SKAGWAY TRADITIONAL COUNCIL
A FEDERALLY RECOGNIZED TRIBE

Pullen Creek Waterbody Recovery Plan
Best Management Practices

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1.0 Introduction

1.1 Purpose of Document

Pullen Creek, located in Skagway, Alaska, has been on the Clean Water Act Section 303(d) list (10303-004) since 1990 for non-attainment of the Toxic and Other Deleterious Organic and Inorganic Substances standard for metals. The lower mile of Pullen Creek was previously Section 303(d) listed with the Skagway Harbor listing but was segmented out into its own listing in Alaska's Final 2004 Integrated Water Quality Monitoring and Assessment Report (April 2006). Pullen Creek remains 303(d) listed at the current time. Under the ACWA Program administered through the Alaska Department of Environmental Conservation (ADEC), Pullen Creek was scheduled for a Total Maximum Daily Load (TMDL) in 2007 that would lead eventual attainment of standards for metals. However, there was a lack of baseline data for an appropriate evaluation to begin this process.

In July of 2003, the Skagway Traditional Council (STC) applied for and received funding through the ACWA program to begin gathering baseline contaminant data on Pullen Creek. The purpose of the Pullen Creek Assessment project (ACWA 04-08) was to complete an environmental assessment of Pullen Creek and prepare a final report that would be used to in evaluating possible alternatives to a TMDL. The final report document also included: historical and background information available on the creek, information on fish and fish habitat, an overview of other Pullen Creek projects, and recommendations for future work. The data gathered provided enough information to ADEC to decide that a Waterbody Recovery Plan for Pullen Creek was the appropriate next step.

The purpose of this document is to summarize all of the information collected during regarding Pullen Creek that is related to heavy metal contamination and any factors that may contribute to overall water quality and fish habitat issues. Furthermore, this document contains recommended Best Management Practices (BMP's) to reduce or lower the potential of any further degradation of water quality and fish habitat. These BMP's were developed in cooperation with stakeholders to apply to any current or future construction projects implemented on or near Pullen Creek. However, it is available to all interested parties. Furthermore, additional information is included that isn't related to construction projects but for the better interest of Pullen Creek.

1.2 Location and General Description

Skagway (59.45º N, 135.31º W) is located at the northernmost end of Lynn Canal, at the head of Taiya Inlet. It is 90 miles northeast of Juneau and 108 road miles south of Whitehorse, Yukon, Canada. Skagway is located in the Skagway Recording District (Sec. 11, T028S, R059E, Copper River Meridian). The greater Skagway area encompasses 455 square miles of land and 12 square miles of water.

The City of Skagway valley lies on unconsolidated floodplain deposits from the Skagway River, which overlay igneous and metamorphic bedrock. The bedrock consists mostly of Jurassic and Cretaceous quartz diorite and granodiorite, but also includes some basalt and aplite dikes. The alluvial delta is within a steep and narrow valley and the fill extends approximately 600 feet deep. In addition, the Skagway waterfront consists of like fill material that was placed there for development purposes.

Skagway has a maritime climate with cool summers and mild winters. Average summer temperatures range from 45-67 ºF and winter temperatures range from 18-37 ºF. Skagway receives less rain than is

typical for Southeast Alaska. Precipitation in Skagway averages 26 inches of rain per year and 39 inches of snow per year.

Vegetation within and surrounding Skagway varies with elevation and soil type, ranging from coastal rainforest to boreal and sub-alpine forests. Common tree species are western and mountain hemlock, Sitka spruce, paper birch, black cottonwood, alder, willow and sub-alpine fir. Understory and herbaceous vegetation includes high bush cranberry, goat's beard, devil's club, blueberry, currant, ferns and mosses. The Skagway valley provides wildlife habitat for moose, mountain goat, brown and black bears, wolf, wolverine, porcupine, hoary marmot, and snowshoe hare. Whales, seals, salmon and trout can also be found in the surrounding area.

Pullen Creek (known as Mill Creek during the Klondike Gold Rush) is located on the northeast side of downtown Skagway at approximately 59° 27' N and 135º 18' W. The creek is within the Hydrologic Unit Code of 1901303. The mainstem of Pullen Creek is approximately 1.5 miles long (recently measured by the National Park Service) and has a spring-fed headwater located at the base of the steep mountainside on the eastern side of town (see Figure 1).

There are two main tributaries to Pullen Creek (see Figure 1). The first splits from the mainstem approximately 0.51 miles upstream from the mouth. Tributary One is fed by a small spring located near the Jerry Meyers Fish Hatchery, approximately 0.34 miles from the confluence of the mainstem. Tributary Two splits from the mainstem at 18th Street, approximately 1.3 miles from the mouth. This tributary is 0.34 miles long and has a headwater directly under the White Pass and Yukon Route rail yard at the northern end of town. Just below the confluence of Tributary One, Pullen Creek receives additional water from the Alaska Power and Telephone (APT) Dewey Lakes Hydroelectric plant. There has not been a hydrological study for Pullen Creek, however a brief description on hydrology may be found in section 4.0 of this document.

Pullen Creek is almost entirely urbanized, as its entire boundary lies within the City of Skagway. The impacts of urbanization are numerous: the creek has been moved and channelized several times, a majority of the mainstem receives runoff from impervious surfaces, there are 31 culverts, and many of the banks are impacted by trampling. In addition, the fish hatchery releases king and pink salmon fry into the creek. However, Pullen Creek does provide over-wintering rearing habitat for coho and Dolly Varden, and it provides spawning habitat for coho, pink and chum salmon (Rusanowski 2005).

There are two parks located on Pullen Creek which hold value for the community. Pullen Pond and Molly Walsh Park provide recreational value, fishing opportunities, tourism value for fish watching, and educational opportunities for kids.

1.3 Population/demographics

Skagway is home to 860 year round residents. Approximately 5.1% of the population is Alaska Native or part Native. During the summer, Skagway gets over 750,000 visitors from cruise ships, the Alaska Marine Highway and the Klondike highway. To accommodate this influx, Skagway hosts a summer seasonal population of approximately 2,000 (includes year round residents).

Compared to state averages, the percent of Skagway residents under the age of 5 and between ages 20-24 is significantly less and the percent of residents that are 55 and older is significantly higher. Approximately 53% of the population is male, and 47% female. During the 2000 U.S. Census, there were 502 total housing units, 101 of which were vacant. Forty-seven of these vacant housing units are

used only seasonally. An Economic Impact Study conducted by the City of Skagway in 1999 found that 51% of the owners of visitor-related businesses are not year-round residents.

The unemployment rate at that time was 14.1%, although 32.2% of all adults were not in the work force. The median household income was $49,375, per capita income was $27,700, and 3.7% of residents were living below the poverty level.

1.4 Land Use

Approximately 452 square miles of land and 12 square miles of water are contained within the City of Skagway. Sixty eight percent of that land is managed by the U.S. Forest Service under the Tongass Land Management Plan, with a small portion managed by the National Park Service as part of the Klondike Gold Rush National Historical Park. Twenty-seven percent is under State of Alaska management through the Alaska Mental Health Trust. The City of Skagway manages approximately 3%, and the remaining 2% is managed by private landowners, which includes some Native Allotments.

Land use designations for Skagway can be found in the City of Skagway's Comprehensive Plan (1999). In general, designations encourage land use and activities that are industrial and commercial in nature. Skagway has limited housing development opportunities, and land use designations encourage both low density and affordable residential living. With respect to the waterfront commercial industrial designation, the City gives priority to development that directly depends on waterfront location. The Comprehensive Plan also calls for reserving land that has potential for drinking water source and/or a hydroelectric generation source. Three recreational designations, Recreation/Open Space, Resource Reserve, and Recreation Reserve, are included in the Plan for undeveloped and high recreation value land. While there is not a Historic Value land use designation, the plan recognizes that there are historic resources in Skagway and that these resources should be encouraged and preserved.

The Comprehensive Plan also outlines how Pullen Creek has been manipulated via culverts to make way for homes and roads. In addition, an RV Park is located on the eastern part of the Port of Skagway. The city has expressed an interest in relocating the RV Park since the early 1990s, since it is utilizing limited and valuable waterfront space that the city believes could be put to better uses. Plans for the land on which the RV Park is located include marine related storage and staging space that will compliment small boat harbor use.

2.0 Historical Information

Skagway is located within the traditional territory of the Chilkoot Band of the Tlingit Tribe. Skagway and its surrounding area were important historically as trade routes and subsistence grounds for the Lukaxh.ádi (Raven-Sockeye), Dakhl'aweidí (Eagle-Killer Whale), Yanyeidí (Eagle-Wolf), and Kaagwaantaan (Eagle-Wolf) clans. Trade routes ranged from interior Alaska/Canada to the tip of California, and may have also included the pacific islands of Hawaii and the east coast of Asia. While what is known as the city of Skagway now was not occupied year-round, the neighboring community of Dyea was a permanent Tlingit village.

In 1896, the discovery of gold brought prospectors to settle in Skagway. Although the Klondike Gold Rush lasted only three years (1896-1899), it drew some 20,000 prospectors traveling through Skagway on their way to either the Chilkoot Pass or White Pass trail. In 1900, Skagway became Alaska's first incorporated city. By then the gold rush years had ended and, as a result, Skagway's economy

stabilized around the railroad industry. The town experienced an economic boom during World War II, and Skagway became an important part in Alaska's defense system. A fuel pipeline was built paralleling the railroad from Skagway to Whitehorse, Yukon Territory of Canada (YT) during the war. The pipeline and the railroad were used to haul materials for the war effort and for the construction of the Alaska-Canada Highway.

Another economic boom occurred during the late 1960's through mid 1970's with the opening of the Cyprus Anvil lead-zinc mine in Faro, Canada. Skagway's freight shipments increased from 132,000 tons annually to 800,000 tons by the mid-seventies. The White Pass and Yukon Route (WP & YR) built an ore terminal and ship basin on city-leased tidelands in order to handle the increased capacity. As labor costs continued to increase and the market price for ore decreased after 1975, the mine was forced to close in 1982. The railroad, which was dependent on the mine shipments, was also shut down. The railroad reopened in 1988 and is now currently used for tourism.

The Klondike Highway, which links Skagway and Whitehorse, YT, was completed in 1978 and became open year-round by 1986. At this time tourism began to play a more important role in the city's economy. Presently, Skagway is a thriving tourist center and serves as an important trade route for Southeast Alaska. The Alaska Marine Highway connects the Panhandle to the Yukon Territory and British Columbia, as well as the Interior of Alaska. Skagway is one of the busiest small town ports in the world, hosting freight barges, ferries, cruise ships, water taxis, and fishing boats. Since the gold rush, the growth of the city has continuously altered the landscape.

3.0 Water Quality

3.1 Heavy Metals

It is suspected that the Nahku Ore Terminal and White Pass and Yukon Route railway activities may have potentially contaminated Pullen Creek because the rail line used to transport lead and zinc ore from the Yukon to the Nahku Ore Terminal runs along a large portion of Pullen Creek. During transport, the ore was uncovered and dust could have been be disbursed by air movement to settle in the local waterways and the surrounding area. White Pass and Yukon Route loaded mining ore concentrate from the Yukon Territory at the terminal from 1967-1993, with a brief break from 1982-1986 due to the closure of the lead-zinc mine located in Faro, Canada. During its operation, approximately 50,000 tons of ore concentrate passed through the terminal each month. The Faro mine, which supplied the industry, was a galena mining and concentrating (by flotation) facility that produced low grade zinc (60%) and lead (40%). Ore was transported by railway until 1982, and then by trucks through town from 1986-1993.

Other potential sources of heavy metal contamination in Skagway include nine formerly used defense sites (FUDS) established during World War II. These sites are still being assessed by the Department of Defense for potential contamination. Urbanization may have also contributed heavy metals to water resources throughout the Skagway area. The STC has sampled Pullen Creek for heavy metals in their ACWA project, the details of which are included in section 6.4.

3.2 Hydrocarbons

There are 12 officially reported hydrocarbon contaminated sites (ADEC) within the City of Skagway (CCTHITA, 2004). These sites include underground storage tanks on private property, operations associated with White Pass and Yukon Route, old military sites from World War II, and the Nahku Ore

Terminal. The Central Council of Tlingit and Haida Indian Tribes of Alaska (CCTHITA) worked in cooperation with the STC to document all hydrocarbon contaminated sites in the Skagway valley. However an assessment of how far these sites relate and/or impact local waterways has not been conducted. The community of Skagway is concerned about whether these sites may be leaching into groundwater, potentially impacting drinking water sources and fish resources in Pullen Creek and the Skagway River.

Run-off from impervious surfaces near and around Pullen Creek may also contribute hydrocarbons to the creek. The STC is screening for hydrocarbons in their ADEC ACWA project and details are included in section 6.4.

3.3 Other water quality parameters

Water temperature, pH, conductivity, and dissolved oxygen are general water quality indicators. Changes in these parameters can affect Pullen Creek if levels are outside of tolerable ranges for aquatic organisms. Changes could affect the types and rates of chemical reactions occurring in a waterbody, and influence biological functions. For these reasons, background data on these basic water quality parameters has been collected in past and current sampling projects conducted on Pullen Creek.

Other contaminants such as poly-chlorinated biphenyls (PCBs) and herbicides also have a potential for impacting Pullen Creek. PCBs may be associated with electrical equipment, hydroelectric activities, and are sometimes used as solvents to facilitate pesticide application. Herbicide spraying was a common activity of the military and herbicides may have been used during World War II as a defoliant in association with railroad activities, to keep vegetation from interfering with railway transportation. Contaminant screening was conducted in STC's ACWA project to determine presence or absence.

4.0 Hydrology

Pullen Creek is a low-gradient stream system, which is spring-fed from three separate headwater locations. The source of these springs is unknown but could be from an independent aquifer or source water from the Skagway River or a combination of both. Pullen Creek may be fed through other groundwater locations, but this has not been documented. Additional water enters the creek through urban run-off and Skagway's storm-water system.

Pullen Creek has undergone significant changes in its hydrology and its location has been altered on several occasions. Because it passes directly through the town, Pullen Creek is a highly urbanized creek. Pullen Creek presently passes through 31 culverts (see Figure 1) in its cumulative length of 2.16 miles.

Discharge in Pullen Creek varies depending upon location. Generally, the creek can be split into two discharge regimes, upstream from the APT tailrace and downstream from the same location. Above the tailrace, average discharge is between 0.5 cfs to 2.0 cubic feet per second (cfs). Below the tailrace discharge ranges from <2.0 cfs to 40.0 cfs, depending on whether APT is discharging into the creek. Water discharged at the APT tailrace comes from Dewey Lakes, which is located above APT at an elevation of approximately 500 feet.

Riparian vegetation along Pullen Creek varies and does not follow a consistent pattern. In some locations, Pullen Creek has riparian vegetation comprised of alder, willow, and herbaceous vegetation. Areas such as these generally have stable banks and provide cover for the stream. There are sections

of the creek that lack riparian vegetation, and in residential areas are mowed to the creek bank. This leaves the banks prone to erosion and can potentially alter stream hydrology by contributing excess sediment to the stream.

Stream substrate in Pullen Creek varies depending upon location. Generally, the channel consists of silt/sand, detritus, and aquatic vegetation (mainly marsh marigold) upstream of the APT tailrace. The substrate downstream of the APT tailrace is primarily composed of gravel, cobble and boulders. High flows issued from the tailrace have been effective in transporting finer material downstream. The STC ACWA project collected substrate data, which is included in section 6.4.

5.0 Fish and Fish Habitat

Pullen Creek is listed as an anadromous fish stream (stream number 115-34-10310-0010) with the Alaska Department of Fish and Game (ADFG). This listing was last updated in 1998 and included coho, pink, and chum salmon, as well as Dolly Varden Char. The coho and Dolly Varden populations are considered native, and the creek offers both spawning and rearing habitat for these species. The extent of chum salmon history is not known, however they are listed as a present species. Pink and king salmon were introduced to Pullen Creek through enhancement programs described in further detail in section 5.1.

Pullen Creek currently supports wild and hatchery salmon runs. However, changes in water quality, fish passage obstructions, hydrology, debris accumulation, and urban runoff could adversely affect fish habitat, which may in turn limit fish populations. According to a River Habitat Study completed by Theodore Merrell, Jr. (1993), the entire population of spawning salmon in Pullen Creek was probably less than 100 pinks, cohos, and chums. In a stream walking survey, the escapement of adult fish from Pullen Creek was significantly higher than in Merrell's report (Bethers, 2003). There were 962 pink salmon carcasses and 43 coho salmon carcasses found in that survey. Trapping efforts performed by STC also trapped juvenile fish in Pullen Creek to gather information about the species present. Trapping events were conducted in the fall and winter of 2003 and the spring and summer of 2004. Results for each calendar year are found in Appendix A and B. In general, coho and Dolly Varden were present in Pullen Creek during all trapping events, and they were found distributed throughout the creek except in the pond at the railyard.

5.1 Jerry Meyers Fish Hatchery

In 1979 Pullen Creek was designated an area meriting special attention as part of the Alaska Coastal Management Plan. As part of the long-range plan, the Skagway School system was given a Scientific Education Permit to operate a hatchery. The Jerry Meyers Fish Hatchery, built in 1981 with a $30,000 appropriation by the Alaska State Legislature, is owned by the city and is run by the School District. The hatchery was built on the upper portion of Tributary One, which is spring fed approximately 100 yards from the structure. The hatchery was recognized as the Alaska Vocational Education Program of the Year in 1989 for its accomplishments as an outdoor classroom.

The hatchery transplants king and pink salmon eggs and fish from other Southeast Alaska locations, such as Burrow Creek and Douglas Island Pink and Chum (DIPAC), into Pullen Creek. King salmon were introduced in recent years as a part of a four-party agreement worked out with DIPAC, Burrow Creek Hatchery, Jerry Meyers Fish Hatchery, and the City of Skagway. According to the agreement, the Skagway hatchery provides eggs for DIPAC, which raises the eggs and returns the fry for "imprinting" at the weir located below the railroad culvert and Congress Way culvert on Pullen Creek.

