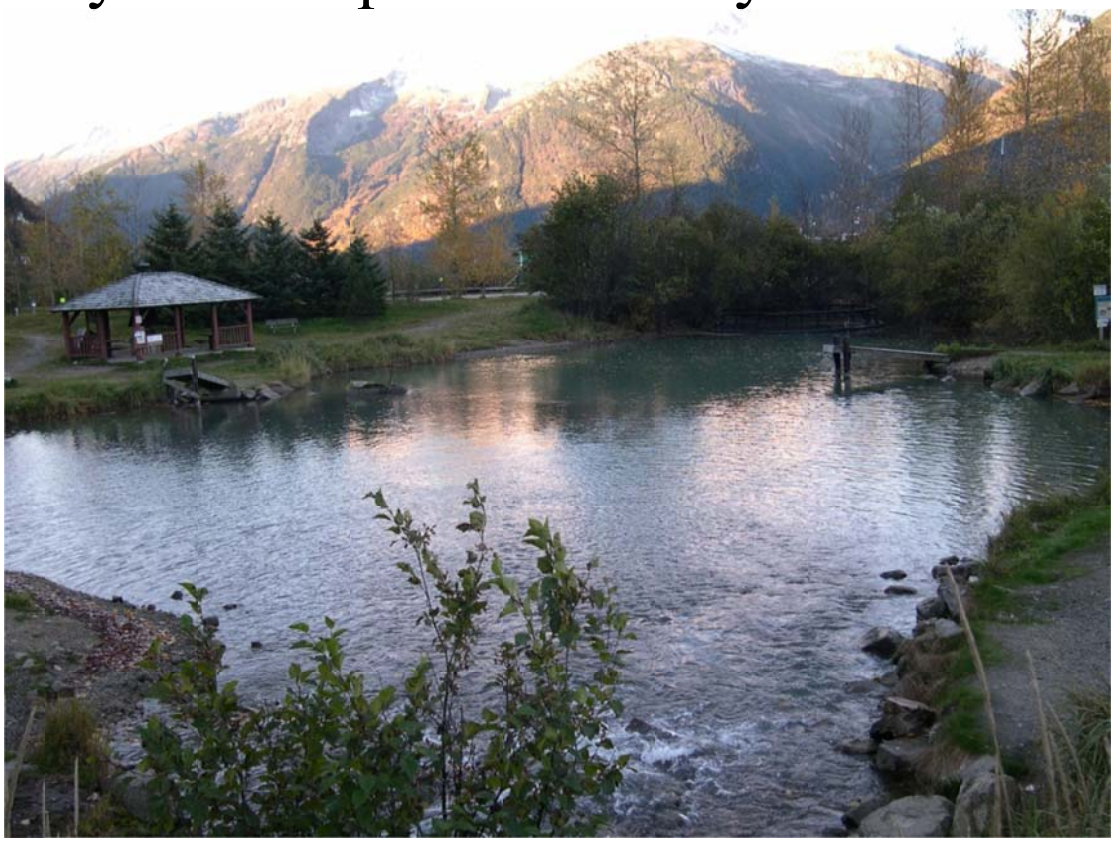
Pullen Creek Monitoring Project
A 10 year Comparative Analysis



Prepared by
Skagway Traditional Council

Prepared for
Environmental Protection Agency
Indian General Assistance Program

August 2016

This page intentionally left blank

TABLE OF CONTENTS

APPENDICES

1.0 Executive Summary

Pullen Creek, located in Skagway, Alaska, has been listed as an impaired waterbody on the Environmental Protection Agency's Section 303(d) Impaired Waterbody List for Alaska since 1990. Pullen Creek was listed for concerns of heavy metals entering the waterway via contaminated dust from historical transport of ore in open railway cars from Canada to Skagway Harbor. The Skagway Traditional Council collected contaminant sampling data on Pullen Creek in 2015 and 2016 to compare back to data collected in 2004. Water, sediment, soil and tissue samples were collected under an Environmental Protection Agency approved Quality Assurance Project Plan, and tested for heavy metals and hydrocarbons. Data were compared back to action levels identified the *Pullen Creek Assessment* document (2005) and in Total Maximum Daily Loads (TMDLs) established for sediments in Pullen Creek in 2010. Both datasets, regardless of whether a contaminant exceeded action levels, were also compared between study years to determine if contaminant levels had changed over time. The current study showed continued exceedances for contaminants in both sediments and soils. Additionally, the data analysis did not show an improvement over the past ten years for heavy metals in sediments and soils associated with Pullen Creek. It is recommended that monitoring efforts should continue on a more frequent basis, especially during construction events, to determine how instream actions are affecting the continued exceedances of TMDLs in sediments of Pullen Creek. Additionally, education and implementation of Best Management Practices may help in increasing the ability of attenuation of heavy metals in sediments of Pullen Creek over time.

