ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES

KEKU CANNERY
KAKE, ALASKA

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1.0 EXECUTIVE SUMMARY

NORTECH has completed this Analysis of Brownfield Cleanup Alternatives (ABCA) for the contaminated soil and sediment surrounding the Keku Cannery complex in Kake, Alaska (the site). The cannery buildings fell into disarray after canning operations ended in 1977. Hazardous building materials (HBM) used in building construction could be released into the environment if the structure(s) were to collapse. Additionally, multiple locations throughout the site have historic contamination from both petroleum spills (on- and off-site) and other cannery activities. Although building restoration and HBM abatement efforts have occurred over the past few decades, soil and sediment contamination has not yet been addressed.

The site is comprised of three known areas of contamination that are discussed separately for the purpose of making remediation recommendations. These areas include the Upland Soils surrounding the generator and main cannery buildings; the Intertidal Sediment Contamination zone over which the main cannery structure is built; and the southeastern property at the former aboveground storage tank (AST) Cluster. Primary contaminants of concern include petroleum-related contaminants and heavy metals which were found throughout the site.

The Organized Village of Kake (OVK) applied for the Alaska Department of Environmental Conservation (ADEC) Brownfield Assessment and Cleanup (DBAC) services to develop an ABCA. The primary goal of this effort is to identify methods to characterize and remediate the contaminated soil so the site can be fully repurposed as office space and an updated tourist attraction. OVK owns the property and is currently responsible for contamination at the site.

Four cleanup alternatives were considered as part of this ABCA:

- Alternative 1: No Action
- Alternative 2: Excavation, Lower 48 Disposal, and Monitored Natural Attenuation (MNA)
- Alternative 3: Excavation, Local Landfarm, Lower 48 Disposal, and MNA
- Alternative 4: Risk Assessment and Targeted Remediation

Evaluation factors included effectiveness, ease of implementation, and a rough order of magnitude cost. Each option was scored on these factors. Only one alternative, No Action, was evaluated that did not meet site cleanup and reuse goals. The remaining three options are expected to meet cleanup and site reuse goals if implemented successfully.

Risk assessment and targeted remediation (Alternative 4) is the recommended option for the site. This option is the highest scoring of the four alternatives and will provide more detailed information regarding risks to human health and the environment. The additional data gathered, and the risk assessment will help facilitate removal or remediation of the material that poses the greatest threat while leaving the rest in place under appropriate management practices. The trade off for cost in this alternative is greater long-term management responsibility for OVK to ensure that the material left in place continues to pose little threat to human health or the environment.

Alternative 2 (Excavation, Lower 48 Disposal, and MNA) had the second highest score. It is the most expensive option, but it is considered to be an efficient and effective option. This alternative would remove accessible contamination in a timely manner and dispose of all excavated soil at an approved facility in the Lower 48, leaving less soil to manage in-place. Accessible material will be removed at one time, and the material will no longer be the responsibility of OVK once it has been transferred to the treatment facility. If financial resources are available, this is the recommended alternative due to its efficiency and timeliness.

2.0 BACKGROUND INFORMATION

The Keku Cannery is a recognized National Historic Landmark in Kake, Alaska, and is owned by OVK. The cannery and associated structures were constructed between 1912 and 1944 with HBM commonplace at the time. Canning operations ceased in 1977, and the building fell into a state of disrepair, presenting a threat of release of HBM to the environment. Additionally, the site has been impacted by both onsite petroleum releases and nearby petroleum spills that have migrated onsite. Other hazardous substances present in materials used during historic operations have impacted the property, including heavy metals and polychlorinated biphenyls (PCB). Numerous site assessments and investigations have occurred since the 1990s. The purpose of this ABCA is to synthesize the data collected from previous site research, assessments, sampling efforts, and discussions and to evaluate potential remediation alternatives.

2.1 Site Location

The Keku Cannery, located at 541 Keku Road in Kake, Alaska, is approximately 90 miles southwest of Juneau, on the northwest shore of Kupreanof Island, along Keku Strait. The Keku Cannery is listed as an active ADEC Contaminated Site (Hazard ID 26209 File No. 1514.38.011). The legal description for the cannery (herein referred to as "site") is described as:

- 541 Keku Road, Kake, Alaska 99830
- Section 35, Township 56 S, Range 72 E of the Copper River Meridian
- 56.964758ºN and 133.926173ºW, at approximately sea level

2.2 Local Geology and Climate

Kake has a temperate climate (*Köppen* Cfb), marked by long, temperate winters and short, warm summers. Kake has average yearly low temperatures ranging from 25.9ºF to 50.2ºF. The average yearly high temperatures range from 32.4ºF to 59.7ºF. February, the coldest month, has an average low of 29.7ºF; August, the warmest month, has an average high of 57.9ºF. Kake receives up to 82.76 inches of rain annually. Based on this climatic information, the site is classified as the "Over 40-inch" zone by 18 Alaska Administrative Code (AAC) 75.990.

Kake is located on the northwestern tip of Kupreanof Island which is part of the Alexander Archipelago within the Coast Mountain Physiographic Province of North America. Surface soils are typically poorly developed mineral soils overlying bedrock. Native soils are comprised of a layer of forest duff overlaying sandy and/or silty soils which grade to weathered bedrock. Bedrock is generally encountered at depths of two to three feet below ground surface (bgs). Glacial till is also present throughout the area, typically in areas bedrock is encountered at deeper depths.

According to the *Targeted Brownfields Assessment* (TBA) conducted by Ecology and Environment, Inc. (E&E) in 2016, a typical surface soil profile at the site includes silt loam from 0- to 1-inch below ground surface (bgs), gravelly sandy loam from 1 to 8 inches, very gravelly coarse sandy loam from 8 to 25 inches, and very gravelly sandy loam from 25 to 30 inches. Surface soils are underlain by rocks that include thin bedded gray tuffaceous volcanic argillite and fine-grained gray tuffaceous volcanic greywacke. Previous site sampling activities encountered bedrock interface within approximately 2 feet bgs and at shallower depths within the intertidal zone.

Given the remote location of Kake and the predominant reliance on surface water as a drinking water source in the area, limited information is available regarding the presence of ground water. The TBA reported that a well log for only one well located near the village was available. According to the log, fractures were encountered 38 to 54 feet and 68 to 88 feet bgs, with the volume of available water increasing as each fracture was encountered. The well was completed at a depth of 90 feet, with ground water equilibrating at 6.5 feet bgs. Previous sampling activities encountered groundwater within approximately 1-foot bgs and typically coincided with more gravelly soil horizons. Given this information, it was reported that more gravelly material appeared to create a preferential groundwater migration pathway while downward migration of groundwater appeared to be limited by relatively shallow bedrock.

2.3 Site Use and History

The subject property consists of a single 14-acre parcel of land comprising what has been referred to as the "cannery district," a complex of what had included 18 buildings constructed between 1912 and 1944. The main cannery building was constructed in 1912 and operated from that time until its closure in 1977. Over time, the building was expanded and/or updated, adding a fish sorting area, boiler house, machine shop, egg room, storeroom, and retorts.

The Keku Cannery operated as a fish processing and packaging business from the early 1900s until 1977, when the cannery closed. The site was designated as a National Historic Landmark in 1997 because the facility is typical of salmon canneries that operated in Alaska in the late 19th and early 20th centuries and is one of few remaining structures of its type. After cannery work ended, various structures in the complex fell into disrepair, with the cannery's original dock and two warehouse buildings that extended over the water collapsing into the bay. Several bunkhouses, fuel storage buildings, and associated ASTs have been demolished (various fuel lines connecting buildings and ASTs were left in place). Many of the remaining buildings in the cannery complex have been used for vehicle and equipment storage, both related and unrelated to the cannery operations. Various debris remains on the beach beneath the main cannery. Most asbestos-containing materials (ACM) that had previously been identified have been abated, though some ACM, like refractory brick, were left in place. Lead-based paint (LBP) and polychlorinated biphenyl (PCB)-containing light ballasts have not been fully removed.

The site is listed on the ADEC Contaminated Site Program (CSP) Database under File Number 1514.38.011. The cannery has been on the CSP database since 2014. OVK received the brownfields award in 2013 from the EPA and funding for a Phase I Environmental Site Assessment (ESA). The site was added to the DEC Contaminated Sites Database shortly after the ESA was completed by Shannon & Wilson due concerns about the deterioration of the cannery and the potential for eminent collapse. In 2015, OVK requested and was awarded a TBA by the EPA. In 2019, asbestos abatement occurred after OVK received DBAC services for the HBM in the cannery. In 2023, construction for adaptive reuse of the site began. OVK applied for and was awarded additional funding through DBAC services to assist in cleanup planning by providing an ABCA for the Keku Cannery.

2.4 Previous Site Assessment Reports and Findings

Between 1993 and 2022, multiple phases of environmental investigation, review, assessment, and cleanup work have occurred on and adjacent to the Keku Cannery site. Reports related to that work are summarized in the following subsections, in chronological order.

1993 – Asbestos Survey and Hazard Assessment, Kake Cannery

In 1993, Med-Tox Northwest performed a limited hazardous materials assessment on the cannery complex. The assessment focused on evaluating the status of and estimating cleanup costs for the abatement of asbestos in building materials at the cannery. The assessment identified gaskets, cement asbestos board, stove insulation, brake shoes, and thermal system insulation (TSI) as ACM. Med-Tox Northwest also provided a basic review of light fixtures and identified numerous PCB-containing light ballasts at the site.

1997 – KTLT Spill Response and Cleanup for OVK Cannery Oil Tanks

In 1996, Kake Tribal Logging and Timber Inc. (KTLT) responded to a petroleum spill associated with two ASTs across Keku Road that were piped to day tank between the generator house and warehouse. The two ASTs reportedly were reportedly owned by OVK and located on OVK property to the east across Kake Road. The release occurred when a vandal broke into the tank building and opened a valve on the tanks, releasing 150-300 gallons of petroleum product on the ground. The spill was listed on the ADEC Prevention, Preparedness and Response (PPR) database under Spill #96119912601, with OVK as the responsible party. Response and subsequent cleanup efforts are documented in a report drafted by Smith Bayliss LeResche Inc., dated 1997. The impacts reportedly extended from the tanks to approximately 12 feet beyond a culvert that runs beneath Kake Road. Approximately 75 cubic yards of petroleum-contaminated soil were excavated and stockpiled on a plastic liner.

Follow-up corrective actions completed in 1997 included removing oil that remained in the tanks, demolishing the tanks and tank building, excavating soil beneath and adjacent to the tanks, and disposing of contaminated soil that had previously been excavated. Analysis of samples collected upon completion of this work indicated that residual contaminant levels were below the ADEC cleanup levels at that time. The spill was granted a “no further action” designation by ADEC.

2009 – OVK Keku Cannery Spill Discovery

In 2009, evidence of a spill on the south side of the cannery warehouse building was discovered during a road construction project. Upon discovery of the spill, OVK retained Kai Environmental Consulting Services, LLC, to characterize the spill. Samples from test pits in the spill area revealed diesel-range organics (DRO) and residual-range organics (RRO) in the soil. Detected concentrations were below ADEC cleanup levels, and no additional evidence of contamination was noted in the test pits. The spill was reportedly given a “no further action” designation by ADEC.

2014 – Phase I Environmental Site Assessment

In 2014, Shannon and Wilson, Inc, (S&W) conducted a Phase I ESA at the site which was performed on behalf of the OVK and ADEC. The purpose of the assessment was to identify recognized environmental conditions (REC) connected to the site. The subject of the assessment was limited to the cannery building and warehouse and excluded the remaining land associated with the cannery complex and other structures on the property.

During their site visit, S&W personnel observed debris in various states of disrepair within the cannery building. The debris included vehicles, drums and containers, metal scraps, unused equipment, and a variety of hazardous building materials. Staining was noted on the floors and other surfaces of the cannery building, the machine shop, and on the intertidal zone underneath the building.

S&W identified the following RECs for the site and vicinity:

- ACM and the likely use of LBP and PCB-containing ballasts in the building
- Floor drains within the cannery building that discharged directly into the water, potentially impacting the bay
- Staining on the shoreline area beneath the cannery machine shop and on the floor in the boiler room of the cannery that was potentially indicative of past releases
- Discarded metal scraps and various drums, tanks, and containers that potentially contained hazardous substances and/or petroleum products which could release into the bay if they were damaged
- Various engines, vehicles, and refrigerators stored in the building that could cause contamination to the environment if damaged
- Two spills in the vicinity of the site

In addition to the RECs, S&W identified two other potential environmental conditions associated with the site that fell outside the area included in the scope of work:

- Risk of impact to soil and water from the 2011 collapse of the warehouse south of the cannery building
- Potential for impacts to the property from spills or releases at the Kake Tribal Fuel Company Tank Farm located on the property adjacent to the southeastern corner of the cannery property

2014 – Post-Project Hazard Abatement Submittal for Kake Keku Cannery
In 2014, Absolute Services, Inc. completed abatement efforts at the cannery on behalf of OVK that focused on ACM identified in the 1993 survey. The abatement included removing TSI from boilers, pipe runs, and a canning retort. The abatement also included collecting and disposing of various asbestos-containing belts, gaskets, and debris within the building. ACM that was left in place, like fire bricks in the boilers, were treated with an encapsulant to mitigate the exposure hazard.