With assistance from the Southeast Conference, the City of Skagway investigated the potential to expand the Jerry Meyers Fish Hatchery. The expansion project had support from the local commercial and sport fishing industry and DIPAC; however a River Habitat Study conducted by Merrell in 1993 determined that the expansion was not feasible at its present location. Merrell's reasoning is that the summer water temperatures are too cold for optimal growth and rearing of fish and that the current location does not present ample space for building a larger facility. Merrell suggests relocating the hatchery to a site downstream from the powerhouse, as Pullen Park is a suitable site and is currently being used as a collection point to capture mature salmon for eggs and for rearing juvenile salmonids before release.

5.2 Fish Passage and Habitat

Fish passage has been a concern on Pullen Creek in the past. For example, the creek outfall had been relocated several times over the last 30 years. In the 1960s, the outfall was relocated from the east boat harbor to make room for the ore terminal construction. It was moved back to its original location in the 1970s due to the boat harbor expansion and the need to reduce freshwater flow in the harbor and subsequent winter icing. Finally, in the late 1990s the ADFG moved the creek mouth to its present location approximately 60 yards east. The outlet was subsequently elevated many feet above its original elevation, forcing fish to migrate into the stream through a culvert that is only accessible during high tide. As part of a mitigation project for the Skagway Airport, the Alaska Department of Transportation Public Facilities (ADOTPF) placed a flume structure at the opening of the culvert, improving access to Pullen Creek for juvenile and adult fish.

In 2000, ADFG identified a fish passage barrier above the Dewey Lakes Hydroelectric Project tailrace. A small culvert was preventing pink salmon from accessing upper Pullen Creek. APT removed this culvert in 2001 with ADFG's guidance. A new creek bed was subsequently created with gravel and the creek banks were revegetated.

To improve fish habitat in the lower reach of Pullen Creek, ADOTPF completed a mitigation project that replaced two culverts between the creek mouth and Broadway Street. In addition, the section between the culverts was "daylighted" utilizing rock dams to create pools to aid fish migrating upstream. In addition, ADOTPF created a rock weir structure and installed baffling on the Second Street culvert to help decrease flow and create "steps" for the fish to pass upstream (see section 6.1 for more details).

Above Pullen Pond, there are two culverts which lead to a section of the creek termed the "Congress Way Reach". This stretch of stream is wide and shallow and appears to be backwatered from the downstream culvert. The east bank has no riparian vegetation. The reach is a known location for spawning, even though the habitat is not ideal spawning conditions. The TIWC has received a grant from USFWS to improve fish passage and habitat in the Congress Way reach of Pullen Creek.

Some of the storm drains connecting to Pullen Creek are accessible to fish at higher flows and lead to the gutter system. The problem is most noticeable at the storm drains that enter the creek on 9th and 10th Streets. Fish can enter the gutter system through the drain pipes and become trapped when water levels decrease. This could result in unnecessary fish kills that could be prevented with screens that block entry into the storm drain system.

Rusanowski (2004) conducted a Tier 1 habitat survey of Pullen Creek from Congress Way upstream to the headwaters for AP&T. The results of the survey showed that the bottoms of the large pools in Pullen Creek have heavy sediment deposits with very little gravels to produce quality habitat. Furthermore, the habitats in some of the riffles are filed with sediments. However, many of the riffles do provide good fish habitat as salmon smolts are found throughout Pullen Creek (Skagway 2005).

5.3 Sport and Commercial Fishing

Salmon returning to Pullen Creek must migrate into the stream through a culvert. Fish must therefore mill in saltwater off the mouth of the stream until a sufficient high tide and stream flows allow them to pass through the culvert. This situation increases the vulnerability of the fish to predation and to sport fishing. To ensure that enough salmon enter Pullen Creek for brood stock needs, the ADFG has closed the area of Taiya Inlet north of a line extending from a department marker on the Broadway Dock to a department marker on the ore terminal dock during June and August.

6.0 Current Projects

Various organizations have implemented separate projects to monitor and evaluate water quality and fish habitat. These organizations include the ADOTPF for Skagway Airport mitigation, APT for Dewey Lakes Hydroelectric relicensing, and TIWC for various projects, and the STC for ACWA programs. Below there is a brief description of the first three projects, and a detailed description of STC's ACWA project, which was the primary focus of the assessment.

6.1 Alaska Department of Transportation Airport Mitigation Project

The ADOTPF received a permit in 1998 to improve the airport, which included a channel modification to the Skagway River to divert flow away from the airport. The airport expansion project required mitigation work in Pullen Creek for the impacts on Skagway River. As part of the mitigation, ADOTPF replaced culverts and rebuilt the lower portion of Pullen Creek, largely to improve fish habitat (see section 5.2). Mitigation projects included replacing the Broadway Street culvert with two larger culverts, creating a "daylighted" segment of Pullen Creek on a stretch located near the ferry terminal, and building a rock weir structure and four baffle plates to back water into the culvert on Second Avenue.

Work for Pullen Creek mitigation was completed in 1999. According to the Skagway Airport Improvements Final Environmental Assessment, monitoring of Pullen Creek mitigation measures will evaluate impacts over a period of five years. Monitoring on Pullen Creek included fish identification and enumeration, fish passage, water flow measurements, and assessment of macroinvertebrate recruitment in the "daylighted" section.

Silver King Environmental completed the first monitoring for fish identification, enumeration, and passage for the ADOTPF in October 2002. At this time, the Pullen Creek structures were found to have two deficiencies: first, the four rock dams located near the ferry terminal have been washed out; second, the rock weir in Pullen Pond has also washed out and, therefore, is insufficient in backing water into the culvert.

The "daylighted" channel, according to the October 2002 evaluation, is likely used more as a migratory passage than a rearing area. The increased flow due to the loss of the rock dams may pose a

velocity barrier to fish attempting to migrate upstream. However, it was noted that there is the possibility of smaller fish being able to seek refuge from the increased flows along the rocky shoreline of the channel.

Both the dams and the rock weir in Pullen Creek were designed with undersized rocks that could not withstand the higher flows. The ADOTPF rebuilt the weir structure in the spring of 2004, but with larger rocks. The ADOTPF also installed additional baffles at the culvert outlet at Pullen Pond near Second Avenue. However, the rock dams will be replaced with boulder clusters.

6.2 Alaska Power and Telephone Dewey Lakes Hydroelectric Project

APT is undergoing the relicensing of the Dewey Lake Hydropower Project. Through its application with the Federal Energy Regulatory Commission, APT will monitor to determine if the power plant may be adversely impacting Pullen Creek. Addressing agency concerns, APT collected baseline data on the following parameters as part of its monitoring efforts: temperature, conductivity, pH, total dissolved solids, total suspended solids, turbidity, nitrogen, phosphorus, biological oxygen demand, alkalinity, chlorophyll A, fecal coliforms, nitrates, nitrites, total coliforms and hardness. Water temperature was monitored within the tailrace, as well as just above the railroad culvert. Water temperature stratification in the reservoir was collected on a quarterly basis, and a habitat survey was completed using the U.S. Forest Service "Fish and Aquatic Stream Habitat Survey" protocols (Rusanowski 2005).

6.3 Taiya Inlet Watershed Council Projects

The community of Skagway formed the TIWC in February of 2003. The council acts as a community stewardship organization for watersheds within the entire Taiya Inlet, but has focused much of its work thus far on Pullen Creek. A variety of projects have been completed or are ongoing, including annual litter pickup events, an annual public workshop focusing on stream ecology, and publication and distribution of a streamside stewardship brochure that provides landowners with suggestions for reducing potential sources of nonpoint source pollution and improving backyard fish and wildlife habitat.

The TIWC has also assisted with water quality monitoring, in cooperation with STC. Using the protocols outlined by STC in their Pullen Creek Quality Assurance Project Plan, TIWC conducted a water quality sampling event in November 2003. The purpose was to provide additional baseline data for STC's ACWA Project. Data obtained during the project are presented in Appendix C.

TIWC hosted a macroinvertebrate sampling training in the spring of 2004, using the volunteer level protocols established by the University of Alaska Anchorage's Environment and Natural Resources Institute. The training was held in conjunction the POWTEC, LLC. Skagway community members had requested macroinvertebrate information be included in the creek assessment. Results of the macroinvertebrate sampling event are presented in Table 29.

TIWC is currently funded in part by by a U.S. Fish and Wildlife Service (USFWS) grant for restoration work on Pullen Creek, starting with the Congress Way reach. The organization will continue to facilitate the exchange of information on Pullen Creek throughout the community of Skagway.

Finally, the TIWC received an FY06 ACWA grant to map and collect baseline data on the stormwater system in Skagway. In conjunction with the City of Skagway, the information will be used for educational outreach and the development of a stormwater management plan.

6.4 Skagway Traditional Council Alaska Clean Water Action Project for FY04

6.4.1 Introduction and Methods

In July 2003, STC received an ACWA grant to collect baseline water quality data for Pullen Creek. The primary purpose of the STC project was to assess water, sediment, bank soil and aquatic life (macroinvertebrates) in Pullen Creek, focusing on heavy metals. Lead, zinc, cadmium and mercury have been found in the Skagway Harbor and within the community of Skagway through various other testing programs. These contaminants are assumed to have originated from an ore transfer facility and the associated railroad. There are, however, other potential sources including seven formerly used defense sites (FUDS) used by the military during World War II, the effects of urbanization, and other undetermined sources.

While sampling was primarily for screening Pullen Creek for heavy metals, other data on hydrocarbons, basic water quality (temperature, dissolved oxygen, conductivity and pH), total suspended solids, discharge, and substrate composition were collected. In addition, a screening tested called a Tentatively Identified Compounds (TIC) was conducted to screen for a variety of common contaminants.

STC developed a Quality Assurance Project Plan (QAPP) for all data collected under their program between July 2003 and June 2005. There were five sampling locations on Pullen Creek, which were chosen to integrate tributaries and to give geographic spread along the creek (Figure 1). There were five sampling events to collect a full years worth of data: February 2004, May 2004, August 2004, November 2004, and March 2005. Water, sediments and bank soils were collected and analyzed for heavy metals and hydrocarbons for each sampling event. In addition, macroinvertebrates were collected in May 2005 and analyzed for heavy metals. Basic water quality, total suspended solids, discharge, substrate composition and TIC were also measured in situ during each sampling event.

All samples were collected in accordance to STC's QAPP. Heavy metal and hydrocarbon analysis on water, sediments and bank soils were conducted at Shoalwater Bay Laboratory and heavy metal analysis on macroinvertebrates was conducted by Columbia Analytical Services, Inc. Data from soil samples were compared back to the State of Alaska's Method 2 soil clean-up levels. Data on water samples were compared back to the State of Alaska water quality standards. For sediments, the data were compared to National Oceanic Atmospheric Administration's (NOAA) Effects Range Median (ERM) for Sediment Quality Guidelines. These guidelines were developed based upon marine sediments. The ERM is representative of concentrations above which effects frequently occur. These guidelines are not intended to be used as regulatory criteria or cleanup standards. There were no guidelines set for barium or selenium in NOAA's guidelines, so these parameters were compared to the State of Alaska's Method 2 soil clean-up levels. There are no standards set for comparison of biological data on macroinvertebrates. Biological samples from Pullen Creek will be compared back to Nelson Creek, which was selected as a reference stream due to it's similarity to Pullen Creek and it's geographic location outside of the Skagway valley basin.

6.4.2 Results and Discussion

The scope of the assessment was limited to contaminant screening purposes and does not address the extent and source of contamination. The data only determine if contaminants are present and at what levels. Tables 1-15 summarize data collected for heavy metal testing and tables 16-25 summarize data for hydrocarbon testing on soil, sediment and water for all sampling events. Table 26 summarizes the data collected for heavy metals on macroinvertebrates.

Arsenic in soils was detected at levels that exceeded the State of Alaska's clean-up standard (1.8 mg/kg) in February, May, August and November of 2004 (tables 1, 4, 7, 10). Arsenic levels were exceeded at every site for each sampling event, with the exception of Pullen Pond in August (1.5 mg/kg) and the confluence to Tributary One in November (1.4 mg/kg). In the March 2005 sampling event, arsenic was not detected in soil at any of the sites (table 13). Arsenic did not exceed sediment (70 mg/kg) or water (50 µg/L) standards for any sampling event. Due to the prevalence of arsenic in soils associated with Pullen Creek samples, a discussion for arsenic is warranted. The State's Method 2 soil clean-up level for arsenic is listed at 1.8 mg/kg. Background levels of arsenic occur naturally in Southeast Alaska soils, and it could be argued that the State of Alaska's regulatory levels are too low for non-drinking water sources.

There have been two previous investigations into background levels of arsenic in soils and sediments in Alaska. For arsenic, background levels in Alaska were found to be a mean of 6.7 mg/Kg and an arithmetic mean of 9.6 mg/Kg (USGS professional paper 1458) and 17.3 mg/Kg (Geochemical Atlas of Alaska). While these papers are not regulatory, they lend evidence that it would be difficult to regulate levels of arsenic that are above the State Method 2 soil clean-up level, because background levels of arsenic will always remain. The levels of arsenic found in this study do not exceed what may be considered background, and are therefore not noted as a high concern.

Barium exceeded the State of Alaska's Method 2 clean-up standard (982.0 mg/kg) at Tributary Two and the Rail Yard Headwater in soil in February 2004 (table 1). Barium also exceeded the State of Alaska's method 2 soil clean-up standard (982.0 mg/kg) at every site in sediment during the same sampling event (table 2). Barium exceeded the State of Alaska water quality standard (2000.0 µg/L) in water sampling once in August 2004 at the Pullen Pond site (table 9). While there are background levels of barium in Southeast Alaska soils, the State of Alaska's clean-up standards appear to be higher than the previously mentioned USGS study indicated as background (595 mg/kg and 698 mg/kg in USGS professional paper 1458). According to the Agency for Toxic Substances and Disease Registry (ATSDR), barium has adverse health impacts as occurs in compound form with other elements such as sulfur, carbon and oxygen. Common barium compounds have been found in drilling muds (lubricants for rock drills), paint, brinks, tiles, glass and rubber.

Cadmium exceeded the State of Alaska's method 2 soil clean-up level (4.5 mg/kg) at the Fish Hatchery site in August 2004 and at the Fish Hatchery and Confluence to Tributary One sites in March 2005. Cadmium was below standards for both sediments (6.6 mg/kg) and water (5.0 µg/L) for all sampling events. The State of Alaska's soil clean-up standards for cadmium are higher than the background levels found in the USGS study indicated as background (1.3 mg/kg and 2.0 mg/kg, USGS professional paper 1458). According to the ATSDR, cadmium can have adverse health impacts if exposure is to high levels over a long term. In addition, cadmium is considered a likely carcinogen. Cadmium can be found associated with production of metals such as zinc, lead and copper. It may also be found in batteries, pigments, metal coatings and plastics.

Chromium exceeded the State of Alaska's Method 2 soil clean-up level (23.0 mg/K) at the Fish Hatchery in March 2005 (table 13). Chromium was below standards for both sediments (370.0 mg/kg) and water (100.0 µg/L) for all sampling events. The State of Alaska's clean-up standards higher than what the USGS studies have determined as potential mean level background (50 mg/kg and 64 mg/kg in USGS professional paper 1458). According to the ATSDR, there are various forms of chromium (forms 0, III and VI) that have adverse impacts on human health. Chromium VI is a known carcinogen. While chromium III occurs naturally in the environment as an essential nutrient, chromium 0 and VI are generally produced by industrial processes. Chromium is used for making steel, chrome plating, dyes and pigments, leather tanning and wood preserving.

Lead exceeded the State of Alaska's Method 2 soil clean-up standards (400 mg/kg) in soil at the Fish Hatchery for all sampling events (tables 1, 4, 7, 10, 13). Lead also exceeded the standard in soil at the Confluence to Tributary One in August 2004 and March 2005 (tables 7 and 13). In February 2004 and May 2004, lead exceeded the standard in soil at the Railyard headwater (tables 1, 4). For sediments, lead exceeded the NOAA ERM (218.0 mg/Kg) at Pullen Pond, the Confluence to Tributary One, the Confluence to Tributary Two and the Rail Yard Headwater in February 2004 (Table 2). Lead also exceeded the NOAA ERM at the Confluence of Tributary Two during the August 2004 sampling event (table 8). Lead did not exceed the State of Alaska's water quality standard (15.0 µg/L). The State of Alaska's method 2 soil clean-up level and NOAA's ERM are both higher than what the USGS studies have determined as potential mean level background (12 mg/kg and 14 mg/kg in USGS professional paper 1458). Lead is a highly regulated contaminant due to its potential adverse effects on human health. While Pullen Creek is not a drinking water source for the community of Skagway, lead is easily transported through soil, air and water and has the potential for entering into the biotic communities and bioaccumulating through the food chain. According to the ATSDR, lead comes from mining, the burning of fossil fuels and the manufacturing of it. It is currently unknown whether or not lead can be considered a carcinogen. Lead can be used in batteries, ammunition, and metal products. In addition, lead can be used to shield against X-rays.

Mercury exceeded the State of Alaska's Method 2 soil clean-up standard (1.24 mg/kg) in soil in March 2005 at the Fish Hatchery (table 13). Mercury did not exceed NOAA's ERM in sediments (0.71 mg/kg) or the State of Alaska water quality standards (1.24 µg/L). There is not a level indicated by the USGS to be considered background for mercury (USGS professional paper 1458). According to the ATSDR, mercury is known to have extreme adverse health effects on human in low short-term and long-term doses. There is insufficient data to determine if mercury is a carcinogen. Mercury can be produced by microscopic organisms into the form of methylmercury. It can also be found naturally in it metallic form. Mercury is used to produce chlorine gas and caustic soda, as well as in thermometers, batteries and dental fillings.

Selenium and silver did not exceed any standard level set in this document for comparison; therefore there is no result to report for these elements.