2.0 Introduction

2.1 Background and Purpose

Pullen Creek, located in Skagway, Alaska, is an impaired waterbody listed on the Alaska's Section of the Environmental Protection Agency (EPA) Section 303(d) Impaired Waterbody List. While Pullen Creek was originally listed in 1990 with Skagway Harbor, it was separated into its own listing in 2006 for heavy metal contamination (ADEC, 2010). At that time there was no evaluation or data to support developing a Total Maximum Daily Load (TMDL) to recover the waterbody from heavy metal contamination. In 2005, the Skagway Traditional Council (STC) completed a "*Pullen Creek Assessment"* with Alaska Clean Water Action (ACWA) funding (STC, 2005). The project included four sampling events in 2004 to test for contaminants in water, sediments and soils associated with the Pullen Creek drainage.

In February 2006, the Taiya Inlet Watershed Council (TIWC) completed the "*Pullen Creek Action Plan"* with U.S. Fish and Wildlife Service funding (TIWC, 2006). The plan outlines several restoration based solutions for fish and fish habitat, as well as addresses storm water issues in Skagway. Since 2006, some restoration activities in the form of revegetation, culvert replacement and new storm water management practices have taken place. In August of 2006, STC completed the "*Pullen Creek Waterbody Recovery Plan: Best Management Practices"*. This plan outlines Best Management Practices (BMPs), including water quality monitoring, addressing bank erosion, directing construction practices, addressing non-point source pollution and public education (STC, 2006). It is unclear whether or not the Pullen Creek BMPs have been implemented and used during and for construction projects over the course of the past 10 years.

In 2008, additional contaminant sampling on Pullen Creek was conducted for the "*Evaluation of Metals and Petroleum Derivatives Skagway Harbor and Pullen Creek Sediments and Surface Waters"* in anticipation of developing Total Maximum Daily Loads (TMDL) (Tetra Tech, 2009). In May of 2010, the Alaska Department of Environmental Conservation (ADEC) finalized TMDLs for cadmium, copper, lead, and zinc for sediments in Pullen Creek (ADEC, 2010). Pullen Creek remains a Category 4a waterbody listed on the pending 2012 Alaska Section 303(d) Impaired Waterbody List.

Natural attenuation of contaminants, in conjunction with following recommended BMPs outlined in the "*Pullen Creek Waterbody Recovery Plan: Best Management Practices"* (STC, 2006) and restoration activities identified in the "*Pullen Creek Action Plan*" (TIWC, 2006), was defined as implementation in the Pullen Creek TMDL (ADEC, 2010). The purpose of this current study is to collect contaminant sampling data to compare back to data collected in the STC's 2005 study, to determine if contaminant levels in Pullen Creek have reduced over time.

2.2 Pullen Creek Projects (2005-2016)

Shortly after the STC 2005 water quality assessment was completed on Pullen Creek, TIWC began construction on the Congress Way Reach Restoration Project. The project, funded by the U.S. Fish and Wildlife Service, was primarily designed to improve fish passage and fish habitat. Secondary goals included enhancing riparian habitat, protecting stream banks from further degradation, increasing sediment transport through culverts and improving aesthetic and educational value of the area for residents and tourists (TIWC, 2006). Instream work included a culvert replacement and streambank revegetation.

In 2008 and 2009, the U.S. Fish and Wildlife Service worked with Southeast Alaska Guiding Association (SAGA) to revegetate riparian zones in several locations throughout Pullen Creek (J. Hudson, USFWS, personal communication). The project included adding native tree species to reaches within the Congress Way Reach and near the tailrace of Alaska Power and Telephone. The primary purpose of the project was to improve bank erosion conditions and provide shading for fish habitat.

In 2010, the Taiya Inlet Watershed Council completed a culvert replacement at 10.5th Street to improve juvenile fish passage. The project was funded by the U.S. Fish and Wildlife Service's Fish Passage Program. The original plan was to also replace the culvert at 16.5th Street, however utilities associated with the crossing prevented that culvert from being replaced (J. Hudson, USFWS, personal communication). Instead, instream improvements were made to bring the creek bed to grade with the culvert to reduce the amount the culvert pipe was perched.