2016 – Keku Cannery (former) Targeted Brownfield Assessment
In 2016, E&E completed a TBA at the site in coordination with the EPA, ADEC, and OVK. The project investigated new and previously identified RECs at the site, identified data gaps, and developed an HBM management strategy. The scope of work included the cannery building, storage warehouse, generator house, and exterior property grounds, all of which were in a state of disrepair. Known RECs included the presence of fuel tanks and lines, petroleum spills at multiple locations, and intertidal zone disposal practices. Other environmental concerns included the potential presence of various HBM at the site, such as ACM, LBP, and PCB-containing light fixtures.

E&E observed debris, such as scrap metal, electrical equipment, and machinery parts throughout the inspected areas. Stained and discolored soil indicated two areas of petroleum contamination. The first was on the east side of the warehouse where concrete anchor pads provided structural support for the cannery building. The second was along the wooden boardwalk on the northern side of the warehouse, between the generator and cannery buildings. An AST that likely fueled vehicles and equipment was identified but had no significant odor and appeared to only contain water. The inspection identified an additional AST near the generator house that posed a release threat to surface and subsurface soils and groundwater.

During the TBA, E&E conducted surface and subsurface soil sampling, sludge sampling, surface sediment samplings, and an additional limited hazardous materials survey was conducted by EHS-International, Inc. The limited hazardous materials report is included in the TBA as Appendix D. In general, E&E identified multiple sources of contamination throughout the site and highlighted three distinct areas to evaluate cleanup. These areas included the Upland Soils around the generator and cannery buildings, the Intertidal Sediment Contamination Zone, and the former AST Cluster. However, due to the numerous sources of contamination and variety of contaminants found in soil and sediment, E&E recommended additional assessment and sampling prior to cleanup activities. Areas not included in the three zones were identified for additional assessment as well, including the northeast corner of the generator building, the area beneath the cannery building and boilers, and the southwest corner of the cannery building.

Section 5 of the TBA presents a preliminary evaluation and cost analysis of cleanup options for the site. Options such as excavation and disposal in the Lower 48, landfarming, and chemical oxidation treatment were proposed for soil and sediment based on the location, accessibility, and contaminants of concern. Assumptions are outlined in the TBA and based on the results of the TBA, though E&E notes that additional assessment is recommended for each area to further delineate and further characterize the nature of impacts to the site. Appendix H of the TBA provides detailed cost estimates for each option proposed in Section 5 of the TBA. Also provided are additional information related to assumptions, and specific cost quotes used to inform the estimate.

E&E provided an additional memorandum with the TBA (Appendix G) to address follow-on sampling and testing. The memorandum notes that the full vertical and lateral extent of contamination has not been fully defined and that there may be unidentified upgradient sources. The plan proposes additional sampling locations and assessment strategy based on the results of the TBA. The plan also includes estimated costs for the proposed effort and a figure of specific recommended sampling locations.

2018 –Analysis of Brownfields Cleanup Alternatives, Keku Cannery

In 2018, an ABCA was written for the Keku Cannery specifically related to HBM. It reviewed previous site investigations and cleanups and presented three remedial alternatives: no action, hazardous building materials abatement and combine local and off-island disposal, and hazardous building materials abatement and disposal off-island. The No Action alternative was not viable as it left hazardous materials in place that could potentially expose community members to health hazards and could hamper redevelopment at the site. While the second and third alternatives were both reasonable and technically feasible, the third alternative – HBM abatement and off-island disposal – was the preferred remedial strategy due to cost constraints and lack of land availability for a local monofill in Kake.

2019 – Post Project Report, Kake Cannery Abatement

In 2019, the Satori Group conducted asbestos abatement at the Keku cannery. Various ACM and TSI remnants were removed and roughly 20,000 pounds of HBM debris were packaged and shipped to Washington for disposal.

2015-2022 – Kake Tribal Fuel Corporation Tank Farm Gasoline Release

In December 2014, approximately 900 gallons of unleaded gasoline leaked from an AST on the former Kake Tribal Fuel Corporation (KTFC) tank farm property, in Kake, Alaska. The fuel spill was reported to ADEC and recorded as Spill # 15119915801. The tank farm site was later transferred to ADEC CSP database under File # 1514.38.009.

The tank farm was decommissioned in 2018, which included removal of ASTs from the KTFC property and the adjacent OVK property to the northwest. Environmental investigations were conducted at the tank farm in 2015 (Carson Dorn), 2019 and 2020 (***NORTECH***), and the 2015 and 2020 investigations included off-site sampling to assess potential impacts to the adjoining properties.

The investigations confirmed both on- and off-KTFC property soils were impacted by gasoline range organic (GRO), multiple volatile organic compounds (VOC), including two chlorinated compounds confined to two on-site locations, and polycyclic aromatic hydrocarbons (PAHs) in concentrations above regulatory cleanup levels. These investigations also indicated groundwater under the site had been impacted by DRO, VOCs, and PAHs in concentrations above cleanup levels. The 2019 and 2020 investigations identified on- and off-KTFC property DRO contamination in exceedance of cleanup levels, indicating an undocumented diesel fuel release had occurred in the past.

NORTECH developed a Corrective Action Plan (CAP) to address the removal of gasoline contaminated soils from the KTFC Tank farm property. As OVK property and the adjacent roadside ditch may have also been impacted by the 2014 gasoline release on KTFC property, these areas were included in the CAP. The CAP was implemented in 2021 and 2022. Phase I of the CAP included the excavation of seven cubic yards of soil impacted with chlorinated VOCs. Laboratory results from the final limits of the excavation confirmed the removal of all chlorinated compounds. The soil was transported to US Ecology's Subtitle C regulated treatment plant and landfill facility in Grand View, Idaho in September 2022.

Phase II of the CAP included the excavation of 2,050 tons of gross petroleum contaminated soil material from the KTFC Tank Farm and adjoining OVK property north and west of the tank farm. The former AST Cluster on the OVK property was removed as part of this work. Laboratory soil sampling at the limits of excavations shows non-chlorinated petroleum contamination remains on KTFC tank farm and OVK property in concentrations exceeding applicable cleanup levels.

2.5 Project Goal and Site Reuse

Stabilization efforts continue at the site with the goal of utilizing the buildings as a office space for the tribe, as well as a hub for arts, culture and nature based tourism, while retaining the significant features of the historic cannery. A new multi-use dock was added to the property in 2012, and OVK also plans to use the buildings as an educational attraction to entice additional cruise tourism to Kake, which includes aesthetic repairs and developments on the exterior of the cannery building. As a National Historic Landmark, the former cannery holds local, economic, and historical significance to numerous stakeholders. Restoration and redevelopment will maximize this significance. The goal of additional assessment and cleanup is to determine and address the extent of impacts that may lead to a risk to human health and the environment, or that would impact future use of the site.

3.0 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

3.1 Cleanup Oversight Responsibility

Cleanup oversight is managed by the ADEC Division of Spill Prevention and Response Contaminated Sites Program under Alaska Administrative Code – Chapter 75: *Oil and Other Hazardous Substances Pollution Control* (October 2023). The work is conducted in accordance with the ADEC *Field Sampling Guidance* (August 2024).

3.2 Cleanup Standards for Major Contaminants

The most stringent ADEC Method Two Cleanup Levels for the Over 40-inch zone as defined in 18 AAC 75.341 Tables B1 and B2 (soil) as amended through October 18, 2023 are provided below. Alternative site-specific cleanup levels may be determined using Method 3 cumulative risk calculations.

Soil Cleanup Levels

Compound	Analysis	Cleanup Level (mg/kg)
RRO	AK103	8,300
DRO	AK102	230
GRO	AK101	260
PCBs	EPA 8082A	1.0
VOCs	EPA 8260D	Various
SVOCs	EPA 8270E	Various
Metals	EPA 6010D	Various

Additionally, the National Oceanic and Atmospheric Administration's Office of Response and Restoration (OR&R) developed Screening Quick Reference Tables (SQuiRT) in 2008 to help evaluate potential risks from contaminated water, sediment, or soil. The tables presented a compilation of screening concentrations for inorganic and organic contaminants in various environmental media. The SQuiRTs were used in the TBA developed by E&E to help evaluate the toxicity of contaminants in sediment at the site. As of April 4, 2024, OR&R removed the SQuiRT cards from their website as they were considered to be out of date. OR&R suggests that more recent literature should be considered in contaminant evaluation, such as OR&R's Chemical Aquatic Fate and Effects database, which provides a more current source of chemical, oil, and dispersant environmental fate and effects information.

3.3 Conceptual Site Model / Exposure Management

No Conceptual Site Model (CSM) has been developed for this site.

3.4 Laws and Regulations Applicable to the Cleanup

Laws and regulations that are applicable to a cleanup funded using EPA Brownfield grant assistance include the Federal Small Business Liability Relief and Brownfields Revitalization Act and state environmental law. Local coordination with tribal and village representatives is recommended to ensure compliance with any local requirements. Federal, state, and local laws regarding procurement of contractors to conduct the cleanup will be followed. In addition, all appropriate permits (e.g., notify before you dig, soil transport/disposal manifests [ADEC]) will be obtained prior to the work commencing.

4.0 IDENTIFICATION OF CLEANUP ALTERNATIVES

This section presents a range of reasonable and proven response actions and cleanup alternatives, based on contaminant concentrations, site characteristics, current and potential site use, potential exposure pathways and associated risks, and overall cleanup goals. The options selected are derived from options detailed in the TBA with modifications as described for each alternative.

Four potential cleanup alternatives are identified below and described in further detail in the following sections.

- Alternative 1: No Action
- Alternative 2: Excavation, Lower-48 Disposal, and MNA
- Alternative 3: Excavation. Local Landfarm and Lower 48 Disposal, and MNA
- Alternative 4: Risk Assessment with Targeted Remediation Strategy

To satisfy EPA requirements, the effectiveness, ease of implementation, and cost of each alternative must be considered prior to selecting a recommended cleanup alternative. Effectiveness and ease of implementation are discussed for each alternative in Section 4.1 – 4.5. Costs for all alternatives are discussed in Section 4.6. Alternatives were scored for each metric from 1 to 5.

- Effectiveness (1= not effective, 5= very effective)
  - The degree to which the toxicity, mobility, and volume of the contamination is expected to be reduced.
  - The degree to which a remedial action option, if implemented, will protect public health, safety and welfare and the environment over time.
  - The degree to which any adverse impacts on public health, safety and welfare and the environment may be posed during the construction and implementation period until case closure.
- Ease of implementation (1=difficult to implement, 5=easy to implement)
  - The technical feasibility of constructing and implementing the remedial action option at the site or facility.
  - The availability of materials, equipment, technologies and services needed to conduct the remedial action option.
  - The administrative feasibility of the remedial action option, including activities and time needed to obtain any necessary licenses, permits or approvals; the presence of any federal or state, threatened or endangered species; and the technical feasibility of recycling, treatment, engineering controls, disposal or naturally occurring biodegradation; and the expected time frame needed to achieve the necessary restoration.
- Cost (3= more than $2M, 4=between $1M and $2M, 5=less than $1M)
  - Capital costs, including both direct and indirect costs.
  - Initial costs, including design and testing costs.
  - Annual operation and maintenance costs.

4.1 Alternative 1: No Action

The no action alternative is included as a basis for comparing active remediation techniques. It assumes no cleanup will be undertaken at the site. Under this approach, the contamination would remain on the site in its current condition.

Effectiveness: 1
This alternative is not considered effective or viable. Contaminants detected above the applicable cleanup levels remain on-site and are not in compliance with regulatory requirements. The no action alternative will not address the contamination and will continue to pose environmental and human health risks. Overall project goals and the interests of stakeholders would not be met with the no action alternative.

Implementability: 5
This alternative is easy to implement as no action is required.

4.2 Alternative 2: Excavation, Lower 48 Disposal, and MNA

This alternative includes excavation of accessible contaminated soils at the site and transport to the landfill in Arlington, Oregon, for final disposal. This Option is derived from Option 1a for Upland Soils, Option 1a for the former AST Cluster soils, and the sole option for Intertidal Sediment Contamination presented in the TBA. Major site work for this alternative is assumed to address accessible soils in the three identified areas of contamination in one mobilization with use of a 5-person crew and is assumed to take six weeks. This also includes the additional 5-year Operations and Maintenance (O&M) costs which are forecasted for the excavation in the TBA cost estimate. A QEP must oversee the workplan development, excavation field screening and sampling.

NORTECH has applied adjustments to the TBA assumptions for this alternative by excluding in-situ treatment (chemical oxidation) of soils based on the rational in Section 4.5. This also eliminates tank removal from the former AST Cluster area due to corrective actions which were completed in 2022. Additional factors were incorporated to provide for workplan development and permitting, site characterization during excavation, and changes to transportation costs based on fuel price fluctuations. Another consideration was the volume of contaminated soil in the AST Cluster area. Although contaminated soil in the former AST Cluster area was excavated in 2022, the area excavated does not appear to coincide with the contaminated area specified in the TBA. Additionally, laboratory results show additional contaminated soil exists in the area. Therefore, a factor was applied to account for additional soil volume in the former AST Cluster area based on additional assessment findings completed since the TBA.