Zinc did not exceed the State of Alaska's Method 2 soil clean-up level (8100.0 mg/kg) for any sampling event. However, zinc did exceed the NOAA ERM (410.0 mg/kg) in sediments at the Fish Hatchery, the Confluence of Tributary One, the Confluence of Tributary Two, and the Rail Yard Headwaters during the February 2004 sampling event (table 2). For sediments, zinc also exceeded the NOAA ERM (410.0 mg/kg) at the Fish Hatchery in May 2004, at the Confluence of Tributary Two in August 2004, and at the Confluence of Tributary One in March of 2005 (tables 5, 8, 14). Zinc did not exceed the State of Alaska's water quality standard (8100.0 mg/kg) for any sampling event. The State of Alaska's Method 2 soil clean-up level and NOAA's ERMs are both higher than what the USGS

study considers background in Alaska (70 mg/kg and 79 mg/kg, in USGS professional paper 1458). According to the ATSDR, zinc is a necessary element in the human diet. However, if exposure to zinc is 10 times what is needed for good health, the effects can be adverse. Zinc is not a known or suspected carcinogen. Zinc is used in coating to prevent rust, in dry cell batteries, and mixed with other metals to create alloys such as those found in U.S. pennies. Zinc compounds are commonly used to make paint, rubber, dyes, wood preservative and ointments.

There were not enough samples in the biological testing to conduct a statistical comparison on heavy metals in macroinvertebrates between the three sites. However, lead and zinc both appear to be found at higher levels in macroinvertebrates sampled at the Confluence of Tributary One (table 26). When comparing functional feeding groups, there was a significant difference in the level of barium between shredders and predators (t-test; $p = 0.025$), where shredders had a higher level. There is also a general trend of zinc levels being higher in shredders than in predators, but this was not significant ($p = 0.50$). Because there are no comparative data to compare levels back to, it is unknown if the levels of barium and zinc are of concern.

The hydrocarbon test used in the study was an analysis of Benzene, Toluene, Ethylbenzene and Xylene (BTEX). Ethylbenzene exceeded the State of Alaska's Method 2 soil clean-up level (5.0 mg/kg) in sediments during the November 2004 sampling event at the Pullen Pond site (77.4 mg/kg) and the Rail Yard Headwater site (17.4 mg/kg). There were no other exceedences in standards for sediment or water for any sampling event. According to the ATSDR there is very little information available on the effects of ethylbenzene on human health. It is also not a known carcinogen. Ethylbenzene can be found in manufactured products such as ink, insecticides, paint and fuels. It is used to make other chemicals like styrene.

Supplemental information collected under this project includes basic water quality data (temperature, dissolved oxygen, conductivity and pH), discharge and pebble count information for each site (table 27). This information was gathered to begin developing a general baseline of information for future data comparison. In addition, Total Suspended Solids were collected, however all samples came back with no detection of suspended solids above the Method detection limit (4.0 mg/L).

In general, water temperatures were coolest at the Pullen Pond site (average 4.3 ºC). A higher temperature measurement in August at this site is extreme, and may have been a result of a fish weir that was left in place without maintenance that had debris and dead salmon carcasses built up. Difficultly with the field calibration of the dissolved oxygen probe may account for abnormal readings (see table 27). All other temperature, pH and conductivity readings are within expected ranges.

Discharge at each site was also measured. At the Pullen Pond site, discharge measurements were dependant upon the Dewey Lakes Hydroelectric Plant. Measurements ranged from low of 2.33 cfs in February 05 to a high of 34.37 cfs in May 04. The Confluence of Tributary One had a mean discharge of 1.75 cfs (±0.43 cfs), the Fish Hatchery had a mean discharge of 0.40 cfs (±0.23 cfs), and the Confluence of Tributary Two had a mean discharge of 1.57 cfs (±0.87 cfs). Discharge was only measured at the Rail Yard Headwater in February 04 at 0.15 cfs and in May 04 at 0.50 cfs. Other measurements at this site were not obtained because of weather and low flowing conditions.

A summary of the pebble count data to qualify substrate at each site can be found in table 27. In general, the Pullen Pond site consisted of boulder (>256 mm) and small cobble (64-127.9 mm) in the stream bed, with sand and silt along the edges at the stream bank. The Confluence of Tributary One bed substrate was comprised of very course gravel (32-63.9 mm) and sand (<2 mm). The Fish

Hatchery site was dominated by silt (< 2mm) and detritus, with some wood. The Confluence of Tributary Two was a mix of sand/silt (<2 mm), detritus and vegetation. The Rail Yard Headwater site had very course gravel (32-63.9 mm) and small cobble (64-127.9 mm) embedded in sand/silt (<2 mm).

The STC performed a TIC (Tentatively Identified Compounds) test below Pullen Pond during the February 2004, May 2004, August 2004, November 2004, and March 2005 sampling events, to screen for other potential contaminants in the water column. The purpose of the TIC test was to determine if sampling should be covering other contaminants such as PCBs, pesticides, herbicides, etc. Two contaminants were detected during the TIC test (Table 28). In both February 2004 and March 2005, bis(2-Ethylhexyl) Phthalate was detected at 10 µg/L and in May pentachlorophenol was detected at 77 µg/L. The State of Alaska's groundwater clean-up level for each contaminant is 6.0 µg/L and 1.0 µg/L respectively.

Bis(2-Ethylhexyl) Phthalate (DEHP) is a common additive to plastics to make them more flexible. According to the Agency for Toxic Substances and Disease Registry (ATSDR) exposure is low and at low levels DEHP is not toxic. Pentachlorophenol is a manufactured chemical which is a restricted use pesticide and is used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings. At high levels, pentachlorophenol can be very toxic.

7.0 Recovery

A TMDL is a process through which pollution sources are identified. The study analyzes pollution sources of a waterbody and calculates the amount or 'load' of that specific pollutant that the water can receive and still maintain Water Quality Standards. TMDLs are a necessary first step toward waterbody recovery and are required for a waterbody to be 'de-listed' from the Alaska 303(d) Category 5 Impaired Waters List. A waterbody can also be taken off the list if other controls are in place to assure the recovery of the waterbody. In the case of Pullen Creek, there are no loads to be calculated since the metals contamination is not the result of a permitted wastewater discharge, nor is there any ongoing ore hauling into Skagway.

7.1 Water quality regulations

Section 303 (a), (b), and (c) of the Clean Water Act set out the requirements regarding the development and implementation of state water quality standards. Alaska's water quality standards are found in 18 AAC 70.

Section 303 (d) (1) (A) of the Clean Water Act requires that "Each State shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(l)(A) and section 301(b)(l)(B) are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters. "

Section 303 (d)(1)(C) further requires that "Each State shall establish for the waters identified in paragraph (l)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable

for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."

7.2 Current Action

Given the data gathered previously, ADEC determined that developing a Waterbody Recovery Plan instead of a TMDL for Pullen Creek was more appropriate. This decision was based in part on the results of the data which did not document any contamination in the water resulting from point source discharges into Pullen Creek. However, there is a potential for resuspending the heavy metal contamination that is documented in the soils and sediments in and around the creek. Any construction or disturbance in or around Pullen Creek could resuspend the heavy metals in the sediments and soils that could potentially harm fishes and other organisms in the creek.

For FY 06 STC proposed, and ADEC agreed to decided to develop a Best Management Practices Plan (BMP) to address the potential problem. The BMP's are being derived with all stakeholders on Pullen Creek to address any construction on or near the Creek. The BMP's will be in the interest of minimizing the impact of soil and sediment disturbance due to construction efforts. However, if the construction effort is going to disturb the soils and sediments, this document will provide some guidelines to follow to minimize any resuspending of the contaminants. Therefore, the following topics where developed with the stakeholders on and around Pullen Creek.

8.0 Best Management Practices

8.1 Water Quality Monitoring

Additional monitoring of the soil, sediment, and water contamination in Pullen Creek should be conducted over time to gather more data to quantify the existing contamination. Currently, there is only one year worth of data documenting the contamination in the creek. Multiple years of contamination data will show if there are certain times of the year the metals are suspended in the water and determine if there are any changes in the levels of contaminants in the soil and sediments over time. Furthermore, the multiple years of information will also show if any new contaminates are being introduced into the creek from another source (e.g. - any hydrocarbon spills near the creek or a similar event). It is recommended to continually monitor the water quality and soil/sediment contamination using the same protocols as above for consistency in the data.

It is also important to point sample for contaminants during certain events such as heavy rainfall. The results of point sampling will describe any "pulses" in heavy metals into the water. Heavy rainfall could cause severe bank erosion, resuspend the adjacent soil contamination, and the increase in flow from rainfall may change the hydrology of Pullen Creek to resuspend the instream sediment contaminants. If there is an increase in heavy metal contamination due to an instantaneous event, continuing to sample around that point in time would describe how long the metals stay in suspension until there is a decrease in flow. If flow is measured simultaneously, it can be determined what velocity of flow is needed to resuspend the contaminants.

8.1.1 Construction Pre and Post Monitoring.

Water quality monitoring using the project protocols should be conducted before and after any construction project that will disturb the bank soils and sediments. The pre construction monitoring will provide continuing baseline water quality data before soils are disturbed. Post construction monitoring of water quality will show if the project resulted in resuspending soils or sediments containing heavy metals. If contaminates were resuspended, the BMPs should be re-vaaluated to address what actions could have been taken to reduce the disturbance of heavy metals and apply that to future projects in the area. The monitoring will need to be conducted by STC under federal grant funding.

8.2 Stream Bank Erosion

Stream bank erosion on Pullen Creek likely contributes to the resuspending of heavy metal contaminants. The known heavy metals in the soils adjacent to Pullen Creek in certain areas (above Congress Way) are easily eroded into the creek due to foot traffic from people viewing the creek. The exposed soils are also susceptible to erosion in heavy rainfall throughout the year and snowmelt in the winter months. Stabilization of the adjacent bank soils will minimize the potential of resuspending the heavy metals in the Creek. Therefore, the following actions will contribute to streambank stabilization and reduce the erosion along the stream.

8.2.1 Revegetation of eroded stream banks

Sections of Pullen Creek are lacking existing vegetation directly adjacent to the stream. The root systems of the vegetation adjacent to the creek contribute to holding the soils in placed making them less susceptible to erosion from foot traffic or hydrology. Therefore, planting indigenous willow species and native herbaceous plants in the areas will help reduce erosion. Planting willows from existing willows on Pullen Creek can be accomplished within a few short days. Furthermore, if the herbaceous vegetation is identified, seeds may be ordered, delivered, and distributed in needed areas. A similar project was conducted directly above the AP&T powerhouse. However, the vegetation needs to be below 5 feet in height for the train operators. If vegetation is above 5 feet in height, it will be removed.

8.2.2 Construct viewing platforms.

Pullen Creek receives a lot of foot traffic along its banks during the tourist season from people viewing the creek and observing spawning salmon within the creek. This is an educational experience for the tourists and locals, but it makes a large contribution to the streambank erosion problem. Building viewing platforms along the creek in high use areas would reduce the erosion from foot traffic. The viewing platforms built along the creek would provide an elevated view of fish within the creek for better viewing. Furthermore, posting educational signs regarding stream erosion, ecology, and fish biology in relation to the platforms purpose would provide educational opportunities for Pullen Creek visitors.

8.2.3 Construction setbacks

Currently, there are no city ordinances for building setbacks along Pullen Creek. Construction directly adjacent to the streambank will contribute to the erosion. The stakeholders should actively pursue the adoption and implementation of city ordinances to address this issue. Existing construction would be grandfathered into the new ordinance, but any new construction would have to adhere to the newly established ordinance. Any construction setback will minimize sediment transport from future

projects. Less erosion would lead to a lower risk of resuspending the existing soil and sediment heavy metal contamination affecting the water quality. However, a city ordinance may be difficult to adopt and the main focus of action should be on voluntary implementation of BMP's until an ordinance can be passed.

8.2.4 Riprap the eroded banks

Riprap consists of placing large boulders along the stream bank with heavy equipment to stabilize the stream bank. The rock is large enough to withstand any velocity the stream may provide and hold back the bank soils to prevent erosion. The stream vegetation will grow up between the rocks to further stabilize the eroded stream bank. Therefore, it provides a two fold protective barrier against erosion with the Riprap and revegetated stream banks. It is suggested that the improvements will reduce the risk of resuspending the heavy metals within the bank soils by the trampling of people viewing the creek. Furthermore, the large boulders can be walked on without contributing to stream bank erosion. The drawback to rip rap is that it acts to transfer stream energy downstream which may accelerate erosion below armored banks.

8.3 Construction Practices

Without city ordinances, current and or future construction projects are not regulated adjacent to Pullen Creek. However, during the construction process, the stakeholder can take action to minimize the potential of resuspending heavy metals in the creek. The following guidelines are stated here as recommendations to the stakeholder as a guideline during construction. If the stakeholders would like to implement city ordinances, it is suggested to approach the City of Skagway and discuss the proper protocols needed to initiate a city ordinance for development setbacks along Pullen Creek.

8.3.1 Silt fences

Construction projects adjacent to the creek involving the disturbance of bank soils will resuspend the contaminants within the soil. The use of silt fences adjacent to the construction site can minimize this potential issue. The fabric allows the passage of water through, but does not allow the soils or sediments to pass through. The fence will not completely halt the impact to the creek given the fence system is not completely closed, impervious to soil spill over the top, and accidental soil spills into the creek during construction. However, it will keep the majority of the disturbed soils and sediments to a more confined area.

8.3.2 Soil removal

Construction projects removing soils and sediments adjacent to Pullen Creek also pose a risk of recontamination. In these instances, a silt fence should be placed around the construction area and soil/sediment placed back from the creek. Heavy rainfall on the loose soil pile will not erode into the creek or accidentally fall into the creek due to sliding from the pile. If the soil is to be replaced in the respective excavation, the continual use of silt fence is needed. However, if the soil is scheduled for removal, proper care of the contaminated soil should be taken to prevent any further contamination

8.3.3 Contaminated soil care

Proper care of excavated soil to be removed from the site containing contaminants must be taken.. Soils should be stored in an area where the contamination will remain enclosed and unable to spread. Using contaminated soil as fill in other areas of Skagway is a bad practice since it may extend the range of heavy metal contamination to unaffected areas of the community. Depending on the degree of contamination, excavated soil could potentially be used in the landfills to cover the areas that are no longer in use. The contaminated soil may also be placed in existing areas of known contamination as fill. Such areas could be along the railroad tracks and/ or used as fill in another area of Pullen Creek known to have existing heavy metals.

8.4 Address other sources of pollution

Pullen Creek is known to have heavy metal contamination in the soils and sediments, but other potential sources of pollution exist within the community that could affect the water quality of Pullen Creek. Other sources of pollution include snow storage and debris. Education and volunteer efforts will reduce the potential for these sources to contribute to the contamination of Pullen Creek.

8.4.1 Snow storage

During the winter months, snow is plowed and moved into various places within the community of Skagway. The snow is removed from streets and parking lots and the snow contains debris and hydrocarbon pollutants that collect from automobiles using the streets and parking lots. When the snow is piled near Pullen Creek, the pollutants are then transferred within a short distance of the creek. When the snow melt occurs in the spring, the pollutants are transferred to the creek as the snow pile recedes. Therefore, the storage of snow at locations away from the stream will prevent pollution from entering the creek.

8.4.2 Debris clean up

Large amounts of debris are currently residing in Pullen Creek and some of the debris has the potential to contribute more contaminates to the creek. Debris such as paper, beverage cans, scrap metal, plastic containers, and other plastic products are contaminating the aesthetic value of Pullen Creek. Large metals drums and containers are also found within the creek. The drums are most likely old fuel drums or another chemical substance that may be leeching into the creek if the drums were recently placed into the creek. It is unlikely a drum that has been in the creek for long periods of time is contributing any contamination, but it does affect the aesthetic value of the Pullen Creek. However, clean up is relatively easy by physically removing the debris from the creek and deposing of it in the Skagway incinerator or the landfill in Haines.

8.4.3 Stormwater

Contamination from stormwater drains is a potential factor in hydrocarbon contamination and is addressed in the Pullen Creek Action Plan developed by the Taiya Inlet Watershed Council (2006).

8.5 Public education

Public education about Pullen Creek and its contaminants is one of the most important aspects of improving or preventing any contamination to the creek. Educating the visitors and residents of Skagway will give them the understanding of what their actions are and how they may be contributing to the contamination issues. As a result of education, people will be more conscious about their

actions and possibly change their actions for the benefit of the creek and the community. Therefore, taking action in the form of public meetings, interpretive signs, and volunteer cleanups will contribute to minimizing future impacts to Pullen Creek and possibly improving overall health of the watershed.

8.5.1 Interpretive signs

Interpretive signs placed along Pullen Creek would have a positive influence on residents and the visitors/tourists in the community of Skagway. Signs explaining the current contamination along Pullen Creek and its effects on the community would be read by the thousands of visitors. Other educational signs would include information on the fish inhabiting Pullen Creek and the possible heavy metal contamination on them caused by trampled streambanks. Furthermore, the signs would educate the public about the actions they could take to improve the problem. For example, view the creek without descending the banks to prevent resuspending any heavy metals in the water and the proper disposal of debris that may eventually get into the creek.

8.5.2 Volunteer Clean up

Volunteer clean up days on Pullen Creek could be held with the residents of Skagway. It is a good way to get private landowners and community residents to take action to remove debris from the creek. It is recommended to hold clean up day's in the early spring, mid summer, and the fall after tourist season. The continuation of the early spring "clean sweep" will address the debris accumulated over the winter months. The mid summer cleanups are the most likely times the creek will receive lots of debris given the large influx of visitors to Skagway. The mid summer and fall cleanups would have to be coordinated by the local stakeholders, but the actions will greatly contribute to the overall health and aesthetic value of Pullen Creek. Finally, the post tourist season clean up will remove debris before heading into the winter months.

8.5.3 Public education meeting

The residents of Skagway are at a low risk of health problems from heavy metals according to the Alaska Health and Social Services (AHSS). In September 1989, AHSS drew blood from 167 residents of Skagway and analyzed the blood for lead. The results showed that the residents of Skagway had blood lead levels that are below the national average. Therefore they suggest that there are no public health problems to the residents of Skagway due to lead exposure (Middaugh et al. 1989).

Public meetings should be held for the residents of Skagway to educate them on the current situation in Pullen Creek. It is a good time to discuss the heavy metal contamination on the Creek and what they can do to prevent resuspending the soil under and near the creek and possibly improve the overall health of Pullen Creek. Discussions about fish in Pullen Creek and how they benefit the community should also be addressed. Furthermore, discussions regarding erosion and how it affects fish, fish habitat, and the community health in relation to heavy metal contamination will further bring the issues to the forefront. The meeting will also present the opportunity for the community to voice their thoughts and establish their priorities for Pullen Creek.

