownsfield Assessment report identifies an area described as the “South Boat Storage Yard” and the “Fuel Dock”. The descriptions of these facilities are misleading. Both the boat storage area as well as the fuel dock are overwater dock structures constructed on pilings.

3.1 August 2014 Environmental Site Investigation

In August 2014, TPECI conducted an Environmental Site Investigation of the Property and the relevant surrounding areas. The investigation consisted of an onsite assessment of the Property and facility structures to determine potential environmental liability associated with the Site. TPECI prepared the subsequent *Chignik Lagoon Cannery Environmental Site Investigation Report* in December 2015 and submitted it to ADEC. The report detailed the findings of the investigation at the Site.

The investigation identified two primary areas of the concern:

- Hydrocarbon contamination was identified at the "New" and "Old" Fuel Tank Farms (Figure 2) and at the fueling headers and dock fuel tank. Numerous fuel and oil spills likely occurred at the Site during the operation of the cannery. The tank farm sites are likely the main areas of contamination. Additional contamination may be present along fuel pipeline corridors on the property. Releases could be impacting groundwater.
- Solid waste was a significant problem at the Site. The landfill was not on the Property (Figure 2). It was unpermitted and contained a large volume of refuse. Additional refuse and debris was present throughout the Site. Some debris was the result of trespassers and vandals. Other debris came from historic canning facility operations. Seasonal, local residents continued to use the site and contribute to solid waste issues for some time after commercial activities had ceased.

TPECI collected soil samples from the New and Old Tank Farms during the 2014 Environmental Site Investigation. Soil samples were analyzed for Diesel Range Organics (DRO), Residual Range Organics (RRO), Gasoline Range Organics (GRO), and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX).

The Old Tank Farm has been in existence since at least 1963. The New Tank Farm has been in existence since at least 1981. Wards Cove indicated that both tank farms contained only diesel fuel. Facility operations seem to support this assertion. Active operation ceased in the early 1990s. Therefore, hydrocarbon contamination found in these areas likely resulted from historic releases of fuels used at the Property.

<u>New Tank Farm</u>
Soil samples collected from the New Tank Farm identified several areas of hydrocarbon contamination. Soil samples NT-1 through NT-3 were all collected within the containment area of the tank farm facility. TPECI personnel were not able to determine if the containment area was lined. No liner was identified in small excavations of approximately 12-inches below ground surface (a liner was found during future work at a greater depth). Samples were collected near pipeline joints within the tank farm.

All soil samples had DRO concentrations significantly higher than the ADEC Method Two cleanup level of 230 mg/Kg for migration to groundwater. Sample NT-2 had the highest DRO concentration at 21,900 mg/Kg.

Old Tank Farm

Soil samples were also collected at the Old Tank Farm. The samples identified numerous areas of hydrocarbon contamination. All soil samples were collected from soil immediately beneath the tanks and their cribbing. The pipelines within the tank farm were cracked or otherwise heavily damaged. Many of the tanks contained rust or puncture holes.

Soil samples OT-1, OT-2, and OT-3 all had DRO concentrations significantly higher than ADEC Method Two cleanup level of 230 mg/Kg for migration to groundwater. OT-2 had the highest DRO concentration at 97,700 mg/kg. Sample OT-3 also contained benzene, ethylbenzene, and total xylene concentrations above the applicable ADEC Method Two cleanup levels.

The soil samples collected confirmed the presence of DRO contamination at the New and Old Tank Farms.

3.2 October 2016 Site Remediation Work

In the fall of 2016, TPECI and Paradigm Marine (Wards Cove's remediation contractor) conducted site investigation and cleanup activities. Using known areas of contamination, TPECI had planned to conduct a concurrent characterization and remediation of the areas of significant concern. The planned remediation approach included soil screening, excavating contaminated soils, landfarming soils, and collecting confirmation samples.

To enable efficient investigation and remediation activities, , significant efforts to provide safe and direct access were conducted. Since the Property was abandoned in 1991, major erosion and vegetation had deteriorated all roads and pathways. Major road repair was needed. A bridge over the unnamed creek had deteriorated and required replacement to allow access to the tank farm areas.

Heavy equipment was brought to the site prior to remediation activities in September 2016. Access was provided through re-establishing road corridors, clearing vegetation and other debris from the roadways as well as re-grading other pathways and access corridors. Wards Cove also cleared and graded several areas near the tank farms on the Property. These locations were utilized to construct landfarm cells for treatment of the excavated soils.

Upon completion of civil site work, Wards Cove removed the fuel tanks from the tank farm sites. No tanks located in the Old Tank Farm contained any fluid.

Nearly all of the fuel tanks in the New Tank Farm contained varying fluid volumes. Upon inspection each tank was found to hold approximately 500 to 2,000 gallons of water. All of this water was mixed with small quantities of fuel resulting in a heavy sheen. TPECI personnel directed the draining of the tanks. All water was treated through a 55-gallon water scrubber at a manufacturer recommended maximum flow rate of five gallons per minute. Discharged water flowed via natural drainage channels, infiltrated through vegetation, and flowed into the unnamed creek on the property.

Once all tanks were fully drained, tank valves were closed. TPECI directed the demolition of tank farm piping. All pipelines were inspected for fuel prior to demolition and drained into 55-gallon drums if necessary. Drained and sealed tanks were lifted out of the tank farms using an excavator and staged elsewhere on the property. The staged tanks do not pose a risk of contaminating additional areas on the site. The long-term disposal of the tanks will be determined by Wards Cove.

Wards Cove removed cribbing and other tank farm structures at both the New and Old Tank Farms. Wards Cove did not disturb any soils within areas of identified petroleum contamination during initial site work, unless under the direction and guidance of TPECI personnel. TPECI personnel were on site during the work to identify access areas, aid in the design and construction of landfarms, delineate clearing areas around the tank farms, and to record site observations for the excavations as needed.

Two separate, excavations were conducted at the facility. Excavation of petroleum-contaminated soils occurred at both the New and Old Tank Farms. The footprint of each tank farm was the primary focus at each site.

3.2.1 Landfarms

Landfarms were located near the two existing tank farms in a partial clearing. Site excavation and development was necessary to construct several flat areas near the tank farms large enough to accommodate the proposed landfarms. Due to the steep terrain at the site, it was more practical to develop multiple, smaller landfarms than a single, large, cell.

A total of three landfarm cells were developed at the Property. Each of the landfarm cells are shown in Figure 2 (Appendix A). Two landfarm cells were constructed on the hilltop adjacent to the Old Tank Farm. These two landfarms are identified as Upper Landfarm (ULF) and Lower Landfarm (LLF). They were established on two benched tiers cut into the hillside. A third landfarm cell was constructed immediately to the northwest of the New Tank Farm. This landfarm was identified as Landfarm #3 (LF3).

Contaminated soils excavated at the Site were transported to the landfarm via the re-cleared access roadways. All excavated soils from the site were immediately transported to the landfarms. Due to steep slopes, and challenging terrain, some soils were temporarily stockpiled at the location of each excavation to facilitate staging and movement of equipment. In these situations, temporarily stockpiles existed for a period of less than one day. All excavated/stockpiled soil characterization samples were collected from these soils after they are placed into the proposed landfarm.

Landfarm cells were constructed in a manner as to segregate the soils from the individual tank farm excavations. Soils from the Old Tank Farm excavated were placed into Upper Landfarm and Lower Landfarm. Soils from the New Tank Farm were placed into Landfarm #3. Excavation at each tank farm stopped when landfarm space was exhausted.

3.2.2 Old Tank Farm

Once site access was established and the necessary tank farm demolition was completed, excavation of petroleum-contaminated soils began at the Old Tank Farm (Figure 2, Appendix A). No bermed containment area had been constructed at the site. All tanks had been placed on elevated cribbing above a semi-level ground surface. The tank farm was located at the top of a hill on the property. The tank farm did not appear to have ever been lined, and no documentation exists suggesting alternative containment measures. The footprint of tank farm and the immediate surrounding area was the focus of the excavation. During the excavation process, TPECI discovered contaminated soils following storm water flow pathways and ravines traveling from the hill top downgradient towards the northwest (unnamed creek) and southeast (Chignik Lagoon). Contamination was found to be significantly more extensive than anticipated.

For excavated areas, TPECI personnel directed the excavation work using field screening results as well as visual and olfactory clues to determine the location, and the vertical and horizontal extents of potentially contaminated soils. All material that exhibited screening results or other characteristics of contamination (staining and/or odor) were segregated and transported via tracked dump truck to onsite landfarms. The excavation of the site was to be limited by project constraints (i.e. excavated to the point where the project can no longer move forward, such as bedrock or continuous boulder or cobble impractical to excavate, or the depth of the contamination extends beyond the reach of the excavator) or to where it appeared there was no residual contamination, whichever event came first. At the Old Tank Farm, the depth of contamination encountered exceeded the reach of the excavator to safely operate.

Based on the 2014 Environmental Site Investigation, TPECI identified surface contamination of soils from diesel spills, leaking fuel lines, and tank overfills. During the 2014 site visit, TPECI was not able to assess the depth of the contamination, limited only to hand tools. Based on the topography, TPECI determined that shallow bedrock formations at the site were possible, limiting contaminated soils.

The October, 2016 excavation determined that bedrock at the site is likely near sea level elevation, greater than 40 feet below the Old Tank Farm site. Thus, the vertical extent of the contaminated soils was limited only by the volume of diesel fuel spilled during the facilities operation. Wards Cove and TPECI were prepared to manage a maximum of 1,000 cubic yards of soil combined from the New and Old Tank Farm site remediation activities. The extent of contaminated soil at the Old Tank Farm was likely far greater.

Due to lack of appropriate equipment to safely continue excavation and lack of adequate disposal options for excavated contaminated soil, Wards Cove and TPECI suspended action on this excavation after removing approximately 246 cubic yards of contaminated soil. Significant quantities of contaminated soils remain in the ground at the site. As the extents of the contamination were not determined, no confirmation samples were collected for field screening or laboratory analysis. However, characterization samples were collected from the excavated/stockpiled soils within the landfarms for field screening and laboratory analysis. These samples were collected to determine an approximate magnitude of contaminant concentrations present at the site and as a baseline for treatment objectives.

Soil samples collected from excavated/stockpiled soils placed into the landfarms ULF and LLF found DRO and GRO concentrations well above ADEC cleanup levels. BTEX concentrations were also found to be above ADEC Method Two cleanup levels. The nature of the contaminants encountered indicates that diesel had impacted the soil beneath and surrounding the Old Tank farm. The total volume of fuels spilled or leaked at the site is unknown. However, contaminant concentrations present in the soil in addition to observed contaminant extents indicate that the total volume was significant.

As the excavation was advanced, the extents of the contamination were not encountered, and contaminant concentrations did not dissipate at greater depths. At a depth of approximately 20 feet below ground surface, continued excavation was no longer safe or feasible with the equipment available on site. Groundwater was encountered at varying depths, typically greater than six feet below ground surface. Given the excavation location at the top of a hill, a static water level was not observed.

As continued excavation was not feasible, TPECI and Wards Cove suspended operations at the Old Tank Farm site. The excavation was graded and sloped, with steep excavation walls collapsed so the site does not pose a risk to trespassers. Significant volumes of contaminated soils remained in the ground at the Old Tank Farm location.

3.2.3 New Tank Farm

Once site access was established and the necessary tank farm demolition was completed, excavation of petroleum-contaminated soils began at the New Tank Farm (Figure 2, Appendix A). The New Tank Farm consisted of a bermed containment area with tanks resting on treated timbers. Initially, no hydrocarbon sheen was visible on the standing water present throughout the containment area. As tanks were removed and soils were disturbed a sheen became visible. Further disturbance of the soils within containment cause by draining tanks of accumulated storm water resulted in additional sheen to be observed. Vegetation was also present within the containment area.

During the 2014 Environmental Site Investigation, TPECI had not determined if the New Tank Farm utilized a liner. At least two feet of soil was present in sampling locations inside the bermed area. Following the removal of the tanks and associated infrastructure in 2016, a HDPE liner was identified buried beneath one to three feet of soil. The welded, multi-piece liner fully contained the bermed area and was found to be intact.

TPECI directed the excavation of all soils within the containment liner. These soils were observed to be contaminated with diesel fuel, exhibiting strong visual and olfactory indicator. All soils from within the containment liner were placed into a treatment landfarm adjacent to the site. Generally, soils beneath the liner were not found to be impacted by hydrocarbon contaminants.

For excavated areas, TPECI personnel directed the excavation work using field screening results as well as visual and olfactory clues to determine the location, and the vertical and horizontal extents of potentially contaminated soils. All material that exhibited screening results or other characteristics of contamination (staining and/or odor) were segregated and transported via tracked dump truck to onsite landfarms. The excavation of the site was to be limited by project constraints (i.e. excavated to the point where the project can no longer move forward, such as bedrock or continuous boulder or cobble impractical to excavate, or the depth of the contamination extends beyond the reach of the excavator) or to where it appeared there was no residual contamination, whichever event came first. The horizontal and vertical extents of contamination were reached (based on field screening) within the majority of tank farm site.

A concrete sump was located at the northeast corner of the New Tank Farm containment cell. A drain pipe with a gate valve extended from the sump to a drainage ditch outside of the tank farm, ultimately flowing into the unnamed creek. During excavation, TPECI noted that the containment liner was not connected to the sump, thus, contaminated storm water and fuel were able to freely seep around the sump basin. Contaminated soils were discovered beneath the sump and spread throughout the northeast corner of the containment cell beneath the liner. Contaminated soils were also identified at the outlet of the drainage pipe. The horizontal and vertical extents of contamination were not reached in this area.

Wards Cove and TPECI suspended action on this excavation after removing approximately 630 cubic yards of contaminated soil from the New Tank Farm. No additional landfarm space was available on the Property, thus there was a lack of adequate disposal options for excavated contaminated soil. Significant quantities of contaminated soil remain in the ground at the site. Confirmation samples for field screening and laboratory analysis were collected from the New Tank Farm site, excluding the northeast corner, where contamination persists.

Soil samples collected from excavated/stockpiled soils placed into the landfarm LF3 found DRO and GRO concentrations well above ADEC cleanup levels. The nature of the contaminants encountered indicated that diesel fuel had impacted the soil beneath and surrounding the new Tank farm. It did not appear that gasoline was stored in the New Tank Farm nor did it directly impact the soils around it.

The presence of an intact liner in the New Tank Farm significantly reduced the total volume of impacted soils. However, several feet of soil within the tank farm liner were removed and require treatment. The New Tank Farm was measured to be 106 feet by 50 feet, thus the volume of contaminated soils removed from inside the liner was not insignificant.

Several pinholes or damaged locations in the tank farm liner did result in additional spot cleanup of soil beneath the liner material. Generally, the depth of this contamination was minimal and contaminated soils were removed as the soil confirmation sampling results indicated. However, several confirmation soil samples did indicate the presence of DRO contamination remaining above ADEC cleanup levels. These samples appear to be isolated spots, as they were surrounded by “clean” samples. Additional excavation will likely be required at these locations.

Wards Cove and TPECI suspended action on this excavation once no additional landfarm space was available on the Property. A lack of adequate disposal options for excavated contaminated soil prevented further site work at the time. Significant quantities of contaminated soil remained in the ground at the site. Confirmation samples indicated that contaminated soils at the New Tank Farm have been mostly removed, excluding the northeast corner, where contamination persists. Where necessary surrounding the sump in the northeast corner, the excavation was graded and sloped, so the site would not pose a risk to trespassers.

3.2.4 Test Pits

As excavation at the tank farm sites was suspended due to lack of landfarm space, TPECI advanced a series of test pits on the Property to attempt to determine the horizontal and vertical extents of the contamination and work to establish areas where future site work and excavation may be required.

TPECI directed the excavation of 15 soil test pits on the property. Each test pit was dug using an excavator. Typical test pit sizes were eight feet by five feet and ranged in depth two to 10 feet. Test pits were only excavated until contamination was encountered. The location of the tests pits are shown in Figure 4 in Appendix A.