Under this alternative, soils and sediments under the cannery building or that are otherwise inaccessible would be further characterized. Once site characterization data gaps are adequately addressed, a risk assessment would be prepared to evaluate the potential exposures to human health and the environment due to the remaining contamination. Risk assessments must be conducted by individuals experienced in the technical and regulatory aspects of risk assessment and in consultation with ADEC's risk assessment staff. Risk management, such as risk reduction and potential remedial actions, are not considered part of the risk assessment. For the purposes of this ABCA, MNA with very limited requirements is assumed to be necessary following the risk assessment. The risk assessment and MNA are estimated at about half the effort of the additional assessment described in Appendix G of the TBA.

As described in the TBA and as modified for this ABCA, the major work tasks and assumptions for this alternative are generally as follows:

Table 4-1 – Base Work Task Descriptions

Work Task Name	Description
Workplan development	Development of required workplan(s) and permitting: • Kickoff and internal coordination meetings • Permitting and coordination with regulatory authorities • ADEC CSP assessment/corrective action workplan • Contractor Procurement documents • Waste Disposal Plan
Debris Removal	Remove and dispose of debris to the extent practicable from the Intertidal Sediment Contamination zone
Soil/sediment excavation	Removal of accessible material from the following areas assuming volumes provided per the TBA cost estimate: • Upland Soils – 210 CY • Intertidal Sediment Contamination zone – 550 CY • Former AST Cluster soils – 110 CY
Site assessment	Perform additional site assessment and disposal characterization during and after soil/sediment removal. Results will be used to document conditions and inform the risk assessment. Notable additional areas of assessment from the TBA include northeast of the generator building, the area beneath the cannery building/boilers, and the southwest corner of the cannery building
Transport and disposal	Includes transport of soil from Kake to final disposal in Oregon, assumes 25-80% of soil (depending on location) requires stabilization
Site restoration	Backfill using clean local fill (within 5 miles) and restoration of tidelands
Monitored natural attenuation and risk assessment	Risk management analysis and yearly monitoring of contaminated soils left in place due to being inaccessible
Long-term management	5-years O&M activities include annual inspections of remediated area for slope and regrade stability, health and success of vegetation, and signs or indicators of residual or new contamination

Effectiveness: 4
This alternative would reduce the toxicity, mobility, and volume of contamination in the soil and sediment. The accessible contaminated material would be removed from the site and treated at a dedicated offsite treatment facility. If implemented, this alternative would protect human health, safety and welfare at the site and in Kake. The contaminated soil that can be excavated would be fully removed from the site and the community.

There is potential for contamination as the soil is transported within Kake, over water, and through the lower 48. Additionally, if the soil is not containerized and instead is stockpiled at other locations while in transport, soil sampling at these locations will be necessary to verify contamination has not spread to those areas. Excavation and the introduction of machinery to complete the excavations could impact human health, safety and welfare and the environment, particularly on the shoreline. There is also risk to the integrity of the cannery building from excavation activities, some of which will be in very close proximity to the building's foundation in the Intertidal Sediment Contamination zone.

Implementability: 4
This alternative is technically and administratively feasible. The Arlington, Oregon, facility is a well-established treatment facility with the necessary infrastructure in place to stabilize and safely dispose of the soil. This alternative also requires more management from OVK in the short term but less than other alternatives in the long term. This alternative accomplishes the desired outcomes at the fastest rate compared to longer-term treatment methods.

Feasibility for Upland Soil is high, while the feasibility for the sediment excavation is lower due to the nature and location of the media, as well as the increased regulatory and permitting requirements potentially associated with working on the shoreline of Keku Straight. Additionally, all work adjacent to the cannery building would need to be coordinated with the Tribal and State Historic Preservation Offices.

4.3 Alternative 3: Excavation, Local Landfarm and Lower 48 Disposal, and MNA

Similar to Alternative 2, accessible soil/sediment in the Intertidal Sediment Contamination zone and at the former AST cluster would be excavated and disposed of off-island with risk assessment and MNA of inaccessible soils. Soil in the Upland area would be excavated, field screened and segregated based on contaminants of concern, targeting the areas with metal contamination for landfill disposal. Polluted soil in the Upland area not containing metals above the cleanup levels would be transported to an off-site location within Kake and landfarmed. This alternative would include the tasks outlined in Table 4-1, as well as the following additional tasks associated with landfarming:

Table 4-2 – Additional Work Task Descriptions

Work Task Name	Description
Identification and procurement of off-site location within Kake	Obtaining and preparing off-site location for new treatment cell
Transport of soil within Kake	Transport of soil from Keku Cannery to the landfarming location
Treatment infrastructure	Design of landfarming techniques best suited to the contaminants of concern and current concentrations
Ongoing long-term treatment	Assumes five years of treatment to meet requirements for unrestricted disposal. Includes equipment, materials and annual sampling (in addition to soil sampling/assessments task
Soil sampling/assessment	Assumes a baseline of two sampling events for landfarm location (baseline/closeout)

This alternative is dependent on the results of soil characterization sampling and accurate field segregation of soils during excavation. Landfarming is only a viable cleanup method for organic (petroleum-related) contamination and this approach assumes that approximately 50% of the contaminated soil can be treated in a landfarm. If metal contaminants are detected above DEC cleanup standards, the contaminated soil would need to be disposed of at an appropriate landfill in the Lower 48. The remaining polluted soil (only petroleum contamination) would be landfarmed. Generally, post-treatment contaminant concentrations must be below the most stringent DEC cleanup levels in order to allow for unrestricted disposal of the soil.

Off-site treatment in Kake would require the development of a new treatment cell at a location selected and procured by OVK. The off-site location chosen for remediation prior to disposal would require DEC and landowner approval. Coordination for the construction and management of a treatment cell would be through the DEC Contaminated Sites Program and the landowner and would require approval for both design and cleanup criteria. Any selected location would need to be secured and a suitable distance from village residents so exposure to the material during treatment can be controlled.

Effectiveness: 4
This alternative is expected to reduce the toxicity, mobility, and concentration of contamination on the site. If implemented and given enough time, this alternative would protect human health, safety and welfare and the environment. The excavated soil will be entirely removed from the site, and petroleum concentrations will be reduced to acceptable limits according to DEC.

There is risk of adverse effects with this alternative, as contaminated soil is transported to an alternate location and is expected to be placed on currently uncontaminated soil. If there is an issue during transportation or if the new treatment cell is not properly established, contamination could spread beyond the current location or the approved landfarm. This long-term treatment method would need to be managed by OVK until the cleanup criteria have been met. Additionally, landfarming remediation methods slow as temperature decreases, placing seasonal constraints on the viability of this method, particularly edue to shorter summers in Kake.

Implementability: 3
The implementability of this is lower than Alternative 2. There are increased logistics, such as additional field screening and stockpiling methods associated with segregating soils during excavation. Additional assessment may also be needed prior to excavation work in order to determine an accurate site-specific correlation between field screening methods and laboratory concentrations of metals in the soil.

The transportation of soil and construction of a treatment cell are relatively straightforward elements of this alternative. However, identifying and procuring a new location, combined with long-term management, may decrease the viability of this alternative during the workplan development stages. Because no treatment facility exists in Kake, nor is one in the process of being constructed, developing a new treatment facility in a new location could have unforeseen challenges and prolong the cleanup process. Additionally, DEC will require annual or periodic monitoring of the remedial process throughout the period of the treatment operation. Long-term soil management also entails making sure the necessary equipment and personnel are available to administer the treatment.

4.4 Alternative 4: Risk Assessment and Targeted Remediation

The overall recommendation of the TBA was to complete further assessment of each of the three areas. Alternative 3 utilizes the assumptions and costs associated with the recommendations of the TBA and assumes that the data will be used to perform a risk analysis of the entire site. The risk analysis can then be used to develop one or more remedial actions that are targeted to reduce a specific type and volume of contaminated material. Figure 1 of the Recommended Sampling Plan identifies proposed locations for surface and subsurface sediment and soil sampling, as well as groundwater sampling. While significant remediation and characterization have since occurred in the area of the former AST Cluster, additional sampling is expected to be needed in each of the three areas of contamination (Intertidal Sediment, Upland Soils and AST Cluster) to complete a comprehensive risk assessment for the site. For the purposes of cost estimating, the comprehensive risk assessment is assumed to be 50% greater than the additional assessment described in the TBA. In addition, the remediation efforts to address the highest levels of contaminated soil (through excavation and shipment to the Lower 48) are represented by 40% of the TBA options (1a, etc.).

Effectiveness: 5
This alternative is intended to identify and manage/reduce the remaining contamination on the site by completing a detailed risk assessment followed with targeted remediation. This is expected to reduce the toxicity, mobility, and concentration of contamination on the site through a risk—based approach that remediates the most toxic locations and provides clear management strategies for any contaminants that are left in place. The detailed delineation will allow the remediation effort to target specific risks in each of the three areas. The risk assessment will provide alternative strategies (i.e. not remediation) to manage less-contaminated material in place while maintaining sufficient protection for human health and the environment. In this way, the overall effectiveness is considered higher due to the greater data density and increased understanding of site conditions relative to Alternatives 2 and 3.

Implementability: 5
The objective of this Alternative is to divide the contaminated areas into two risk categories: locations that have an acceptable risk and those that require remediation. By specifically focusing on risk-based exposure pathways to human health and the environment, the delineation is expected to identify much smaller areas for remediation and provide clear risk management tools for other areas. The data collection for this task is expected to be easily implementable because it is essentially defined in the TBA and is an extension of the work that has already been completed. The targeted remediation (with Lower 48 disposal) will be more easily implemented than Alternatives 2 and 3 because the scope and volumes will be reduced. Furthermore, the longer term management of the site will be the same or easier than Alternatives 2 and 3 because the additional data will provide clarity regarding the risks and management.

4.5 Excluded Alternatives

As noted in the TBA, some treatment methods proposed may not be feasible options to reduce metals and some SVOC contaminants that are present at the site. Additionally, the sensitive nature of this site due to its proximity to Keku Straight make it likely that cleanup options such as in-situ chemical oxidation could require significant and unforeseen costs, such as multi-agency regulatory coordination and post-treatment monitoring. In order to move the site towards closure, the cleanup options proposed in this ABCA focus on methods that are appropriate for the documented contaminants and are most likely to be successful in achieving project objectives based on effectiveness, implementability, and cost. Options that were excluded based on the evaluation criteria, including those proposed in the TBA as well as other alternatives considered, are described below.

In-situ Treatment
Due to accessibility challenges with much of the soil that needs remediation, treating the soil in-place would reduce excavation requirements and address more of the petroleum contaminated soil than excavation-focused alternatives. However, more intensive and longer-term management would be required to monitor the treatment processes and ensure that the treatment is working effectively, such as regular soil sampling for an indefinite period of time. This alternative would also require close coordination with DEC and other agencies, along with oversight by qualified, third-party personnel.

The TBA specifically proposed multiple applications of chemical oxidation of soils at the site, including in-situ and via excavating soil in batches and applying the treatment, and placing the soil back in its original place. Though prescribed in the TBA due to the widespread petroleum contamination at the site, in-situ would not be an effective remediation solution for soils contaminated with inorganic contaminants, such as metals. The TBA also notes that in-situ treatment petroleum-related contaminants would be reduced using this method, but the corresponding cost and feasibility may not be appropriate for a remediation technique that does not achieve the cleanup goals. It is likely difficult to estimate costs for in-situ treatment due to greater than anticipated amounts of coordination, monitoring, and risk management, especially in consideration of the apparent migration of groundwater and impacted media to the intertidal environment. Due to the ineffectiveness with some contaminants (particularly metals) and the potential ecological risks associated with the chemical oxidizers (particularly in the Intertidal Sediment Contamination zone), this option is not considered viable.

Bicknell Landfarm Disposal
Bicknell Landfarm, located in Juneau, Alaska, is a Class C Offsite Treatment Facility that treats petroleum-contaminated soils from recent and historic petroleum sources. The soil would be transported to Juneau via barge. However, the Bicknell Landfarm cannot accept RCRA hazardous waste. The Bicknell location is north of the Site while the nearest facility permitted to take RCRA hazardous waste is south of the facility. While this facility is closer to the Site, this would require an entirely separate barge mobilization. On a site that already has highly complex logistics, increasing the barge logistics to transport soil to multiple locations is not considered reasonable and is unlikely to reduce costs.

4.6 Cost Comparison

NORTECH has attempted to estimate costs for these alternatives by identifying the major work tasks of each alternative from the TBA and using reasonably available information from recent projects to adjust costs for the current construction environment. While the detailed costs developed by E&E for each work task have not been reevaluated, the total estimated costs for the tasks are considered adequate as a starting point to understand the rough order of magnitude of each alternative relative to the other alternatives. Table 4-3 provides a summary of the alternatives and costs that are expected to be included in each of the three active alternatives. Additional cost details are provided in Appendix A. Appendix B includes relevant cost information referenced from the TBA. Alternative 1 is not included due to its lack of viability.