9.0 Nine Key Elements

As described above, Pullen Creek is listed on the 303(d) list for heavy metals that are from a legacy industrial activity. The metals are found within the soils and sediments and are of non point pollution sources. It is noted that the water has shown no data to describe any heavy metals in water of Pullen

Creek. Therefore, we will address the nine key components of a Waterbody recovery Plan including implementing BMP's as construction is initiated. Fully implemented BMPs are expected to contain the current contamination in place and possibly decrease soil and sediment contamination.

9.1 Load Reductions

The STC has not quantified potential load reductions in this report. It is very difficult to calculate or model a specific load reduction in this instance due to the nature and location of the contamination. Current loading, if any, is most likely the result of natural events (blowing dust) and continued erosion of bank materials. The goal of BMP implementation is to eliminate or minimize the exposure of contaminated soils in locations where there is a potential transport pathway to Pullen Creek. If the BMP's are not implemented by the community and stakeholders, there will likely be an increase in levels of contamination in the sediments in Pullen Creek. The increase in contamination would be a result of resuspending the existing contaminates that is found in soils below the surface. Future estimation of load reductions could be accomplished by implementing the monitoring strategies described in this plan.

9.2 Assistance

Implementing and measuring the success of the BMP's will require technical and financial assistance from outside sources. The Alaska Department of Environmental Conservation will provide technical assistance as needed to stakeholders who will implement and monitor the BMP's. POWTEC, LLC would also be available for contractual assistance with water quality monitoring to quantify the effects of BMP implementation. The assistance could be in the form of Pullen Creek site visits with STC and TIWC. Financially, STC or TIWC could fund the monitoring with federal and state assistance grants. The ACWA grant program from ADEC is the most likely source. However, EPA may have assistance available to supplement any ACWA funds and/or fund the projects solely.

9.3 Schedule

The STC will work to educate local builders on the benefits of implementing BMP's before, during, and after construction along Pullen Creek as well as any other areas where construction is likely to occur. Implementation of BMP's will act to prevent re-suspension of soil and sediment contaminants. A set schedule is difficult to project as future construction is not on a set schedule; however, the BMP's will be used and implemented as the construction begins.

9.4 Milestones

Projecting milestones in terms of load reduction is difficult as there is no ore hauling or storage at the current time. The use of the BMP's may show a reduction over time as old sediments containing contaminants are naturally flushed through Pullen Creek and future sediment introduction is controlled. If the BMP's are implemented, the concentration of contaminants in the soils and sediments should be reduced and not increased because the soils and sediments will not be resuspended. Monitoring the heavy metals of Pullen Creek every 5 years may gradually show a reduction in loading even as construction occurs adjacent to the creek. If there are increases in contaminants, then the BMP's should be reevaluated.

9.5 Monitoring Methods

It is recommended to continually monitor the effects of the BMP's using the methods/protocols that are described in section 6.4.1.

9.6 Information and Education

It is important to provide information and education to the residents of Skagway regarding the BMP's through public meetings. Public meetings should be held to explain the BMP's to the residents and then have annual meetings to discuss the status of the contamination to the residents. The BMP's should also be distributed to the contractors who are going to initiate any construction along the creek to educate them on the practices to reduce the risk of resuspending the heavy metals. The BMP's shall be made available to the contractor when the permits are issued.

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We are from Skagway. Our grandfathers and grandmothers are our Ancestors who have gone on we call them Haa Shagoon. It is from ages past that they have called this land Chilkoot Lkóot Aani. That is how we know it today. We who now walk this land seek to learn the ways of our Ancestors, to live in harmony and balance on this land. It will be this way, because of your help. Your kindness is amazing. We have always had respect for each other through our culture. Thank you so much, our friends and relatives.

This land is sacred to our people, and we are grateful for those who help us watch over and care for the land of our grandparents. The Skagway Traditional Council would like to acknowledge the work, dedication, and kindness of the following people and organizations for making this project a success:

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Land Owners along Pullen Creek
For allowing sampling and other work done along the property. A community-wide sense of responsibility and cooperation is necessary for the long term health of Pullen Creek

Tables

Table 1. Results of February, 2004 soil sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	2/23/2004	2/24/2004	2/23/2004	2/23/2004	2/24/2004
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
FIELD SAMPLE ID:	PPSOM2	FHSOM2	T1SOM2	T2SOM2	HWSOM2
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-02	40226-15	40226-18	40226-07	40226-10
DATE RECEIVED:	2/26/2004	2/26/2004	2/26/2004	2/26/2004	2/26/2004
DATE ANALYZED	4/29/2004	4/29/2004	4/29/2004	4/29/2004	4/29/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) - 1.8 mg/Kg	3.7	8.2	20	8.1	12.9
Barium (Ba) - 982.0 mg/Kg	367	653	452	1060	1360
Cadmium (Cd) - 4.5 mg/Kg	ND	1.3	0.9	0.800	2.8
Chromium (Cr) - 23.0 mg/Kg	7.7	19.9	13	6.2	19.8
Lead (Pb) - 400.0 mg/Kg	123.0	1240	346	116	520
Mercury (Hg) - 1.24 mg/Kg	ND	ND	ND	ND	ND
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) - 19.0 mg/Kg	ND	2.1	ND	ND	2.60
Zinc (Zn) - 8100.0 mg/Kg	85	673	317	263	391

Table 2. Results of February, 2004 sediment sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the NOAA's Effects Range Median for Sediment Quality Guidelines (for arsenic, cadmium, chromium, lead, mercury, silver and zinc) and the State of Alaska's Method 2 soil clean-up levels (for barium and selenium).

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	2/24/2004	2/23/2004	2/24/2004	2/24/2004	2/23/2004
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID:	PPSDM2	FHSDM2	T1SDM2	T2SDM2	HWSDM2
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-03	40226-16	40226-19	40226-08	40226-11
DATE RECEIVED:	2/26/2004	2/26/2004	2/26/2004	2/26/2004	2/26/2004
DATE ANALYZED	4/29/2004	4/29/2004	4/29/2004	4/29/2004	4/29/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) – 70.0 mg/Kg	13.0	19.2	7.1	15	17.5
Barium (Ba) - 982.0 mg/Kg	1290	1340	1080	1070	1840
Cadmium (Cd) – 6.6 mg/Kg	ND	1.7	0.7	2.000	1.6
Chromium (Cr) - 370.0 mg/Kg	20	43.5	12	32	30.6
Lead (Pb) - 218.0 mg/Kg	422	207	263	373	633
Mercury (Hg) – 0.71 mg/Kg	ND	ND	ND	ND	ND
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) – 3.73 mg/Kg	1.2	0.7	ND	0.9	2.40
Zinc (Zn) - 410.0 mg/Kg	293	835	551	913	557

Table 3. Results of February, 2004 water sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 208.2, 245.1, and 289.2. Clean up levels are indicated next to contaminant and are based on the State of Alaska groundwater clean-up levels.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		2/23/2004	2/24/2004
TYPE OF SAMPLE:	Blank	Water	Water
FIELD SAMPLE ID:	BLWM	PPWM2	HWWM2
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-22	40226-05	40226-13
DATE RECEIVED:	2/26/2004	2/26/2004	2/26/2004
DATE ANALYZED	4/29/2004	4/29/2004	4/29/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L
Arsenic (As) – 50 ug/L	ND	ND	ND
Barium (Ba) - 2000.0 ug/L	ND	77	84
Cadmium (Cd) - 5.0 ug/L	ND	ND	ND
Chromium (Cr) - 100.0 ug/L	1.4	1.6	0.63
Lead (Pb) - 15.0 ug/L	ND	ND	ND
Mercury (Hg) – 1.24 mg/Kg	ND	ND	ND
Selenium (Se) - 50.0 ug/L	ND	ND	ND
Silver (Ag) – 180.0 ug/L	ND	1.01	ND
Zinc (Zn) – 11000.0 ug/L	ND	ND	ND

Table 4. Results of May, 2004 soil sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	5/17/2004	5/17/2004	5/17/2004	5/17/2004	5/17/2004	5/17/2004
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil	Soil
FIELD SAMPLE ID:	PPSOM3	FHSOM3	T1SOM3	T2SOM3	HWSOM3	HWSOM3
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40519-06	40519-23	40519-19	40519-27	40519-14	40519-14 Dup
DATE RECEIVED:	5/19/2004	5/19/2004	5/19/2004	5/19/2004	5/19/2004	5/19/2004
DATE ANALYZED	5/26/2004	5/26/2004	5/26/2004	5/26/2004	5/26/2004	5/26/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) - 1.8 mg/Kg	4.4	3.0	1.9	2.7	4.7	4.5
Barium (Ba) - 982.0 mg/Kg	280.0	180.0	210.0	290.0	120.0	110.0
Cadmium (Cd) - 4.5 mg/Kg	ND	ND	ND	ND	ND	ND
Chromium (Cr) - 23.0 mg/Kg	2.4	6.4	5.1	3.6	11.0	3.7
Lead (Pb) - 400.0 mg/Kg	90.0	620.0	340.0	54.0	740.0	640.0
Mercury (Hg) - 1.24 mg/Kg	ND	ND	ND	ND	ND	ND
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND	ND
Silver (Ag) - 19.0 mg/Kg	ND	ND	ND	ND	2.2	2.3
Zinc (Zn) - 8100.0 mg/Kg	130.0	650.0	1800.0	94.0	290.0	300.0

Table 5. Results of May, 2004 sediment sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the NOAA's Effects Range Median for Sediment Quality Guidelines (for arsenic, cadmium, chromium, lead, mercury, silver and zinc) and the State of Alaska's Method 2 soil clean-up levels (for barium and selenium).

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	5/17/2004	5/17/2004	5/17/2004	5/17/2004	5/17/2004
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID:	PPSDM3	FHSDM3	T1SDM3	T2SDM3	HWSDM3
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40519-07	40519-24	40519-20	40519-28	40519-15
DATE RECEIVED:	5/19/2004	5/19/2004	5/19/2004	5/19/2004	5/19/2004
DATE ANALYZED	5/26/2004	5/26/2004	5/26/2004	5/26/2004	5/26/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) – 70.0 mg/Kg	0.8	3.4	1.2	1.6	1.2
Barium (Ba) - 982.0 mg/Kg	250.0	180.0	190.0	200.0	170.0
Cadmium (Cd) – 6.6 mg/Kg	ND	ND	ND	ND	ND
Chromium (Cr) - 370.0 mg/Kg	5.5	14.0	5.5	5.6	6.9
Lead (Pb) - 218.0 mg/Kg	80.0	98.0	75.0	66.0	130.0
Mercury (Hg) – 0.71 mg/Kg	ND	ND	ND	ND	ND
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) – 3.73 mg/Kg	ND	0.6	ND	ND	ND
Zinc (Zn) - 410.0 mg/Kg	110.0	770.0	240.0	200.0	160.0

Table 6. Results of May, 2004 water sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 208.2, 245.1, and 289.2. Clean up levels are indicated next to contaminant and are based on the State of Alaska groundwater clean-up levels.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Rail Yard Headwater (State St.)**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		5/17/2004	5/17/2004	5/17/2004
TYPE OF SAMPLE:	Blank	Water	Water	Water
SAMPLE ID:	BLWM3	PPWM3	HWWM3	HWWM3 DUP
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	Blank	40519-09	40519-17	40519-17 DUP
DATE RECEIVED:	5/19/2004	5/19/2004	5/19/2004	5/19/2004
DATE ANALYZED	5/26/2004	5/26/2004	5/26/2004	5/26/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L
Arsenic (As) – 50 ug/L	ND	ND	ND	ND
Barium (Ba) - 2000.0 ug/L	ND	ND	ND	ND
Cadmium (Cd) - 5.0 ug/L	ND	ND	ND	ND
Chromium (Cr) - 100.0 ug/L	ND	ND	ND	ND
Lead (Pb) - 15.0 ug/L	ND	ND	ND	ND
Mercury (Hg) – 1.24 mg/Kg	ND	ND	ND	ND
Selenium (Se) - 50.0 ug/L	ND	ND	ND	ND
Silver (Ag) – 180.0 ug/L	0.6	0.6	0.5	0.6
Zinc (Zn) – 11000.0 ug/L	ND	ND	ND	ND

Table 7. Results of August, 2004 soil sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Rail Yard Headwater (State St.)**	**Pullen Creek Rail Yard Headwater (State St.)**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**				
DATE OF SAMPLE:	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:	PPSOM4	FHSOM4	T1SOM4	T2SOM4	HWSOM4	HWSOM4
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40902-01	40902-12	40902-08	40902-16	40902-20	40902-20 Dup
DATE RECEIVED:	9/2/2004	9/2/2004	9/2/2004	9/2/2004	9/2/2004	9/2/2004
DATE ANALYZED	9/21/2004	9/21/2004	6/21/2004	9/21/2004	9/21/2004	9/21/2004
CONCENTRATION UNITS:	Mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) - 1.8 mg/Kg	1.5	12.0	7.0	6.1	7.6	6.8
Barium (Ba) - 982.0 mg/Kg	105.0	302.0	408.0	250.0	344.0	NA
Cadmium (Cd) - 4.5 mg/Kg	ND	5.4	0.7	ND	2.3	2.3
Chromium (Cr) - 23.0 mg/Kg	2.2	12.0	6.1	7.2	15.0	15.0
Lead (Pb) - 400.0 mg/Kg	54.6	1627.0	438.0	129.0	358.0	NA
Mercury (Hg) - 1.24 mg/Kg	ND	ND	ND	ND	ND	ND
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND	ND
Silver (Ag) - 19.0 mg/Kg	ND	5.4	ND	ND	1.9	2.1
Zinc (Zn) - 8100.0 mg/Kg	49.3	2554.0	960.0	179.0	320.0	NA

Table 8. Results of August, 2004 sediment sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the NOAA's Effects Range Median for Sediment Quality Guidelines (for arsenic, cadmium, chromium, lead, mercury, silver and zinc) and the State of Alaska's Method 2 soil clean-up levels (for barium and selenium).

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek Confluence of Tributary**	**Pullen Creek Confluence of Tributary**	**Pullen Creek Rail Yard Headwater**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**One**	**Two**	**(State St.)**
DATE OF SAMPLE:	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:	PPSDM4	FHSDM4	T1SDM4	T2SDM4	HWSDM4
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40902-02	40902-13	40902-09	40902-17	40902-21
DATE RECEIVED:	9/2/2004	9/2/2004	9/2/2004	9/2/2004	9/2/2004
DATE ANALYZED	9/21/2004	9/21/2004	9/21/2004	9/21/2004	9/21/2004
CONCENTRATION UNITS:	Mg/Kg	mg/Kg	Mg/Kg	mg/Kg	mg/Kg
Arsenic (As) – 70.0 mg/Kg	2.9	4.8	2.3	8.6	7.8
Barium (Ba) - 982.0 mg/Kg	394.0	180.0	99.7	248.0	397.0
Cadmium (Cd) – 6.6 mg/Kg	ND	ND	ND	1.0	0.6
Chromium (Cr) - 370.0 mg/Kg	3.6	7.1	2.7	14.0	14.0
Lead (Pb) - 218.0 mg/Kg	52.8	64.4	60.7	232.0	159.0
Mercury (Hg) – 0.71 mg/Kg	ND	ND	ND	ND	ND
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) – 3.73 mg/Kg	ND	ND	ND	0.8	0.8
Zinc (Zn) - 410.0 mg/Kg	137.0	218.0	179.0	565.0	145.0

Table 9. Results of August, 2004 water sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 208.2, 245.1, and 289.2. Clean up levels are indicated next to contaminant and are based on the State of Alaska groundwater clean-up levels.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Rail Yard Headwater (State St.)**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		8/31/2004	8/31/2004	8/31/2004
TYPE OF SAMPLE:	Blank	Water	Water	Water
SAMPLE ID:	BLWM4	PPWM4	HWWM4	HWWM4 DUP
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	Method Blank	40902-04	40902-23	40902-23 DUP
DATE RECEIVED:	9/2/2004	9/2/2004	9/2/2004	9/2/2004
DATE ANALYZED	9/21/2004	9/21/2004	9/21/2004	9/21/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L
Arsenic (As) – 50 ug/L	ND	ND	ND	ND
Barium (Ba) - 2000.0 ug/L	ND	1200.0	130	140
Cadmium (Cd) - 5.0 ug/L	ND	ND	ND	ND
Chromium (Cr) - 100.0 ug/L	4.7	1.6	0.7	0.5
Lead (Pb) - 15.0 ug/L	ND	ND	ND	ND
Mercury (Hg) – 1.24 mg/Kg	ND	ND	ND	ND
Selenium (Se) - 50.0 ug/L	ND	ND	ND	ND
Silver (Ag) – 180.0 ug/L	ND	ND	ND	ND
Zinc (Zn) – 11000.0 ug/L	ND	ND	ND	ND

Table 10. Results of November, 2004 soil sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Rail Yard Headwater (State St.)**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**			
DATE OF SAMPLE:	11/15/2004	11/15/2004	11/15/2004	11/15/2004	11/15/2004
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:	PPSOM5	FHSOM5	T1SOM5	T2SOM5	HWSOM5
TESTING LABORATORY	Edge Analytical	Edge Analytical	Edge Analytical	Edge Analytical	Edge Analytical
LABORATORY SAMPLE ID:	40902-01	41117-24	41117-20	41117-16	41117-08
DATE RECEIVED:	11/19/2004	11/19/2004	11/19/2004	11/19/2004	11/19/2004
DATE ANALYZED	12/10/2004	12/13/2004	12/10/2004	12/10/2004	12/10/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) - 1.8 mg/Kg	14.0	5.8	1.4	2.6	5.7
Barium (Ba) - 982.0 mg/Kg	99.0	250.0	156.0	133.0	318.0
Cadmium (Cd) - 4.5 mg/Kg	1.5	3.4	1.5	2.0	3.5
Chromium (Cr) - 23.0 mg/Kg	7.9	6.7	5.4	7.9	12.0
Lead (Pb) - 400.0 mg/Kg	60.0	592.0	18.0	33.0	168.0
Mercury (Hg) - 1.24 mg/Kg	0.1	0.2	0.0	0.1	0.2
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) - 19.0 mg/Kg	ND	ND	ND	ND	ND
Zinc (Zn) - 8100.0 mg/Kg	63.0	373.0	48.0	109.0	127.0

Table 11. Results of November, 2004 sediment sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the NOAA's Effects Range Median for Sediment Quality Guidelines (for arsenic, cadmium, chromium, lead, mercury, silver and zinc) and the State of Alaska's Method 2 soil clean-up levels (for barium and selenium).