TPECI utilized visual and olfactory indicators as well as heated headspace PID field screening to determine if contamination was present in each soil test pit. For screening samples that exhibited high PID results, TPECI reported those results in ranges such as ">1,000ppm" or ">5,000ppm." No soil samples were collected for laboratory analysis from the test pits.

Test pit soils were staged immediately adjacent to each test pit, then backfilled upon completion of soil sample collection. No test pit soils were moved or transported elsewhere on the property.

Field screening and visual and olfactory observations during the excavation of test pits found significant contamination surrounding both the New Tank Farm and Old Tank Farm. In general, test pits that exhibited the presence of contamination were all found to have high concentrations, visible free product, or fuel-contaminated groundwater. Contaminants appeared to be spreading with groundwater movement. Thus, those areas downgradient of each tank farm were the most impacted.

At the Old Tank Farm, test pits successfully identified the eastern and western horizontal extents. Contamination appeared to travel to the northwest, downhill towards the unnamed creek. Significant contamination was noted to extend to the northwest, towards the New Tank Farm. Test pits following drainage gullies indicated that contamination also extended to the southeast, down the hillside towards the beach and Chignik lagoon. Due to the steepness of the hillside, it was not safe to dig test pits on the slope itself. An estimated area of the Old Tank Farm contaminant plume is shown in Figure 5 in Appendix A, based on where contamination was identified in test pits. This area encompassed approximately 38,200 square feet. The vertical extent of the contamination was unknown.

The contamination remaining at the New Tank Farm was primarily located in the northeast corner, at the site of the sump. Additional contamination was identified at the outlet of the tank farm drainage pipe. Test pits in these areas found contamination traveling downgradient to the north, towards the unnamed creek. An existing drainage ditch flowed directly from the northeast corner of the tank farm into the creek. Subsurface, groundwater flow appeared to move along the same pathway. Test pits dug along the ditch and immediately adjacent to the unnamed creek all contained contaminated soils. An estimated area of the New Tank Farm contaminant plume is shown in Figure 5 in Appendix A, based on where contamination was identified in test pits. This area encompasses approximate 9,400 square feet. The vertical extent of the contamination is unknown.

3.2.5 Groundwater

TPECI installed two drive-point temporary groundwater monitoring wells at the property to determine if contaminants were mobile and being transported in groundwater. The proximity to the unnamed creek was a concern and a well was placed downgradient (towards the creek) from the likely contaminant source (New and Old Tank Farms) to determine contaminant transport and characterize the groundwater.

Groundwater samples collected from MW1, within the Old Tank Farm excavation area, exceeded the ADEC cleanup levels for DRO GRO, and BTEX. This well was not placed at the static groundwater depth, instead it was placed approximately nine feet bgs, intercepting a perched layer of groundwater.

The benzene concentrations in the groundwater also exceeded the U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) maximum contaminant concentration for benzene (0.5 mg/L), thus the groundwater meets the definition of a characteristic hazardous waste for benzene if extracted from the ground. The presence of benzene at these concentrations makes any onsite treatment of groundwater challenging as the property would require permitting as a RCRA Treatment, Storage, and Disposal Facility. Additionally, any extraction of groundwater for well development or sampling would require handling and management as a hazardous waste.

MW2 was located in the drainage ditch, approximately 125 feet (downgradient) from the New Power Plant. While no contaminants were found to exceed ADEC cleanup levels, elevated DRO concentrations were observed in the well. The observed contaminant concentrations in both wells indicated that the contaminants were being transported by the groundwater at the site.

3.2.6 Request for Additional Work

Since significant contamination remains on the property surrounding the New and Old Tank Farms, the ADEC requested that additional site characterization work be conducted. A June 12, 2017 letter requested that Wards Cove Packing Company, LLC characterize the extent of the soil and groundwater contamination on the property as well as address concerns regarding fuel pipelines, potential lead or PCB contamination, and conduct a fuel tank inventory. This work plan describes that site characterization work.

4.0 POTENTIAL CONTAMINANTS OF POTENTIAL CONCERN

The contaminants of potential concern (COPC) are diesel fuel, PCBs, and lead. Analytical laboratory samples will be collected for DRO, RRO, GRO, Volatile Organic Compounds (VOCs) including BTEX and Polycyclic Aromatic Hydrocarbons (PAH) in areas where hydrocarbon contaminants are suspected. Analytical laboratory samples will be collected for PCBs (in oil, in surface wipes, or in soil depending on impacted matrix) where PCB contaminants are suspected. Analytical laboratory samples for Total Lead (in soil) will be collected where lead contamination is suspected.

Soil and groundwater samples will be submitted to SGS Environmental Laboratories, Inc. in Anchorage, Alaska for laboratory analysis. The qualified sampler will also perform field screening using a PID to screen soils for volatile organic compounds. If necessary where severely weathered hydrocarbons are encountered, the qualified sampler will also perform field screening using PetroFlag® to screen soils for Total Petroleum Hydrocarbons (TPH).

The project target soil cleanup levels shown in Table 1 below were established from ADEC Title 18, Alaska Administrative Code, Section 75.341 (January 2019), Table B1, Method Two – Soil Cleanup Levels, Over 40 Inch Zone, Migration to Groundwater as shown in Table 1 below. All non-BTEX VOC project cleanup levels are as listed in Table B1, Method Two.

Table 1: Preliminary Project Soil Cleanup Levels

Analyte	Units	Cleanup Level
DRO	mg/Kg	230
RRO	mg/Kg	9,700
GRO	mg/Kg	260
Benzene	mg/Kg	0.022
Ethylbenzene	mg/Kg	0.13
Total Xylenes	mg/Kg	1.5
Toluene	mg/Kg	6.7
1-Methylnaphthalene	mg/Kg	0.41
2-Methylnaphthalene	mg/Kg	1.3
Acenaphthene	mg/Kg	37
Acenaphthylene	mg/Kg	18
Anthracene	mg/Kg	390
Benzo(a)anthracene	mg/Kg	0.70
Benzo[a]pyrene	mg/Kg	1.9
Benzo[b]fluoranthene	mg/Kg	20
Benzo[g,h,i]perylene	mg/Kg	15,000
Benzo[k]fluoranthene	mg/Kg	190
Chrysene	mg/Kg	600
Dibenz[a,h]anthracene	mg/Kg	6.3
Fluoranthene	mg/Kg	590
Fluorene	mg/Kg	36
Indeno[1,2,3-c,d]pyrene	mg/Kg	65
Naphthalene	mg/Kg	0.038
Phenanthrene	mg/Kg	39
Pyrene	mg/Kg	87
Total Lead	mg/Kg	400

PCBs (Total)	mg/Kg	1.0

The project target groundwater cleanup levels shown in Table 2 were established from ADEC Title 18, Alaska Administrative Code, Section 75.345, Table C, Groundwater Cleanup Levels as shown in Table 2 below. All non-BTEX VOC project cleanup levels are as listed in Table C.

Table 2: Project Groundwater Cleanup Levels

Analyte	Units	Cleanup Level
DRO	µg/L	1,500
RRO	µg/L	1,100
GRO	µg/L	2,200
Benzene	µg/L	4.6
Ethylbenzene	µg/L	15
Total Xylenes	µg/L	190
Toluene	µg/L	1,100
1-Methylnaphthalene	µg/L	11
2-Methylnaphthalene	µg/L	36
Acenaphthene	µg/L	530
Acenaphthylene	µg/L	260
Anthracene	µg/L	43
Benzo(a)anthracene	µg/L	0.30
Benzo[a]pyrene	µg/L	0.25
Benzo[b]fluoranthene	µg/L	2.5
Benzo[g,h,i]perylene	µg/L	0.26
Benzo[k]fluoranthene	µg/L	0.80
Chrysene	µg/L	2.0
Dibenz[a,h]anthracene	µg/L	0.25
Fluoranthene	µg/L	260
Fluorene	µg/L	290
Indeno[1,2,3-c,d]pyrene	µg/L	0.19
Naphthalene	µg/L	1.7
Phenanthrene	µg/L	170
Pyrene	µg/L	120

An updated conceptual site model has been prepared and is enclosed in Appendix B.

5.0 PROPERTY FUEL TANK INVENTORY

TPECI will develop an inventory on onsite fuel tanks at the property. This inventory shall include heating oil tanks as well as any other stationary above-ground fuel storage tanks or underground fuel storage tanks. No containers less than 55-gallons will be included in this inventory. This inventory will not include the drained, out of service tanks that have been removed from the New and Old Tank Farms that are still staged on the property awaiting transport for disposal.

The fuel tank inventory will include an identification number, location of each tank, the construction of the tank, and the estimated volume of the tank. GPS coordinates will be collected for each tank. TPECI will note the presence or absence of any fluids within each tank and if feasible, attempt to determine the volume and type of fluids/fuel present. TPECI will inspect the ground surface surrounding each tank to look for any indications of leaks, spills, or other releases that may have impacted surrounding media. A spreadsheet shall be developed containing of this information and will be included in the final report. In addition to the spreadsheet, TPECI will photograph each tank. Those photos will be included in the report photographic log.

If fuel or other fluids are discovered inside any of these tanks, they will be drained into clean 55-gallon drums for transport for disposal. Sludge or other debris within each tank will also be removed. The tanks will be secured for transport and off-site disposal. No tanks will be cleaned onsite.

6.0 SAMPLING PLAN

This work will be conducted in accordance with the *ADEC 18 AAC 75 Oil and Other Hazardous Substances Pollution Control (revised October 2018)*. Where applicable, the site characterization and analysis will be modeled after procedures described in the *ADEC Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites (March 2017)*. Sampling efforts will be conducted in accordance with the *ADEC Field Sampling Guidance (August 2017)* unless otherwise specified within this document.

TPECI personnel meet the ADEC definition of “Qualified Environmental Professional” in accordance with 18 AAC 75.333. TPECI personnel assigned to this project have not been determined at this time. Resumes for all TPECI personnel are available in Appendix D. While on site, TPECI personnel will be aided by Wards Cove Packing Company, LLC personnel and third-party contractors. However, all sample collection and site work will be conducted by or under the direction supervision of TPECI personnel.

6.1 Hydrocarbon Contaminants

TPECI personnel will coordinate with Wards Cove personnel and third-party contractors, including a drilling contractor on site. TPECI personnel will advance 35 soil borings using a track mounted 6-inch diameter hollow-stem auger and split spoon sampler. The locations of the proposed soil borings are shown in Figure 6 in Appendix A. Upon advancement, GPS coordinates of each soil boring will be recorded. Soil borings will be installed in locations based on the information obtained during the 2016 site remediation work.

These soil borings will allow for a complete characterization of the horizontal and vertical extents of contaminants at both the Old Tank Farm and the New Tank Farm as well as delineating any contamination in downgradient areas. Additionally, soil borings will be placed in areas where fuel pipelines were known to exist, near the former fuel dock, and in the former north boat storage area.

The former fuel dock itself is located over water on Chignik Lagoon (as shown on Figure 3 in Appendix A from the 2007 Brownsfield Assessment Report). Any spills from the dock would have dispersed without impacting soils as noted within the Brownsfield Assessment Report. However, some fuel dock infrastructure, including pipelines, was located on land near the generator shed. The investigation will assess those areas.

The south boat storage area shown on Figure 3 in Appendix A from the 2007 Brownsfield Assessment Report was also located over water. Any drips or spills associated with boat maintenance would not have resulted in soil impacts. The investigation will instead focus on the north boat storage area near the marine way.

TPECI may elect to place additional borings following the completion of the fuel tank inventory on the property. These borings do not appear on Figure 6 in Appendix A, but their location will be documented with GPS coordinates and in the final report.

Soil samples will be collected for field screening at two-foot intervals within each from each soil boring (i.e. 0-2', 2-4', etc.). Soil borings will be advanced to a depth of two feet below groundwater interface or until bedrock (refusal). If borings are advanced to a depth of more than 20 feet below ground surface (bgs) and neither bedrock nor groundwater have been encountered, the field screening sampling frequency shall be reduced to once per four feet. Ultimately, the depth of the borings shall be dependent on the groundwater depth or boring refusal due to bedrock.

TPECI will use a PID and an elevated field screening threshold to screen for contaminated soils as described in Section 6.1.1. If applicable, or if non-volatile hydrocarbon contaminants are found, a Dexsil® PetroFlag® testing kit and an elevated field screening threshold may be utilized. However, due to the nature of the COC, and observed presence of volatile contaminants during 2016 site work, it is unlikely that a PetroFlag® test kit will be necessary for field screening. TPECI will also use an analytical sampling kit on site in addition to olfactory and visual clues to determine the presence or absence of the contamination in soils. TPECI will document the presence of any sheen or light non-aqueous phase liquid (LNAPL) during the collection of samples for field screening and laboratory analysis.

Potential seasonal precipitation and proximity to Chignik Lagoon and the Pacific Ocean necessitate careful management of excavated soils and site operations during contaminated soil excavations. Soil disturbance will be minimized wherever possible Wards Cove will utilize storm water best management practices (BMPs) throughout the course of the project. BMPs may be installed along site perimeters or access routes to prevent sediment transport as needed.

6.1.1 Field Screening

The following describes the sampling protocols that TPECI field personnel will follow to screen and collect soil samples within soil borings. Field screening will occur first to characterize the presence (if any) of hydrocarbon contamination within the soil borings. A MiniRAE™ Systems 3000 PID will be the primary equipment utilized for field screening. A Dexsil® PetroFlag® test kit will also be utilized. However, its use will be secondary to PID screenings and will only be applicable if extremely weathered (non-volatile) contaminants are encountered (non-volatile being when visual indications of hydrocarbon contaminants are present, but no olfactory indicators are observed).

TPECI personnel will field screen soils with a PID or PetroFlag® test kit in accordance with the ADEC *August 2017 Field Sampling Guidance*, Section 3.0 Soil Sampling.

6.1.1.1 PID Calibration and Use

The PID will be calibrated according to the manufacturer's specifications in the field using a fresh-air charcoal blank and 100-ppm isobutylene calibration span gas. A re-sealable polyethylene bag with a total capacity not less than eight ounces (approximately 250mL) will be filled one-third to one-half full of soil from the screening sample. The soil, sealed in the bag, will be allowed to warm up to 40 degrees Fahrenheit where it shall be held for at least 10 minutes, but no longer than 60 minutes. The soil sample will be agitated for approximately 15 seconds at the beginning and end of the headspace development period to assist in volatilization. The tip of the calibrated PID will then be placed inside the bag for thirty seconds or until the reading stabilizes.

6.1.1.2 Dexsil® PetroFlag® Calibration and Use

The PetroFlag® analyzer test kit will be calibrated in the field in accordance to the manufacturer's specifications. This process involves using a blank standard and a known standard with a TPH concentration of 1,000ppm. The PetroFlag® test kit may require calibration at two temperatures as results via chemical reaction are dependent on the ambient air temperature. If the ambient temperature range varies more than 10 degrees Celsius throughout the period of work, two temperature calibrations will be performed. Should this be necessary, both calibrations will be stored and either can be used accordingly. The appropriate response factor for unidentified petroleum contamination is "7" and shall be programmed in the analyzer prior to field screening being conducted. The field calibration methodology shall follow the PetroFlag® *User's Manual April 1, 2009*. The field screening methodology shall also follow the procedures described in the PetroFlag® *User's Manual April 1, 2009.*

6.1.2 Collection of Samples for Laboratory Analysis

TPECI personnel will collect at least two characterization samples for laboratory analysis from each of the soil borings. The field screening sample which exhibited the highest reading on the PID will be chosen for laboratory analysis and one sample will be collected from the groundwater interface depth for laboratory analysis. Additionally, some characterization samples may be collected from locations of particular concern or significantly differing soil types. In these cases, the sampling location may not have exhibited the highest PID readings. TPECI anticipates the collection of two samples for laboratory analysis from each soil boring.
Samples collected for laboratory analysis shall be analyzed in accordance with Section 6.1.4.

6.1.3 Excavated/Stockpiled Soil

Excavated soil cuttings from the soil borings will be temporarily stockpiled immediately adjacent to each boring. Soil cuttings will be used to backfill the borings. Where permanent groundwater monitoring wells are installed, soil cuttings will be stockpiled on site with fate and disposal based on future site work.