In 2012, the TIWC had sediments in Pullen Pond excavated and permanently removed. The project was funded by the U.S. Fish and Wildlife Service. Sediment deposition was at a high rate, resultant from high discharges from the APT Dewey Lake Hydroelectric Project. The intent of the project was to reduce the sediment deposition around the replaced Congress Way culvert and improve hydrology.

In September of 2015 the construction of the Pullen Creek StreamWalk began. The project was funded by Federal Highways Administration's Federal Lands Access Program and the National Park Service. The goal of the project was to provide an educational walking tour for Skagway visitors and residents within the lower Pullen Creek corridor. Additionally, the StreamWalk would provide an alternative pedestrian route from the waterfront to the center of town. Benefits of the project include identifying opportunities to rehabilitate stream and riparian habitats as well as expose pedestrians to creek features such salmon, stream and riparian habitats. No direct instream restoration work was completed, however some riparian revegetation occurred, as well as a footbridge replacement. Construction was on-going during the data collection for the 2015-2016 study year.

In May of 2016, construction of the City Public Safety facility began. The facility is located at 18th and State Streets and construction included removal of trees and vegetation in the riparian

zone. A 5 foot buffer with silt fencing was placed during construction. Photo 1 was taken during the May 2016 sampling event and shows the proximity of the construction zone in the riparian area near Pullen Creek at the Tributary 2 sampling site.

Photo 1. City of Skagway Maintenance Facility construction adjacent to Pullen Creek at the Tributary 2 sampling site in the Pullen Creek Assessment in May 2016, Skagway, Alaska.

2.3 Objectives

The overall goal of this current study is to evaluate whether Pullen Creek is meeting the developed TMDLs and whether previous contaminant levels in Pullen Creek have been reduced over time. To make this determination, two things will be looked at across both datasets:

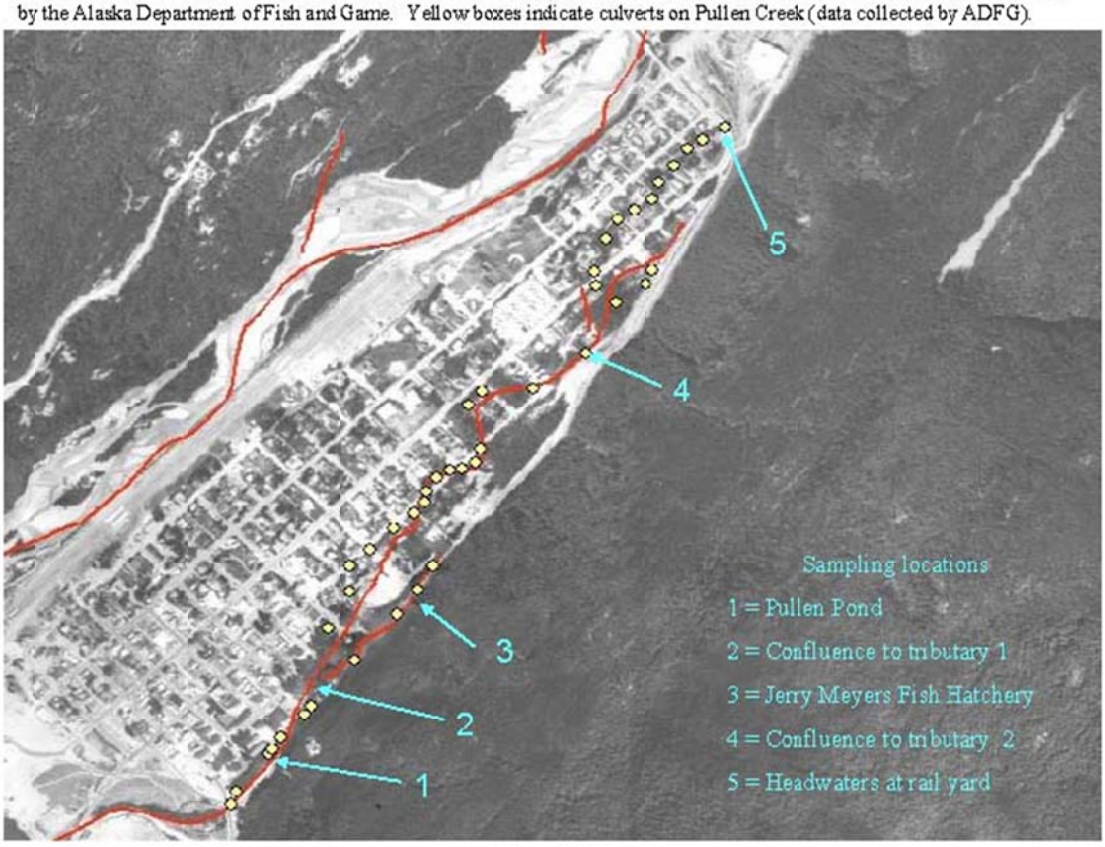
a. All laboratory data collected in this study will be compared back to the TMDL, Threshold Effects Level (TEL), and/or the STCs 2005 set Preliminary Remediation Goals (PRGs). Values that exceed these levels will be highlighted.
b. A comparative analysis will be made to determine if detected levels of contaminants in this study differ significantly from detected contaminates in the 2005 study.