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Rail Yard Headwater (State St.)**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**			
DATE OF SAMPLE:	11/15/2004	11/15/2004	11/15/2004	11/15/2004	11/15/2004
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:	PPSDM5	FHSDM5	T1SDM5	T2SDM5	HWSDM5
TESTING LABORATORY	Edge Analytical	Edge Analytical	Edge Analytical	Edge Analytical	Edge Analytical
LABORATORY SAMPLE ID:	41117-02	41117-25	41117-21	41117-17	41117-09
DATE RECEIVED:	11/19/2004	11/19/2004	11/19/2004	11/19/2004	11/19/2004
DATE ANALYZED	12/10/2004	12/13/2004	12/13/2004	12/10/2004	12/10/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) – 70.0 mg/Kg	2.4	4.5	5.5	4.0	4.2
Barium (Ba) - 982.0 mg/Kg	168.0	172.0	172.0	136.0	159.0
Cadmium (Cd) – 66.0 mg/Kg	2.1	2.5	3.1	3.1	2.3
Chromium (Cr) – 370.0 mg/Kg	7.3	11.2	12.0	4.3	12.0
Lead (Pb) - 218.0 mg/Kg	113.0	70.0	108.0	53.0	123.0
Mercury (Hg) – 0.71 mg/Kg	0.1	0.1	0.1	0.0	0.1
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) – 3.73 mg/Kg	ND	ND	ND	ND	ND
Zinc (Zn) - 410.0 mg/Kg	174.0	170.0	353.0	91.0	139.0

Table 12. Results of November, 2004 water sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 208.2, 245.1, and 289.2. Clean up levels are indicated next to contaminant and are based on the State of Alaska groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek Rail Yard**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Headwater (State St.)**
DATE OF SAMPLE:	11/15/2004	11/15/2004
TYPE OF SAMPLE:	Water	Water
SAMPLE ID:	PPWM5	HWWM5
TESTING LABORATORY	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	41117-04	41117-11
DATE RECEIVED:	11/19/2004	11/19/2004
DATE ANALYZED	12/8/2004	12/8/2004
CONCENTRATION UNITS:	ug/L	ug/L
Arsenic (As) – 50 ug/L	ND	0.0002
Barium (Ba) - 2000.0 ug/L	0.0460	0.0520
Cadmium (Cd) - 5.0 ug/L	ND	ND
Chromium (Cr) - 100.0 ug/L	ND	ND
Lead (Pb) - 15.0 ug/L	ND	0.0010
Mercury (Hg) – 1.24 mg/Kg	ND	0.0010
Selenium (Se) - 50.0 ug/L	ND	ND
Silver (Ag) – 180.0 ug/L	ND	ND
Zinc (Zn) – 11000.0 ug/L	ND	ND
Zinc (Zn) - 8100.0 mg/Kg	0.0030	ND

Table 13. Results of March, 2005 soil sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005
TYPE OF SAMPLE:	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:	PPSOM6	FHSOM6	T1SOM6	T2SOM6	HWSOM6
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	50309-01	50309-12	50309-08	50309-16	50309-20
DATE RECEIVED:	4/1/2005	4/1/2005	4/1/2005	4/1/2005	4/1/2005
DATE ANALYZED	4/5/2005	4/5/2005	4/5/2005	4/13/2005	4/13/2005
CONCENTRATION UNITS:	Mg/Kg	mg/Kg	Mg/Kg	mg/Kg	mg/Kg
Arsenic (As) - 1.8 mg/Kg	ND	ND	ND	ND	ND
Barium (Ba) - 982.0 mg/Kg	53.3	320.0	240.0	244.0	356.0
Cadmium (Cd) - 4.5 mg/Kg	ND	7.1	8.0	ND	3.0
Chromium (Cr) - 23.0 mg/Kg	6.9	22.8	14.2	7.5	18.7
Lead (Pb) - 400.0 mg/Kg	19.6	2090.0	485.0	186.0	350.0
Mercury (Hg) - 1.24 mg/Kg	ND	2.1	0.3	0.2	0.2
Selenium (Se) - 3.0 mg/Kg	ND	ND	ND	ND	ND
Silver (Ag) - 19.0 mg/Kg	ND	ND	ND	ND	2.6
Zinc (Zn) - 8100.0 mg/Kg	39.3	1790.0	1200.0	166.0	345.0

Table 14. Results of March, 2005 sediment sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the NOAA's Effects Range Median for Sediment Quality Guidelines (for arsenic, cadmium, chromium, lead, mercury, silver and zinc) and the State of Alaska's Method 2 soil clean-up levels (for barium and selenium).

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Rail Yard Headwater (State St.)**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**			
DATE OF SAMPLE:	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:	PPSDM6	FHSDM6	T1SDM6	T2SDM6	HWSDM6
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	50309-02	50309-13	50309-09	50309-17	50309-21
DATE RECEIVED:	4/1/2005	4/1/2005	4/1/2005	4/1/2005	4/1/2005
DATE ANALYZED	4/5/2005	4/5/2005	4/5/2005	4/13/2005	4/13/2005
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) – 70.0 mg/Kg	ND	ND	ND	ND	ND
Barium (Ba) - 982.0 mg/Kg	132.0	196.0	191.0	198.0	187.0
Cadmium (Cd) – 6.6 mg/Kg	1.3	ND	2.4	2.0	2.0
Chromium (Cr) - 370.0 mg/Kg	4.2	8.7	11.4	11.7	16.9
Lead (Pb) - 218.0 mg/Kg	9.7	17.3	36.8	20.7	47.3
Mercury (Hg) – 0.71 mg/Kg	33.4	50.3	116.0	107.0	215.0
Selenium (Se) - 3.0 mg/Kg	0.1	0.1	0.1	0.1	0.2
Silver (Ag) – 3.73 mg/Kg	ND	ND	ND	ND	ND
Zinc (Zn) - 410.0 mg/Kg	ND	ND	ND	ND	ND
Zinc (Zn) - 8100.0 mg/Kg	90.6	134.0	452.0	271.0	200.0

Table 15. Results of March, 2005 water sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 208.2, 245.1, and 289.2. Clean up levels are indicated next to contaminant and are based on the State of Alaska groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek Rail Yard Headwater (State St.)**
DESCRIPTION OF LOCATION:	**Pullen Pond**	
DATE OF SAMPLE:	3/7/2005	3/7/2005
TYPE OF SAMPLE:	Water	Water
SAMPLE ID:	PPWM6 Shoalwater	HWWM6 Shoalwater
TESTING LABORATORY	Tribal	Tribal
LABORATORY SAMPLE ID:	50309-04	50309-23
DATE RECEIVED:	4/1/2005	4/1/2005
DATE ANALYZED	4/12/2005	4/12/2005
CONCENTRATION UNITS:	ug/L	ug/L
Arsenic (As) – 50 ug/L	ND	ND
Barium (Ba) - 2000.0 ug/L	0.0520	0.0520
Cadmium (Cd) - 5.0 ug/L	ND	ND
Chromium (Cr) - 100.0 ug/L	ND	ND
Lead (Pb) - 15.0 ug/L	ND	ND
Mercury (Hg) – 1.24 mg/Kg	ND	0.0010
Selenium (Se) - 50.0 ug/L	ND	ND
Silver (Ag) – 180.0 ug/L	ND	ND
Zinc (Zn) – 11000.0 ug/L	ND	ND
Zinc (Zn) - 8100.0 mg/Kg	0.0070	ND

Table 16. Results of February, 2004 sediment sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to Contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	2/23/2004	2/24/2004
TYPE OF SAMPLE:	Sediment	Sediment
FIELD SAMPLE ID:	PPSDB2	HWSDB2
TESTING LABORATORY	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-04	40226-12
DATE RECEIVED:	2/26/2004	2/26/2004
DATE ANALYZED	3/1/2004	3/1/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg
Benzene - 0.02 mg/Kg	ND	ND
Ethylbenzene - 5.0 mg/Kg	ND	ND
Toluene - 4.80 mg/Kg	0.03	0.030
Xylenes (Total) - 69.0 mg/Kg	ND	ND
o-Xylene	ND	0.020

Table 17. Results of February, 2004 water sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels. The Tributary One site was not analyzed because the sample bottle was broken during shipping.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		2/23/2004	2/24/2004	2/23/2004	2/24/2004
TYPE OF SAMPLE:	Blank	Water	Water	Water	Water
FIELD SAMPLE ID:	BLWBB	PPWB2B	FHWB2A	T2WB2A	HWWB2A
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-23B	40226-06	40226-21A	40226-9A	40226-14A
DATE RECEIVED:	2/26/2004	2/26/2004	2/26/2004	2/26/2004	2/26/2004
DATE ANALYZED	2/26/2004	2/26/2004	2/26/2004	2/26/2004	2/26/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene - 5.0 ug/L	ND	ND	ND	ND	ND
Ethylbenzene - 700.0 ug/L	ND	ND	ND	ND	ND
Toluene - 1000 ug/L	ND	ND	ND	ND	ND
Xylenes (Total)- 10.0 ug/L	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND

Table 18. Results of May, 2004 sediment sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		5/17/2004	5/17/2004
TYPE OF SAMPLE:	Blank	Sediment	Sediment
FIELD SAMPLE ID:	BLSOBB	PPSDB3	HWSDB3
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	MB052504	40519-08	40519-16
DATE RECEIVED:	5/19/2004	5/19/2004	5/19/2004
DATE ANALYZED	5/25/2004	5/25/2004	5/25/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg
Benzene - 0.02 mg/Kg	ND	ND	ND
Ethylbenzene - 5.0 mg/Kg	ND	ND	ND
Toluene - 4.80 mg/Kg	ND	ND	ND
Xylenes (Total) - 69.0 mg/Kg	ND	ND	22
o-Xylene	ND	ND	14

Table 19. Results of May, 2004 water sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		5/17/2004	5/17/2004	5/17/2004	5/17/2004	5/17/2004
TYPE OF SAMPLE:	Blank	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	BLWBB	PPWB3A	FHWB3B	T1WB3A	T2WB3A	HHWB3B
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	MB052004	50519-10	40519-26	40519-21	40519-12	40519-29
DATE RECEIVED:	5/19/2004	5/19/2004	5/19/2004	5/19/2004	5/19/2004	5/19/2004
DATE ANALYZED	5/20/2004	5/20/2004	5/20/2004	5/20/2004	5/20/2004	5/20/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene - 5.0 ug/L	ND	ND	ND	ND	ND	ND
Ethylbenzene - 700.0 ug/L	ND	ND	ND	ND	ND	ND
Toluene - 1000 ug/L	ND	ND	ND	ND	ND	ND
Xylenes (Total)- 10.0 ug/L	ND	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND	ND

Table 20. Results of August, 2004 sediment sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	8/31/2004	8/31/2004
TYPE OF SAMPLE:	Sediment	Sediment
SAMPLE ID:	PPSDB4	HWSDB4
TESTING LABORATORY	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40902-03	40902-22
DATE RECEIVED:	9/2/2004	9/2/2004
DATE ANALYZED	9/15/2004	9/15/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg
Benzene - 0.02 mg/Kg	ND	ND
Ethylbenzene - 5.0 mg/Kg	ND	ND
Toluene - 4.80 mg/Kg	ND	ND
Xylenes (Total) - 69.0 mg/Kg	ND	25
o-Xylene	ND	16.6

Table 21. Results of August, 2004 water sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004
TYPE OF SAMPLE:	Water	Water	Water	Water	Water
SAMPLE ID:	PPWB4A	FHWB4A	T1WB4A	T2WB4A	HHWB4A
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40902-05	40902-14	40902-10	40902-18	40902-24
DATE RECEIVED:	9/2/2004	9/2/2004	9/2/2004	9/2/2004	9/2/2004
DATE ANALYZED	9/14/2004	9/14/2004	9/14/2004	9/14/2004	9/14/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene 5.0 ug/L	ND	ND	ND	ND	ND
Ethylbenzene 700.0 ug/L	ND	ND	ND	ND	ND
Toluene 1000.0 ug/L	ND	ND	ND	ND	ND
m,p-Xylene 10.0 ug/L	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND

Table 22. Results of November, 2004 sediment sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	11/15/2004	11/15/2004
TYPE OF SAMPLE:	Sediment	Sediment
SAMPLE ID:	PPSDB5	HWSDB5
TESTING LABORATORY	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	41117-03	41117-10
DATE RECEIVED:	11/17/2004	11/17/2004
DATE ANALYZED	11/19/2004	11/19/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg
Benzene - 0.02 mg/Kg	ND	ND
Ethylbenzene - 5.0 mg/Kg	77.4	17.4
Toluene - 4.8 mg/Kg	ND	ND
m,p-Xylene - 69.0 mg/Kg	20.1	24.65
o-Xylene	12.6	13.25

Table 23. Results of November, 2004 water sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:	11/15/2004	11/15/2004	11/15/2004	11/15/2004	11/15/2004
TYPE OF SAMPLE:	Water	Water	Water	Water	Water
SAMPLE ID:	PPWB5A	FHWB5A	T1WB5A	T2WB5A	HHWB5A
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	41117-05	41117-14	4117-22	41117-18	41117-12
DATE RECEIVED:	11/17/2004	11/17/2004	11/17/2004	11/17/2004	11/17/2004
DATE ANALYZED	11/18/2004	11/18/2004	11/18/2004	11/18/2004	11/18/2004
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene – 5.0 ug/L	ND	ND	ND	ND	ND
Ethylbenzene – 700.0 ug/L	ND	ND	ND	ND	ND
Toluene – 1000.0 ug/L	ND	ND	ND	ND	ND
m,p-Xylene – 10.0 ug/L	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND

Table 24. Results of March, 2005 sediment sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		
TYPE OF SAMPLE:	Sediment	Sediment
SAMPLE ID:	PPSDB6	HWSDB6
TESTING LABORATORY	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	50309-03	50309-22
DATE RECEIVED:	3/9/2005	3/9/2005
DATE ANALYZED	3/16/2005	3/16/2005
CONCENTRATION UNITS:	mg/Kg	mg/Kg
Benzene – 0.02 mg/Kg	ND	ND
Ethylbenzene – 5.0 mg/Kg	ND	ND
Toluene – 4.8 mg/Kg	ND	ND
m,p-Xylene – 69.0	ND	ND
o-Xylene	ND	12

Table 25. Results of March, 2005 water sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels.

LOCATION OF SAMPLE:	**Blank**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Pullen Pond**	**Fish Hatchery**	**Confluence of Tributary One**	**Confluence of Tributary Two**	**Rail Yard Headwater (State St.)**
DATE OF SAMPLE:		3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005
SAMPLE ID:	BLWBB	PPWBA6	FHWBA6	T1WBA6	T2WBA6	HHWBA6
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	MB052004	50309-05	50309-14	50309-10	50309-18	50309-24
DATE RECEIVED:	3/9/2005	3/9/2005	3/9/2005	3/9/2005	3/9/2005	3/9/2005
DATE ANALYZED	3/16/2005	3/16/2005	3/16/2005	3/16/2005	3/16/2005	3/16/2005
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene – 50.0 ug/L	ND	ND	ND	ND	ND	ND
Ethylbenzene – 700.0 ug/L	ND	ND	ND	ND	ND	ND
Toluene – 1000.0 ug/L	ND	ND	ND	ND	ND	ND
M,p-Xylene – 10.0 ug/L	ND	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND	ND

Table 26. Results of March, 2005 biological sampling for heavy metals on Pullen Creek and Nelson Creek, Skagway, Alaska. Samples were analyzed using EPA method 200.8, 6010B, and 7740.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Nelson Creek**	**Nelson Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Pullen Pond**	**Confluence of Tributary One**	**Above Bridge**	**Above Bridge**
DATE OF SAMPLE:	5/23/2005	5/23/2005	5/24/2005	5/25/2005	5/25/2005
TYPE OF SAMPLE:	Tissue (shredders)	Tissue (predators)	Tissue (shredders)	Tissue (shredders)	Tissue (predators)
SAMPLE ID:	PCPPTM1-S	PCPPTMI-P	PCT1TM1-S	NSABTM1-S	NSABTM1-P
TESTING LABORATORY	Columbia Analytical	Columbia Analytical	Columbia Analytical	Columbia Analytical	Columbia Analytical
DATE RECEIVED:	6/4/2005	6/4/2005	6/4/2005	6/4/2005	6/4/2005
DATE EXTRACTED	6/17/2005	6/17/2005	6/17/2005	6/17/2005	6/17/2005
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As)	0.8	0.5	1.4	0.8	0.5
Barium (Ba)	181.0	23.0	393.0	315.0	39.4
Cadmium (Cd)	1.3	0.3	1.6	0.5	0.4
Chromium (Cr)	1.1	1.9	1.5	0.8	0.5
Copper	18.0	20.2	18.5	10.5	17.5
Lead (Pb)	9.1	2.0	32.9	0.9	0.3
Selenium (Se)	2.3	2.6	2.2	1.0	2.3
Zinc (Zn)	421.0	459.0	949.0	215.0	375.0

Table 27. Summary of basic water quality parameter, discharge and substrate type for each sampling site and event on Pullen Creek, in Skagway Alaska. See Figure 1 for sampling site locations.