Table 4-3 – Updated Cost Estimate

Cleanup Alternative	2016 Estimate[(1)]	2025 Estimate[(2)]	Additional Factor[(3)]	Total
Alternative 2 – Excavation and Off-Island Landfill Disposal, and MNA	1,923,850	2,558,721	17%	**2,989,673**
Alternative 3 – Targeted Excavation and Off-Island Landfill Disposal, Landfarming, and MNA	1,876,350	2,495,546	17%	**2,907,887**
Alternative 4 – Risk Assessment and Targeted Remediation	1,029,758	1,369,579	8%	**1,475,736**

Notes:
(1) Adjustments to the 2016 estimate and task activities are detailed in Section 4.2 and Appendix A.
(2) The adjustment to 2025 dollars is based on the +33% change in Consumer Price Index Inflation from 2016 to 2024 (U.S. Bureau of Labor Statistics)
(3) The additional factors that increased the price for each Alternative are discussed in the alternatives.

5.0 RECOMMENDED CLEANUP ALTERNATIVE

5.1 Preferred Alternative Analysis

The table below provides each alternative with a rating according to the above discussion. The total score was used to inform the recommended alternatives identified below.

Table 5-1 – Cleanup Alternative Evaluation Summary

Cleanup Alternative	Effectiveness	Ease of Implementation	Cost	Total
Alternative 1 – No Action	1	5	5	11
Alternative 2 – Landfill Disposal	4	4	3	11
Alternative 3 – Landfill & Landfarm	4	3	3	10
Alternative 4 – Risk Assessment	5	5	4	14

Based on the total evaluation scores, Alternatives 2 and 4 are the most favorable cleanup options for the site. In this analysis, the no action option appears to score as high as or higher than the active alternatives. However, this is due to the “zero” cost and effort due to the inherent nature of performing less work. As Alternative 1 does not achieve the project goals, it is not considered a viable Alternative. Alternative 3 is the lowest scoring option and is not considered viable because it does not represent an increase in value over Alternative 4 or a significant reduction in cost over Alternative 2

Alternative 4 is the highest scoring and most cost-effective option. It will provide necessary information about the site, is implementable, and is the least cost based on the reduced quantity of soil that is expected to be remediated off-site. Alternative 4 improves the long-term user experience at the site by assessing the risk and selecting a targeted remediation approach that best reduces the actual risks associated with the contaminants at the site. The main trade-off for this reduced cost is the long-term management of the risk associated with the residual contaminants by the owner/operator of the facilities. This alternative provides a risk-based balance that is considered the best value and preferred alternative with limited available funding.

Alternative 2 is the second highest score and represents the removal of the contaminants from the site and the community, permanently transferring most risk associated with the contamination to commercial entities developed for this specific purpose. This requires significantly more financial resources, but remediation of the site would be accomplished rapidly and efficiently. If the financial resources are available, Alternative 2 is the preferred option.

5.2 Climate Adaptation Considerations

This remediation project does not have many significant items related to climate change and/or adaptation. While limited information is available related to climate change adaptation in southeast Alaska, the material is not in an area that appears to be subject to significant flooding, erosion potential, or sea level changes due to climate change, and none of the alternatives will move it to a location with greater climate risk factor(s). The site is already in the process of being redeveloped and the future use is considered the same for all alternatives. As the site is no longer used as a cannery, climate change impacts to marine resources such as fish and shellfish are not applicable.

Due to the limited number of options for treatment of the contaminated material at the site, any remedial alternative will likely have a similar carbon footprint. Therefore, the primary impact of the project on climate change is expected to be the carbon footprint of the transportation of the material. Alternatives 2 and 3 have a similar carbon footprint for hauling the material within Kake and off-island, while Alternative 4 has a lower carbon footprint as it is expected to include reduced overall remedial action. However, Alternatives 2 and 3 have more defined timeframes and therefore are likely to have less ongoing long-term carbon footprint. Each of these four options is consistent with typical remediation projects in this part of Alaska.

5.3 Green and Sustainable Remediation Measures for Selected Alternative

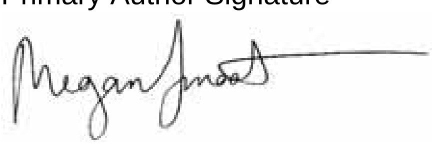
To make the selected alternative greener, or more sustainable, several techniques should be planned. The most recent Best Management Practices (BMP) issued under ASTM Standard E-2893: Standard Guide for Greener Cleanups will be used as a reference in this effort. For example, the OVK could require the cleanup contractor to follow an idle-reduction policy and use heavy equipment with advanced emissions controls operated on ultra-low sulfur diesel. Due to the limited number of options for transportation and remediation of this stockpile, none of these BMPs are expected to be incorporated into the final project.

6.0 LIMITATIONS AND USE OF THIS ABCA

NORTECH provides a level of service that is performed within the standards of care and competence of the environmental engineering profession. This ABCA is intended to provide project stakeholders and the public with an overview of the project history, goals of the project, and cleanup alternatives, and does not constitute a cleanup workplan. Each work task and associated cost is based on a major component of work that will be necessary to complete one or more of the alternatives.

These work tasks and associated costs are based on the TBA and previous experience with similar projects. The estimated costs are considered adequate to understand the rough order of magnitude (ROM) of each alternative relative to the other alternatives. More specific information regarding the rationales, regulatory acceptability, and detailed costs for specific work tasks are recommended after the list of alternatives has been reduced based on review of the conceptual viability of each alternative as described in this document.

Primary Author Signature



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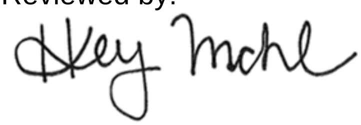

Haley Michael, PE
Environmental Engineer

Appendix A
Tables

Table A-1: Updated Cost Estimate

Area	Action	Variable x	% x	Variable y	% y	2016 Estimate*	8-year CPI (33%)	Add Factor	2025 Estimate
Alternative 2									
Upland Soil	Haul South	100% of Option 1a (Upland)	100%	n/a	-	$ 509,647	$ 677,831	10%	$ 745,614
Sediment	Haul South	100% of Sediment Removal Alternative	100%	n/a	-	$ 960,000	$ 1,276,800	10%	$ 1,404,480
ASTs Soil	Haul South	100% of Option 1a (ASTs)	100%	n/a	-	$ 354,119	$ 470,978	50%	$ 706,467
Inaccessible	MNA and Risk Eval at Limits	50% of Additional Assessment	50%	n/a	-	$ 100,084	$ 133,112	0%	$ 133,112
				Alternative 2 totals		**$ 1,923,850**	**$ 2,558,721**	17%	**$ 2,989,673**
Alternative 3									
Upland Soil	Targeted Haul South and Landfarm Remaining	75% of Option 1a	75%	25% of Option 1b	25%	$ 462,147	$ 614,656	8%	$ 663,828
Sediment	Haul South	100% of Sediment Removal Alternative	100%	n/a	-	$ 960,000	$ 1,276,800	10%	$ 1,404,480
ASTs Soil	Haul South	100% of Option 1a (ASTs)	100%	n/a	-	$ 354,119	$ 470,978	50%	$ 706,467
Inaccessible	MNA and Risk Eval at Limits	50% of Additional Assessment	50%	n/a	-	$ 100,084	$ 133,112	0%	$ 133,112
				Alternative 3 totals		**$ 1,876,350**	**$ 2,495,546**	17%	**$ 2,907,887**
Alternative 4									
Upland Soil	Detailed Assess, Risk Eval, Limited Haul South	150% of Additional Assessment	150%	25% haul south**	40%	$ 504,111	$ 670,467	5%	$ 703,991
Sediment	Detailed Assess, Risk Eval, Limited Haul South	Included in other costs	-	25% haul south**	40%	$ 384,000	$ 510,720	5%	$ 536,256
ASTs Soil	Detailed Assess, Risk Eval, Limited Haul South	Included in other costs	-	25% haul south**	40%	$ 141,648	$ 188,391	25%	$ 235,489
Remaining	MNA	Included in other costs	-	n/a	-	$ -	$ -	0%	$ -
				Alternative 4 totals		**$ 1,029,758**	**$ 1,369,579**	8%	**$ 1,475,736**

Notes

*	Adjustments to the 2016 estimate and task activities are provided in the following table A-2
**	Excavation and shipment of 25% of the soil to the Lower 48 are represented by 40% of the TBA Options
n/a	not applicable
-	none

Table A-2: TBA Cost Adjustment Summary (2016 Dollars)

Option	Total	ORC	Tank Removal	Adjusted Total
Upland 1a	$ 550,000	$ 40,353	n/a	$ 509,647
ASTs 1a	$ 380,000	n/a	$ 25,881	$ 354,119
Sediment Removal	$ 960,000	n/a	n/a	$ 960,000
Additional Assessment	$ 200,168	n/a	n/a	$ 200,168
Upland 1b	$ 360,000	$ 40,353	n/a	$ 319,647
ASTs 1b	not used			

Note: See Section 4 for additional explanation of 2016 cost estimate scope modifications

Appendix B
Excerpts from the *Targeted Brownfields Assessment*, Ecology and Environment, Inc. (2016)

G Additional Sampling Memo

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ecology and environment, inc.
Global Environmental Specialists
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MEMORANDUM

DATE: December 15, 2016

TO: Joanne LaBaw, Task Monitor, EPA, Seattle, WA, Mail Stop ECL-122

FROM: Derek Pulvino, Project Manager, E & E, Seattle, WA

THROUGH: Linda Ader, START-IV Team Leader, E & E, Seattle, WA LEA

SUBJECT: Follow-on Sampling and Testing
Keku Cannery (former)
Kake, Alaska

REF: Contract Number: EP-S7-13-07
Technical Direction Document Number: 15-05-0003

Soil and ground water sampling completed at the Keku Cannery (former) site in support of a Targeted Brownfields Assessment (TBA) has identified multiple areas of contamination. As discussed in detail within the associated TBA report, cleanup of those contaminated areas is recommended. However, the full vertical and lateral extent of contamination does not appear to have been fully defined nor have all potential upgradient sources been identified.

This memorandum outlines a recommended sampling strategy that will address remaining data gaps and provides a rough cost estimate for completing this work. Suggested sampling equipment is also discussed. Figure 1 depicts the recommended sample locations. For additional detail and rational for recommended sampling, please refer to the TBA report.

Sampling Locations:

- **Intertidal and Subtidal Surface and Subsurface Sediment Samples**: Collecting both surface and subsurface sediment samples is recommended from thirteen locations around the perimeter of known contamination. These samples would help define the vertical and lateral extent of contamination. It is recommended that two sediment samples be collected per location with one from 0 to 6 inches and one from 12 to 18 inches below the sediment surface.

  In addition, it is recommended that subsurface sediment samples be collected from six locations within the area of sediment contamination identified during the TBA. Sample locations would target areas where bedrock was not encountered during surface sediment sampling. These samples would also be collected from 12 to 18 inches beneath the sediment surface.

- **Aboveground Storage Tank Surface Soil Samples:** Six locations with one surface soil sample collected from 0 to 6 inches per location in the area surrounding the aboveground storage tank (AST) cluster. Previous sampling in this area did not fully define the lateral extent of soil impacts.
- **Upland Subsurface Soil and Ground Water Boring Samples**: Nine boring locations with three soil samples per boring. It is suggested that all borings be advanced using a drill rig as opposed to advancing any with hand tools due to uncertain subsurface conditions. Ground water samples are proposed from five of these locations. This includes:
    - Five borings in the gravel parking/drive area, along the fuel line that ran from the old fuel house to the day tank by the generator building. That area, building, and associated fuel line represent potential contaminant sources upgradient from the generator building. It is recommended that subsurface soil sampling target maximum depths of at least 16 to 20 feet or the bedrock contact (whichever is first), collecting the three samples as needed between this depth and the ground surface. Ground water samples are recommended from at least three of these locations;
    - Two borings north/northwest and cross- to down-gradient of the area of contamination identified near the generator building. These borings would target depths of at least 4 to 8 feet, with ground water collected from one location; and
    - Two boring on the downgradient side of the AST cluster. Both borings would target depths of 8 to 12 feet, with ground water sampled from one location.
- **Generator Building Upland Area and Intertidal Ground Water Samples**: Four shallow (i.e., greater than 2 feet beneath the ground surface) ground water samples are proposed, including two in the upland area west of generator building, and two in the area of the apparent seep identified in the intertidal zone. As envisioned, these samples would be collected from hand dug holes, likely using a peristaltic pump.

Analysis:

The bulleted text below outlines the recommended analytical strategy. Table 1 summarizes this information.

- Analysis of all AST area and upland soil and ground water samples for diesel range organics (DRO) and residual range organics (RRO). Samples from the AST area should also be analyzed for gasoline range organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX).
- Analysis of intertidal/subtidal zone sediment and ground water samples for polycyclic aromatic hydrocarbons (PAHs) and the eight metals that were detected at concentrations above regulatory standards (i.e., arsenic, barium, cadmium, chromium, copper, lead, nickel, silver, and zinc). Although there are no regulatory “cleanup levels” for DRO/RRO in sediment, given the previous detections of DRO/RRO in the intertidal zone

and the associated toxicity of these compounds, it is recommended that all inter/sub-tidal zone sediment sample analyses include DRO/RRO.