3.0 Methods

3.1 Sampling Sites

There were 5 sampling sites chosen in the 2004 study, which are replicated in this current 2015/2016 study for comparative purposes (Figure 1).

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).



The sites included:

a. **Pullen Pond** – located just below Pullen Pond and below the footbridge which crosses the creek.
b. **Tributary 1** – located just below the tailrace of the Alaska Power and Telephone hydropower plant.
c. **Fish Hatchery –** located just below the fish hatchery which is at the headwaters of Tributary 1.
d. **Tributary 2 –** located at the confluence of where Tributary 2 meets the mainstem of Pullen Creek at 18th and State Street.
e. **Railyard –** located at the White Pass Railroad Yard on State Street, at the headwaters of the mainstem.

The Pullen Pond site on Pullen Creek represented an accumulation of waters within the watershed of Pullen Creek. Photos 2 and 3 depict the stretch of creek where Pullen Pond samples were taken. Photo 2 was taken during the 2004 sampling event, while Photo 3 was taken in 2015 and shows less vegetation in the riparian area from preparation work for the Pullen Creek StreamWalk.

Photo 2. The Pullen Pond sampling site on Pullen Creek in 2004, Skagway, Alaska.

Photo 3. The Pullen Pond sampling site on Pullen Creek in 2015, Skagway, Alaska.

The Tributary 1 site on Pullen Creek is located just below the Alaska Power and Telephone tailrace that supplies hydropower from Dewey Lakes. The site was chosen to represent an area of the creek where there would be high sediment transport and scour. Photos 4 and 5 depict the Tributary 1 sampling site on Pullen Creek, looking upstream at the tailrace. Photo 4 shows the tailrace during discharge, while Photo 5 depicts the tailrace without discharge.

Photo 4. The Tributary 1 sampling site looking upstream while tailrace is discharging on Pullen Creek in 2015, Skagway, Alaska.

Photo 5. Tributary 1 sampling site looking upstream while tailrace is not discharging on Pullen Creek in 2004, Skagway Alaska.

The Fish Hatchery site was located on Tributary 1, just below the Jerry Meyers Fish Hatchery. The site was chosen to represent the contribution of water from Tributary 1 to the watershed. Additionally, the site is immediately adjacent to railway tracks from White Pass Railway and is slow moving with a lot of sediment deposition. Photos 6 and 7 depict the Fish Hatchery sampling site on Pullen Creek looking upstream to the Jerry Meyers Fish Hatchery.

Photo 6. The Fish Hatchery sampling site on Pullen Creek in 2004, Skagway, Alaska.

Photo 7. The Fish Hatchery sampling site on Pullen Creek in 2015, Skagway, Alaska.

The Tributary 2 site on Pullen Creek is located at the confluence of the mainstem and Tributary 2, which is the last split on Pullen Creek prior to spring fed headwaters. The site was chosen to partition out the contribution of water from Tributary 2, which headwaters at the White Pass Rail Yard. Photos 8 and 9 depict the Tributary 2 sampling site on Pullen Creek looking upstream.

Photo 8. Tributary 2 sampling site on Pullen Creek in 2004, Skagway, Alaska

Photo 9. Tributary 2 sampling site on Pullen Creek in 2015, Skagway, Alaska.

The Rail Yard site on Pullen Creek represents one of two headwaters to the watershed. It is a spring fed pond, which is located immediately adjacent to the White Pass Railyard. The site was chosen over the second headwaters, for the likelihood that contaminants associated with

historical transport of ore by train would be found in samples. Photos 10 and 11 depict the Rail Yard sampling site on Pullen Creek.