	Pullen Pond					Tributary One					Fish Hatchery					Tributary Two					White Pass Pond				
	Feb, 04	May, 04	Aug, 04	Nov, 04	Feb, 05	Feb, 04	May, 04	Aug, 04	Nov, 04	Feb, 05	Feb, 04	May, 04	Aug, 04	Nov, 04	Feb, 05	Feb, 04	May, 04	Aug, 04	Nov, 04	Feb, 05	Feb, 04	May, 04	Aug, 04	Nov, 04	Feb, 05
Air Temp (°C)	7	13.5	-	-	-	7	14.5	-	-	-	7	15	-	-	-	6	-	-	-	-	6	-	-	-	-
Water Temp (°C)	2.2	5.45	9.22	2.51	2.11	4.59	6.06	5.65	4.13	3.72	4.33	5.62	5.4	4.55	4.37	4.32	5.38	4.95	4.12	4.44	4.21	4.43	5.06	4.36	3.77
DO (mg/L)	14.70	-	14.80	16.00	14.48	14.05	-	16.87	10.66	11.49	10.75	10.20	32.50	9.00	8.68	9.40	-	17.98	9.25	8.45	-	-	18.70	10.59	10.56
pH	7.42	7.46	7.24	6.32	7.36	7.72	7.55	7.42	7.25	7.49	7.65	7.58	7.61	7.44	7.63	7.32	7.24	7.53	7.06	7.42	7.28	7.03	7.25	7.15	7.37
Conductivity (µS/cm)	0.131	0.081	0.057	0.102	0.271	0.192	0.233	0.180	0.209	0.385	0.227	0.285	0.213	0.243	0.430	0.166	0.205	0.159	0.183	0.318	0.167	0.201	0.153	0.179	0.299
Discharge (cfs)	5.282	34.37	-	9.69	2.33	1.872	2.436	1.657	1.356	1.457	0.723	0.388	-	0.251	0.233	1.945	2.608	1.668	1.388	0.23	0.149	0.5	-	-	-
Substrate Type																									
Silt (Si)	13%	14%	4%	17%	0%	0%	0%	0%	11%	18%	37%	30%	7%	29%	40%	7%	22%	20%	32%	17%	19%	1%	19%	4%	7%
Sand (S)	12%	5%	5%	11%	0%	32%	31%	17%	4%	16%	9%	16%	10%	8%	16%	11%	0%	8%	4%	10%	20%	35%	35%	33%	3%
Very Fine Gravel (VFG)	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Fine Gravel (FG)	0%	0%	0%	0%	0%	0%	1%	1%	0%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%	3%	3%	0%	0%
Medium Gravel (MGR)	2%	2%	8%	2%	0%	9%	10%	12%	3%	9%	2%	4%	9%	0%	5%	3%	3%	3%	0%	2%	9%	13%	6%	3%	5%
Coarse Gravel (CGR)	6%	5%	5%	6%	3%	12%	15%	19%	12%	19%	2%	1%	10%	5%	3%	2%	7%	10%	5%	9%	7%	7%	6%	2%	14%
Very Coarse Gravel (VCG)	17%	16%	5%	5%	42%	18%	27%	25%	15%	21%	1%	9%	10%	4%	4%	3%	9%	10%	8%	9%	11%	6%	6%	12%	25%
Small Cobble (SC)	22%	18%	19%	30%	55%	14%	10%	17%	28%	12%	1%	4%	3%	4%	2%	2%	7%	6%	8%	4%	7%	8%	4%	9%	19%
Large Cobble (LC)	8%	3%	1%	5%	0%	1%	1%	0%	1%	0%	0%	4%	1%	1%	0%	3%	3%	0%	0%	2%	5%	3%	0%	2%	0%
Boulder (B)	19%	25%	37%	20%	0%	4%	1%	1%	8%	2%	12%	6%	4%	5%	10%	4%	5%	2%	13%	2%	0%	1%	11%	6%	0%
Detritus (D)	0%	0%	3%	3%	0%	3%	1%	4%	17%	0%	25%	15%	29%	39%	10%	36%	6%	6%	24%	23%	11%	17%	9%	22%	16%
Wood (W)	1%	5%	1%	1%	0%	5%	1%	4%	1%	1%	6%	7%	11%	5%	5%	12%	21%	17%	6%	15%	4%	4%	1%	4%	2%
Garbage (G)/Plastic	0%	1%	0%	0%	0%	2%	1%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	2%	2%	2%	0%	0%	9%
Vegetation (V)	0%	6%	1%	0%	0%	0%	1%	0%	0%	0%	4%	4%	6%	0%	4%	16%	17%	18%	0%	5%	0%	0%	0%	3%	0%

Si/S	<2 mm	MG	8 - 15.9 mm	SC	64 - 127.9 mm
VFG	2 - 3.9 mm	CG	16 - 31.9 mm	LC	128 - 255.9 mm
FG	4 - 7.9 mm	VCG	32 - 63.9 mm	B	>256 mm

Table 28. Results of water sampling for Tentatively Identified Compounds (TIC) on Pullen Creek, Skagway, Alaska. Samples were analyzed using the modified EPA method 8270C. Clean-up levels are indicated for those contaminants which were detected. These results are for screening purposes only.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**
DATE OF SAMPLE:	2/23/2004	5/17/2004	8/31/2004	11/15/2004	3/7/2005
TYPE OF SAMPLE:	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	PPWTC2	PPWTC3	PPWTC4	PPWTC5	PPWTC6
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-17	40519-18	40902-07	41117-07	50309-07
DATE RECEIVED:	2/26/2004	5/19/2004	9/2/2004	11/7/2004	3/9/2005
DATE ANALYZED	3/4/2004	6/14/2004	12/3/2004	12/3/2004	4/12/2005
CONCENTRATION UNITS:	ug/L	ug/L	Ug/L	ug/L	ug/L
Phenol	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND
N-nitroso-di-n-propylamine	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND
2,4-Dimethulphenol	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND
4-Chloro-3-methyl phenol	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND
2-Chloronapthalene	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND

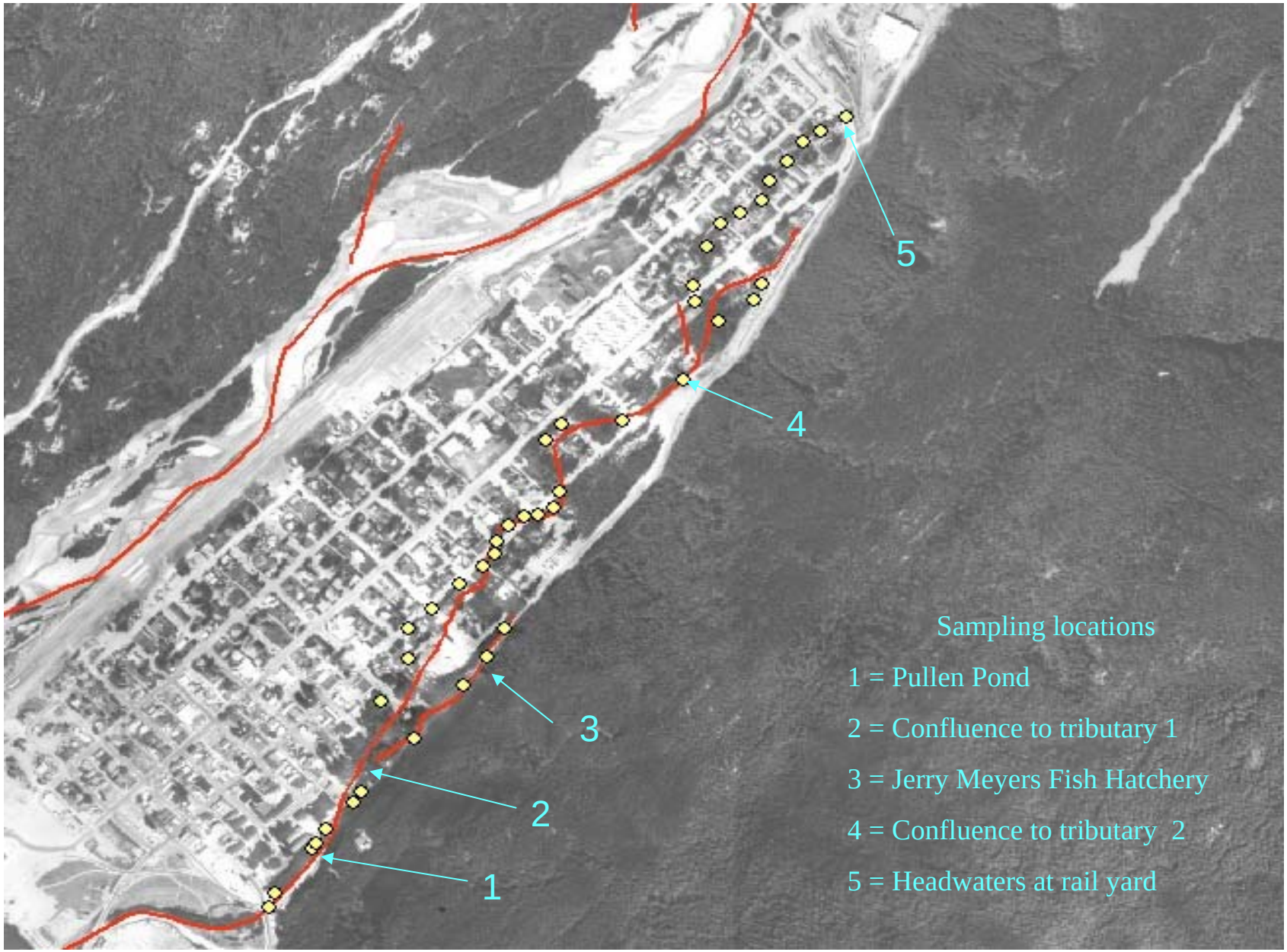
LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**
DATE OF SAMPLE:	2/23/2004	5/17/2004	8/31/2004	11/15/2004	3/7/2005
TYPE OF SAMPLE:	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	PPWTC2	PPWTC3	PPWTC4	PPWTC5	PPWTC6
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	Shoalwater
LABORATORY SAMPLE ID:	40226-17	40519-18	40902-07	41117-07	50309-07
DATE RECEIVED:	2/26/2004	5/19/2004	9/2/2004	11/7/2004	3/9/2005
DATE ANALYZED	3/4/2004	6/14/2004	12/3/2004	12/3/2004	4/12/2005
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L
4-Nitrophenol	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	ND
Diethyl Phthalate	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND
Azobenzene	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND
Pentachlorophenol = 1.0 ug/L	ND	77	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
di-n-Butyl Phthalate	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND
Butyl Benzyl Phthalate	ND	ND	ND	ND	ND
Benz[a]anthracene	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND
bis(2-Ethylhexyl) Phthalate = 6.0 ug/L	10	ND	ND	ND	10
di-n-octyl phthalate	ND	ND	ND	ND	ND
Benzo[b]fluoranthene	ND	ND	ND	ND	ND
Benzo[k]fluoranthene	ND	ND	ND	ND	ND
Benzo[a]pyrene	ND	ND	ND	ND	ND
Indeno[1,2,3-cd]pyrene	ND	ND	ND	ND	ND
Dibez[a,h]anthracene	ND	ND	ND	ND	ND
Benzo[ghi]perylene	ND	ND	ND	ND	ND

Table 29. Macroinvertebrates found in two locations on Pullen Creek, using the ENRI Volunteer level protocols.

	Below Pullen Pond		Above APT Tailrace	
	Estimated number	Number of different types	Estimated number	Number of different types
Mayflies	13	4	100	2
Stoneflies	15	3	128	2
Caddisflies	115	4	14	4
Midges	200	6	400	6
Craneflies	0	0	5	2
Aquatic Mites	4	1	8	1
Worms	60	1	12	1
other	2	1	8	1

Figures

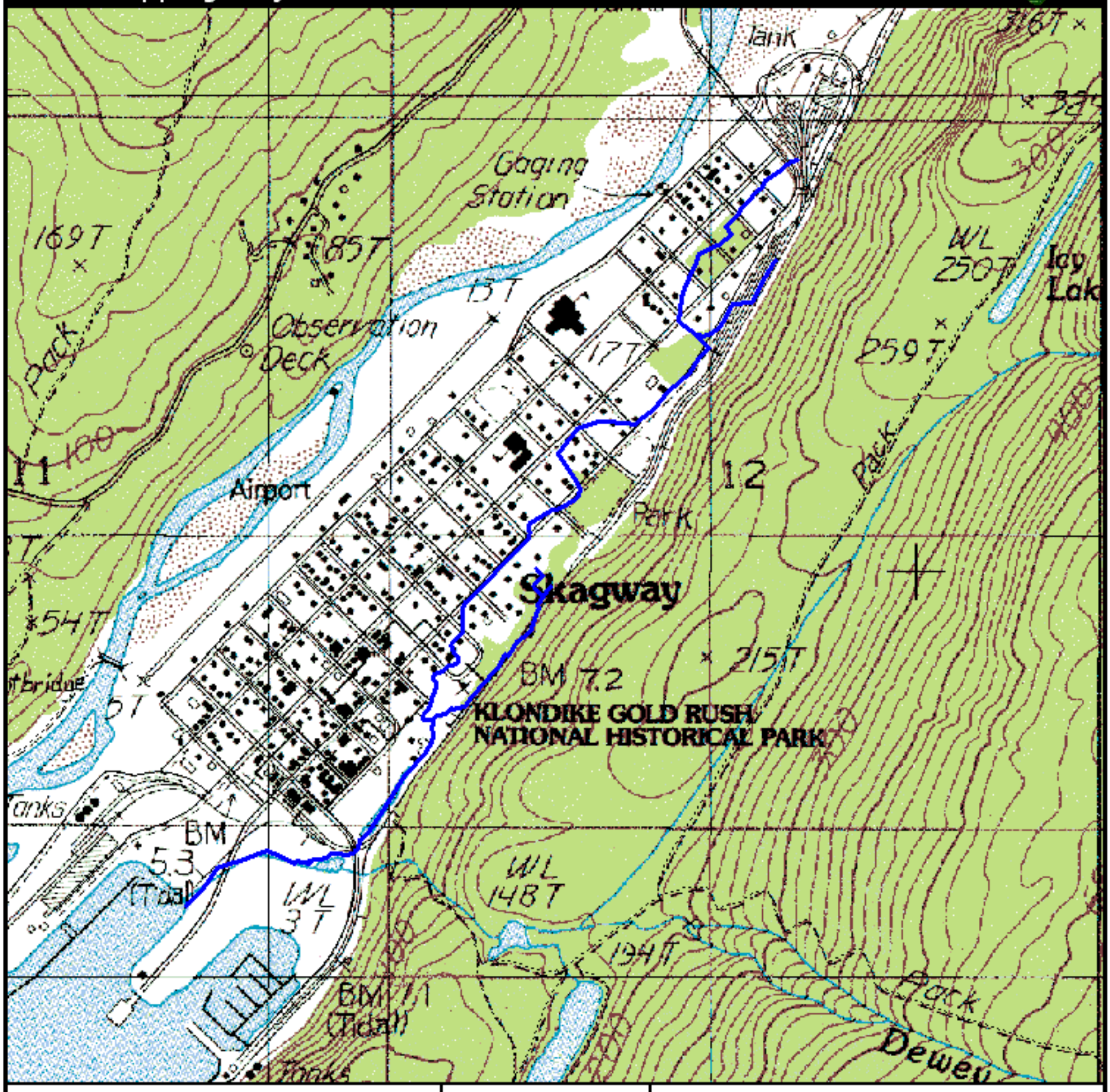
Figure 1. Map of Pullen Creek (right) and Skagway River (left). Red lines indicate anadromous fish presence data collected by the Alaska Department of Fish and Game. Yellow boxes indicate culverts on Pullen Creek (data collected by ADFG).



Pullen Creek

GPS Mapping Project

National Park Service
U.S. Department of the Interior



Pullen Creek

Map Location

Klondike Gold Rush
National Historical Park

N
W E
S

250 0 250 500 Meters

1 : 12,598 1 inch = 320.00 meters

October 15, 2003

Appendix A
2003 STC Fish Trapping Report

2003 Pullen Creek Fish Trapping Report (Permit # SF-2003-139)
Report to the Alaska Department of Fish and Game

In October of 2003, the Skagway Traditional Council (STC) began an assessment project on Pullen Creek, in Skagway, Alaska. The project, funded through an Alaska Clean Water Action (ACWA) grant, has a primary objective of determining whether Pullen Creek needs to remain on Alaska's impaired waterbody list. In addition to contaminant testing, STC has been tasked with developing an assessment report for the creek, a document which can be used as a starting point for future decision making on Pullen Creek issues.

POWTEC, LLC (the firm hired to assist STC in the project) will be collecting baseline information for Pullen Creek, including fish use information, through the Spring of 2004. Results in this report are from the first of two minnow trapping events scheduled for Pullen Creek, where trapping occurred October 15-16, 2003.

Methods used for this study are outlined in the Fish Resource Permit Study Plan (Appendix A). For minnow trapping, there were no deviations from the outlined protocol. Trap locations were determined on-site and were limited to the mainstem up to tributary 1 and throughout tributary 1 (Table 1). The entire creek was not trapped, due to limited time and not having permission from the multiple private residential landowners in which Pullen Creek runs (see Appendix B for a map of Pullen Creek). It is expected that the entire drainage will be trapped during the Spring, 2004 (given land owner permission)

Table 1 outlines the total number of fish trapped in Pullen Creek, by trap number and trap location. Trapped fish were identified to species and measured to fork length. To minimize the stress on the fish and because no anesthesia was used, measurements were obtained in increments of 5 mm, before the fish were released back into the stream. Figures 1 and 2 represent the approximate size categories of fish trapped, for Coho smolt and Dolly Varden, respectively.

A foot survey to document adult fish counts was conducted during the trapping event. However, due to timing, very few adult fish were observed in the creek. On October 15th, 2003, five adult Coho salmon were seen on the mainstem, below tributary 1 near the footbridge. Eight Dolly Varden were observed in the pool of water directly above the Jerry Meyers Fish Hatchery. On October 16th, 2003, three Dolly Varden were observed at the headwaters of the mainstem (see Appendix B for a map of Pullen Creek).

Additional data, including temperature, pH, dissolved oxygen, conductivity and discharge were not taken during this trapping event, as parameters will be measured during water quality and soil sampling events.

All information gather during this trapping event will be integrated into the Pullen Creek Assessment document, which will be produced by the Skagway Traditional Council in the Spring of 2004. Any questions regarding this present work may be directed to Lance Twitchell, President of Skagway Traditional Council (ltwitchell@skagwaytradtional.org) or Cathy Needham, Principal Investigator for POWTEC, LLC (cneedham@powtec.net).

Table 1: Results of the October, 2003 trapping event on Pullen Creek in Skagway, Alaska. Traps 1-17 were set and checked on October 15, 2003 and traps 18-19 were set and checked on October 16, 2003.