Table 1 includes four additional "opportunity" borings, with up to three soil subsurface soil samples per boring, and ground water samples from up to two of these borings to account for unforeseen conditions that may warrant the placement of additional borings.

Additional Recommendations:

It may be beneficial to employ various field screening techniques to assist with the selection of sample locations for fixed laboratory analysis and to help determine whether "opportunity" borings should be drilled. More specifically, reagent kits with specialized field reading instrumentation are available for petroleum compounds (e.g., PetroFlag™) and PAHs. In addition, an X-Ray Fluorescence (XRF) unit could be used to screen metals concentrations in sediment; though these samples would likely require drying and sieving prior to analysis with the XRF in order to generate data of sufficient quality for decision making.

With the remote nature of the site and commensurate mobilization and demobilization costs, collecting deeper subsurface sediment samples from 24 to 30 inches below sediment surface, and collecting surface and subsurface samples from a second more distant perimeter "ring" of sample locations during the first round of sampling may be prudent. This second "ring" of samples is depicted on the attached sampling plan map (Figure 1) as "Potential Follow-on Sediment" locations and includes 13 points. Deeper subsurface sediment sample would be collected at all locations.

Finally, since the source of PAHs in sediment is unclear (i.e., they could be from petroleum sources or from the creosote-treated cannery building pilings), conducting a PAH "fingerprint analysis" may also be warranted. While the costs for this analysis are not included in the estimates below, the analytical cost may range from $200 to $250 per sample.

Estimated Costs:

The estimated costs to undertake the above discussed sampling are provided below.

Base Sampling: Covers preparation of a basic sampling plan, health and safety plan, labor for field sampling, subcontractor costs (laboratory and drilling work), preparation of a summary report, and general project management:

- Labor — $40,000 to $60,000
  (Assumes all planning work, reporting work, and two days of mob/demob time with six 12-hour field days for 2 workers)
- Travel and Per Diem: — $4,700
- Equipment, Supply, and Sample Shipping: — $3,000-$3,500
- Subcontractor Costs (Laboratory and Drilling): — $57,000
  (Assumes 5% markup by consultant on subcontracted services)

Total Estimated Cost: **$104,700 to $125,200**

Addition of Field Screening: Covers cost for travel and field time for one field chemist to be onsite during the sampling event, as well as the cost for field screening kits to process up to 50 samples. Assumes consultant has an XRF and sample preparation equipment to allow for metals field screening. Depending on number of samples to be screened, additional personnel may be needed:

- Labor — $7,000 to $13,000

(Assumes two days of mob/demob time with six 12-hour field days for one chemist)

- Travel and Per Diem: — $2,286
- Field Screening Kits: — $10,450
  (Assumes 5% markup by consultant on kit purchase)

Total Estimated Cost: **$19,736 to $25,736**

Collection of Additional Sediment Samples: Covers cost for travel and field time for two personnel to be onsite for the duration of sampling:

- Labor — $20,000 to $26,000

(Assumes two days of mob/demob time with six 12-hour field days for two field staff)

- Travel and Per Diem: — $4,680
- Additional Equipment and Sample Shipping: — $1,500
- Subcontractor Cost (Laboratory): — $17,052
  (Assumes 5% markup by consultant on subcontracted services)

Total Estimated Cost: **$43,232 to $49,232**

Note that these costs are only estimates. Actual costs are likely to vary based on work undertaken, contractor/consultant labor rates, and the analysis performed and laboratory used.

Additionally, depending on tides and actual locations selected for sampling, collecting some recommended surface and subsurface sediment samples may require the use of a boat with a davit, and specialized sampling equipment (e.g., Van Veen sampler, coring equipment). Rental and/or subcontract costs for such services or equipment are not included in the estimates outlined above.

Attachments:

Table 1 – Summary of Analysis

Figure 1 – Recommended Sampling Plan

Table 1 - Summary of Analysis

Base Sampling								
Sampling Area	**Media**	**Number of Locations (a)**	**Samples Per Location (b)**	**Total Samples (a x b)**	**Analysis**			
					GRO / BTEX	**DRO / RRO**	**PAHs**	**Select Metals**
Intertidal/Subtidal Samples	Surface and Subsurface Sediment	13	2	26		26	26	26
	Subsurface Sediment	6	1	6		6	6	6
AST Samples	Soil	6	1	6	6	6		
Upland Borings	Soil	9	3	27	3	27		
	GW	5	1	5	1	5		
Generator Bldg and Intertidal Samples	GW	4	1	4		4		
Borings (Opportunity)	Soil	4	3	12	12	12		
	GW	2	1	2	2	2		
				Subtotal	**24**	**88**	**32**	**32**

Additional Sediment Sampling								
Sampling Area	**Media**	**Number of Locations**	**Samples Per Location**	**Total Samples**	**Analysis**			
					GRO / BTEX	**DRO / RRO**	**PAHs**	**Metals**
Second Ring Sediment	Sediment	13	2	26		26	26	26
Deeper Sediment	Sediment	32	1	32		32	32	32
				Subtotal	**0**	**58**	**58**	**58**

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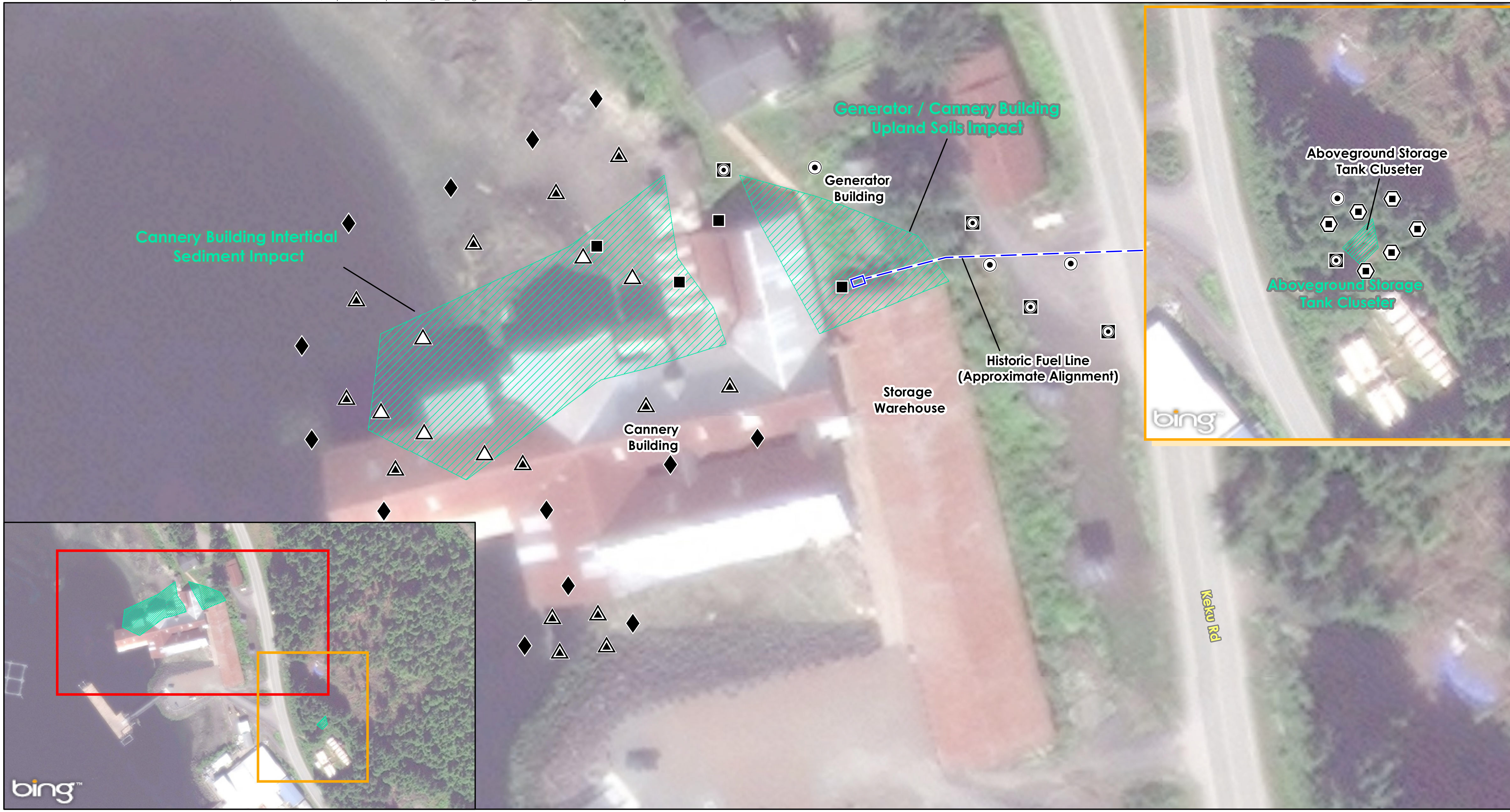

Zone of Contamination

Sample Key:

- Sediment (Surface & Subsurface)
- Sediment (Subsurface Only)
- Potential Follow-on Sediment
- Ground Water (Only)
- Surface & Shallow Subsurface Soil
- Subsurface Soil (Borings)
- Subsurface Soil and Ground Water (Borings)

Figure 1
Keku Cannery (former)
Recommended Sampling Plan
Kake, AK

ecology and environment, inc.
Global Environmental Specialists

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H Cleanup Cost Estimate

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Table 1a
Cost Estimate
Soils Removal Alternative 1a - Landfill Disposal
Keku Cannery (Former)
Kake, Alaska

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DC1a	Mobilization/Demobilization	1	lump sum	$40,987	$40,987
DC2	Field Overhead and Oversight	2	week	$15,374	$30,747
DC3a	Site Preparation	1	lump sum	$14,362	$14,362
DC4a	Remove Contaminated Soil for Landfill Disposal	210	cubic yard	$1,174	$246,475
DC5a	Backfill/Restore Excavated Areas	180	cubic yard	$31	$5,600
DC6	Site Restoration	1	lump sum	$6,033	$6,033
DC7a	Construction Completion	1	lump sum	$17,662	$17,662
Total Direct Capital Costs (rounded to nearest $1,000)					***$362,000***
Indirect Capital Costs					
	Engineering and Design (5%)	5%			$18,000
	Administration (4%)	4%			$14,000
	Legal Fees and License/Permit Costs (4%)	4%			$14,000
	3rd Party Construction Oversight (5%)	5%			$18,000
Subtotal Indirect Capital Costs (rounded to nearest $10,000)					***$60,000***
Subtotal Capital Costs					$422,000
Contingency Allowance (20%)					$84,000
Total Capital Cost (rounded to nearest $1,000)					**$506,000**
Annual Direct Operation & Maintenance Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1a	Operation and Maintenance Costs	1	lump sum	$7,000	$7,000
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$7,000*
Annual Indirect O&M Costs					
	Administration	5%			$350
	Insurance, Taxes, Licenses	3%			$210
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
	Subtotal Annual O&M Costs				*$8,000*
	Contingency Allowance	15%			$1,200
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$9,000**
5 Year Cost Projection (Assume Discount Rate Per Year: 0.6%)					
Total Capital Costs					506,000
Present Worth of O&M assuming 0.6% Discount Factor (Rounded to Nearest $10,000)					$40,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$550,000**

Notes
1. Unit costs provided by Means were taken from *RSMeans Heavy Construction Cost Data, 30th Ed., 2016.*
2. Barging, Disposal, and ORC costs were taken from vendor quotes, or extrapolated from vendor quotes received in 2016.
3. O&M costs account for an annual site inspection with minimal maintenance, an annual report, and mobilization/demobilization effort.

Table 1b
Cost Estimate
Soils Removal Alternative 1b - Land Farm Disposal Near Site
Keku Cannery (Former)
Kake, Alaska

Direct Capital Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DC1a	Mobilization/Demobilization	1	lump sum	$40,987	$40,987
DC2	Field Overhead and Oversight	1	week	$15,374	$15,374
DC3a	Site Preparation	1	lump sum	$14,362	$14,362
DC4b	Remove Contaminated Soil for Land Farm	210	cubic yard	$266	$55,917
DC5a	Backfill/Restore Excavated Areas	180	cubic yard	$31	$5,600
DC6	Site Restoration	1	lump sum	$6,033	$6,033
DC7a	Construction Completion	1	lump sum	$17,662	$17,662
Total Direct Capital Costs (rounded to nearest $1,000)					***$156,000***
Indirect Capital Costs					
	Engineering and Design (5%)	5%			$8,000
	Administration (4%)	4%			$6,000
	Legal Fees and License/Permit Costs (4%)	4%			$6,000
	3rd Party Construction Oversight (5%)	5%			$8,000
Subtotal Indirect Capital Costs (rounded to nearest $10,000)					***$30,000***
Subtotal Capital Costs					$186,000
Contingency Allowance (20%)					$37,000
Total Capital Cost (rounded to nearest $1,000)					**$223,000**
Annual Direct Operation & Maintenance Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1b	Operation and Maintenance Costs	1	lump sum	$13,000	$13,000
ES	Land Farm Operation and Maintenance Costs	1	lump sum	$8,900	$8,900
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$22,000*
Annual Indirect O&M Costs					
	Administration	5%			$1,100
	Insurance, Taxes, Licenses	3%			$660
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$2,000*
	Subtotal Annual O&M Costs				*$24,000*
	Contingency Allowance	15%			$3,600
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$28,000**
5 Year Cost Projection (Assume Discount Rate Per Year: 0.6%)					
Total Capital Costs					223,000
Present Worth of O&M assuming 0.6% Discount Factor (Rounded to Nearest $10,000)					$140,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$360,000**

Notes

1. Unit costs provided by Means were taken from *RSMeans Heavy Construction Cost Data, 30th Ed., 2016.*
2. Barging, Disposal, and ORC costs were taken from vendor quotes, or extrapolated from vendor quotes received in 2016.
3. ES = Engineer's Estimate
4. O&M costs account for an annual site inspection with minimal maintenance, an annual report, and mobilization/demobilization effort.