Photo 10. The Rail Yard sampling site on Pullen Creek in 2004, Skagway, Alaska.

Photo 11. The Rail Yard sampling site on Pullen Creek in 2016, Skagway, Alaska.

3.2 Sampling Design

The sample design was originally established in an approved Quality Assurance Project Plan (QAPP) approved by the EPA in 2004. The QAPP was subsequently amended in May of 2005 to accommodation additional work performed by STC. In June of 2015, the EPA approved an amendment to the QAPP for the sampling being conducted in 2015/2016 (Appendix A). The main changes to the QAPP were to accommodate a change in personnel within all partnering organizations and a change in laboratory facilities, as the laboratories used in 2004 are no longer in business.

Sampling activities are detailed in the QAPP (2015), which may be found in Appendix A. There were no changes to sampling locations between the two study years. Sampling locations are identified in Figure 1. In 2004, the heavy metals analysis did not include copper, which was included as part of the heavy metals analysis for 2015/2016. For the Benzene, Ethylbenzene, Toluene and Xylene (BTEX) analysis, the 2004 data reported xylene as total xylene, while in 2015/2016 xylenes were separated as m,p-Xylene and 0-Xylene. In 2004 a Tentatively Identified Compound (TIC) test was performed on water, however this test was not available in 2015/2016. The change in the QAPP was to substitute the Polycyclic Aromatic Hydrocarbon (PAH) test which incorporated 16 of the 63 original analytes. Sampling frequency included four sampling events for each years set of data. In 2004 all four sampling events were done in the same year (February, May, August and November). In the current study, the same months were sampled as 2004, but were done over 2015 (August and November) and 2016 (February and May).

Table 1 outlines the sampling matrix for heavy metals, BTEX and TIC/PAH for each media (water, sediments and soils) for each sampling site. The table is adapted from Appendix D of the

Pullen Creek Assessment Project QAPP revised and approved in 2015 (STC, 2015).

Table 1. Sample matrix for testing contaminants at five sites in Pullen Creek, Skagway, Alaska.

	Pullen Pond	Tributary 1	Fish Hatchery	Tributary 2	Railyard
Water – Heavy metals	X				X
Water – BTEX	X	X	X	X	X
Water – TIC/PAH	X				
Sediments – Heavy metals	X	X	X	X	X
Sediments – BTEX	X			X	
Soils – Heavy Metals	X	X	X	X	X

Additionally, macroinvertebrates were sampled and tested for heavy metals in May of 2004 in Pullen Creek and at a reference site (Nelson Slough). Nelson Slough is located in the Taiya Inlet watershed and has very little development associated with it. As a reference site, data could be collected on macroinvertebrates from Pullen Creek and compared back to Nelson Slough, in order to determine if contaminants are higher than a place less impacted. In May of 2016, macroinvertebrates were again sampled and tested for heavy metals in Pullen Creek for a comparison to the 2004 data as well as comparisons to the reference locations. Nelson Slough was not resampled. Two feeding types of macroinvertebrates were tested for each study year: predators and shredders. Pullen Creek was split into two sampled sections in order to get the macroinvertebrate biomass needed for the analysis. The Pullen Pond samples included macroinvertebrates captures below the pond, within the pond and above the pond to the footbridge located just below the confluence of Tributary 2. The Above Bridge samples included Pullen Creek from above the aforementioned footbridge throughout the mainstem.

In 2003, the Taiya Inlet Watershed Council conducted some preliminary water quality sampling on Pullen Creek. This data was included in the *Pullen Creek Watershed Assessment* (2005). The data from this sampling event will be incorporated into summary data tables, however the data will not be included in the data analysis or discussed. It is provided for reference only.

3.3 Data Analysis

To address the first objective of this study, a simple data comparison of results back to the TMDL and TELs for sediments and the PRGs for all other media set in STC's 2005 study was done. The 2015 QAPP included a table of action levels which was incorrect. The QAPP table combined PRGs for soils and sediments; however STC's 2005 assessment had separate PRGs for each media. Additionally, the original table in the QAPP did not include the TMDL for copper. Table 2 includes the TMDL and/or TEL for sediments (ADEC 2010) and soil/sediment PRGs for heavy metals that were written incorrectly into the 2015 QAPP (Appendix A). For the purpose of this current document and analysis, the original PRGs from STC's 2005 study will be used.