Trap	Latitude	Longitude	Coho Salmon	Dolly Varden
1	59° 27.069' N	135° 19.172' W	0	0
2	59° 27.074' N	135° 19.125' W	0	0
3	59° 27.070' N	135° 18.037' W	0	0
4	59° 27.075' N	135° 19.011' W	0	0
5	59° 27.076' N	135° 19.025' W	1	0
6	59° 27.067' N	135° 19.007' W	0	0
7	59° 27.083' N	135° 18.566' W	1	0
8	59° 27.103' N	135° 18.558' W	36	12
9	59° 27.124' N	135° 18.521' W	45	4
10	59° 27.137' N	135° 18.501' W	3	0
11	59° 27.163' N	135° 18.459' W	30	9
12	59° 27.198' N	135° 18.397' W	27	15
13	59° 27.223' N	135° 18.331' W	14	29
14	59° 27.236' N	135° 18.341' W	0	0
15	59° 27.249' N	135° 18.326' W	0	0
16	59° 27.256' N	135° 18.306' W	0	0
17	59° 27.265' N	135° 18.307' W	0	0
18	59° 27.507' N	135° 17.578' W	0	28
19	59° 27.582' N	135° 17.592' W	0	0
Total Fish			**157**	**97**

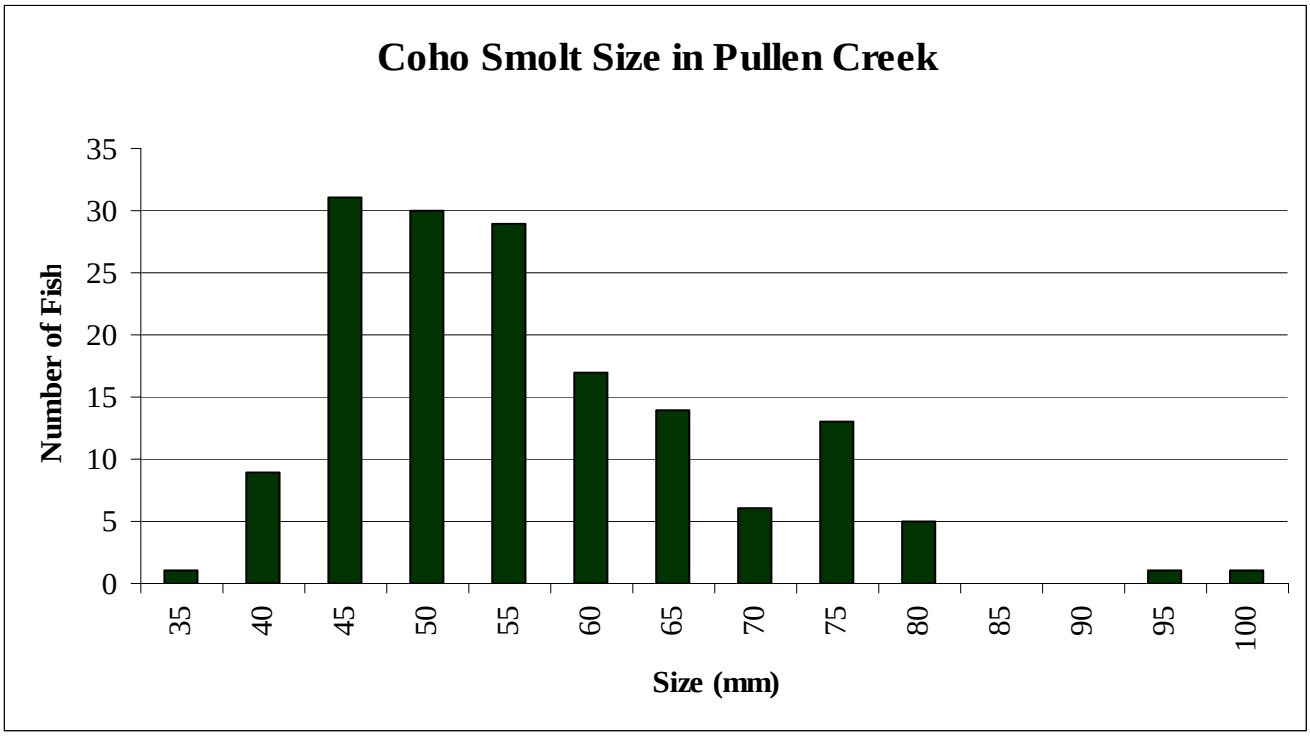


Figure 1. Size distribution of Coho smolt trapped in Pullen Creek, Skagway, Alaska. A total of 157 fish were trapped and measured to nearest 5 mm, in October, 2003.

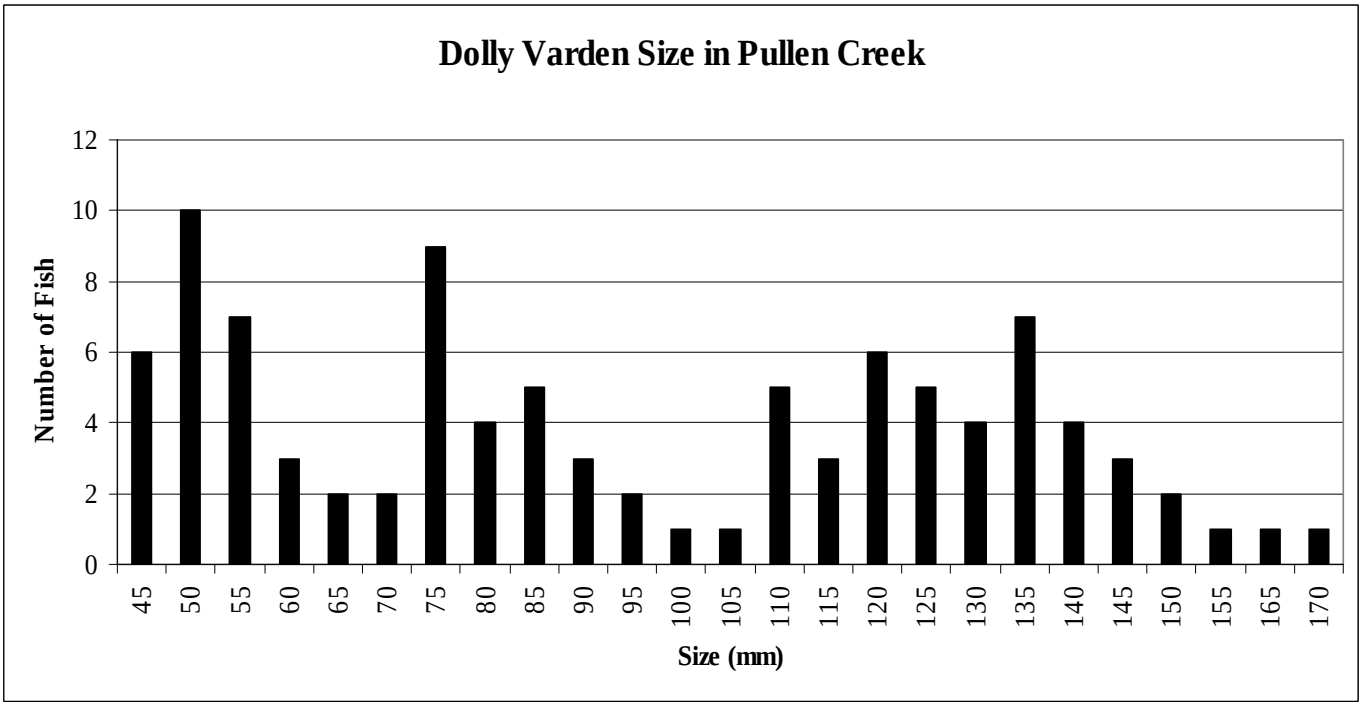


Figure 2. Size distribution of Dolly Varden trapped in Pullen Creek, Skagway, Alaska. A total of 97 fish were trapped and measured to nearest 5 mm, in October, 2003.

Appendix A
Fish Resource Permit Study Plan

Pullen Creek Fish Trapping Study Plan

Pullen Creek, located through the center of the City of Skagway, is listed on Alaska's Section 303(d) impaired waterbody list and on the Alaska Clean Water Action (AWCA) list for metal contamination. Trace metals have been found associated with the creek, and Skagway Harbor, and are believed to have originated from an ore transfer facility and it's railroad. Pullen Creek is currently scheduled for a Total Maximum Daily Load (TMDL) in October, 2003, however there is a lack of baseline data needed to evaluate the need for a TMDL. In addition, Pullen Creek is listed as an anadromous waterbody, hosting King, Coho, Pink and Chum salmon, Dolly Varden Char and sea-run Cutthroat trout. The King and Pink Salmon are hatchery enhanced, through a Skagway School District run hatchery program. Pullen Creek has had extensive urban impacts to it's fish habitat, including numerous oil and fuel spills, extensive bank erosion, building development and culverts. A comprehensive assessment for Pullen Creek is needed, to identify and prioritize habitat restoration efforts.

The Skagway Traditional Council was awarded a FY2004 Alaska Clean Water Action (ACWA) grant to address the above issues, including a comprehensive assessment for Pullen Creek. The environmental assessment will be performed by POWTEC, LLC. It will include a historical records and information search for Pullen Creek, and will be based on all potential impacts to the creek over time. POWTEC, LLC will perform a site visit and take baseline water quality, water quantity, and fish distribution and habitat use data, as well as map the creek system.

Methods

Baseline fish distribution and habitat use data will be collected by means of fish trapping and a walking survey. Trapping and walking surveys will occur during the Fall of 2003 and trapping will occur again in the Spring of 2004. Trapping locations will be determined on-site (dependent on water flow and available pools) and marked with flagging. GPS way-points will be logged to help determine sites for future repeated trapping. Walking survey's will be performed to get an estimation of adult counts in Pullen Creek for the Fall of 2003.

Fish trapping will consist of using baited minnow traps, with standard mesh sizes of both 0.125 and 0.25-inch diameters. The traps will be tethered with 6-10 ft. of nylon cord. Minnow traps will be baited with approximately 1 ounce of salmon eggs, disinfected for 10 minutes in a 1:100 solution of betadyne in water. Baited traps will be placed in pools of water, preferably with cover (i.e. undercut banks). Traps will be soaked for approximately 2 hours, to capture fish. Trapped fish will be placed in white-bottomed plastic trays with water and identified to species, measured to fork length, counted and returned to the creek. No anesthetic will be used. Data will include a description of trap location, description of habitat, identification of fish trapped, size of fish trapped and number of fish trapped. Additional data taken on the same day (but not at each trap location) will include discharge, dissolved oxygen, pH, and temperature.

During the Fall of 2003, a walking survey will be performed on Pullen Creek to document the use of the creek by adult spawning Coho salmon. The survey crew will walk the entirety of Pullen Creek, from the mouth to the headwaters, and note the presence of adult fish. Data collected will include: approximate location of fish, species of fish, number of fish, sex of fish (if determinable) and whether the fish was alive or dead on the banks of the creek.

All data will be presented in the Pullen Creek Assessment report, which is a deliverable of the ACWA grant received by Skagway Traditional Council.

Appendix B
2004 STC Fish Trapping Report

2004 Pullen Creek Fish Trapping Report (Permit # SF-2004-017)
Report to the Alaska Department of Fish and Game

In October of 2003, the Skagway Traditional Council (STC) began an assessment project on Pullen Creek, in Skagway, Alaska. The project, funded through an Alaska Clean Water Action (ACWA) grant, has a primary objective of determining whether Pullen Creek needs to remain on Alaska's impaired waterbody list. In addition to contaminant testing, STC has been tasked with developing an assessment report for the creek, a document that can be used as a starting point for future decision-making on Pullen Creek issues.

POWTEC, LLC (the firm hired to assist STC in the project) will be collecting baseline information for Pullen Creek, including fish use information, through the spring of 2004. Results in this report are from the February and May 2004 trapping event that occurred on Pullen Creek.

Methods used for this study are outlined in the Fish Resource Permit Study Plan (Appendix A). For minnow trapping, there were no deviations from the outlined protocol except the traps were set overnight during the May event. Trap locations were determined on-site and were represented throughout the drainage except for a short length of creek we did not obtain permission to trap directly above the Dewey Lake hydropower plant (Tables 1 & 2 and see Appendix B for a map of Pullen Creek). However, less traps were set in the February event.

Tables 1 and 2 outline the total number of fish trapped in Pullen Creek, by trap number and trap location. Trapped fish were identified to species, measured to nearest 5mm fork length, and released into the stream. Figures 1 and 2 represent the approximate size categories of fish trapped, for Coho smolt and Dolly Varden in February, respectively. Figures 3 & 4 represent the May event.

Additional data, including temperature, pH, dissolved oxygen, conductivity and discharge were taken during this trapping event with water quality parameters.

All information gathered during this trapping event will be integrated into the Pullen Creek Assessment document, which will be produced by the Skagway Traditional Council in the Spring of 2004. Any questions regarding this present work may be directed to Lance Twitchell, President of Skagway Traditional Council (ltwitchell@skagwaytradtional.org) or Cathy Needham, Principal Investigator for POWTEC, LLC (cneedham@powtec.net).

Table 1: Results of the February 2004 trapping event on Pullen Creek in Skagway, Alaska.

Trap	Latitude	Longitude	Coho Salmon	Dolly Varden
1	59° 45.255' N	135° 31.792' W	0	0
2	59° 45.234' N	135° 31.577' W	0	0
3	59° 45.234' N	135° 31.499' W	0	0
4	59° 45.253' N	135° 31.517' W	0	0
5	59° 45.271' N	135° 31.395' W	0	0
6	59° 45.300' N	135° 31.395' W	0	0
7	59° 45.038' N	135° 31.282' W	0	0
8	59° 45.451' N	135° 31.160' W	0	0
9	59° 45.491' N	135° 31.940' W	3	0
10	59° 45.595' N	135° 30.927' W	16	1
11	59° 45.663' N	135° 30.817' W	38	0
12	59° 45.695' N	135° 30.762' W	3	0
13	59° 45.744' N	135° 30.708' W	0	0
14	59° 45.800' N	135° 30.663' W	0	0
15	59° 45.695' N	135° 30.762' W	0	1
16	59° 45.904' N	135° 30.751' W	0	0
17	59° 46.300' N	135° 30.770' W	0	0
18	59° 46.347' N	135° 30.112' W	0	0
19	59° 46.632' N	135° 29.793' W	4	14
20	59° 46.461' N	135° 29.750' W	0	0
21	59° 46.674' N	135° 29.659' W	0	0
		Total	**64**	**16**

Table 2: Results of the May 2004 trapping event on Pullen Creek in Skagway, Alaska.

Trap	Latitude	Longitude	Coho Salmon	Dolly Varden
1	59° 45.257' N	135° 31.806' W	0	0
2	59° 45.241' N	135° 31.682' W	0	0
3	59° 45.228' N	135° 31.594' W	0	0
4	59° 45.225' N	135° 31.494' W	0	0
5	59° 45.260' N	135° 31.454' W	0	0
6	59° 45.257' N	135° 31.513' W	1	6
7	59° 45.269' N	135° 31.401' W	1	4
8	59° 45.304' N	135° 31.405' W	2	1
9	59° 45.374' N	135° 31.274' W	1	2
10	59° 45.454' N	135° 31.144' W	0	0
11	59° 45.459' N	135° 31.148' W	0	0
12	59° 45.479' N	135° 31.108' W	3	2
13	59° 45.599' N	135° 30.916' W	6	7
14	59° 45.654' N	135° 30.824' W	4	1
15	59° 45.459' N	135° 31.152' W	0	0
16	59° 45.459' N	135° 31.152' W	0	0
17	59° 45.695' N	135° 30.745' W	0	1
18	59° 45.731' N	135° 30.726' W	0	1
19	59° 45.599' N	135° 31.084' W	0	0
20	59° 45.638' N	135° 31.015' W	0	0
21	59° 45.791' N	135° 30.916' W	0	5
22	59° 45.880' N	135° 30.755' W	0	1
23	59° 46.138' N	135° 30.504' W	0	1
24	59° 46.132' N	135° 30.293' W	0	1
25	59° 46.299' N	135° 30.044' W	0	2
26	59° 46.343' N	135° 30.117' W	0	1
27	59° 46.500' N	135° 30.117' W	0	1
28	59° 46.671' N	135° 29.656' W	0	3
29	59° 46.399' N	135° 29.824' W	0	3
30	59° 46.454' N	135° 29.739' W	0	5
		Total	**18**	**48**

Figure 1. Size distribution of Coho smolt trapped in Pullen Creek, Skagway, Alaska Feb-2004.

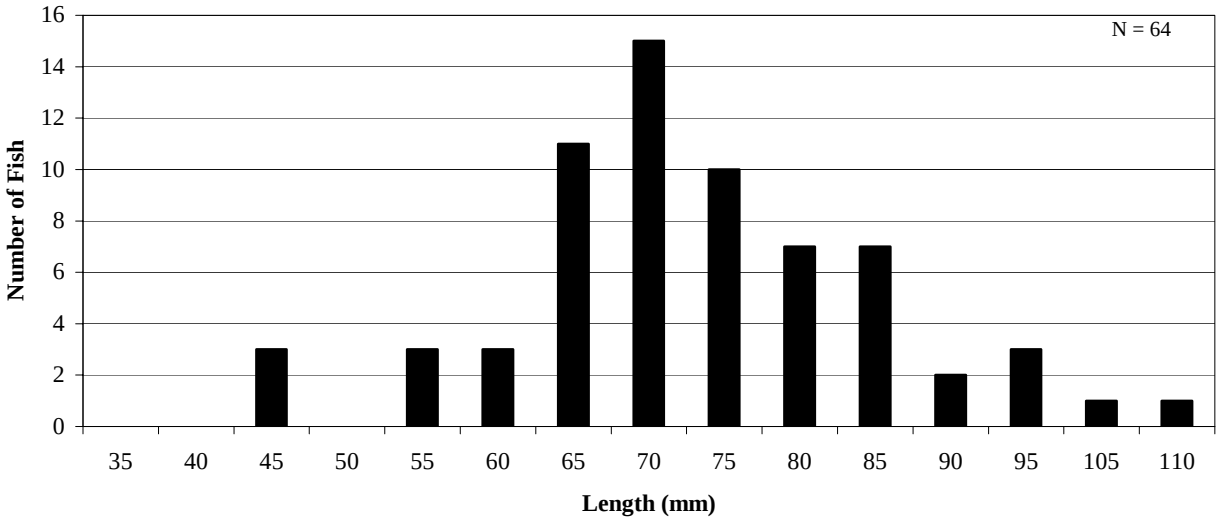


Figure 2. Size distribution of Dolly Varden trapped in Pullen Creek, Skagway, Alaska Feb-2004.