Table 2
Cost Estimate
Soils Removal Alternative 2 - ORC Treatment
Keku Cannery (Former)
Kake, Alaska

Direct Capital Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DC1b	Mobilization/Demobilization	1	lump sum	$10,770	$10,770
DC2	Field Overhead and Oversight	1	week	$15,374	$15,374
DC3a	Site Preparation	1	lump sum	$14,362	$14,362
DC4c	Treat Contaminated Soil	210	cubic yard	$613	$128,769
DC6	Site Restoration	1	lump sum	$6,033	$6,033
DC7a	Construction Completion	1	lump sum	$17,662	$17,662
Total Direct Capital Costs (rounded to nearest $1,000)					***$193,000***
Indirect Capital Costs					
	Engineering and Design (5%)	5%			$10,000
	Administration (4%)	4%			$8,000
	Legal Fees and License/Permit Costs (4%)	4%			$8,000
	3rd Party Construction Oversight (5%)	5%			$10,000
Subtotal Indirect Capital Costs (rounded to nearest $10,000)					***$40,000***
Subtotal Capital Costs					$233,000
Contingency Allowance (20%)					$47,000
Total Capital Cost (rounded to nearest $1,000)					**$280,000**
Annual Direct Operation & Maintenance Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1b	Operation and Maintenance Costs	1	lump sum	$13,000	$13,000
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$13,000*
Annual Indirect O&M Costs					
	Administration	5%			$650
	Insurance, Taxes, Licenses	3%			$390
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
	Subtotal Annual O&M Costs				*$14,000*
	Contingency Allowance	15%			$2,100
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$16,000**
5 Year Cost Projection (Assume Discount Rate Per Year: 0.6%)					
Total Capital Costs					280,000
Present Worth of O&M assuming 0.6% Discount Factor (Rounded to Nearest $10,000)					$80,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$360,000**

Notes

1. Unit costs provided by Means were taken from *RSMeans Heavy Construction Cost Data, 30th Ed., 2016.*
2. Barging, Disposal, and ORC costs were taken from vendor quotes, or extrapolated from vendor quotes received in 2016.
3. O&M costs account for an annual site inspection with minimal maintenance, an annual report, and mobilization/demobilization effort.

Table 3
Cost Estimate
Sediment Removal Alternative - Landfill Disposal
Keku Cannery (Former)
Kake, Alaska

Direct Capital Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DC1a	Mobilization/Demobilization	0	lump sum	$40,987	$0
DC2	Field Overhead and Oversight	2	week	$15,374	$30,747
DC4d	Remove Contaminated Sediment	550	cubic yard	$1,082	$595,362
DC5b	Backfill/Restore Excavated Areas	480	cubic yard	$38	$18,242
DC7a	Construction Completion	0	lump sum	$17,662	$0
Total Direct Capital Costs (rounded to nearest $1,000)					***$644,000***
Indirect Capital Costs					
	Engineering and Design (5%)	5%			$32,000
	Administration (4%)	4%			$26,000
	Legal Fees and License/Permit Costs (4%)	4%			$26,000
	3rd Party Construction Oversight (5%)	5%			$32,000
Subtotal Indirect Capital Costs (rounded to nearest $10,000)					***$120,000***
Subtotal Capital Costs					$764,000
Contingency Allowance (20%)					$153,000
Total Capital Cost (rounded to nearest $1,000)					**$917,000**
Annual Direct Operation & Maintenance Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1a	Operation and Maintenance Costs	1	lump sum	$7,000	$7,000
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$7,000*
Annual Indirect O&M Costs					
	Administration	5%			$350
	Insurance, Taxes, Licenses	3%			$210
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
	Subtotal Annual O&M Costs				*$8,000*
	Contingency Allowance	15%			$1,200
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$9,000**
5 Year Cost Projection (Assume Discount Rate Per Year: 0.6%)					
Total Capital Costs					917,000
Present Worth of O&M assuming 0.6% Discount Factor (Rounded to Nearest $10,000)					$40,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$960,000**

Notes

1. Unit costs provided by Means were taken from *RSMeans Heavy Construction Cost Data, 30th Ed., 2016.*
2. Barging and Disposal costs were taken from vendor quotes, or extrapolated from vendor quotes received in 2016.
3. Mobilization and Demobilization costs are not included in this alternative. It is assumed the equipment will be brought as part of Soils Alternate 1a or 1b.
4. Site preparation costs (DC3a) are not included in this Alternative. It is assumed site preparation will be performed as part of the chosen soils removal alternative, and will be sufficient for sediment removal as well.
5. Site restoration costs (DC6) are not included in this Alternative. It is assumed site restoration will be performed as part of the chosen soils removal alternative.
6. O&M costs account for an annual site inspection with minimal maintenance, an annual report, and mobilization/demobilization effort.

Table 4a
Cost Estimate
AST Soils Removal Alternative 1a - Landfill Disposal
Keku Cannery (Former)
Kake, Alaska

Direct Capital Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DC1a	Mobilization/Demobilization	0	lump sum	$40,987	$0
DC2	Field Overhead and Oversight	2	week	$15,374	$30,747
DC3b	Site Preparation	1	lump sum	$1,601	$1,601
DC4e	Remove Contaminated AST Soil for Landfill	220	cubic yard	$908	$199,850
DC5c	Backfill/Restore Excavated Areas	190	cubic yard	$28	$5,245
DC7b	Construction Completion	1	lump sum	$2,961	$2,961
Total Direct Capital Costs (rounded to nearest $1,000)					***$240,000***
Indirect Capital Costs					
	Engineering and Design (5%)	5%			$12,000
	Administration (4%)	4%			$10,000
	Legal Fees and License/Permit Costs (4%)	4%			$10,000
	3rd Party Construction Oversight (5%)	5%			$12,000
Subtotal Indirect Capital Costs (rounded to nearest $10,000)					***$40,000***
Subtotal Capital Costs					$280,000
Contingency Allowance (20%)					$56,000
Total Capital Cost (rounded to nearest $1,000)					**$336,000**
Annual Direct Operation & Maintenance Costs					
Item Description		**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1a	Operation and Maintenance Costs	1	lump sum	$7,000	$7,000
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$7,000*
Annual Indirect O&M Costs					
	Administration	5%			$350
	Insurance, Taxes, Licenses	3%			$210
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
	Subtotal Annual O&M Costs				*$8,000*
	Contingency Allowance	15%			$1,200
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$9,000**
5 Year Cost Projection (Assume Discount Rate Per Year: 0.6%)					
Total Capital Costs					336,000
Present Worth of O&M assuming 0.6% Discount Factor (Rounded to Nearest $10,000)					$40,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$380,000**

Notes

1. Unit costs provided by Means were taken from *RSMeans Heavy Construction Cost Data, 30th Ed., 2016.*
2. Barging and Disposal costs were taken from vendor quotes, or extrapolated from vendor quotes received in 2016.
3. Mobilization and Demobilization costs are not included in this alternative.
It is assumed the equipment will be brought as part of Soils Alternate 1a or 1b.
4. It is assumed the staging area for Soils Removal Alternative 1a, 1b, or 2 will be used for this work as well.
5. O&M costs account for an annual site inspection with minimal maintenance, an annual report, and mobilization/demobilization effort.

Table 4b
Cost Estimate
AST Soils Removal Alternative 1b - Land Farm Disposal
Keku Cannery (Former)
Kake, Alaska

Direct Capital Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DC1a	Mobilization/Demobilization	0	lump sum	$40,987	$0
DC2	Field Overhead and Oversight	1	week	$15,374	$15,374
DC3b	Site Preparation	1	lump sum	$1,601	$1,601
DC4f	Remove Contaminated AST Soil for Land Farm	220	cubic yard	$116	$25,427
DC5c	Backfill/Restore Excavated Areas	190	cubic yard	$28	$5,245
DC7b	Construction Completion	1	lump sum	$2,961	$2,961
Total Direct Capital Costs (rounded to nearest $1,000)					***$51,000***
Indirect Capital Costs					
	Engineering and Design (5%)	5%			$3,000
	Administration (4%)	4%			$2,000
	Legal Fees and License/Permit Costs (4%)	4%			$2,000
	3rd Party Construction Oversight (5%)	5%			$3,000
Subtotal Indirect Capital Costs (rounded to nearest $10,000)					***$10,000***
Subtotal Capital Costs					$61,000
Contingency Allowance (20%)					$12,000
Total Capital Cost (rounded to nearest $1,000)					**$73,000**
Annual Direct Operation & Maintenance Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1b	Operation and Maintenance Costs	1	lump sum	$13,000	$13,000
ES	Land Farm Operation and Maintenance Costs	1	lump sum	$8,900	$8,900
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$22,000*
Annual Indirect O&M Costs					
	Administration	5%			$1,100
	Insurance, Taxes, Licenses	3%			$660
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$2,000*
	Subtotal Annual O&M Costs				*$24,000*
	Contingency Allowance	15%			$3,600
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$28,000**
5 Year Cost Projection (Assume Discount Rate Per Year: 0.6%)					
Total Capital Costs					73,000
Present Worth of O&M assuming 0.6% Discount Factor (Rounded to Nearest $10,000)					$140,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$210,000**

Notes
1. Unit costs provided by Means were taken from *RSMeans Heavy Construction Cost Data, 30th Ed., 2016.*
2. Barging and Disposal costs were taken from vendor quotes, or extrapolated from vendor quotes received in 2016.
3. Mobilization and Demobilization costs are not included in this alternative. It is assumed the equipment will be brought as part of Soils Alternate 1a or 1b.
4. It is assumed the staging area for Soils Removal Alternative 1a, 1b, or 2 will be used for this work as well.
5. ES = Engineer's Estimate
6. O&M costs account for an annual site inspection with minimal maintenance, an annual report, and mobilization/demobilization effort.

Derived Cost DC1a - Mobilization/Demobilization (Soil Alt 1a, Alt 1b; Sediment Removal; AST Soil Alt 1a, Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Barge equipment from Seattle to Kake, and back	1	each	$40,987	$40,987	Alaska Marine Lines quote (see Vendor Quote)	Includes Gradall excavator, backhoe loader, 40' dump truck, 40' container with misc. equip., 2 pickup trucks, and associated fees
			DC1a Subtotal	*$40,987*	*lump sum*	

Derived Cost DC1b - Mobilization/Demobilization (Soil Alt 2)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Barge equipment from Seattle to Kake, and back	1	each	$10,770	$10,770	Alaska Marine Lines quote (see Vendor Quote)	Crew B-23 equipment is assumed; also need 40' container of misc. equip
			DC1b Subtotal	*$10,770*	*lump sum*	

Derived Cost DC2 - Field Overhead and Oversight (Soil Alt 1a, Alt 1b, Alt 2; Sediment Removal; AST Soil Alt 1a, Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Superintendent	0.50	month	$15,517	$7,759	2016 RSMeans, 01 31 13.20 0260	Assume 1 week to complete any alternative
Porta John (1)	0.50	month	$222	$111	2016 RSMeans, 01 54 33 40 6410	Assume 1 week to complete any alternative
Per Diem	0.50	month	$15,008	$7,504	Engineer Estimate	Assume $108/person/day. Assume 4 people. Assume 1 week to complete any alternative
			DC2 Subtotal	*$15,374*	*per week*	

Derived Cost DC3a - Site Preparation (Soil Alt 1a, Alt 1b, Alt 2; Sediment Removal)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Silt Fencing	600	linear foot	$1.85	$1,112	2016 RS Means, 31 25 14.16 1000	Assume silt fence each side of construction entrance.
Staging Area Geotextile	889	square yard	$1.64	$1,462	2016 RSMeans, 31 32 19.16 1500	Assume 8000 sft area along east side of cannery, along road
Staging Area Aggregate Base	889	square yard	$7.76	$6,897	2016 RSMeans, 32 11 23.23 0100	Assume 8000 sft area along east side of cannery, along road
Construction entrance	500	square yard	$9.79	$4,893	2016 RSMeans, 32 11 23.23 0302	1-1/2" stone, 6" depth, Assume 300 feet of improved existing drive for construction entrance, 15 ft. wide.
			DC3a Subtotal	*$14,362*	*lump sum*	

Derived Cost DC3b - Site Preparation (AST Soil Alt 1a, Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Silt Fencing	160	linear foot	$1.85	$296	2016 RS Means, 31 25 14.16 1000	Assume silt fence each side of construction entrance.
Construction entrance	133	square yard	$9.79	$1,305	2016 RSMeans, 32 11 23.23 0302	1-1/2" stone, 6" depth, Assume 80 feet of improved existing drive for construction entrance, 15 ft. wide.
			DC3b Subtotal	*$1,601*	*lump sum*	