Table 3 includes the TMDL/TEL for sediments and the corrected sediment and soil PRGs, as well as water PRGs, used for the comparative purposes in this document. In STC's 2005 *Pullen Creek Assessment*, copper was not tested. The original PRGs in STC's 2005 study were taken from the State of Alaska's Method 2 soil clean-up levels and the State of Alaska's groundwater clean-up levels. Therefore, those standards were used for copper PRGs in soil and water for comparisons in the current study. The PRG for copper in soils is 460 mg/kg and the PRG for copper in water is 1,300 µg/L. For sediments, the copper TMDL of 35.7 mg/kg was added to Table 3.

Table 4 includes the soil/sediment and water PRGs for BTEX, which were used in the original assessment document (STC, 2005) and are correct in the 2015 QAPP (Appendix A). The 2015 sediment sample values that exceed the TMDL/TEL for the metal analyte will be highlighted as red text in the data summary tables (Appendix B - D). The 2015 water samples, sediment samples, and soil samples will also be compared back to PRGs, and any exceeded level for heavy metals or BTEX will be highlighted in blue text in the data summary tables (Appendix B - D).

Table 2. Heavy metal action levels originally identified in the Pullen Creek Assessment Project Quality Assurance Project Plan (QAPP) (2015) for Skagway, Alaska. Preliminary Remediation Goals (PRGs) were erroneously combined in the QAPP for sediments and soils. The Total Maximum Daily Load /Threshold Effects Levels (TMDL/TEL) were finalized in 2010.

	TMDL/TEL Sediments (mg/kg)	Soil/Sediments PRG (mg/kg)	Water PRG (mg/L)
Arsenic (As)	5.9	1.8	0.05
Barium (Ba)	N/A	982	2.00
Cadmium	0.596	4.5	0.005
Chromium	37.3	23	0.10
Lead (Pb)	35	400	0.015
Mercury (Hg)	0.174	1.24	N/A
Selenium (Se)	N/A	3	0.05
Silver (Ag)	N/A	19	0.18
Zinc (Zn)	123	N/A	N/A

Table 3. Corrected heavy metal action levels for the Pullen Creek Assessment Project, using separated Preliminary Remediation Goals (PRG) for sediments and soils. The Water PRGs were converted from mg/L to µg/L.

	TMDL/TEL Sediments (mg/kg)	Sediments PRG (mg/kg)	Soil PRG (mg/kg)	Water PRG (µg/L)
Arsenic (As)	5.9	70	1.8	50
Barium (Ba)	N/A	982	982	2000
Cadmium	0.596	6.6	4.5	5
Chromium	37.3	370	23	100
Copper	35.7	35.7	460*	1300*
Lead (Pb)	35	400	400	15
Mercury (Hg)	0.174	0.71	1.24	1.2
Selenium (Se)	N/A	3	3	50
Silver (Ag)	N/A	3.73	19	180
Zinc (Zn)	123	410	8100	11,000

* Copper was not tested in 2004, therefore no PRG was set. For the purpose of the comparative analysis, the soil PRG was set at 460 mg/kg and the water PRG was set at 1300 µg/L.

Table 4. Action levels for Benzene, Ethylbenzene, Toluene and Xylenes (BTEX) for the Pullen Creek Assessment Project. Preliminary Remediation Goals were set in the Pullen Creek Assessment Project Quality Assurance Project Plan (QAPP) (2015) for Skagway, Alaska.

	Soil/Sediments PRG (mg/kg)	Water PRG (µg/L)
Benzene	0.02	5
Ethylbenzene	5.00	700
Toluene	4.80	1000
Xylenes	69.00	10

To address the second objective, for each analyte at each location for each type of sampled media, a t-test was used (two-tailed) to determine whether or not there was a significant difference in results between the two study years (2004 vs. 2015/2016). The statistical test is run on the average for each year and when there were the same number of sampling events between each year, the test was run with equal variances. When the number of sampling events within the study year varied, the test was run with unequal variances. A p-value of less than 0.05 was considered a significant difference between years.

4.0 Results

Tables compiling the 2003, 2004, and 2015/2016 sampling events were cumbersome for integration into the body of this report, therefore they may be found in the Appendices B - D of this document. The 2003 sampling event conducted by the TIWC is presented in the tables as background information; however the data were not used in the analyses or discussed as being compared back to the standards set forth in this document.

4.1 Water

Tables B1 - B6 in Appendix B summarize water sampling results for the 2003, 2004 and 2015/2016 sampling events. Each table represents compiled data for the metals and BTEX analysis by sampling location. For water, the TMDL/TELs do not apply; therefore data were compared back to the original PRGs (Table 2 and 3) set forth in the *"Pullen Creek Assessment"* (STC, 2005). Exceedances of the PRGs are highlighted as blue text on Tables B1 - B5 (Appendix B). There were no PRGs set for the TIC/PAH test results, as these were screening tests (Table B6).