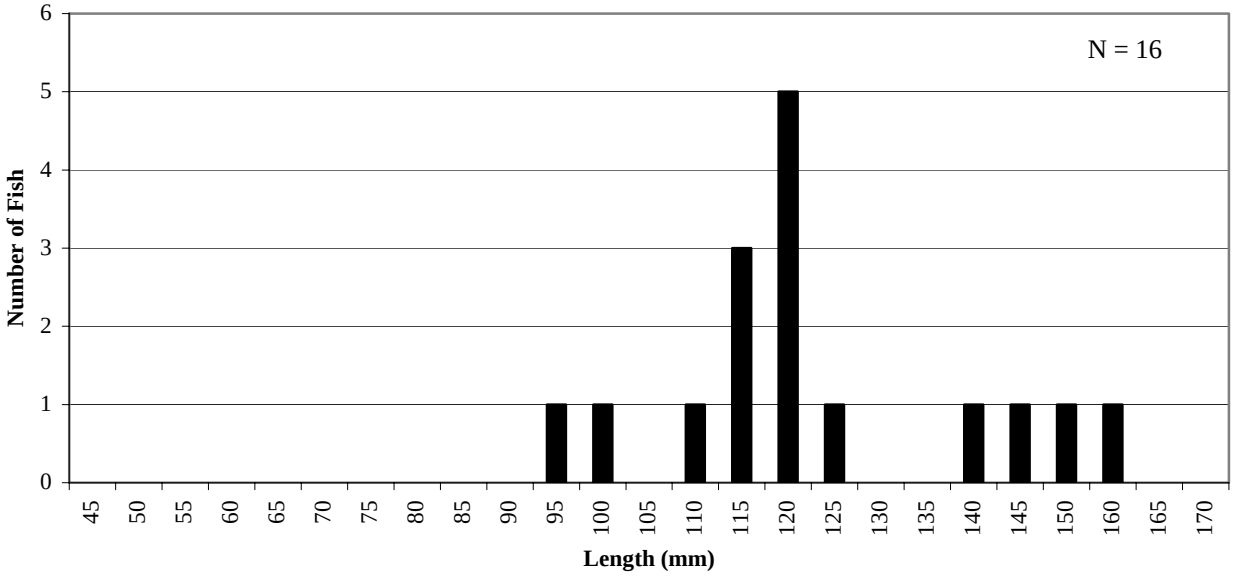


Figure 3. Size distribution of Coho smolt trapped in Pullen Creek in Skagway, Alaska May 2004.

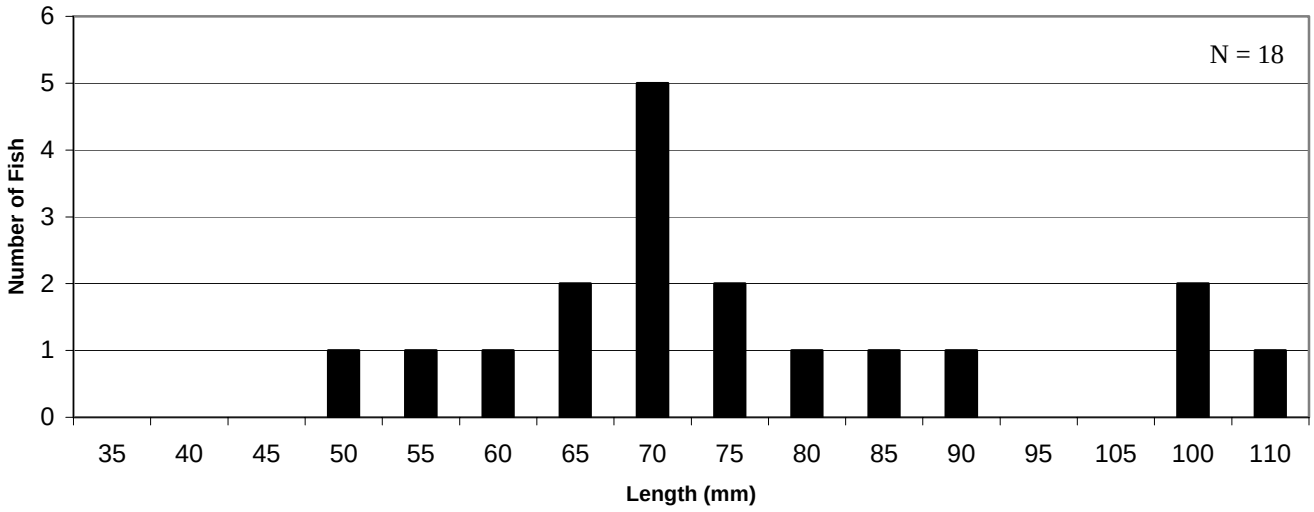
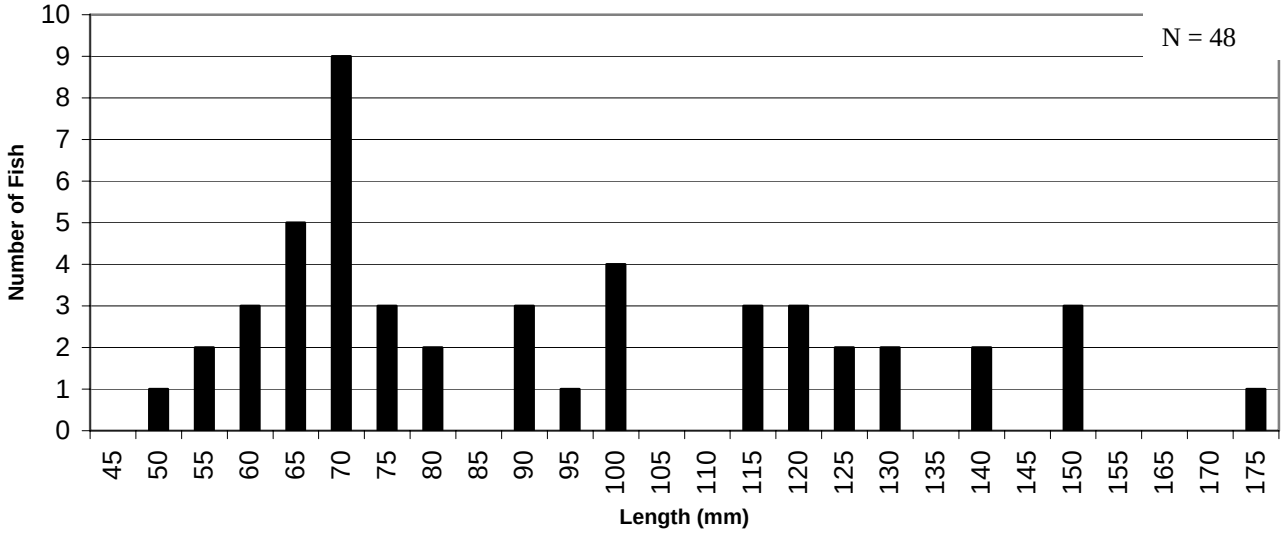


Figure 4. Size distribution of Dolly Varden trapped in Pullen Creek in Skagway, Alaska May 2004.



Appendix A
Fish Resource Permit Study Plan

Pullen Creek Fish Trapping Study Plan

Pullen Creek, located through the center of the City of Skagway, is listed on Alaska's Section 303(d) impaired waterbody list and on the Alaska Clean Water Action (AWCA) list for metal contamination. Trace metals have been found associated with the creek, and Skagway Harbor, and are believed to have originated from an ore transfer facility and it's railroad. Pullen Creek is currently scheduled for a Total Maximum Daily Load (TMDL) in October, 2003, however there is a lack of baseline data needed to evaluate the need for a TMDL. In addition, Pullen Creek is listed as an anadromous waterbody, hosting King, Coho, Pink and Chum salmon, Dolly Varden Char and sea-run Cutthroat trout. The King and Pink Salmon are hatchery enhanced, through a Skagway School District run hatchery program. Pullen Creek has had extensive urban impacts to it's fish habitat, including numerous oil and fuel spills, extensive bank erosion, building development and culverts. A comprehensive assessment for Pullen Creek is needed, to identify and prioritize habitat restoration efforts.

The Skagway Traditional Council was awarded a FY2004 Alaska Clean Water Action (ACWA) grant to address the above issues, including a comprehensive assessment for Pullen Creek. The environmental assessment will be performed by POWTEC, LLC. It will include a historical records and information search for Pullen Creek, and will be based on all potential impacts to the creek over time. POWTEC, LLC will perform a site visit and take baseline water quality, water quantity, and fish distribution and habitat use data, as well as map the creek system.

Methods

Baseline fish distribution and habitat use data will be collected by means of fish trapping and a walking survey. Trapping and walking surveys will occur during the Fall of 2003 and trapping will occur again in the Spring of 2004. Trapping locations will be determined on-site (dependent on water flow and available pools) and marked with flagging. GPS way-points will be logged to help determine sites for future repeated trapping. Walking survey's will be performed to get an estimation of adult counts in Pullen Creek for the Fall of 2003.

Fish trapping will consist of using baited minnow traps, with standard mesh sizes of both 0.125 and 0.25-inch diameters. The traps will be tethered with 6-10 ft. of nylon cord. Minnow traps will be baited with approximately 1 ounce of salmon eggs, disinfected for 10 minutes in a 1:100 solution of betadyne in water. Baited traps will be placed in pools of water, preferably with cover (i.e. undercut banks). Traps will be soaked for approximately 2 hours, to capture fish. Trapped fish will be placed in white-bottomed plastic trays with water and identified to species, measured to fork length, counted and returned to the creek. No anesthetic will be used. Data will include a description of trap location, description of habitat, identification of fish trapped, size of fish trapped and number of fish trapped. Additional data taken on the same day (but not at each trap location) will include discharge, dissolved oxygen, pH, and temperature.

During the Fall of 2003, a walking survey will be performed on Pullen Creek to document the use of the creek by adult spawning Coho salmon. The survey crew will walk the entirety of Pullen Creek, from the mouth to the headwaters, and note the presence of adult fish. Data collected will include: approximate location of fish, species of fish, number of fish, sex of fish (if determinable) and whether the fish was alive or dead on the banks of the creek.

All data will be presented in the Pullen Creek Assessment report, which is a deliverable of the ACWA grant received by Skagway Traditional Council.

Appendix C
Data from Taiya Inlet Watershed Council testing
November, 2003

Table 1. Results of November, 2003 sediment sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 7081, 7471A, and 7951. Clean up levels are indicated next to contaminant and are based on the State of Alaska's Method 2 soil clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Fork at 18th & State**	**Rail Yard Headwater (State St.)**	**Hillside Spring Headwater**
DATE OF SAMPLE:	11/20/2003	11/20/2003	11/20/2003	11/21/2003	11/21/2003
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID:	PPS1_N20/03	FHS1_N20/03	T2S1_N20/03	HWS1_N21/03	HW2S1_N21/03
TESTING LABORATORY	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.
LABORATORY SAMPLE ID:	J0311126-02C	J0311126-04C	J0311126-06C	J0311126-08C	J0311126-10C
DATE RECEIVED:	11/22/2003	11/22/2003	11/22/2003	11/22/2003	11/22/2003
DATE ANALYZED	12/8/2003	12/8/2003	12/8/2003	12/8/2003	12/8/2003
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As) - 1.8 mg/Kg	0.550	4.27	2.58	4.10	2.69
Barium (Ba) - 982.0 mg/Kg	140	214	192	301	168
Cadmium (Cd) - 4.5 mg/Kg	0.0586	0.627	0.700	0.534	0.353
Chromium (Cr) - 23.0 mg/Kg	3.57	10.4	8.03	16.7	6.27
Lead (Pb) - 400.0 mg/Kg	43.0	125	123	291	192
Mercury (Hg) - 1.24 mg/Kg	0.0692	0.129	ND	0.193	ND
Selenium (Se) - 3.0 mg/Kg	0.246	1.30	0.686	0.655	0.380
Silver (Ag) - 19.0 mg/Kg	1.09	1.42	0.722	1.10	1.06

Table 2. Results of November, 2003 water sampling for heavy metals on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA methods 200.9, 208.2, 245.1, and 289.2. Clean up levels are indicated next to contaminant and are based on the State of Alaska groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Fork at 18th & State**	**Rail Yard Headwater (State St.)**	**Hillside Spring Headwater**
DATE OF SAMPLE:	11/20/2003	11/20/2003	11/20/2003	11/21/2003	11/21/2003
TYPE OF SAMPLE:	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	PPW1_N20/03	FHW1_N20/03	T2W1_N20/03	HWW1_N20/03	HW2W1_N21/03
TESTING LABORATORY	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.
LABORATORY SAMPLE ID:	J0311126-01A	J0311126-03A	J0311126-05A	J0311126-07C	J0311126-09A
DATE RECEIVED:	11/22/2003	11/22/2003	11/22/2003	11/22/2003	11/22/2003
DATE ANALYZED	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003.
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L
Arsenic (As) - 50 ug/L	ND	ND	ND	ND	ND
Barium (Ba) - 2000.0 ug/L	45.9	40.5	50.1	49.2	51.5
Cadmium (Cd) - 5.0 ug/L	ND	ND	ND	ND	ND
Chromium (Cr) - 100.0 ug/L	ND	ND	0.148	0.189	0.193
Lead (Pb) - 15.0 ug/L	0.168	ND	ND	0.181	ND
Mercury (Hg) - 1.24 mg/Kg	ND	ND	ND	ND	0.00035
Selenium (Se) - 50.0 ug/L	ND	ND	ND	ND	ND
Silver (Ag) - 180.0 ug/L	1.01	0.601	0.530	0.489	0.486

Table 3. Results of November, 2003 sediment sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Fork at 18th & State**	**Rail Yard Headwater (State St.)**	**Hillside Spring Headwater**
DATE OF SAMPLE:	11/20/2003	11/20/2003	11/20/2003	11/21/2003	11/21/2003
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID:	PPS1_N20/03	FHS1_N20/03	T2S1_N20/03	HWS1_N21/03	HW2S1_N21/03
TESTING LABORATORY	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.
LABORATORY SAMPLE ID:	J0311126-02C	J0311126-04C	J0311126-06C	J0311126-08C	J0311126-10C
DATE RECEIVED:	11/22/2003	11/22/2003	11/22/2003	11/22/2003	11/22/2003
DATE ANALYZED	12/2/2003	12/8/2003	12/8/2003	12/8/2003	12/8/2003
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Benzene - 0.02 mg/Kg	ND	ND	ND	ND	ND
Ethylbenzene - 5.0 mg/Kg	0.012	ND	ND	ND	ND
Toluene - 4.80 mg/Kg	ND	ND	0.027	0.015	0.0092
Xylenes (Total) - 69.0 mg/Kg	0.05	ND	0.053	0.030	0.015

Table 4. Results of November, 2003 water sampling for hydrocarbons on Pullen Creek, Skagway, Alaska. Samples were analyzed using EPA method 8260A. Clean up levels are indicated next to contaminant and are based on the State of Alaska's groundwater clean-up levels.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Fish Hatchery**	**Fork at 18th & State**	**Rail Yard Headwater (State St.)**	**Hillside Spring Headwater**
DATE OF SAMPLE:	11/20/2003	11/20/2003	11/20/2003	11/20/2003	11/20/2003
TYPE OF SAMPLE:	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	PPW1_N20/03	FHW1_N20/03	T2W1_N20/03	HWW1_N20/03	HW2W1_N21/03
TESTING LABORATORY	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.	Analytica, Inc.
LABORATORY SAMPLE ID:	J0311126-01A	J0311126-03A	J0311126-05A	J0311126-07C	J0311126-09A
DATE RECEIVED:	11/22/2003	11/22/2003	11/22/2003	11/22/2003	11/22/2003
DATE ANALYZED	12/2/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003.
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene - 5.0 ug/L	ND	ND	ND	ND	ND
Ethylbenzene - 700.0 ug/L	ND	ND	ND	ND	ND
Toluene - 1000 ug/L	ND	ND	ND	ND	ND
Xylenes (Total)- 10.0 ug/L	ND	ND	ND	ND	ND

Table 5. Summary of basic water quality parameter, discharge and substrate type for each sampling site and event on Pullen Creek, in Skagway Alaska. See Figure X for sampling site locations.

	Pullen Pond	Tributary One	Fish Hatchery	Tributary Two	White Pass Pond	Headwaters
Air Temp (°C)	-6	-	-4	-	-2	-3
Water Temp (°C)	0.25	-	3.12	3.72	4.13	4.39
DO (mg/L)	28.20	-	18.34	11.36	10.72	16.20
pH	6.17	-	7.11	6.61	6.14	6.26
Conductivity (µS/cm)	0.099	-	0.202	0.154	0.154	0.153
Discharge (cfs)	0.135	-	0.018	0.056	0.003	0.032
Substrate Type						
Silt (Si)	18%	-	0%	11%	18%	4%
Sand (S)	10%	-	50%	8%	15%	8%
Very Fine Gravel (VFG)	0%	-	0%	0%	2%	2%
Fine Gravel (FG)	0%	-	0%	4%	10%	10%
Medium Gravel (MGR)	7%	-	0%	4%	14%	25%
Coarse Gravel (CGR)	9%	-	0%	6%	5%	14%
Very Coarse Gravel (VCG)	20%	-	0%	13%	5%	8%
Small Cobble (SC)	16%	-	0%	7%	5%	4%
Large Cobble (LC)	6%	-	0%	2%	3%	0%
Boulder (B)	11%	-	0%	3%	1%	1%
Detritus (D)	0%	-	50%	25%	10%	4%
Wood (W)	1%	-	0%	8%	4%	0%
Garbage (G)/Plastic	2%	-	0%	1%	8%	0%
Vegetation (V)	0%	-	0%	8%	0%	0%

Si/S	<2 mm	MG	8 - 15.9 mm	SC	64 - 127.9 mm
VFG	2 - 3.9 mm	CG	16 - 31.9 mm	LC	128 - 255.9 mm
FG	4 – 7.9 mm	VCG	32 - 63.9 mm	B	>256 mm