6.1.4 Soil Laboratory Methods

All laboratory soil samples will be analyzed for GRO compounds by method AK101, VOCs by EPA Method 8260C, and DRO by method AK102, RRO by method AK103. For each source area, PAH analysis shall be performed on a sufficient percentage of the samples of the most likely contaminated locations based on field screenings and site observations to determine if PAHs are contaminants of concern. At a minimum, one sample for every 10 laboratory samples will be analyzed for PAH by EPA Method 8270D SIM to comply with the ADEC requirement for PAH sampling for diesel contamination (ADEC August 2017 Field Sampling Guidance Appendix F). However, adequate samples will be analyzed for PAH to characterize the full extent of PAH contamination at each contaminant source.

Table 3: Laboratory Analytical Methods for Soils

Method	**Matrix**	**Container (jars)**	**Preservative**	**Hold time**
8260C (VOCs)	Soil	1 4-oz amber wide mouth jar with septa lid	MeOH and 0-6° C.	14 days
AK101 (GRO)	Soil	1 4-oz amber wide mouth jar with septa lid	MeOH and 0-6° C.	14 days
AK102 (DRO)	Soil	1 4oz amber wide mouth jar	0-6° C.	14 days
AK103 (RRO)	Soil	1 4oz amber wide mouth jar	0-6° C.	14 days
8270D SIM (PAH)	Soil	1 4oz amber wide mouth jar	0-6° C.	14 days

Soil samples destined for volatile analysis will be collected first, follow by samples collected for non-volatile analysis. Pre-weighed and pre-labeled soil sample containers will be filled to a volume (mass) ranging from 25 to 50 grams of soil (approximately 1/3rd container volume) and will be immediately preserved by pouring methanol over the soil and promptly securing the Teflon-lined container lid. Care will be taken to ensure soils are completely covered with preservative provided by the analytical laboratory in pre-measured 25mL portions. Should more than 25mL of preservative be required for a given sample, documentation of total preservative volume will be recorded in the field notes and on the laboratory Chain-of-Custody.

Sample Field Preparation

Sampling shall be performed in accordance with the applicable regulations:

- All samples will be collected using disposable or cleaned and decontaminated sampling equipment;
- Field personnel shall wear disposable gloves, safety goggles, steel toed boots, hard hat, reflective vest, and other appropriate Class D personal protective equipment (PPE). Gloves and sampling devices will be changed between samples;
- Samples will be collected as quickly as possible and placed in laboratory supplied containers;
- Soil for analytical sample testing will not be obtained from field screening *sample* material;

- All samples will be labeled; and
- All samples will be preserved in accordance with laboratory specifications and cooled to a temperature of 0 to 6 degrees Celsius.

6.2 Lead Paint (In Soil) Sampling

The 2007 Brownsfield Assessment Report noted that due to the age of the buildings at the facility, the original building paint may contain lead. The report stated that the weathered paint may have deteriorated and impacted soils around the buildings.

The warehouse/store, machine shop, and the secondary warehouse are all newer, metal-sided buildings. Additionally, these buildings are fully encircled by concrete or asphalt paving. It is unlikely that any lead contamination from peeling lead-based paints exists on these buildings. The primary buildings of concern are older, wood-sided structures including the office, the mess hall, several houses, and the bunkhouses. Faded, weathered paint has been observed on these structures during previous site work. No information regarding the lead content of facility building paint is available.

The excavation or removal of potentially-lead contaminated soils may result in the generation of a Resource Conservation and Recovery Act (RCRA) waste. To avoid the generation of RCRA waste to the maximum extent possible, no soil samples will be collected for field screening for lead. The presence or absence of lead contaminated soils will be determined solely by the collection of soil samples for laboratory analysis. No additional potentially lead-contaminated soils will be removed.

TPECI will collect soil samples below the drip edge of the exterior walls of facility buildings for laboratory analysis for lead. TPECI will utilize Incremental Sampling Methodology (ISM) to collect composite soil samples from selected wood sided buildings on the property. Each incremental sample will be comprised of 10 increments collected from all four sides of a single building. Generally, sampling locations will be selected based on visual observations of peeling paint or paint chips present on the ground surface or where building weathering appears most severe. Soil samples will be collected from the surface soils extending zero to three inches below ground surface using a clean sampling spoon or stainless-steel trowel.

The wood-sided buildings on the property are located in a small geographic area and are constructed from similar materials. TPECI believes that the characterization of soils at selected buildings will be representative of all wood-sided buildings at the site. The buildings selected for assessment are shown on Figure 7 in Appendix A. During the investigation, if TPECI finds that additional or alternate buildings may be more representative of whole site conditions, those buildings will be sampled and documented in field notes, photographs, and reporting.

All laboratory soil samples will be analyzed for Total Lead by EPA Method SW6020A to comply with ADEC's requirement for lead contamination (ADEC August 2017 Field Sampling Guidance Appendix F). Lead paint is not leachable without an acidic catalyst, thus, collection of soil samples for Toxicity Characteristic Leaching Procedure (TCLP) for lead is not necessary at this time.

However, should lead contaminated soils be identified, TCLP analysis may be required for disposal at a future date.

Table 4: Laboratory Analytical Methods for Soils (Lead)

Method	Matrix	Container (jars)	Preservative	Hold time
SW6020A (Total Lead)	Soil	1 4-oz amber wide mouth jar	None	180 days

Sample Field Preparation
Sampling shall be performed in accordance with the applicable regulations:

- All samples will be collected using disposable or cleaned and decontaminated sampling equipment;
- Field personnel shall wear disposable gloves, safety goggles, steel toed boots, hard hat, reflective vest, and other appropriate Class D PPE. Gloves and sampling devices will be changed between samples;
- Samples will be collected as quickly as possible and placed in laboratory supplied containers;
- Soil for analytical sample testing will not be obtained from field screening *sample* material;
- All samples will be labeled; and
- All samples will be preserved in accordance with laboratory specifications.

6.3 Groundwater Wells and Sampling

The extent of potential hydrocarbon contaminated groundwater on the property remains unknown following the excavation and removal of contaminated soils in 2016. To delineate the extent and ensure that contaminated groundwater is not traveling off site, TPECI will install 8 permanent groundwater monitoring wells on the property. The location of the groundwater monitoring wells is shown in Figure 6 in Appendix A.

Each of the permanent groundwater monitoring wells will be installed to below groundwater depth. Based on previous site work and observed groundwater depths in open excavations, TPECI estimates wells will have a maximum depth ranging from six to 20 feet bgs. The topography and the drainage patterns of the property result in highly variable groundwater depths based on location and nearby surface waters. The wells will be constructed in accordance with ADEC well installation recommendations as outlined by the ADEC Monitoring Well Guidance document (September 2013). A schematic of the proposed groundwater monitoring wells is enclosed in Appendix C.

A six-inch diameter, hollow-stem auger drill rig will be used to advance soil borings to below groundwater depth. TPECI personnel and the drilling contractor will install the permanent groundwater monitoring wells within these borings. The installed wells will be commercially manufactured, two-inch diameter Schedule 40 PVC and machine-perforated (20-slot). The perforated well screens will be 10 feet long and will be placed so that approximately six feet of well screen is below the groundwater elevation and four feet is above the observed groundwater elevation to accommodate seasonal fluctuations in groundwater. Where shallow groundwater depths (less than 10 feet) are encountered, the length of the well screen will be shortened, but the same 60/40 placement at the groundwater interface shall be maintained.

TPECI and the drilling contractor will use #10 silica sand for the construction of a well filter pack. The filter pack shall extend at least one foot above the well screen except in shallow depth wells where less than two feet exists between the ground surface and the groundwater elevation. A bentonite annular seal will be placed to fill the top 24 to 36 inches of the soil boring to protect the well from infiltration of storm water or other surface contaminants.

Well casings will utilize locking well caps. In areas where wells require flush mounting, monument caps will be used. The casings will be installed immediately following the placement of bentonite grouting, as soon as the grouting has solidified. Where wells will extend above the ground surface, a protective metal casing will extent at least six inches above the top of the well casing. All wells will be protected from vehicle traffic or other impact damage through marking or installation of protective barriers.

The groundwater monitoring wells shall be developed following installation. The groundwater monitoring wells will be allowed to set for a period of 24 hours between installation and development. Due to the high permeability of the soils on site, well development shall be conducted using a surge block alternating with pumping allowing for a multidirectional flow through the well filter pack. No compressed air will be used for development of the wells at the property. Pumping and surging will continue until turbidity decreases. At the completion of well development, water pumped from the well shall ideally be clear and free of sediment.

Following monitoring well installation and development of the temporary wells, TPECI personnel will wait to allow groundwater stabilization so as to provide a representative sample of groundwater and accurate gradient measurements. Following well development, a water wheel meter will be used for a depth-to-groundwater measurement and to confirm that groundwater levels within each well are in stasis. If the groundwater level for any well is still fluctuating, then TPECI will wait until it is in stasis.

TPECI personnel will measure the depth-to-groundwater surface to the top of each well casing) using a water-wheel meter. The water-wheel meter will be used to measure the distance from the bottom of the well and the top of the casing. The difference between these two points will be calculated to determine the depth of groundwater in the well-point casing. TPECI personnel will calculate the total volume of water in the well casing and convert this amount to gallons. Based on previous site investigations at the property and the observed high permeability of site soils, TPECI does not anticipate that the wells will purge dry.

A peristaltic pump will be used to purge at least three times the calculated well volume. Pumping flow rates shall be electronically controlled via the peristaltic pump controller. Flow rates shall be measured utilizing a stop watch and a container of a known volume. Pumping flow rates shall be maintained at a speed that does not agitate the water within the well casing. TPECI anticipates a drawdown of water elevations within the well casing. However, pumping flow rates shall be controlled so that the well drawdown does not result in purging the well dry. Due to the variation in possible well recharge rates, exact purging/pumping flow rates cannot be specified at this time.

Upon completion of the well purging process, TPECI will use a bladder pump for the collection of groundwater samples from each well due to the presence of high concentrations of VOCs. Pump bladders and all tubing will all be changed and disposed between monitoring wells. Each monitoring well will be sampled for DRO, RRO, GRO, VOC, and PAH. Field duplicate samples will be collected from the wells that have the highest potential for being contaminated and in accordance with Section 7.3.1.1. Groundwater samples for laboratory analysis will be collected, handled, and stored in accordance with *ADEC Field Sampling Guidance (August 2017).* Laboratory analysis methods are detailed below.

At the completion of groundwater sample collection, TPECI personnel will thoroughly mark the permanent groundwater monitoring wells with a survey lath identifying the well number, installation date, and owner. High-visibility flagging will also be placed in the immediate vicinity of each well. A professional land surveyor registered in the State of Alaska will complete a survey of permanent groundwater monitoring wells at the site. The surveyor will survey the top of the well casing in addition to the well monument. The survey will meet or exceed a vertical accuracy of 0.01 feet and a horizontal accuracy of 1.0 feet. The survey will aid in the determination of groundwater flow direction on the property.

All pump tubing, bladders, and associated solid waste will be disposed in accordance with Section 9.0. Soil cuttings will be returned to the soil borings where possible. For permanent groundwater wells, some soil cuttings may be generated and will require stockpiling or disposal in existing landfarms (if space available). Any new stockpile generated would utilize a 20-mil polyethylene liner with a 20-mil polyethylene cover. The location and size of any generated stockpile will be documented and described within the final report. The fate and disposal of stockpiled contaminated soils will be addressed within that report.

An estimated maximum of 500-gallons of development and purge water will be collected as part of the sampling process. This water will be collected in clean 55-gallon drums. All containerized groundwater monitoring well development and purge water will be retained until laboratory results are returned. Where applicable, the presence of sheen or LNAPL will be utilized to segregate development and purge water in an effort to minimize the total volume of waste that may require disposal. Containerized water will be transported off site for treatment and disposal in accordance with State and Federal regulations.

Table 5: Laboratory Analytical Methods for Groundwater

Method	Matrix	Container (jars)	Preservative	Hold time
8260C (VOC)	Water	3, 40 mL amber glass VOA vial	HCL and 0-6° C.	14 days
AK101 (GRO)	Water	3, 40 mL amber glass VOA vial	HCL and 0-6° C.	14 days
AK103 (RRO)	Water	1, 1 L amber glass	HCL and 0-6° C.	14-40 days
AK102 (DRO)	Water	1, 1 L amber glass	HCL and 0-6° C.	14-40 days
8270D SIM (PAH)	Water	2, 1 L amber glass	0-6° C.	7 days

Water samples destined for volatile analysis will be collected first, followed by samples collected for semi-volatile analysis.

Sample Field Preparation
Sampling shall be performed in accordance with the applicable regulations:

- All samples will be collected using disposable or cleaned and decontaminated sampling equipment;
- Field personnel shall wear disposable gloves, safety goggles, steel toed boots, hard hat, reflective vest, and other appropriate Class D personal protective equipment. Gloves and sampling devices will be changed between samples;
- Samples will be collected as quickly as possible and placed in laboratory supplied containers;
- All samples will be labeled; and
- All samples will be preserved in accordance with laboratory specifications and cooled to a temperature of 0 to 6 degrees Celsius.

6.4 PCB Sampling

6.4.1 Fluorescent Light Ballasts

TPECI will conduct an inspection of all buildings on the property that are structurally safe to enter to assess for PCB-containing fluorescent light ballasts (FLBs) within the light fixtures. All FLBs manufactured before July 1, 1979 may contain PCBs. FLBs manufactured between July 1, 1979 and July 1, 1998 that do not contain PCBs will be labeled "No PCBs". Any FLBs manufactured after 1998 do not require a label but would not contain PCBs. TPECI personnel will assess all identified FLB to determine manufacturer date (if possible) and determine presence of PCBs through manufacturer date or FLB labeling. Any FLBs (broken or intact) identified to contain PCBs, likely to contain PCBs, or where content is unknown, will be removed from the fixtures, placed in sealed 55-gallon ring-top drums, and transported for disposal. If no PCB-containing FLBs are identified no removal of fixtures will occur.

PCB wastes are managed and regulated as a non-RCRA hazardous waste when PCB concentrations are greater than 5ppm in liquid wastes or 50ppm in non-liquid wastes. PCB-containing FLBs are a listed Hazardous Waste and U.S. Department of Transportation manifesting is required for transport. However, they are not considered a "contaminated media" and do not require the ADEC *Transport, Treatment, & Disposal Approval Form for Contaminated Media* to be completed prior to transport.

TPECI personnel will document the location of all PCB-containing FLBs on the property, if any, and will note the total number removed from the property, as well as a total weight of the generated waste.

6.4.2 Generator Shed Transformers

TPECI personnel will conduct an investigation of the generator shed to assess for the presence of PCB-containing electrical transformers, or residual PCB-containing transformer oil. TPECI will also assess any other electrical transformers identified on the property.
Similar to the FLBs, TPECI personnel will attempt to determine the manufacture date of any transformers identified on the property as well as use labels or placarding to determine if PCB-containing oils are present. If PCB containing oils are suspected, a sample of the oil will be collected for laboratory analysis for PCBs. If no oils remain but PCBs are suspected, TPECI will utilize PCB wipe samples, swabbing the inside of the transformer as well as any solid surface that appear stained by possible transformer oil leaks. If visible staining is present on soils beneath a transformer, a soil sample will be collected for laboratory analysis. Soil samples will be collected from surface soils extending zero to three inches below ground surface using a clean sampling spoon or stainless-steel trowel. The laboratory analytical methods for PCBs analyses are listed in Table 6.

The suspected transformer (if it contains fluid) will be placed into an overpack drum for transport for disposal as a potentially non-RCRA hazardous waste. If no PCBs are suspected, the transformers will not be removed from the property.