4.1.1 Pullen Pond

At Pullen Pond there were no exceedances to the PRGs for any metal or BTEX analytes (Table B1). Benzene was detected at 0.56 µg/l for one sampling event in 2015/2016. This did not exceed the PRG of 5.0 µg/l. The number of samples between study years were different, therefore a two-tailed t-test with unequal variance was performed on the heavy metals data. There were no significant differences between study years at Pullen Pond in water for heavy metals. There was no statistical analysis performed on the BTEX data because there were not enough detections to run the statistical test.

At Pullen Pond, water was also collected and analyzed for TIC (in 2004) and PAH (in 2015/2016). In 2004, two analytes were detected in the TIC test. Bis(2-Ethylhexyl) Phthalate was detected in February at 10 µg/l (Table B6). The PRG in that study for bis(2-Ethylhexyl) Phthalate was 6.0 µg/l. In May of 2004, pentachlorophenol was detected at 77 µg/l (Table B6). The 2004 study listed a PRG for pentachlorophenol as 1.0 µg/l. In 2004, both analytes exceeded the PRGs. Neither analyte was part of the PAH test conducted in 2015/2016, therefore no comparison could be made. No other sampling event in either study year had detections for either the TIC or PAH test. Because there are no other detections, no statistical analysis could be performed to determine if there were significant differences between study years.

4.1.2 Tributary 1

No water was sampled for heavy metal analysis at Tributary 1 for either study year. Further, there were no detections for samples collected and analyzed for BTEX at Tributary 1 in either study year (Table B2).

4.1.3 Fish Hatchery

No water was sampled for heavy metals analysis at the Fish Hatchery for either study year. Further, there were no detections for samples collected and analyzed for BTEX at the Fish Hatchery in either study year (Table B3).

4.1.4 Tributary 2

At Tributary 2, the first two sampling events in the 2015/2016 study mistakenly collected water for heavy metals analysis rather than taking the samples at the Rail Yard. There were no exceedances to the PRGs for these samples (Table B4). Because there were no samples analyzed

in 2004 at this site, no statistical analysis was performed. There were no detections for samples collected and analyzed for BTEX at Tributary 2 in either study year (Table B4).

4.1.5 Rail Yard

At the Rail Yard there were no exceedances to the PRGs for heavy metals for either study year (Table B5). Further, there were no detections for samples collected and analyzed for BTEX at the Rail Yard in either study year (Table B4). The number of samples between study years were different, therefore a two-tailed t-test with unequal variance was performed on the heavy metals data. There were no significant differences between study years at the Rail Yard in water for heavy metals.

4.1.6 Summary of Pullen Creek Water Tests

There were no exceedances to water action levels for heavy metals or BTEX at any site in either study year. Two analytes from the TIC test performed in 2004 exceeded the PRGs: Bis(2-Ethylhexyl) Phthalate and pentachlorophenol. Each analyte was only ever detected once. There were no statistical differences between study years for any contaminant detected in water.

4.2 Sediments

Tables C1 - C5 in Appendix C summarize sediment sampling results for the 2003, 2004 and 2015/2016 sampling events. Each table represents compiled data for the metals and BTEX analysis by sampling location. For metals analysis in sediments, the TMDL/TELs apply as outlined in Table 2. Exceedances to the TELs are highlighted as red text on Tables C1 - C5 (Appendix C). For all other analytes, data were compared back to the original PRGs (Table 3 and 4) set forth in the *"Pullen Creek Assessment"* (STC, 2005). Exceedances of the PRGs are highlighted as blue text on Tables C1 – C5 (Appendix C).