Derived Cost DC4a - Remove Contaminated Soil for Landfill (Soil Alt 1a)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Contaminated Material and Load 20' containers	210	cubic yard	$3.32	$696	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume 2' deep, 275 syd = 180 cyd; times 1.15 expansion
Confirmation Sampling	40	each	$232	$9,264	Engineer Estimate	Elevated subsurface concentrations were closer to 4,000 sft, so used 40
Dewatering, pumping in high concentration areas	2	week	$179	$359	2016 RSMeans 01 54 33.40 4100	Assume contaminated water is pumped into 20' containers with soil
ORC Treatment, post-excavation	1	each	$32,893	$32,893	See vendor quote	Treatment of exposed soil and unreachable areas; assume treatment of entire footprint to 1.5' deep
Mechanical mixing of soil and ORC	222	cubic yard	$3.84	$853	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume use of skid steer, loader, excavator, dump truck for mixing. 1.5' deep x 4000 sft of treated area
Spread ORC/Soil mixture	222	cubic yard	$23.74	$5,275	2016 RSMeans, 31 23 23.15 4050	Assume backhoe loader used to spread after truck dumps mixture
Rough Grade ORC/Soil mixture	1	each	$1,332	$1,332	2016 RSMeans, 31 22 13.20 0130	
Barge Contaminated Soil to Seattle; rail freight to Arlington, OR	1	each	$147,450	$147,450	Vendor quote	See calculations on Vendor Quotes tab
Disposal of Contaminated Material	50	percent	$967	$48,353	Vendor quote	Assume stabilization of 105 cubic yards of soil as hazardous material due to land disposal restrictions.
			DC4a Subtotal	*$1,174*	*cubic yard*	

Derived Cost DC4b - Remove Contaminated Soil for Land Farm (Soil Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Contaminated Material and Load dump trucks	210	cubic yard	$3.32	$696	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume 2' deep, 275 syd = 180 cyd; times 1.15 expansion
Confirmation Sampling	40	each	$232	$9,264	Engineer Estimate	Elevated subsurface concentrations were closer to 4,000 sft, so used 40
Dewatering, pumping in high concentration areas	2	week	$179	$359	2016 RSMeans 01 54 33.40 4100	Assume contaminated water is pumped into 20' containers with soil
ORC Treatment, post-excavation	1	each	$32,893	$32,893	See vendor quote	Treatment of exposed soil and unreachable areas; assume treatment of entire footprint to 1.5' deep
Mechanical mixing of soil and PersulfOx/ORC	222	cubic yard	$3.84	$853	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume use of skid steer, loader, excavator, dump truck for mixing. 1.5' deep x 4000 sft of treated area
Spread ORC/Soil mixture	222	cubic yard	$23.74	$5,275	2016 RSMeans, 31 23 23.15 4050	Assume backhoe loader used to spread after truck dumps mixture
Rough Grade ORC/Soil mixture	1	each	$1,332	$1,332	2016 RSMeans, 31 22 13.20 0130	
Haul Contaminated Material to Land Farm Site	210	cubic yard	$15.46	$3,246	2016 RSMeans, 31 23 23.20 1025	Assume land fill site is within 5 miles (10 mile cycle); Assume land fill site is available, no site prep work required
Rough Grading at Land Farm Site	1	each	$1,998	$1,998	2016 RSMeans, 31 22 13.20 0140	Assume 3,780 sft (210 cyd, 1.5' max depth for land farm); Assume skid steer shipped in 40' container of equipment for grading
			DC4b Subtotal	*$266*	*cubic yard*	

Derived Cost DC4c - Treat Contaminated Soil (Soil Alt 2)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Confirmation Sampling	40	each	$232	$9,264	Engineer Estimate	Elevated subsurface concentrations were closer to 4,000 sft, so used 40
In Situ PersulfOx and ORC Treatment	1	each	$106,821	$106,821	See vendor quote	Treatment of entire area after hot spot excavation
Mechanical mixing of soil and PersulfOx/ORC	420	cubic yard	$3.31	$1,390	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume use of skid steer, loader, excavator, dump truck for mixing. 3.5' deep, used end area method to estimate volume between top surface (275 syd) and subsurface (4000 sft)
Spread PersulfOx/ORC/Soil mixture	420	cubic yard	$23.74	$9,963	2016 RSMeans, 31 23 23.15 4050	Assume backhoe loader used to spread after truck dumps mixture
Rough Grade PersulfOx/ORC/Soil mixture	1	each	$1,332	$1,332	2016 RSMeans, 31 22 13.20 0130	
			DC4c Subtotal	*$613*	*cubic yard*	

Derived Cost DC4d - Remove Contaminated Sediment (Sediment Alt)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Remove debris	3	day	$4,789	$14,367	2016 RSMeans B-12J crew, times 2 for additional laborer and equip. operator	Assume 3 days to remove and stockpile debris under dock/cannery with a B-12J crew (muliply x2 for extra laborer and backhoe equip)
Excavate Contaminated Material and Load Haul Trucks	550	cubic yard	$3.32	$1,824	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume 1' deep, 1,436 syd = 480 cyd; times 1.15 expansion
Confirmation Sampling	13	each	$232	$3,011	Engineer Estimate	Based on 1,436 syd (~13,000 sft), and 1 sample per 1,000 sft
Barge Contaminated Sediment to Seattle; rail freight to Arlington, OR	1	each	$373,540	$373,540	Vendor quote	See calculations on Vendor Quotes tab
Disposal of Contaminated Material	80	percent	$2,533	$202,620	Vendor quote	Assume stabilization of 440 cubic yards of sediment as hazardous material due to land disposal restrictions.
			DC4d Subtotal	*$1,082*	*cubic yard*	

Derived Cost DC4e - Remove Contaminated AST Soil for Landfill (AST Soil Alt 1a)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Contaminated Material and Load 20' containers	220	cubic yard	$3.32	$730	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume 3' deep, 190 syd = 190 cyd; times 1.15 expansion
Confirmation Sampling	2	each	$232	$463	Engineer Estimate	
Remove 5,550 gal tanks, load, and backfill + decon	3	each	$3,666	$10,999	2016 RSMeans, 02 65 10.30 1233 + 0833	
Remove 2,000 gal tanks, load, and backfill + decon	2	each	$3,656	$7,312	2016 RSMeans, 02 65 10.30 1233 + 0823	
Remove wood cribbing	40	V.L.F.	$13.14	$526	2016 RSMeans, 02 41 13.74 2000	Assume up to 8 vertical linear feet of cribbing per each of 5 tanks
Barge Contaminated Soil to Seattle; rail freight to Arlington, OR	1	each	$147,450	$147,450	Vendor quote	See calculations on Vendor Quotes tab
Barge 5,550 gal tanks to Seattle	54,266	lb	$0.10	$5,427	Assume $0.10/lb based on Vendor quote	Vender quote for barging averaged to $0.10/lb; assume scrapping in Seattle
Barge 2,000 gal tanks to Seattle	16,172	lb	$0.10	$1,617	Assume $0.10/lb based on Vendor quote	Vender quote for barging averaged to $0.10/lb; assume scrapping in Seattle
Disposal of Contaminated Material	25	percent	$1,013	$25,328	Vendor quote	Assume stabilization of 55 cubic yards of soil as hazardous material due to land disposal restrictions.
			DC4e Subtotal	*$908*	*cubic yard*	

Derived Cost DC4f - Remove Contaminated AST Soil for Land Farm (AST Soil Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Contaminated Material and Load dump trucks	220	cubic yard	$3.32	$730	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume 3' deep, 190 syd = 190 cyd; times 1.15 expansion
Confirmation Sampling	2	each	$232	$463	Engineer Estimate	
Remove 5,550 gal tanks, load, and backfill + decon	3	each	$3,666	$10,999	2016 RSMeans, 02 65 10.30 1233 + 0833	Assume scrapping near site
Remove 2,000 gal tanks, load, and backfill + decon	2	each	$3,656	$7,312	2016 RSMeans, 02 65 10.30 1233 + 0823	Assume scrapping near site
Remove wood cribbing	40	V.L.F.	$13.14	$526	2016 RSMeans, 02 41 13.74 2000	Assume up to 8 vertical linear feet of cribbing per each of 5 tanks
Haul Contaminated Material to Land Farm Site	220	cubic yard	$15.46	$3,401	2016 RSMeans, 31 23 23.20 1025	Assume land farm site is within 5 miles (10 mile cycle); Assume land farm site is available, no site prep work required
Rough Grading at Land Farm Site	1	each	$1,998	$1,998	2016 RSMeans, 31 22 13.20 0140	Assume 3,960 sft (220 cyd, 1.5' max depth for land farm); Assume skid steer shipped in 40' container of equipment for grading
			DC4f Subtotal	*$116*	*cubic yard*	

Derived Cost DC5a - Backfill/Restore Excavated Areas (Soil Alt 1a, Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Borrow Material for Backfilling; load trucks for transport to site	180	cubic yard	$3.32	$597	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume backfill material is accessible to contractor
Haul Backfill Material to Excavation Areas	210	cubic yard	$15.46	$3,246	2016 RSMeans, 31 23 23.20 1025	Assume backfill material location is within 5 miles (10 mile cycle)
Grade Backfill Areas to Match Existing Topography	275	square yard	$5.67	$1,560	2016 RSMeans, 31 22 16.10 3120	Assume hand grading to be conservative; likely also use skid steer
Seeding	2	MSF	$79.32	$196	2016 RSMeans, 32 92 19.14 0020	
			DC5a Subtotal	*$31*	*cubic yard*	

Derived Cost DC5b - Backfill/Restore Excavated Areas (Sediment Alt)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Borrow Material for Backfilling; load trucks for transport to site	480	cubic yard	$3.32	$1,592	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume backfill material is accessible to contractor
Haul Backfill Material to Excavation Areas	550	cubic yard	$15.46	$8,503	2016 RSMeans, 31 23 23.20 1025	Assume backfill material location is within 5 miles (10 mile cycle)
Grade Backfill Areas to Match Existing Topography	1,436	square yard	$5.67	$8,148	2016 RSMeans, 31 22 16.10 3120	Assume hand grading to be conservative; likely also use skid steer
Seeding	0	MSF	$79.32	$0	2016 RSMeans, 32 92 19.14 0020	Assume no seeding necessary in sediment area
			DC5b Subtotal	*$38*	*cubic yard*	

Derived Cost DC5c - Backfill/Restore Excavated Areas (AST Soil Alt 1a, Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Excavate Borrow Material for Backfilling; load trucks for transport to site	190	cubic yard	$3.32	$630	2016 RSMeans, 31 23 16.42 0200 + 0020	Assume backfill material is accessible to contractor
Haul Backfill Material to Excavation Areas	220	cubic yard	$15.46	$3,401	2016 RSMeans, 31 23 23.20 1025	Assume backfill material location is within 5 miles (10 mile cycle)
Grade Backfill Areas to Match Existing Topography	190	square yard	$5.67	$1,078	2016 RSMeans, 31 22 16.10 3120	Assume hand grading to be conservative; likely also use skid steer
Seeding	2	MSF	$79.32	$136	2016 RSMeans, 32 92 19.14 0020	
			DC5c Subtotal	*$28*	*cubic yard*	

Derived Cost DC6 - Site Restoration (Soil Alt 1a, Alt 1b, Alt 2, Sediment Alt)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Regrade staging areas to match existing topography	944	square yard	$5.67	$5,359	2016 RSMeans, 31 22 16.10 3120	8,000 sft staging area + construction entrance; Assume hand grading to be conservative; likely also to use skid steer
Seeding Staging area	9	MSF	$79.32	$674	2016 RSMeans, 32 92 19.14 0020	
			DC6 Subtotal	*$6,033*	*lump sum*	

Derived Cost DC7a - Construction Completion (Soil Alt 1a, Alt 1b, Alt 2, Sediment Alt)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Erosion and Sediment Controls Removal	600	linear foot	$1.85	$1,112	2016 RSMeans, 31 25 14.16 1000	
Staging Area Removal	1,389	square yard	$11.06	$15,360	2016 RSMeans, 02 41 13.17 5050	
Equipment Decontamination	1	day	$1,190	$1,190	2016 RSMeans, Crew B-1D (portion of crew onl	2 Laborer + 1 Pressure Washer. $930.40+97.46/day. Assume 1 day.
			DC7a Subtotal	*$17,662*	*lump sum*	

Derived Cost DC7b - Construction Completion (AST Soils Alt 1a, Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Erosion and Sediment Controls Removal	160	linear foot	$1.85	$296	2016 RSMeans, 31 25 14.16 1000	
Construction Entrance Removal	133	square yard	$11.06	$1,475	2016 RSMeans, 02 41 13.17 5050	
Equipment Decontamination	1	day	$1,190	$1,190	2016 RSMeans, Crew B-1D (portion of crew onl	2 Laborer + 1 Pressure Washer. $930.40+97.46/day. Assume 1 day.
			DC7b Subtotal	*$2,961*	*lump sum*	