Table 6: Laboratory Analytical Methods for PCBs

Method	Matrix	Container (jars)	Preservative	Hold time
SW8082A (PCBs)	Soil	1 4-oz amber wide mouth jar	0-6° C.	14 days
SW8082A (PCBs)	Oil/Xylene	20ml amber glass.	0-6° C.	40 days
SW8082A (PCBs)	Wipes	$10cm^2$ Fiber wipe in 1 4-oz amber wide mouth jar	Hexane and 0-6° C.	7 days

6.5 Machine Shop Drain Assessment

The 2007 Brownsfield Assessment Report noted that the machine shop at the facility had a concrete floor, but the lack of legal site access prevented an investigation to determine if any floor drains or other conduits were present. Though past site work by Wards Cove and TPECI had utilized this building for staging, no investigation has been made regarding the presence of floor drains. There is no information currently available that indicates the suspected presence of a floor drain or other conduit from the concrete floor.

TPECI personnel will assess the machine shop floor to determine if any floor drains or other potential conduits are present. If a floor drain or conduit is discovered, TPECI will attempt to determine the routing of the drain and collect soil samples for field screening and laboratory analysis from the drain outlet as applicable. The method for collection of soil samples will depend on the location of any drain outlet and accessibility. Samples may be collected using the hollow-stem auger and split spoon sample, through hand tools including shoves and trowels, or through the use of test pits and heavy equipment such as a backhoe or excavator.

All collected soil samples would be field screened in accordance with Section 6.1.1 of this work plan. Soil samples collected for laboratory analysis would be analyzed in accordance with Section 6.1.4 and Table 3 of this work plan.

6.6 Data Collection for Alternative Cleanup Levels

Site-specific alternative cleanup levels could be developed for the property using Method Three or Method Four. Chemical and physical parameters required for the Four Phase Calculator (development and release pending following the phasing out of the "Hydrocarbon Risk Calculator) will be collected to determine if alternative cleanup levels may be beneficial for use at this site.

Soils samples will be collected that characterize contamination from the areas of previously identified contaminant releases such as the New and Old Tank Farms. These samples will be analyzed for Extractable Petroleum Hydrocarbons (EPH) and Volatile Petroleum Hydrocarbons (VPH). Samples collected for laboratory analysis for EPH and VPH will be collected from at least four soil borings on the property with two samples collected in each boring (eight samples total). Samples will be collected within each boring at those same locations described within Section 6.1.

Samples that characterize general soil properties will also be collected, including Total Organic Carbon (TOC). TPECI will conduct this sampling in accordance with the March 6, 2017 ADEC Technical Memorandum *Determining the Fraction of Organic Carbon (foc) for Method Three and Four* where applicable. These samples will be collected from soils located within the same hydrologic unit and with the same soil type but appears to be uncontaminated based on field screening observations. All soil samples analyzed for TOC will also be analyzed for DRO and RRO to ensure that petroleum contamination does not result in a TOC bias. These samples will typically be collected in areas upgradient or on the edge of the identified contaminant plumes. Samples collected for laboratory analysis for TOC will be collected from four soil borings on the property with two samples collected in each boring (eight samples total). Samples will be collected within each boring at those same locations described within Section 6.1.

Soil samples will also be collected to characterize soil physical properties including dry bulk density, specific gravity, moisture content, and particle size distribution. Four samples will be collected to ensure that all soil types present on the property are accurately represented. These soil samples will be collected in locations where soil field screening (PID readings or PetroFlag® results) are not elevated above background levels.

No aquifer slug testing or other direct hydrologic testing is planned. Aquifer hydraulic conductivity data will be estimated based on literary review, soil particle size distribution and soil classification. Additional, necessary information on groundwater and aquifer characteristics will be determined during the installation of groundwater monitoring wells.

During site characterization work TPECI will collect the following additional information:

- Soil temperature;
- Depth to groundwater; and
- Sample location (including GPS coordinates).

TPECI will determine through research, calculate through field-collected data, or estimate based on professional judgement and experience at similar sites:

- Source length parallel to groundwater flow;
- Aquifer thickness;
- Infiltration rate;
- Soil particle density; and
- Hydraulic gradient.

The following sections describe field preparation, and sampling protocols.

7.0 FIELD AND SAMPLING PROTOCOLS

7.1 Standard Operating Procedures

The standard operating procedures (SOP) for this project fall into two categories, field SOP and laboratory SOP. Throughout the sampling effort, laboratory hold-times and sample temperatures shall be maintained. The laboratory SGS Quality Assurance Project Plan is filed at the laboratory and at TPECI. Thus, the SOP contained herein refers to generic field sampling and sample preparation.

7.1.1 Field Sampling SOPs

Field personnel shall keep detailed notes that include:

- Project name/Site ID/Client/Page Number;
- Date;
- Weather, site conditions, and other salient observations;
- Full name of on-site personnel, affiliations and project title e.g., team leader (including all visitors);
- Daily objectives;
- Time and location of activities;
- Field observations and comments;
- Deviations from the ADEC Contaminated Sites Program site-specific approved work plan;
- Photographic log (photographic name, roll or frame number, description of photograph, date, and time);
- Site sketches with reference to north direction, sample and field screening locations and depths, and on-site groundwater flow direction;
- Survey and location (latitude and longitude coordinates when possible);

- All field measurements (e.g. leak check results, geochemical parameters, field screening results);
- Daily equipment calibrations and maintenance;
- Sample record (sample identification, date, time, media, number of samples, and location);
- Cleanup or remediation activities (system performance, system calibration or maintenance record, excavation activities and volume of material removed); and
- Waste tracking (when, how much, destination).

Site drawings shall be included within the field notes as part of the field investigations. Site drawings should include a north arrow, and, if applicable, at least one permanent identifying feature (such as a building). All samples collected (screening and analytical) should be noted on the figure. Alternatively, sample locations may be indicated on a field copy of Figure 6 (Appendix A) where applicable.

All laboratory sampling locations shall be documented on Figure 6 (Appendix A) or within separate plan view site drawings within the field notes. If applicable, the sampling location cross-sectional view may be drawn. Any unusual characteristics of the sampling location and any problems encountered during sample collection shall also be recorded for each sample location. GPS coordinates of each sample location shall be documented within the field notes.

Field notes will be collected in an all-weather notebook. The notebook utilized will not be dedicated solely to this project, but only information relevant to the project will be included on pages assigned. Combined project field notebooks reduce project costs and minimize waste generation.

Filed notes will be written in pen, pencil, or water-resistant marker. When field conditions result in illegible content due to dirt, precipitation, or poor penmanship, field notes will be recopied immediately after field activities.

7.1.2 Field Sample Preparation SOP

All samples will be prepared in accordance with laboratory instructions. At a minimum, the following information will be included on the sample label:

- Client name;
- Date and time of sample collection;
- Sampler;
- Sample location;
- Preservative, and
- Analytical test(s) to be run.

In addition, the above information will be recorded in the field notes. Chain of custody records will be maintained for each sample. Samples will be kept between zero (0) and six (6) degrees centigrade (°C). The field technician will place custody seals on all coolers to determine if the samples may have been tampered while being transported to the laboratory. The laboratory will notify TPECI in such an event so that a decision can be made on whether or not re-sampling is necessary.

7.1.3 Field Decontamination Procedures

Decontamination procedures for equipment and personnel are described in the following sections.

7.1.3.1 Equipment

After working in an area of contamination (as determined by field screening) and before moving equipment to another area, equipment and tools shall be decontaminated to remove soil that may contain contamination. Buckets, blades, augers of equipment shall be sprayed with a solution of Alconox or Citrisol and wiped down with paper towels or rags until all soil is removed. Cleaning solution shall be applied such that it does not drip or run off of the equipment, but is absorbed by paper towels or rags used to wipe the equipment. All decontamination shall be conducted immediately adjacent to the known area of contamination. Additionally, decontamination of small hand tools including the washing of sampling spoons/trowels in Alconox or CitriSol shall be conducted in this location. All decontamination waste from the site shall be placed in a drum, contractor trash bag, or other appropriate container for proper disposal as described in Section 9.0.

7.1.3.2 Personnel

In the presence of petroleum contaminated soils or groundwater, all personal may elect to don disposable coveralls, booties, and gloves. Disposable nitrile gloves shall be worn by the Qualified Environmental Professional during the collection and handling of all soil and water samples for field screening and laboratory analysis. All worn disposable PPE must be collected at the end of the day and disposed in accordance with Section 9.0 Investigation Derived Waste.

7.2 Field and Laboratory Calibration Methods

All field and laboratory procedures requiring instrument calibration will be conducted according to the applicable EPA methods, the ADEC methods, and standard operating procedures. TPECI shall calibrate the PetroFlag® test kit daily or when significant changes to ambient air temperature occur. The manufacturer certified dealer calibrates the PID annually. The PID will also be calibrated with fresh air and a 100 ppm isobutylene calibration standard daily before it is potentially used. The EPA checks the calibrations traceable quality control standards for the laboratory.

7.3 Routine and Periodic Quality Control Activities

SGS Laboratory, an ADEC-approved laboratory, will be used for all project analyses. This section describes the methods used for determining the quality of laboratory results.

7.3.1 Field Quality Control Samples

Field personnel will take two types of field quality control samples. These are sample duplicates and trip blanks. The objective and frequency of these samples are discussed below.

Due to the remote location, and logistical challenges associated with this location, TPECI will not collect field blanks or equipment blanks. TPECI will rely on field duplicates and trip blanks for quality control and determination of artificially introduced contamination.

7.3.1.1 Field Duplicates

Field duplicates are samples collected simultaneously from the same sampling locations. Field personnel will use identical sampling methods to retrieve one duplicate for every 10 samples for each sample matrix and analyte, per day. Field duplicate samples will be collected from screening locations exhibiting the highest PID heated headspace screening results. Field personnel will split one sample for duplicate analysis from the excavation or stockpile and will follow the same QA/QC methods for collecting, packaging, recording, and shipping the duplicate samples as all other samples.

7.3.1.2 Trip Blank

Trip blanks are samples prepared from sterile media at the laboratory and shipped with the sample containers. Trip blanks remain with the samples after collection and are analyzed for volatile compounds. This analysis determines if any cross-contamination occurred during shipping. Field personnel will never open the trip blank containers during the entire sampling process. Field personnel will use one trip blank per cooler. If the laboratory finds any contamination within the trip blank, the results will be used to evaluate any possible impacts to associated samples.

7.3.1.3 Field Blank

TPECI will not collect field blanks for this project.

7.3.1.4 Equipment Blank

TPECI will not collect equipment blanks for this project. TPECI will conduct thorough field decontamination procedures as described in Section 7.1.3.

7.3.2 Laboratory Quality Control Samples

The project laboratory will use matrix-spiked samples, spiked duplicates, surrogates, method blanks, duplicates, and laboratory control samples to measure data quality. Matrix spiked samples and laboratory control samples assess sample matrix interference and analytical errors and accuracy. Surrogates evaluate accuracy of an analytical measurement. Method blanks check for laboratory contamination and instrument bias. Duplicates measure the precision of the analysis.

The laboratory will use one method blank per sample period and use one laboratory control sample. The laboratory will use a surrogate spike for every sample, standard, and blank. The laboratory will use one matrix spike per sample period.

7.4 Data Reduction, Validation and Reporting

Data reduction is conducted by the analyst. All calculations are made as specified by the particular analytical method. Units are reported as mg/Kg, µg/Kg, or as otherwise called for in the method. Analytical data reports will include:

- Client name;
- Date and time of sample collection;
- Sample location;
- Date and time samples received at the laboratory;
- Date analysis completed;
- Laboratory sample ID number;
- A list of parameters analyzed;
- The analytical method number for each parameter; and
- Concentration of each parameter.

The laboratory will forward a copy of the completed analytical results to TPECI. Upon receipt of the analytical laboratory report, TPECI will review the data and complete the ADEC Laboratory Data Review Checklist. The Data Quality Objective for the acceptance criteria for laboratory data shall be based on the EPA standard of precision, accuracy, representativeness, completeness, and comparability (PARCC). The primary inputs for a PARCC determination can be made using the project-specific Data Quality Indicators (DQIs) which are in Appendix E as well as using the ADEC Laboratory Data Review Checklist. Through this validation a standard of 85% usable data has been established as the DQO criteria for this project.

8.0 SITE SPECIFIC SAFETY

The elements of personnel safety for this project are outlined in the following sections. Wards Cove maintains a company health and safety plan. An Activity Hazard Analysis shall be completed prior to the start of all site activities to ensure property safety precautions are in place for each task. TPECI personnel and all third-party contractors shall abide by all Wards Cove safety guidelines while operating on the site. The third-party contractor may implement additional safety guidelines while operating on the site.

8.1 Hazard Assessment

Project hazards include typical construction hazards (noise, heavy equipment, excavations, slips trips and falls, etc.) and potential exposure to petroleum products.

As soil borings are advanced to groundwater depth; the complete pathways associated with groundwater may be considered a risk. The project will generally consist of work outside which is well ventilated and windy; the complete pathways associated with inhalation of outdoor and indoor air are not considered a risk at this time. If any indoor work does occur, appropriate ventilation or respiratory protection through the use of personal protective equipment should be considered.

8.2 Site Control

Workers and the public shall be protected from construction and chemical hazards associated with excavation within a potentially contaminated area through marking, fencing, and placing barriers between public areas, work areas, and soil borings.

8.3 Monitoring

No air quality monitoring is proposed.

8.4 Personal Protective Equipment

All workers who have contact with the soil and groundwater in potentially contaminated areas may elect to wear disposable coveralls, booties, and gloves (in addition to typical worksite PPE including safety-toe shoes, safety glasses, high visibility clothing, hardhat, and hearing protection). Workers may wear respiratory protection in accordance with Occupational Safety and Health Administration requirements and comply with the contractor's respiratory protection program.

9.0 INVESTIGATION DERIVED WASTE

Decontamination waste, disposable PPE, disposable sampling equipment, and all other investigative derived solid or liquid waste shall be placed in labeled drums, 5-gallon buckets, contractor trash bags, or other appropriate containers. After project completion, TPECI will provide Wards Cove with the labeled drums, buckets, contractor trash bags, or other appropriate containers containing the investigative derived waste. Solid wastes shall be disposed in a permitted landfill. Ultimate disposal of the investigative derived waste is the responsibility of Wards Cove.

Soil cuttings will be returned to the soil borings where possible. For permanent groundwater wells, some soil cuttings may be generated and will require stockpiling or disposal in existing landfarms (if space is available). Any new stockpile generated would utilize a 20-mil polyethylene liner with a 20-mil polyethylene cover. The location and size of any generated stockpile will be documented and described within the final report. The fate and disposal of stockpiled contaminated soils will be addressed within that report.

Any liquid (potential) hazardous wastes discovered during the tank inventory including fuels, used oil, or other chemicals will be properly containerized, manifested, and transported off site for disposal in accordance with State and Federal regulations. Solid hazardous wastes, including any PCB-containing materials will be properly containerized, manifested, and transported off site for disposal in accordance with State and Federal regulations.
Hazardous wastes, fuels, used oil, and other hazardous materials are not considered contaminated media and as such, no ADEC *Transport, Treatment, & Disposal Approval Form for Contaminated Media* is required prior to handing, transport, or disposal of these materials.

An estimated maximum of 500-gallons of development and purge water will be collected as part of the sampling process. This water will be collected in clean 55-gallon drums. Efforts will be made to containerize this water based on likelihood of hydrocarbon contaminants (i.e. visibly contaminated water will be segregated from non-visibly contaminated water). Containerized water will be transported off site for treatment and disposal in accordance with State and Federal regulations. An ADEC *Transport, Treatment, & Disposal Approval Form for Contaminated Media* will be completed with an estimated volume prior to site work being conducted. A revised form with the final volume of contaminated water will be included in the report.

10.0 PROJECT SCHEDULE

Proposed cleanup actions are planned for summer 2019. Actual start date is dependent on weather and site access. However, all site work is dependent on approval and funding by Wards Cove's insurers and their representatives.

Development of a written report on site activities shall occur following the receipt of laboratory data. Currently, laboratory turn-around times range from approximately two to six weeks. The development of a complete report is estimated to be completed within two weeks following receipt of laboratory data. Additionally, Wards Cove's insurers and their representatives will require review of the report prior to submittal to the ADEC.

TPECI will notify the ADEC project manager by phone and email at least 10 calendar days prior to beginning site work.

11.0 DELIVERABLES

TPECI will document daily operations within the project field notes. The daily summary will include notes regarding weather, site activities, QC activities, safety issues, include a general summary of work completed, observed the extents of contamination, identification of additional contamination or alternate contaminant sources (if any), and any other information pertinent to daily activities. All field notes and daily summaries will be provided to the ADEC project manager with the final written report at the completion of the project.

The data deliverables for the project shall include at the completion of the project a written report summarizing field activities, results, and conclusions. The report shall specifically address the following information:

- Site investigation overview;
- Laboratory results summary for soil boring soil samples and groundwater samples;
- Laboratory results;
- Data Validation and Completion of ADEC Laboratory Data Review Checklist;
- Field observations;
- Property Fuel Tank Inventory;
- A Revised Conceptual Site Model;
- Investigation findings; and
- Recommendations for site closure.

12.0 CONCLUSIONS

A written report summarizing field activities and characterizing the site will be submitted upon receiving laboratory results. The report will propose remediation efforts or site closure measures and address the final disposal of any contaminated media. Because of the site remoteness and frequent inclement weather, every effort will be made to fully characterize the site to eliminate the need for additional site work.

13.0 LITERATURE CITED

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DEC, 2014. *Transport, Treatment, & Disposal Approval Form for Contaminated Media.* State of Alaska, Department of Environmental Conservation, Juneau, Alaska. Available at dec.alaska.gov/spar/csp/guidance_forms

DEC, 2013. *Monitoring Well Guidance.* State of Alaska, Department of Environmental Conservation, Juneau, Alaska.

DEC, 2017. *Determining the Fraction of Organic Carbon (foc) for Methods Three and Four*. State of Alaska, Department of Environmental Conservation, Juneau, Alaska.

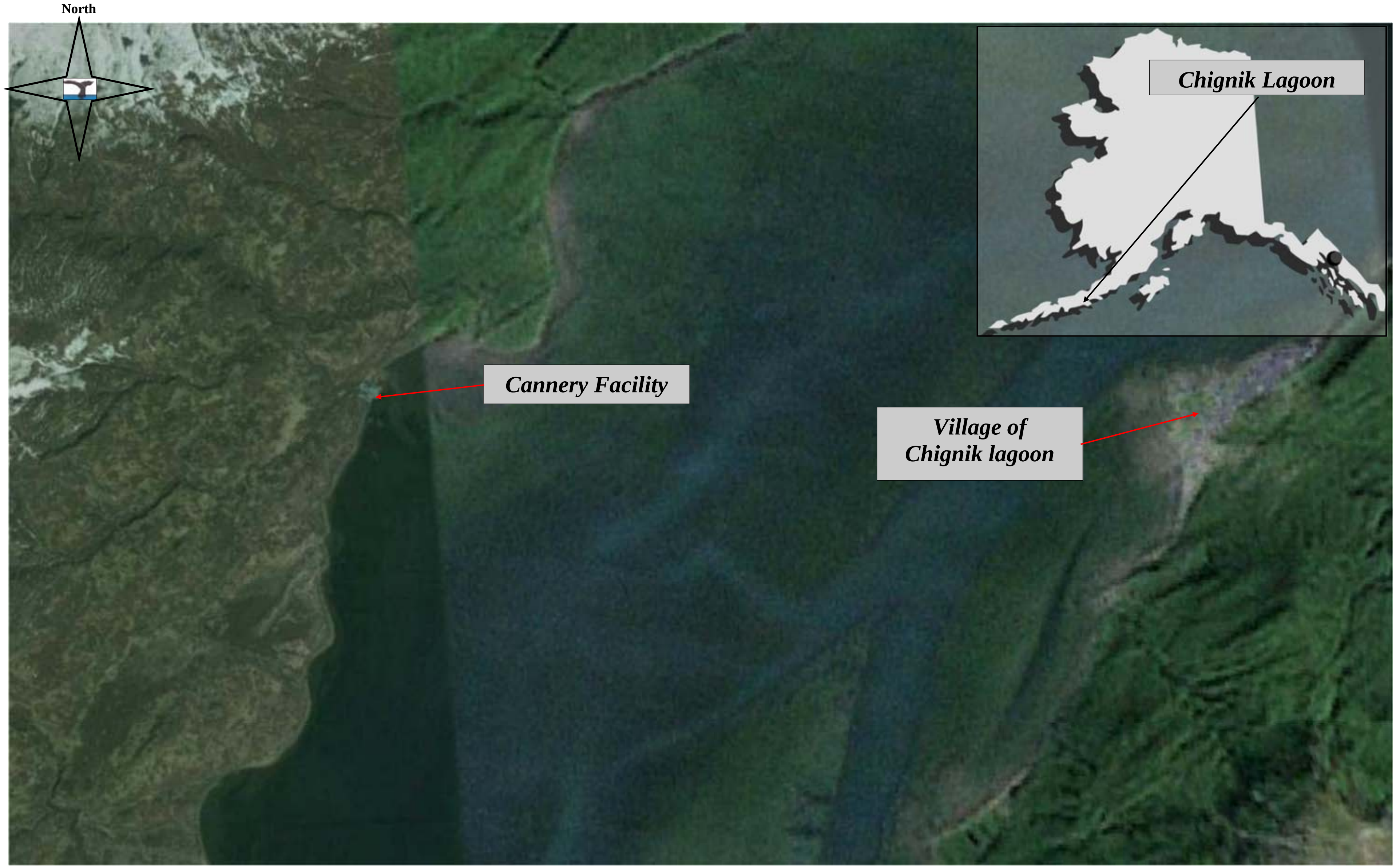
DEC, 2017. *Field Sampling Guidance.* State of Alaska, Department of Environmental Conservation, Juneau, Alaska.

DEC, 2017. *Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites.* State of Alaska, Department of Environmental Conservation, Juneau, Alaska.

Hart Crowser, Inc., 2007. *Limited Phase I Environmental Site Assessment. Columbia Ward Fisheries Facility, Dumpsite, and "License to Enter" Properties, Chignik Lagoon, Alaska.* State of Alaska, Department of Environmental Conservation, Juneau, Alaska.

18 AAC 75 *Oil and Other Hazardous Substances Pollution Control, Revised as of October, 2018.* State of Alaska, Department of Environmental Conservation, Juneau, Alaska.

APPENDIX A:
Figures



Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Chignik Lagoon Cannery Site Characterization Work Plan** **Chignik Lagoon, Alaska**	**General Location Map** **Figure #1**

Project No: 1028-17	**File: Shared\Projects1028-17\Figures**	**Date: 1/30/19**	**Scale: None**

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CHIGNIK (B-2) QUADRANGLE
ALASKA
1:63 360 SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1952, field annotated 1963. Map not field checked
Selected hydrographic data compiled from USC&GS Chart 8710 (1952). This information is not intended for navigational purposes
Universal Transverse Mercator projection. 1927 North American datum 10,000 foot grid based on Alaska coordinate system, zone 6 1000 meter Universal Transverse Mercator grid ticks, zone 4, shown in blue
Gray land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management Folio S.26, Seward Meridian
Lake elevations are unchecked

APPROXIMATE MEAN DECLINATION, 1963

SCALE 1:63 360

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

DEPTH CURVES AND SOUNDINGS IN FEET DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 7 FEET

FOR SALE BY U. S. GEOLOGICAL SURVEY
FAIRBANKS, ALASKA 99701, DENVER, COLORADO 80225, OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Unimproved dirt

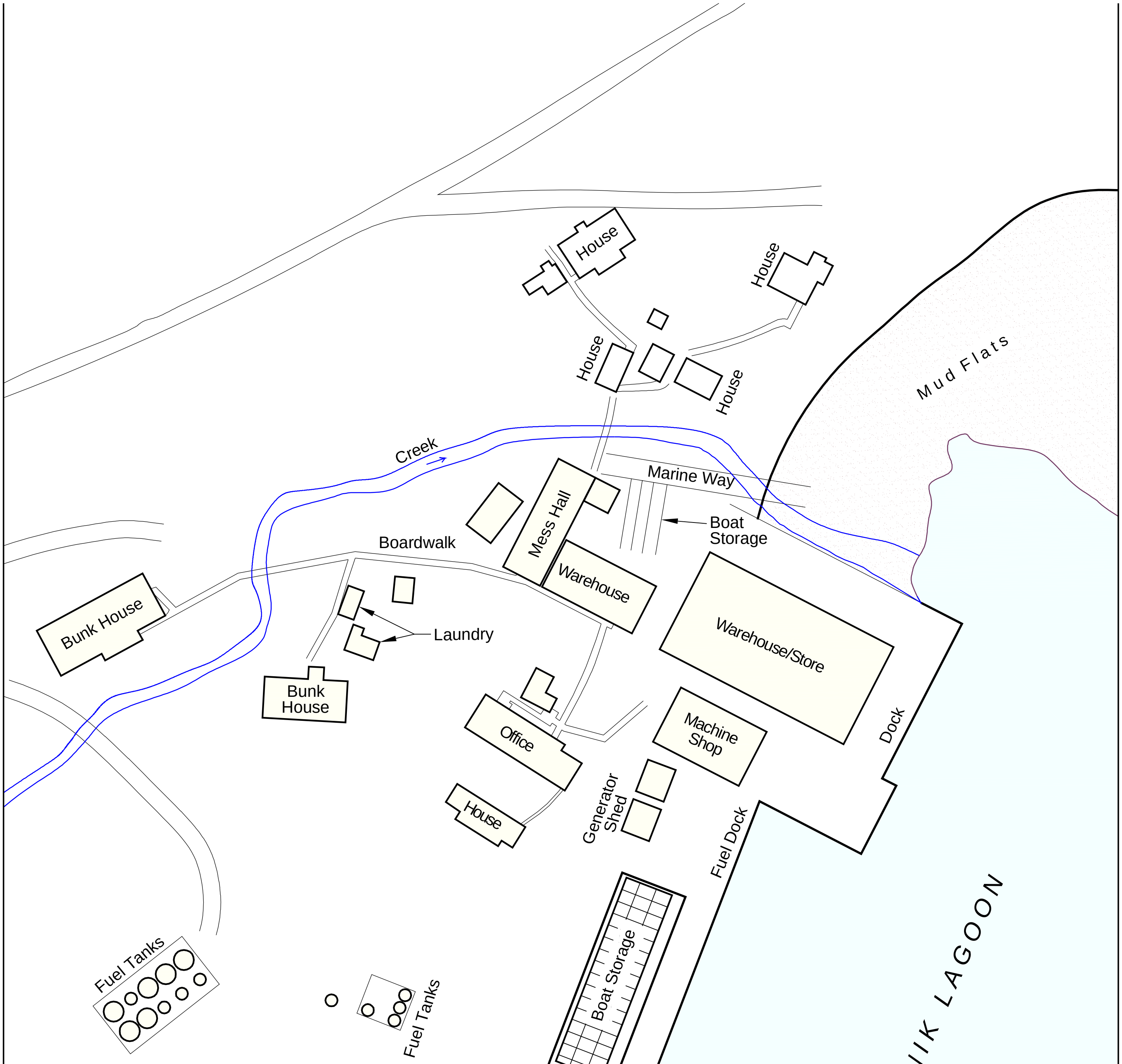
CHIGNIK (B-2), ALASKA
N5615—W15820/15X20
1963

TPECI Figure 1A.
1/30/2019

Base Image: DigitalGlobe May, 2004

Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Chignik Lagoon Cannery Site Characterization Work Plan** **Chignik Lagoon, Alaska**	**Site Map** **Figure #2**

Project No: 1028-17	**File: Jupiter\backup\Erik\1028-17\Figures**	**Date: 1/30/2019**	**Scale: As Shown**



The Fuel Tanks depicted show the New Tank Farm and Old Tank Farm at the site. Both tank farms were demolished in 2016 and no longer exist as shown.
Other site infrastructure may no longer exist as depicted due to damage, decay, or weathering as the property is not maintained.
-TPECI Note 1/30/2019

JAB 6/4/07

H:\8969-04 Chignik Lagoon\Figures\896904 02 (CWF Facility - 2007).dwg

Source: Aerial Photograph.