Derived Cost OM1a - Operation and Maintenance Costs (Soil Alt 1a, Sediment Removal, AST Soil Alt 1a)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Mobilization and Demobilization	1	each	$2,000	$2,000	Engineer Estimate	Travel/Lodging/Per Diem
Site Inspection	1	each	$1,000	$1,000	Engineer Estimate	Assume 1 day Junior Engineer at $125/hr, 8 hours/day
Site Maintenance	1	each	$1,000	$1,000	Engineer Estimate	
Annual Report	1	each	$3,000	$3,000	Engineer Estimate	
			OM1a Subtotal	*$7,000*	*lump sum*	

Derived Cost OM1b - Operation and Maintenance Costs (Soil Alt 1b, Alt 2, AST Soil Alt 1b)

Description	Quantity	Unit	Unit Cost	Cost	Reference	Notes
Mobilization and Demobilization	1	each	$2,000	$2,000	Engineer Estimate	Travel/Lodging/Per Diem
Site Inspection	1	each	$1,000	$1,000	Engineer Estimate	Assume 1 day Junior Engineer at $125/hr, 8 hours/day
Site Maintenance	1	each	$5,000	$5,000	Engineer Estimate	
Annual Report	1	each	$5,000	$5,000	Engineer Estimate	
			OM1b Subtotal	*$13,000*	*lump sum*	

2016 RSMeans Heavy Construction Cost Data Historical Cost Indices

2016	207.2
2013	201.2
2016/2013 multiplier	**1.030**

Location Factors	Materials	Installation	Total	
Anchorage	121.7	115.8	119.1	
Fairbanks	124.2	116.9	120.9	
Juneau	123.9	115.8	120.3	
Ketchikan	**134.9**	**1.158**	**126.5**	Use installation % since any materials brought to site have already accounted for barging in vendor quotes

Equipment
Gradall hydraulic excavator (XL 5200 V)
Backhoe loader
Dump truck (2 axle)

Tractor with disk, hourly cost	128	hour	$69	$8,869	Engineer Estimate	32 hours each quarter

Typical Soil Characteristics (from Lindeburg, *Civil Engineering Reference Manual*), 12th edition, Table 35.6; page 35-8

Soil Type	Dry Density lb/ft^3	Dry Density ton/yd^3	Saturated Density lb/ft^3	Saturated Density ton/yd^3
Sand, loose and uniform	90	1.215	118	1.593
Sand, dense and uniform	109	1.4715	130	1.755
Sand, loose and well graded/mixed	99	1.3365	124	1.674
Sand, dense and well graded/mixed	116	1.566	135	1.8225
Glacial clay, soft	76	1.026	110	1.485
Glacial clay, stiff	106	1.431	125	1.6875

Assume 34B soil type (see Soils Map.pdf and Soils Physical Properties Report)

Report—Physical Soil Properties

Physical Soil Properties–Stikine Area, Alaska														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
34B—Mitkof-Mosman complex, 5 to 35 percent slopes														
Mitkof	0-1	-69-	-24-	5- 8- 10	0.90-1.00 -1.10	4.23-9.17-14.11	0.21-0.22-0. 23	0.0- 1.5- 2.9	12.0-13.5 -15.0	.37	.37	5	3	86
	1-11	-38-	-60-	0- 3- 5	1.20-1.25 -1.30	4.23-9.17-14.11	0.10-0.11-0. 12	0.0- 1.5- 2.9	6.0- 7.0- 8.0	.15	.43			
	11-60	-50-	-48-	0- 3- 5	1.30-1.35 -1.40	4.23-9.17-14.11	0.06-0.07-0. 08	0.0- 1.5- 2.9	1.0- 2.0- 3.0	.10	.37			
Mosman	0-1	-47-	-45-	5- 8- 10	1.10-1.15 -1.20	4.23-9.17-14.11	0.10-0.11-0. 12	0.0- 1.5- 2.9	8.0-10.0- 12.0	.15	.32	1	5	56
	1-11	-49-	-46-	0- 5- 10	1.10-1.15 -1.20	4.23-9.17-14.11	0.10-0.11-0. 12	0.0- 1.5- 2.9	10.0-12.0 -14.0	.15	.55			
	11-15	—	—	—	—	—	—	—	—					

Use 1.3 g/cc

1	g/cc	
0.842777	ton/cyd	
1.10	ton/cyd	moist density
1.5	**ton/cyd**	**use as assumed**
		saturated density
		for conservative hauling costs

Steel tank assumptions

Density, low (g/cm^3)	7.7	
Density, high (g/cm^3)	8.03	
Density, low (lb/ft^3)	480.6953	
Density, high (lb/ft^3)	501.2965	500 assume 500 lb/ft^3

Assumed 5,550 gallon cylindrical tank dimensions:

Diameter (ft)	5.5	estimated based on photo
area (sft)	23.75829	
volume (gallons)	5550	
volume (cft)	741.9296	
estimated length (ft)	31.22823	estimated based on known volume and estimated diameter

Use assumed dimensions to find volume of steel:

Outside volume (cft)	741.9296
Assumed steel thickness (ft)	0.0625
Inside volume to subtract (cft)	705.7524
Volume of steel (cft)	36.17717
Estimated weight of steel (lb)	18088.59

Assumed 2,000 gallon rectangular tank dimensions:

assumed width and depth (ft)	5	estimate; no photo found for reference
area (sft)	25	
volume (gallons)	2000	
volume (cft)	267.362	
estimated length (ft)	10.69448	estimate

Use assumed dimensions to find volume of steel:

Outside volume (cft)	267.362
Assumed steel thickness (ft)	0.0625
Inside volume to subtract (cft)	251.1903
Volume of steel (cft)	16.1717
Estimated weight of steel (lb)	8085.851

SUPER SACKS

Bagcorp
Michelle - sales for northwest region
1-800-331-9200

Landfill Bag (UN Cert II and III)
1cyd bag
cost = $16.54 each

	soil	sed	ast soil
cyd	210	550	220
bag cost	$3,473.40	$9,097.00	$3,638.80

BARGE EQUIPMENT TO KAKE

Alaska Marine Lines (AML)
Tyler Maurer
tylerm@Lynden.com
907-617-5420

See email and quote dated Aug. 29, 2016

Mobilization Fees	Mobilization	Wharfage	Size Fee	Trucking	Mob. Total	
Gradall Excavator =	$ 4,305.00	$ 175.00	$ 861.00		$ 5,341.00	
Backhoe Loader =	$ 3,444.00	$ 70.00	$ 688.80		$ 4,202.80	
40' Dump Truck =	$ 1,950.00	$ 105.00	$ 195.00		$ 2,250.00	
40' container of misc. tools & equipment =	$ 3,942.20	$ 161.00	$ 252.00	$ 98.18	$ 4,453.38	trucking fee to move container to jobsite
2 pickup trucks =	$ 2,736.00	$ 24.50			$ 2,760.50	total cost for both trucks
Fuel surcharge =	$ 1,108.33				$ 1,108.33	

Demobilization Fees	Mobilization	Wharfage	Size Fee	Trucking	Demob. Total
Gradall Excavator =	$ 4,305.00	$ 175.00	$ 861.00		$ 5,341.00
Backhoe Loader =	$ 3,444.00	$ 70.00	$ 688.80		$ 4,202.80
40' Dump Truck =	$ 1,950.00	$ 105.00			$ 2,055.00
40' container of misc. tools & equipment =	$ 3,942.20	$ 161.00		$ 98.18	$ 4,201.38
2 pickup trucks =	$ 2,646.00	$ 24.50			$ 2,670.50
Fuel surcharge =	$ 1,076.11				$ 1,076.11

TOTAL EQUIPMENT BARGING = $ 39,662.80

Also need a water truck for ORC mixing
assume LeeBoy DS water truck, 4000 gal: 6200 lb truck
Typical $/lb shipping cost for quote: 8.61 $/100 lb
Typical wharfage fee from quote: 7 $/ton
Typical overwidth fee: 20% of shipping cost

Mobilization	Wharfage	Size Fee	Mob. Total	Demob. Total
$ 533.82	$ 21.70	$ 106.76	$ 662.28	$ 662.28

REVISED TOTAL EQUIPMENT BARGING COST = $ 40,987.37 for Soil Alt 1, Alt 2, Sediment Alt, and AST Soils Alt1, Alt 2

	Mobilization	Wharfage	Size Fee	Trucking	Mob. Total	Demob. Total
Crew B-23 Equipment only	$ 1,033.20	$ 42.00	$ 206.64		$ 1,281.84	$ 1,281.84
40' container of misc. equipment	$ 3,942.20	$ 161.00		$ 98.18	$ 4,103.20	$ 4,103.20

B-23 Crew	weight	
Drill Rig, Truck Mounted	6000	assumed
Flatbed Truck, 3 Ton	6000	
Total	12000	

Additional Trucks required for land farming option
additional dump trucks: 3 for a total of 4 trucks onsite
additional weight: 90000 lb (30,000 lb each)

Mobilization	Wharfage	Size Fee	Mob. Total	Demob. Total
$ 7,749.00	$ 315.00	$ 1,549.80	$ 9,613.80	$ 9,613.80

CONTAMINATED SOILS DISPOSAL

Republic Services / Regional Disposal Company (RDC)
Teresa Dillashaw
tdillashaw@republicservices.com
206-652-8893

See email and quote dated Aug. 30, 2016
20-ft open top containers (47 cyd)

cost =	$	2,664.00	each, up to 25 tons (includes AML barge, trucking on Seattle side, container liner, and disposal)
over 25 tons:	$	45.00	per ton from 25 tons to 27 tons. Load limit is 27 tons.
wharfage fee =	$	7.00	per ton at Kake dock

* this quote does not include moving containers from Kake dock to the site, or back to dock
* this quote includes 4.6% Washington State refuse tax
* Material must meet Washington State Department of Ecology regs for "Non-Dangerous" Wastes

Waste Management
Troy Tyacke
Ttyacke@wm.com
360-507-6613

See email and quote dated Sept. 1, 2016
20-ft containers (Haz. Waste)

cost =	$	9,730.00	each, including liner cost per container (up to 22 net-tons)
rental =	$	10.00	per day, per container
Variable FEA fee =		13%	of the disposal total (Variable fuel, environmental, and adminstrative fee)
Haz. Waste DEQ fee =	$	20.00	per ton DEQ fee for all hazardous direct landfill waste from remedial activities into Chemical Waste Management (CWM)
Stabilization DEQ fee =	$	2.00	per ton DEQ fee for all stabilization loads into CWM
profile fee =	$	75.00	per profile of material
Haz. Waste for Subtitle C Disposal =	$	100.00	per ton (must meet LDR's, paint filter test, no asbestos)
Haz. Waste with stabilization =	$	285.00	per ton (stabilization requiring addition of multiple reagents. As, Ba, Cd, Ni, Pb up to 50 ppm by TCLP; Cr, Se up to 30 ppm by TCLP; Hg up to 10 ppm by TCLP; no antimony; debris < 10%

Regenesis In Situ Treatment Quotes 21-Oct-16

Owen Miller (630) 277-0855 OMiller@Regenesis.com
Ryan Moore (219) 286-4838 RMoore@Regenesis.com

	Soils Alt 1a, 1b	Soils Alt 2
Quoted Amounts:	**$ 32,893**	**$ 106,821**

Regenesis highly recommends removal of hotspots via excavation prior to placement of any reagent for efficient remediation
Placement of PersulfOx close to water may prove difficult with regulators due to high sufate and sodium concentrations, and the potential for leaching during low tide

Recommended products for the site are PersulfOx for immediate chemical treatment and ORC-Advanced pellets for long-term aerobic bioremediation
Due to identified "hot spots," Regenesis recommends spot excavation of high concentration areas (approximately 2000 sft), and in situ treatment of the remaining footprint
The application is surficial, and will require mixing with the soils to the desired depth. Assumptions for soil mixing are not part of the Regenesis quote, and are captured on the Derived Costs
Benefits of PersulfOx over RegenOx are the following:
- easier handling based on how its shipped
- built in catalyst eliminates mixing of multiple parts

Soils Alt 1: initial excavation; followed by treatment (assume treating down to 1.5 feet below excavation)
Soils Alt 2: Treatment only; assume treating down to 3.5 feet below surface

* assume water charge is minimal

SHIPPING VIA 20' CONTAINERS

	Soil	Sediment	AST Soil	Notes
cyd	210	550	220	post-excavation volume
tons	315	825	330	used 1.5 tons/cyd
20' containers	15	38	15	22 net-tons per container
cont. cost	$ 145,950.00	$369,740.00	$ 145,950.00	
daily fee	$ 1,500.00	$ 3,800.00	$ 1,500.00	assume 10 days per container
total	$ 147,450.00	$373,540.00	$ 147,450.00	

SOILS DISPOSAL

	Soil	Sediment	AST Soil	Notes
tons	315	825	330	used 1.5 tons/cyd
haz disp. Fee	$ 6,300.00	$ 16,500.00	$ 6,600.00	
stabilize fee	$ 630.00	$ 1,650.00	$ 660.00	
disposal w/ treatment	$ 89,775.00	$235,125.00	$ 94,050.00	
total	$ 96,705.00	$253,275.00	$ 101,310.00	

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