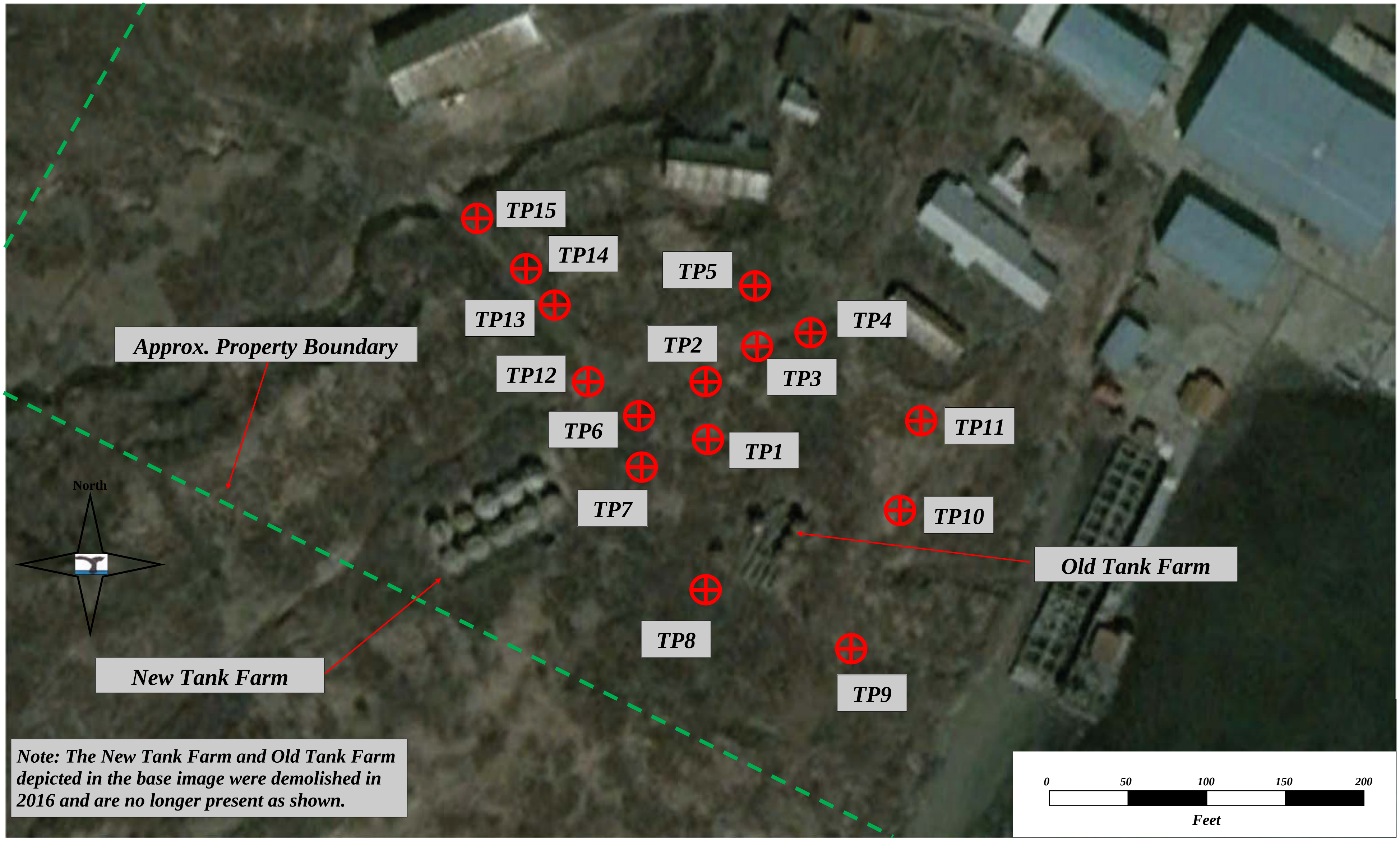
Chignik Lagoon
Alaska

CWF Facility Configuration - Current

8969-04 6/07

HARTCROWSER

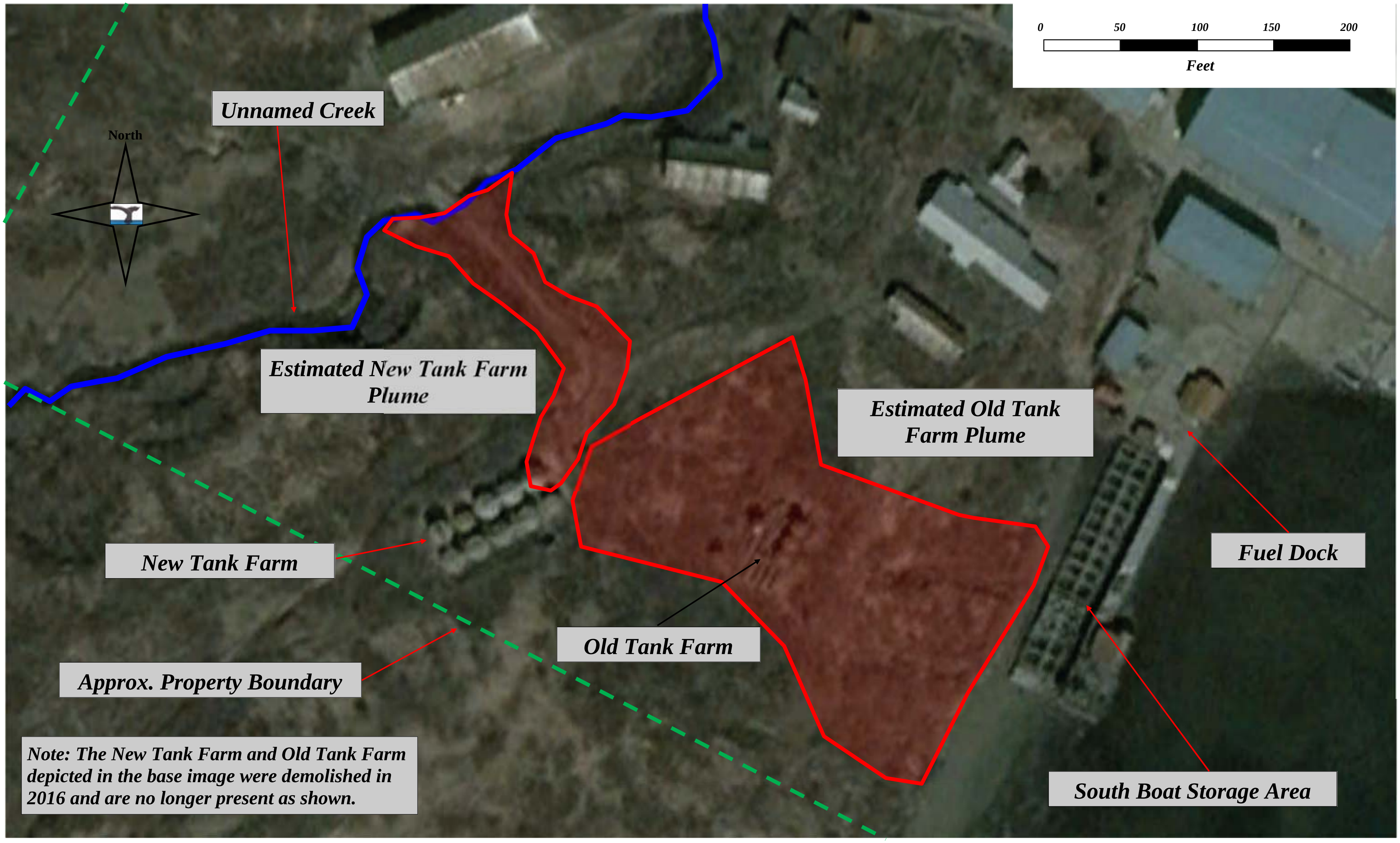
TPECI
Figure 3



Base Image: DigitalGlobe May, 2004

Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Chignik Lagoon Cannery Site Characterization Work Plan** **Chignik Lagoon, Alaska**	**Test Pits** **Figure #4**

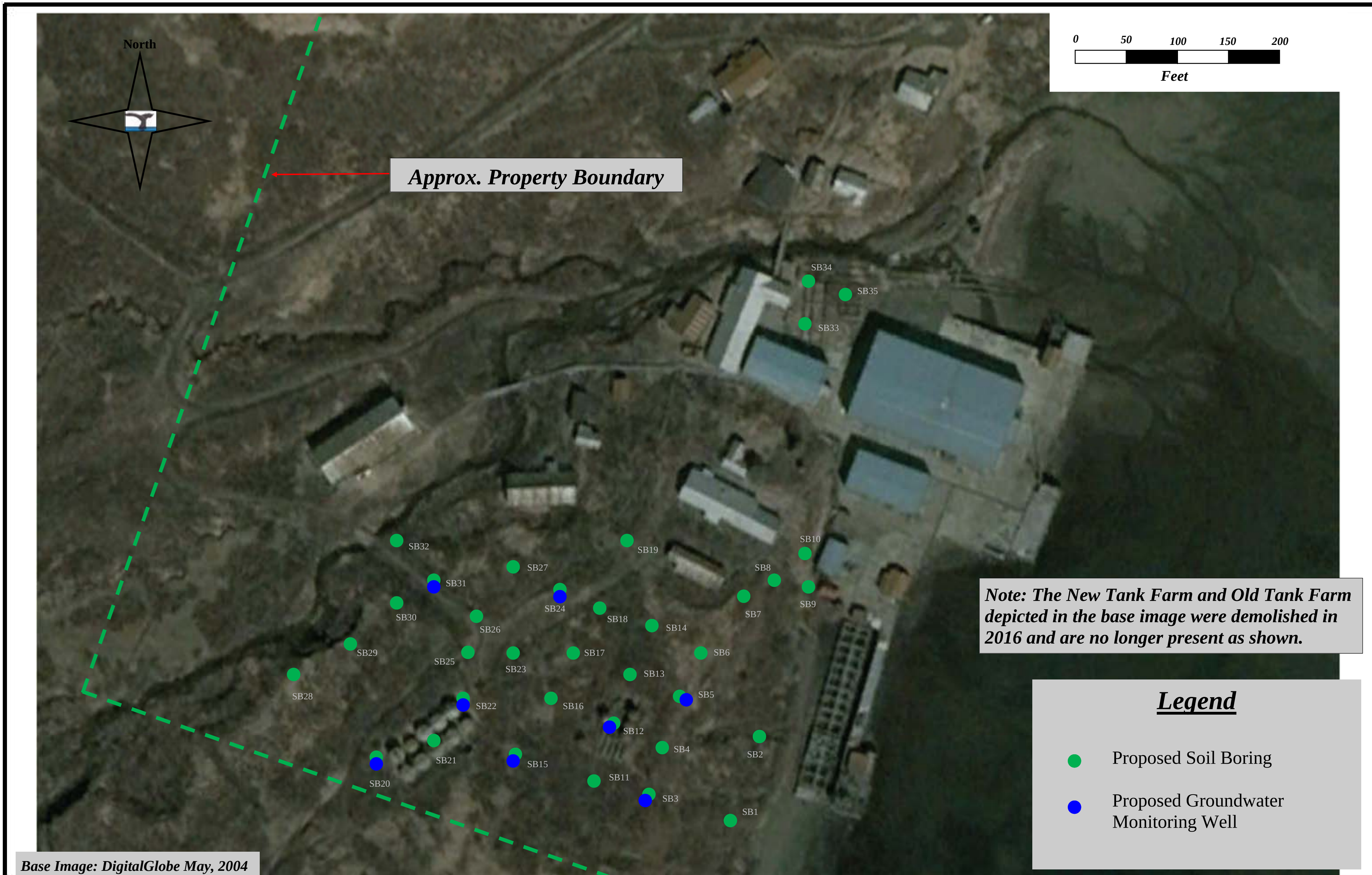
Project No: 1028-17	**File: Shared\Projects\1028-17\Figures**	**Date: 1/30/2019**	**Scale: As Shown**



Base Image: DigitalGlobe May, 2004

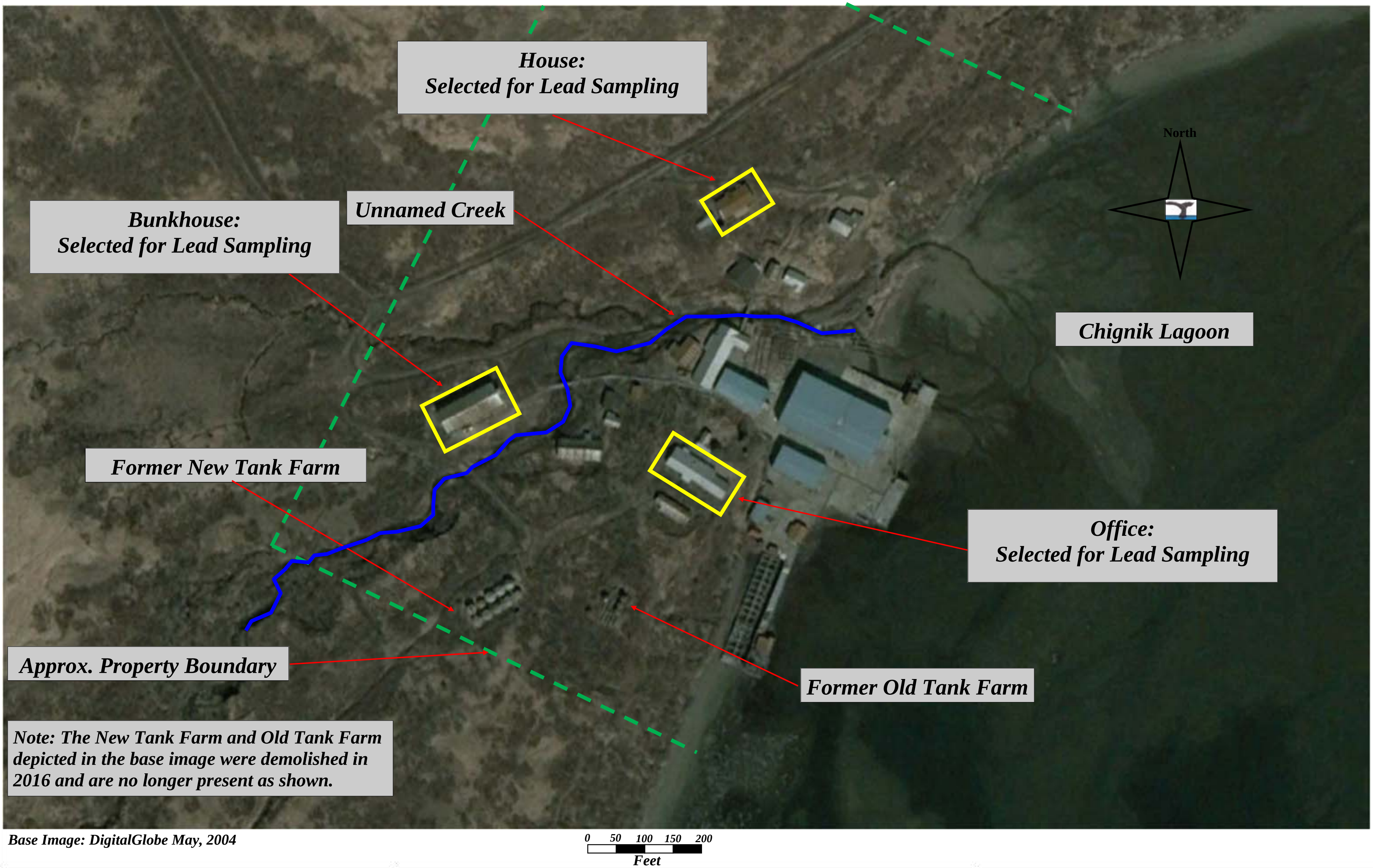
Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Chignik Lagoon Cannery Site Characterization Work Plan** **Chignik Lagoon, Alaska**	**Estimate Tank Farm Contaminant Plumes** **Figure #5**

Project No: 1028-17	**File: Shared\Projects\1028-17\Figures**	**Date: 1/30/2019**	**Scale: As Shown**



Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Chignik Lagoon Cannery Site Characterization Work Plan** **Chignik Lagoon, Alaska**	**Site Map: Soil Boring and Groundwater Monitoring Well Locations** **Figure #6**

Project No: 1028-17	**File: Shared\Projects\1028-17\Figures**	**Date: 1/30/2019**	**Scale: As Shown**



Base Image: DigitalGlobe May, 2004

Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, AK 99503 907-522-4337	**Chignik Lagoon Cannery Site Characterization Work Plan** **Chignik Lagoon, Alaska**	**Buildings Selected for Lead Sampling Map** **Figure #7**

Project No: 1028-17	**File: Shared\Projects\1028-17\Figures**	**Date: 1/30/2019**	**Scale: As Shown**

APPENDIX B:
Conceptual Site Model

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Former Chignik Lagoon Cannery
ADEC File No. 2532.38.004

Completed By: Erik D. Mundahl, P.E.
Date Completed: 6/14/2018

***Instructions**: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.*

(1) *Check the media that could be directly affected by the release.*

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.*

(3) *Check all exposure media identified in (2).*

(4) *Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5) *Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.*

Media / Transport Mechanisms

[x] Surface Soil (0-2 ft bgs)
- Direct release to surface soil — check soil
- [x] *Migration to subsurface* — check soil
- [x] *Migration to groundwater* — check groundwater
- [ ] *Volatilization* — check air
- [x] *Runoff or erosion* — check surface water
- [ ] *Uptake by plants or animals* — check biota
- [ ] *Other (list):*

[x] Subsurface Soil (2-15 ft bgs)
- Direct release to subsurface soil — check soil
- [x] *Migration to groundwater* — check groundwater
- [ ] *Volatilization* — check air
- [ ] *Uptake by plants or animals* — check biota
- [ ] *Other (list):*

[x] Ground-water
- Direct release to groundwater — check groundwater
- [ ] *Volatilization* — check air
- [x] *Flow to surface water body* — check surface water
- [ ] *Flow to sediment* — check sediment
- [ ] *Uptake by plants or animals* — check biota
- [ ] *Other (list):*

[ ] Surface Water
- Direct release to surface water — check surface water
- [ ] *Volatilization* — check air
- [ ] *Sedimentation* — check sediment
- [ ] *Uptake by plants or animals* — check biota
- [ ] *Other (list):*

[ ] Sediment
- Direct release to sediment — check sediment
- [ ] *Resuspension, runoff, or erosion* — check surface water
- [ ] *Uptake by plants or animals* — check biota
- [ ] *Other (list):*

Exposure Media / Exposure Pathway/Route / Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
[x] soil	[x] Incidental Soil Ingestion	F	F	C/F	C/F	C/F		
	[ ] Dermal Absorption of Contaminants from Soil							
	[ ] Inhalation of Fugitive Dust							
[x] groundwater	[x] Ingestion of Groundwater	F	F	C/F	C/F	C/F		
	[ ] Dermal Absorption of Contaminants in Groundwater							
	[ ] Inhalation of Volatile Compounds in Tap Water							
[ ] air	[ ] Inhalation of Outdoor Air							
	[ ] Inhalation of Indoor Air							
	[ ] Inhalation of Fugitive Dust							
[x] surface water	[ ] Ingestion of Surface Water	F	F	C/F	C/F	C/F		
	[ ] Dermal Absorption of Contaminants in Surface Water							
	[ ] Inhalation of Volatile Compounds in Tap Water							
[ ] sediment	[ ] Direct Contact with Sediment							
[ ] biota	[ ] Ingestion of Wild or Farmed Foods							

Print Form

Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

Site Name: Former Chignik Lagoon Cannery

File Number: 2532.38.004

Completed by: Erik D. Mundahl, P.E.

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☒ ASTs
- ☒ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☐ Other:

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☐ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☐ Sediment
- ☒ Groundwater
- ☒ Surface water
- ☐ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☒ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the ground-water is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☒

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☐

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☐

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Incomplete

Comments:

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- o Climate permits recreational use of waters for swimming.
- o Climate permits exposure to groundwater during activities, such as construction.
- o Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- o The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- o The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

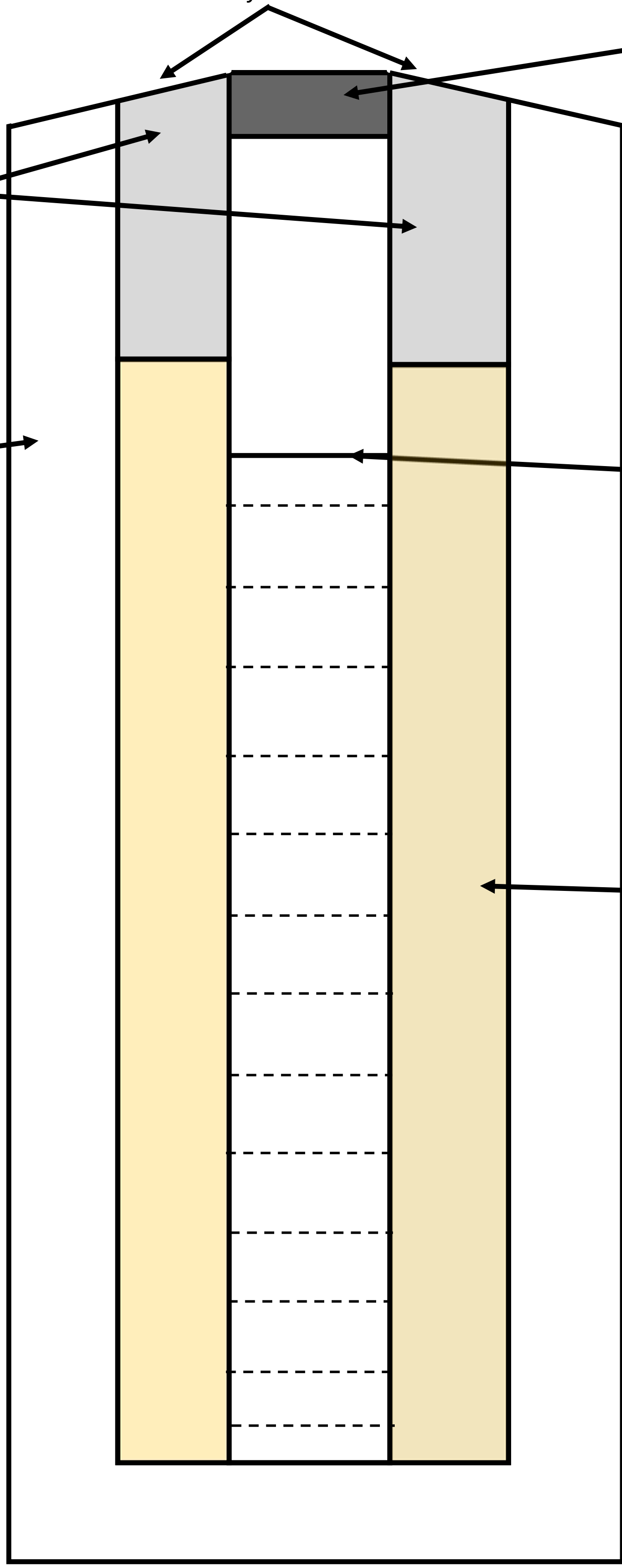
Comments:

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

No active sources believed to be present on the site. No additionally, leaks, spills, or releases are possible. Contaminated soils remain in the ground. Contamination may be readily mobile in the groundwater and migrate to surface waters.

APPENDIX C:
Groundwater Monitoring Well Diagram

Monitoring Well Diagram for Proposed Wells



* All well measurements are from the top of the PVC casing. Monitoring Well is constructed of: PVC 2 3/8” O.D., 2.0” I.D., ASTM threads, Schedule 40, screen slot size 0.020”, silica sand well pack.

Travis/Peterson Environmental Consulting, Inc. 3305 Arctic Boulevard, Suite 102 Anchorage, Alaska 99503	**Chignik Lagoon Cannery Work Plan** **Chignik Lagoon, Alaska**		**Monitoring Well Diagram**
Project No: 1028-17	File: Jupiter\backup\Erik\1028-17	Date: 1/30/19	No Scale

APPENDIX D:
TPECI Personnel Resumes

Michael D. Travis, P. E.

Environmental Engineer

Mike has over 37 years of experience in Environmental projects in Alaska. He manages National Environmental Policy Act (NEPA) documents throughout Alaska. His vast experience with State agencies, Federal laws and statutes, and working with local communities enables him to effectively manage a wide variety of projects He is a registered civil engineer in Alaska. Relevant projects include Spenard Road Contaminated Sites Study – Municipality of Anchorage and the Spenard Road, Hillcrest to Minnesota Drive Categorical Exclusion – DOT&PF.

Work Experience

Principal, Travis/Peterson Environmental Consulting, Inc.

Responsibilities: Co-Owner and Principal of an environmental engineering consulting firm. Provided a wide range of environmental and engineering services for private and governmental agencies. Performed environmental impact analysis for new and expanded utilities, highways, airports, mines, and power plants. Impact analysis involved air and noise modeling, storm water planning, public involvement, and social-economic analysis.

Chief of Professional Services, Alaska Department of Transportation and Public Facilities (DOT&PF)

Responsibilities: Supervised the contracting and negotiating of engineering and construction projects within the Central Region of the Department. Assisted in the final design of the Whittier Tunnel Access project. Provided environmental expertise for DOT&PF defense of a lawsuit within the Ninth Circuit Court of Appeals.

Vice President, AGRA Earth and Environmental, Inc.

Responsibilities: Managed geotechnical and environmental engineering offices in Fairbanks and Anchorage, Alaska. Reviewed final work products before submitting them to clients. Designed hazardous waste remediation systems. Developed corrective action plans for spill sites. Designed water treatment systems for remote canneries. Performed Environmental Assessments to fulfill requirements of the NEPA for construction projects throughout Alaska. Environmental Manager for the Whittier Tunnel EIS. Supervised 30 employees.

Education

University of Alaska Fairbanks

B.S. Biology

M.S. Environmental Quality Science

Certifications

Hazardous Waste Operations and Emergency Response Certification, Supervisors Course

Registered Civil Engineer in Alaska. Registration number CE 8048

Affiliations

International Right Of Way Association

Erik D. Mundahl, P.E.
Environmental Engineer
Travis/Peterson Environmental Consulting, Inc.
3305 Arctic Boulevard, Suite 102
Anchorage, Alaska 99503

Telephone (907) 522-4337
Fax (907) 522-4313
EMundahl@tpeci.com

EDUCATION

B.S. Environmental Engineering
Michigan Technological University
Houghton, Michigan

REPRESENTATIVE EXPERIENCE

Environmental Engineer

Travis/Peterson Environmental Consulting, Inc., (Alaska), 5/2009 - Present

Senior Environmental Engineer for an environmental consulting and engineering firm. General duties include writing complex environmental documents, design and construction oversight of water and wastewater treatment systems, conducting baseline environmental research, site characterization and remediation, biological assessments and species data collection, writing scientific reports, managing projects, and interfacing with regulatory agencies and clients. Other duties include performing environmental records reviews, site assessments, biological analysis, soil sampling, wetlands delineations, and site reconnaissance. These duties require field work in remote areas throughout Alaska while working in inclement weather.

As an Environmental Engineer, he has 9 years of experience in Alaska. Assignments have required close familiarity with designing and implementing remediation plans, hazardous waste management, and performing Environmental Site Assessments and Facility Compliance Audits. Additional assignments have included wetland delineation and restoration work. Mr. Mundahl has designed, permitted, and provided construction supervision for watershed restoration programs including water quality monitoring and analysis. Mr. Mundahl also has a significant background in aquatic biology including fish collection and identification, stream/river habitat assessments, GPS based wildlife monitoring, and aquatic invertebrate collection, sorting, and identification.

Environmental Engineer Intern

Restoration Science and Engineering, (Alaska), 5/2008 – 8/2008

Worked as an engineering intern throughout Alaska including remote project sites. Conducted contaminated site remediation and routine groundwater contaminate modeling. Work also included Phase I and II Environmental Site Assessments and watershed hydraulic analysis for river and stream systems throughout southcentral Alaska.

Environmental Engineer Intern

Oasis Environmental, (Montana), 5/2007 – 8/2007

Worked as an engineering intern in Montana specializing in stream habitat restoration, wetland mitigation, and aquatic biological surveys. Performed wetland mitigation workout throughout

Montana with work ranging from design to construction. Work also included stream hydraulic analysis and restoration design returning agriculturally affected stream channels to natural habitats. Conducted fish and invertebrates population surveys including in-depth studies on the endangered West Slope Cutthroat Trout.

CERTIFICATIONS

State of Alaska	Registered Professional Engineer EV14420
AGC of Alaska	Certified Erosion & Sediment Control Lead #AGC-16-0040
NANA Training Systems	HAZWOPER 40-hr. Course, 2009
Environmental Management, Inc.	HAZWOPER 8-hr. Refresher, 5/10, 5/11, 5/12, 5/13, 4/14, 3/15, 2/16, 2/17
Satori Group, Inc.	HAZWOPER 8-hr. Refresher, 2/18
State of Alaska	Certified Sanitary Survey Inspector
Richard Chinn Training	U.S. Army Corps of Engineers Wetland Delineation Training
American Red Cross	CPR & First Aid Certified
Wilderness Medicine Institute	Wilderness First Responder
North Slope Training Cooperative	NSTC

Ryan Kingsbery - Staff Scientist

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3305 Arctic Boulevard, Suite 102
Anchorage, Alaska 99503
Telephone: (907) 522-4337
Fax: (907) 522-4313
rkingsbery@tpeci.com

EDUCATION

Alaska Pacific University	MSc: Environmental Science
Principia College	BA: Environmental Studies

REPRESENTATIVE EXPERIENCE

Staff Environmental Scientist
Travis/Peterson Environmental Consulting, Inc.

Staff Environmental Scientist for an environmental consulting and engineering firm. General duties include project management, site inspections, field operations, report writing, baseline environmental research, site characterization, site remediation, biological assessments, species data collection, and regulatory agency coordination. Other duties include performing environmental records reviews, Phase 1 site assessments, wetland delineation, biological analysis, soil sampling, and spill response.

Biological Science Technician
U.S. Geological Survey, Alaska Science Center

Biological Science Technician duties included field technician supervision, field logistics, vegetation plot sampling, North Slope bird nesting surveys and capture effort, data entry and data analysis. Additional duties included field logistics preparations and assistance in a large-scale marine mammal tagging effort on the Chukchi Sea coast.

Alaska Pacific University
Master of Science, Environmental Science

Successfully defended my thesis in May 2012. Thesis pertained to northern fur seal marine debris entanglement on St. George Island, Alaska. Documentation included five years of observations throughout the summer season from 2005-2010. Satellite work involved northern fur seal tagging, Steller sea lion entanglement monitoring and near-shore killer whale monitoring.

CERTIFICATIONS

Environmental Management, Inc.	*HAZWOPER 40-hr. Initial Course, 4/2014*
Environmental Management, Inc.	*HAZWOPER 8-hr. Refresher, 4/2015*
Satori Group	*HAZWOPER 8-hr. Refresher, 2016, 2017*
The Associated General Contractors (ACG)	*Alaska Certified Erosion & Sediment Control Lead, Certified since: 5/2014*
Richard Chinn Environmental Training, Inc.	*38-hr. Army Corps of Engineers Wetland Delineation Training Program, Certified since: 5/2018*

EMPLOYMENT RECORD

3/2014 – Present	Travis/Peterson Environmental Consulting, Inc.
1/2013 – 10/2013	U.S. Geological Survey, Alaska Science Center

APPENDIX E:
Data Quality Indicator Worksheets

SAP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: Extractable Hydrocarbons (DRO/RRO)

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference	Project Quantitation Limit Goal (mg/Kg)	Laboratory-specific		
					LOQs (mg/Kg)	LODs (mg/Kg)	MDLs (mg/Kg)
DRO (nC10-<nC25)	DRO	23	ADEC 2017	230	20	10	6.2
RRO (nC25-nC36)	RRO	1100	ADEC 2017	11000	20	10	6.2

†DEC 2017, Procedures for calculating cumulative risk, Section 2 - PAL is equal to 1/10 Human Health clean up standard published at 18 AAC 341 Table B2

‡ 18 AAC 75.341 Table B2

NS - No published cleanup standard

SAP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: Volatiles (GRO)

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference†	Project Quantitation Limit Goal‡ (mg/Kg)	Laboratory-specific*		
					LOQ (mg/Kg)	LOD (mg/Kg)	DL (mg/Kg)
Gasoline Range Organics (GRO)-C6-C10	GRO	26	ADEC 2017	260	2.5	1.25	0.75

*Limits are dependent on moisture content and sample mass.

†DEC 2017, Procedures for calculating cumulative risk, Section 2 - PAL is equal to 1/10 Human Health clean up standard published at 18 AAC 341 Table B2

‡ 18 AAC 75.341 Table B2

NS - No published cleanup standard

SAP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Solid (Medium Level, Methanol Preserved)
Analytical Group: Volatiles

Analyte	CAS Number	Project Action Limit†	Project Action Limit Reference	Human Health Over 40 Inch Zone (mg/Kg)	Project Quantitation Limit Goal‡ (mg/kg)	Laboratory-specific		
						LOQs (mg/kg)*	LODs (mg/kg)	DLs (ug/kg)
1,1,1,2-Tetrachloroethane	630-20-6	1.5	ADEC 2017	15	0.022	0.02	0.01	0.0062
1,1,1-Trichloroethane	71-55-6	36	ADEC 2017	360	32	0.025	0.0125	0.0078
1,1,2,2-Tetrachloroethane	79-34-5	0.44	ADEC 2017	4.4	0.003	0.0125	0.00625	0.0039
1,1,2-Trichloroethane	79-00-5	0.11	ADEC 2017	1.1	0.0014	0.01	0.005	0.0031
1,1-Dichloroethane	75-34-3	3.3	ADEC 2017	33	0.092	0.025	0.0125	0.0078
1,1-Dichloroethene	75-35-4	NS	ADEC 2017	NS	1.2	0.025	0.0125	0.0078
1,1-Dichloropropene	563-58-6	NS	ADEC 2017	NS	NS	0.025	0.0125	0.0078
1,2,3-Trichlorobenzene	87-61-6	6.6	ADEC 2017	66	0.15	0.05	0.025	0.015
1,2,3-Trichloropropane	96-18-4	0.0054	ADEC 2017	0.054	0.000031	0.025	0.0125	0.0078
1,2,4-Trichlorobenzene	120-82-1	3.2	ADEC 2017	32	0.082	0.025	0.0125	0.0078
1,2,4-Trimethylbenzene	95-63-6	3.3	ADEC 2017	33	0.16	0.05	0.025	0.015
1,2-Dibromo-3-chloropropane	96-12-8	NS	ADEC 2017	NS	NS	0.1	0.05	0.031
1,2-Dibromoethane	106-93-4	0.031	ADEC 2017	0.31	0.00024	0.01	0.005	0.0031
1,2-Dichlorobenzene	95-50-1	7.8	ADEC 2017	78	16	0.025	0.0125	0.0078
1,2-Dichloroethane	107-06-2	0.39	ADEC 2017	3.9	0.0055	0.01	0.005	0.0031
1,2-Dichloropropane	78-87-5	0.8	ADEC 2017	8	0.016	0.01	0.005	0.0031
1,3,5-Trimethylbenzene	108-67-8	3.7	ADEC 2017	37	1.3	0.025	0.0125	0.0078
1,3-Dichlorobenzene	541-73-1	6.2	ADEC 2017	62	2.3	0.025	0.0125	0.0078
1,3-Dichloropropane	142-28-9	NS	ADEC 2017	NS	NS	0.01	0.005	0.0031
1,4-Dichlorobenzene	106-46-7	1.5	ADEC 2017	15	0.037	0.025	0.0125	0.0078
2,2-Dichloropropane	594-20-7	NS	ADEC 2017	NS	NS	0.025	0.0125	0.0078
2-Butanone (MEK)	78-93-3	2300	ADEC 2017	23000	15	0.25	0.125	0.078
2-Chlorotoluene	95-49-8	NS	ADEC 2017	NS	NS	0.025	0.0125	0.0078
2-Hexanone	591-78-6	21	ADEC 2017	210	0.11	0.1	0.05	0.031
4-Chlorotoluene	106-43-4	NS	ADEC 2017	NS	NS	0.025	0.0125	0.0078
4-Isopropyltoluene	99-87-6	NS	ADEC 2017	NS	NS	0.025	0.0125	0.0078
4-Methyl-2-pentanone (MIBK)	108-10-1	220	ADEC 2017	2200	18	0.25	0.125	0.078
Benzene	71-43-2	0.81	ADEC 2017	8.1	0.022	0.0125	0.00625	0.0039
Bromobenzene	108-86-1	16	ADEC 2017	160	0.36	0.025	0.0125	0.0078
Bromochloromethane	74-97-5	NS	ADEC 2017	NS	NS	0.025	0.0125	0.0078
Bromodichloromethane	75-27-4	0.26	ADEC 2017	2.6	0.0043	0.025	0.0125	0.0078
Bromoform	75-25-2	17	ADEC 2017	170	0.1	0.025	0.0125	0.0078
Bromomethane	74-83-9	0.74	ADEC 2017	7.4	0.024	0.2	0.1	0.062
Carbon disulfide	75-15-0	50	ADEC 2017	500	2.9	0.1	0.05	0.031
Carbon tetrachloride	56-23-5	0.66	ADEC 2017	6.6	0.021	0.0125	0.00625	0.0039

Chlorobenzene	108-90-7	18	ADEC 2017	180	0.46	0.025	0.0125	0.0078
Chloroethane	75-00-3	NS	ADEC 2017	NS	0.072	0.2	0.1	0.062
Chloroform	67-66-3	0.29	ADEC 2017	2.9	0.0071	0.025	0.0125	0.0078
Chloromethane	74-87-3	12	ADEC 2017	120	0.61	0.025	0.0125	0.0078
cis-1,2-Dichloroethene	156-59-2	17	ADEC 2017	170	1.2	0.025	0.0125	0.0078
cis-1,3-Dichloropropene	10061-01-5	NS	ADEC 2017	NS	NS	0.0125	0.00625	0.0039
Dibromochloromethane	124-48-1	8.8	ADEC 2017	88	0.0027	0.025	0.0125	0.0078
Dibromomethane	74-95-3	2.2	ADEC 2017	22	0.025	0.025	0.0125	0.0078
Dichlorodifluoromethane	75-71-8	11	ADEC 2017	110	3.9	0.05	0.025	0.015
Ethylbenzene	100-41-4	3.5	ADEC 2017	35	0.13	0.025	0.0125	0.0078
Freon-113	76-13-1	NS	ADEC 2017	NS	740	0.1	0.05	0.0031
Hexachlorobutadiene	87-68-3	0.33	ADEC 2017	3.3	0.02	0.02	0.01	0.0062
Isopropylbenzene (Cumene)	98-82-8	5.4	ADEC 2017	54	5.6	0.025	0.0125	0.0078
Methylene chloride	75-09-2	36	ADEC 2017	360	0.33	0.1	0.05	0.031
Methyl-t-butyl ether	1634-04-4	48	ADEC 2017	480	0.4	0.1	0.05	0.031
Naphthalene	91-20-3	2	ADEC 2017	20	0.038	0.025	0.0125	0.0078
n-Butylbenzene	104-51-8	2	ADEC 2017	20	20	0.025	0.0125	0.0078
n-Propylbenzene	103-65-1	5.2	ADEC 2017	52	1	0.025	0.0125	0.0078
o-Xylene	95-47-6	5.7	ADEC 2017	57	1.5	0.025	0.0125	0.0078
P & M -Xylene	P & M -Xylene	5.7	ADEC 2017	57	1.5	0.05	0.025	0.015
sec-Butylbenzene	135-98-8	2.8	ADEC 2017	28	28	0.025	0.0125	0.0078
Styrene	100-42-5	18	ADEC 2017	180	10	0.025	0.0125	0.0078
tert-Butylbenzene	98-06-6	3.5	ADEC 2017	35	11	0.025	0.0125	0.0078
Tetrachloroethene	127-18-4	6.8	ADEC 2017	68	0.19	0.0125	0.00625	0.0039
Toluene	108-88-3	20	ADEC 2017	200	6.7	0.025	0.0125	0.0078
trans-1,2-Dichloroethene	156-60-5	96	ADEC 2017	960	1.3	0.025	0.0125	0.0078
trans-1,3-Dichloropropene	10061-02-6	NS	ADEC 2017	NS	NS	0.0125	0.00625	0.0039
Trichloroethene	79-01-6	0.35	ADEC 2017	3.5	0.011	0.01	0.005	0.0031
Trichlorofluoromethane	75-69-4	98	ADEC 2017	980	41	0.05	0.025	0.015
Vinyl acetate	108-05-4	100	ADEC 2017	1000	1.1	0.1	0.05	0.031
Vinyl chloride	75-01-4	0.061	ADEC 2017	0.61	0.0008	0.01	0.005	0.0031
Xylenes (total)	1330-20-7	5.7	ADEC 2017	57	1.5	0.075	0.0375	0.0228

†DEC 2017, Procedures for calculating cumulative risk, Section 2 - PAL is equal to 1/10 Human Health clean up standard published at 18 AAC 341 Table B1

‡ 18 AAC 75.341 Table B1

NS - No published cleanup standard

SAP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Solid

Analytical Group: Semivolatiles (PAH & SVOC by 8270D)

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference†	Human Health Over 40 Inch Zone (mg/kg)	Project Quantitation Limit Goal‡ (mg/kg)	Laboratory-specific		
						LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
1,2,4-Trichlorobenzene	120-82-1	3.2	ADEC 2017	32	0.082	0.25	0.125	0.078
1,2-Dichlorobenzene	95-50-1	7.8	ADEC 2017	78	2.4	0.25	0.125	0.078
1,3-Dichlorobenzene	541-73-1	6.2	ADEC 2017	62	2.3	0.25	0.125	0.078
1,4-Dichlorobenzene	106-46-7	1.5	ADEC 2017	15	0.037	0.25	0.125	0.078
1-Chloronaphthalene	90-13-1	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
1-Methylnaphthalene	90-12-0	6.8	ADEC 2017	68	0.41	0.25	0.125	0.078
2,4,5-Trichlorophenol	95-95-4	670	ADEC 2017	6700	28	0.25	0.125	0.078
2,4,6-Trichlorophenol	88-06-2	6.7	ADEC 2017	67	0.092	0.25	0.125	0.078
2,4-Dichlorophenol	120-83-2	20	ADEC 2017	200	0.21	0.25	0.125	0.078
2,4-Dimethylphenol	105-67-9	130	ADEC 2017	1300	3.2	0.25	0.125	0.078
2,4-Dinitrophenol	51-28-5	13	ADEC 2017	130	0.34	3	1.5	0.94
2,4-Dinitrotoluene	121-14-2	1.8	ADEC 2017	18	0.024	0.25	0.125	0.078
2,6-Dichlorophenol	87-65-0	NS	ADEC 2017	NS	0.21	0.25	0.125	0.078
2,6-Dinitrotoluene	606-20-2	0.38	ADEC 2017	3.8	0.005	0.25	0.125	0.078
2-Chloronaphthalene	91-58-7	510	ADEC 2017	5100	26	0.25	0.125	0.078
2-Chlorophenol	95-57-8	41	ADEC 2017	410	0.71	0.25	0.125	0.078
2-Methyl-4,6-dinitrophenol	534-52-1	NS	ADEC 2017	NS	NS	2	1	0.62
2-Methylnaphthalene	91-57-6	25	ADEC 2017	250	1.3	0.25	0.125	0.078
2-Methylphenol (o-Cresol)	95-48-7	340	ADEC 2017	3400	6.2	0.25	0.125	0.078
2-Nitroaniline	88-74-4	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
2-Nitrophenol	88-75-5	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
3&4-Methylphenol (p&m-Cresol)	3&4-Methylphen.	1010	ADEC 2017	10100	6.1	1	0.5	0.31
3,3-Dichlorobenzidine	91-94-1	1.3	ADEC 2017	13	0.056	0.5	0.25	0.15
3-Nitroaniline	99-09-2	NS	ADEC 2017	NS	NS	0.5	0.25	0.15
4-Bromophenyl-phenylether	101-55-3	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
4-Chloro-3-methylphenol	59-50-7	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
4-Chloroaniline	106-47-8	2.9	ADEC 2017	29	0.015	0.5	0.25	0.15
4-Chlorophenyl-phenylether	7005-72-3	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
4-Nitroaniline	100-01-6	NS	ADEC 2017	NS	NS	3	1.5	0.94

4-Nitrophenol	100-02-7	NS	ADEC 2017	NS	NS	1	0.5	0.31
Acenaphthene	83-32-9	380	ADEC 2017	3800	37	0.25	0.125	0.078
Acenaphthylene	208-96-8	190	ADEC 2017	1900	18	0.25	0.125	0.078
Aniline	62-53-3	NS	ADEC 2017	NS	NS	2	1	0.62
Anthracene	120-12-7	1900	ADEC 2017	19000	390	0.25	0.125	0.078
Azobenzene	103-33-3	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
Benzo(a)Anthracene	56-55-3	0.17	ADEC 2017	1.7	0.28	0.25	0.125	0.078
Benzo[a]pyrene	50-32-8	0.017	ADEC 2017	0.17	0.27	0.25	0.125	0.078
Benzo[b]Fluoranthene	205-99-2	0.17	ADEC 2017	1.7	27	0.25	0.125	0.078
Benzo[g,h,i]perylene	191-24-2	190	ADEC 2017	1900	2300	0.25	0.125	0.078
Benzo[k]fluoranthene	207-08-9	1.7	ADEC 2017	17	20	0.25	0.125	0.078
Benzoic acid	65-85-0	10000	ADEC 2017	100000	200	1.5	0.75	0.47
Benzyl alcohol	100-51-6	670	ADEC 2017	6700	5.7	0.25	0.125	0.078
Bis(2chloro1methylethyl)Ether	108-60-1	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
Bis(2-Chloroethoxy)methane	111-91-1	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
Bis(2-Chloroethyl)ether	111-44-4	0.21	ADEC 2017	2.1	0.00042	0.25	0.125	0.078
bis(2-Ethylhexyl)phthalate	117-81-7	41	ADEC 2017	410	88	0.25	0.125	0.078
Butylbenzylphthalate	85-68-7	300	ADEC 2017	3000	16	0.25	0.125	0.078
Carbazole	86-74-8	NS	ADEC 2017	NS	NS	0.25	0.125	0.078
Chrysene	218-01-9	17	ADEC 2017	170	82	0.25	0.125	0.078
Dibenzo[a,h]anthracene	53-70-3	0.017	ADEC 2017	0.17	0.17	0.25	0.125	0.078
Dibenzofuran	132-64-9	7.7	ADEC 2017	77	0.97	0.25	0.125	0.078
Diethylphthalate	84-66-2	5400	ADEC 2017	54000	16	0.25	0.125	0.078
Dimethylphthalate	131-11-3	5400	ADEC 2017	54000	66	0.25	0.125	0.078
Di-n-butylphthalate	84-74-2	820	ADEC 2017	8200	16	0.25	0.125	0.078
di-n-Octylphthalate	117-84-0	67	ADEC 2017	670	370	0.5	0.25	0.15
Fluoranthene	206-44-0	250	ADEC 2017	2500	590	0.25	0.125	0.078
Fluorene	86-73-7	250	ADEC 2017	2500	36	0.25	0.125	0.078
Hexachlorobenzene	118-74-1	0.15	ADEC 2017	1.5	0.0082	0.25	0.125	0.078
Hexachlorobutadiene	87-68-3	0.33	ADEC 2017	3.3	0.02	0.25	0.125	0.078
Hexachlorocyclopentadiene	77-47-4	0.1	ADEC 2017	1	0.0093	0.7	0.35	0.2
Hexachloroethane	67-72-1	1.2	ADEC 2017	12	0.018	0.25	0.125	0.078
Indeno[1,2,3-c,d] pyrene	193-39-5	0.17	ADEC 2017	1.7	2	0.25	0.125	0.078
Isophorone	78-59-1	610	ADEC 2017	6100	2.7	0.25	0.125	0.078
Naphthalene	91-20-3	2	ADEC 2017	20	0.038	0.25	0.125	0.078
Nitrobenzene	98-95-3	3.1	ADEC 2017	31	0.0079	0.25	0.125	0.078
N-Nitrosodimethylamine	62-75-9	0.002	ADEC 2017	0.02	0.0000033	0.25	0.125	0.078
N-Nitroso-di-n-propylamine	621-64-7	0.082	ADEC 2017	0.82	0.00068	0.25	0.125	0.078

N-Nitrosodiphenylamine	86-30-6	120	ADEC 2017	1200	4.6	0.25	0.125	0.078
Pentachlorophenol	87-86-5	1.1	ADEC 2017	11	0.0043	2	1	0.62
Phenanthrene	85-01-8	190	ADEC 2017	1900	39	0.25	0.125	0.078
Phenol	108-95-2	2000	ADEC 2017	20000	29	0.25	0.125	0.078
Pyrene	129-00-0	190	ADEC 2017	1900	87	0.25	0.125	0.078

†DEC 2017, Procedures for calculating cumulative risk, Section 2 - PAL is equal to 1/10 Human Health clean up standard published at 18 AAC 341 Table B1

‡ 18 AAC 75.341 Table B1

SAP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Solid

Analytical Group: Metals

Analyte	CAS Number	Project Action Limit Reference†	Project Action Limit Reference	Human Health Over 40 Inch Zone (mg/kg)	Project Quantitation Limit Goal[2] (mg/Kg)	Laboratory-specific		
						LOQs (mg/Kg)*	LODs (mg/Kg)	DLs (mg/Kg)
Arsenic	7440-38-2	0.72	ADEC 2017	7.2	0.2	1	0.5	0.31
Barium	7440-39-3	1700	ADEC 2017	17000	2100	0.3	0.15	0.094
Cadmium	7440-43-9	7.6	ADEC 2017	76	9.1	0.2	0.1	0.062
Chromium	7440-47-3	10000	ADEC 2017	100000	100000	0.4	0.2	0.13
Lead	7439-92-1	40	ADEC 2017	400	400	0.2	0.1	0.062
Mercury	7439-97-6	0.31	ADEC 2017	3.1	0.36	0.04	0.02	0.012
Selenium	7782-49-2	41	ADEC 2017	410	6.9	1	0.5	0.31
Silver	7440-22-4	41	ADEC 2017	410	11	0.2	0.1	0.062

†DEC 2017, Procedures for calculating cumulative risk, Section 2 - PAL is equal to 1/10 Human Health clean up standard published at 18 AAC 341 Table B1 (2018)

‡ 18 AAC 75.341 Table B1

SAP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Solid

Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit Reference†	Project Action Limit Reference	Human Health Over 40 Inch Zone (mg/kg)	Project Quantitation Limit Goal[1] (mg/Kg)	Laboratory-specific		
						LOQs (mg/Kg)*	LODs (mg/Kg)	DLs (mg/Kg)
Aroclor - 1016	12674-11-2	0.1	ADEC 2017	1.0	1.0	0.05	0.025	0.015
Aroclor - 1221	11104-28-2	0.1	ADEC 2017	1.0	1.0	0.02	0.01	0.0062
Aroclor - 1232	11141-16-5	0.1	ADEC 2017	1.0	1.0	0.05	0.025	0.015
Aroclor - 1242	53469-21-9	0.1	ADEC 2017	1.0	1.0	0.05	0.025	0.015
Aroclor - 1248	12672-29-6	0.1	ADEC 2017	1.0	1.0	0.05	0.025	0.015
Aroclor - 1254	11097-69-1	0.1	ADEC 2017	1.0	1.0	0.05	0.025	0.015
Aroclor - 1260	11096-82-5	0.1	ADEC 2017	1.0	1.0	0.05	0.025	0.015

†DEC 2017, Procedures for calculating cumulative risk, Section 2 - PAL is equal to 1/10 Human Health clean up standard published at 18 AAC 341 Table B1 (2018)

‡ 18 AAC 75.341 Table B1

[1] Summation of all Aroclors may not exceed 1.0 mg/Kg