4.2.1 Pullen Pond

At the Pullen Pond site, sediments exceeded the TMDL/TEL for arsenic (5.9 mg/kg) for one out of four sampling events in 2004 and did not exceed the arsenic TMDL/TEL in 2015/2016 (Table C1). Sediments exceeded the TMDL/TEL for lead (35 mg/kg) for four out of four sampling events in 2004 and one out of four sampling events in 2015/2016. Sediments also exceeded the TMDL/TEL for zinc (123 mg/kg) for three out of four sampling events in 2004 and one out four sampling events in 2015/2016. No other heavy metal TMDL/TELs were exceeded for either study. The lead PRG (218 mg/kg) and barium PRG (982 mg/kg) was exceeded in one out of four sampling events in 2004 and did not exceed the lead or barium PRG in 2015/2016 (Table C1). No other heavy metal PRGs was exceeded for either study. The PRG for ethylbenzene (5.0 mg/kg) was exceeded once in 2004 (Table C1). No other BTEX in sediments exceeded PRGs in 2004 or 2015/2016. The number of samples between study years for heavy metals is equal, therefore a two-tailed t-test with equal variance was performed on the metals results. The number of samples between study years for BTEX was unequal, therefore a two-tailed t-test with unequal variance was performed on the BTEX results. There were no significant differences between study years at Pullen Pond in sediments for heavy metals or BTEX.

4.2.2 Tributary 1

At the Tributary 1 site, sediments exceeded the TMDL/TEL for arsenic (5.9 mg/kg) one out of four sampling events in 2004 and did not exceed the arsenic TMDL/TEL in 2015/2016 (Table C2). Sediments also exceeded the TMDL/TEL for cadmium (0.596 mg/kg) two out of four sampling events in 2004 and did not exceed the cadmium TMDL/TEL in 2015/2016 (Table C2). Sediments exceeded the TMDL/TEL for lead (35 mg/kg) for all four sampling events in 2004 and all four sampling events in 2015/2016 (Table C2). And sediments exceeded the TMDL/TEL for zinc (123 mg/kg) for all four sampling events in 2004 and three of four sampling events in 2015/2016 (Table C2). The barium PRG (982 mg/kg) was exceeded during one of four sampling events in 2004, and did not exceed the barium PRG in 2015/2016 (Table C2). BTEX was not sampled at Tributary 1, there for no comparison or analyses were performed. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results. There were no significant differences between study years in sediments for heavy metals at Tributary 1.

4.2.3 Fish Hatchery

At the Fish Hatchery sediments exceeded the TMDL/TEL for arsenic (5.9 mg/kg) one out of four sampling events in 2004 and did not exceed the arsenic TMDL/TEL in 2015/2016 (Table C3). Sediments also exceeded the TMDL/TEL for cadmium (0.596 mg/kg) in two out of four sampling events in 2004 and did not exceed the cadmium TMDL/TEL in 2015/2016 (Table C3). The chromium TMDL/TEL (37.3 mg/kg) was exceeded in one out of four sediment sampling events in 2004, and was not exceeded in 2015/2016 sampling events. Sediments exceeded the TMDL/TEL for lead (35 mg/kg) for all four sampling events in 2004 and all four sampling events in 2015/2016 (Table C3). And sediments exceeded the TMDL/TEL for zinc (123 mg/kg) for all four sampling events in 2004 and three of four sampling events in 2015/2016 (Table C3). The barium PRG (982 mg/kg) was exceeded during one of four sampling events in 2004, but did not exceed the barium PRG in 2015/2016 (Table C3). BTEX was not sampled at the Fish Hatchery site, therefore no comparison or analyses were performed. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results. There were no significant differences between study years in sediments for heavy metals at the Fish Hatchery.

4.2.4 Tributary 2

At Tributary 2 sediments exceeded the TMDL/TEL for arsenic (5.9 mg/kg) two out of four sampling events in 2004, and did not exceed the arsenic TMDL/TEL in 2015/2016 (Table C4). Sediments also exceeded the TMDL/TEL for cadmium (0.596 mg/kg) for three out of four sampling events in 2004 and 1 out four sampling events in 2015/2016 (Table C4). Sediments did not exceed the TMDL/TEL for copper in the 2004 study, but did exceed the TMDL/TEL for copper (35.7 mg/kg) in one out of four sampling events in 2015/2016 (Table C4). Sediments exceeded the TMDL/TEL for lead (35 mg/kg) for all four sampling events in 2004 and all four sampling events in 2015/2016 (Table C4). And sediments exceeded the TMDL/TEL for zinc

(123 mg/kg) for three out of four sampling events in 2004 and three out of four sampling events in 2015/2016 (Table C4). The barium PRG (982 mg/kg) was exceeded during one of four sampling events in 2004, and did not exceed the barium PRG in 2015/2016 (Table C4). All other metals and BTEX samples were below the PRGs. BTEX was not sampled in soils at Pullen Pond in the 2004 sample events, therefore no analysis was performed. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results. There were no significant differences between study years in sediments for heavy metals at Tributary 2.

4.2.5 Rail Yard

At the Rail Yard sediments exceeded the TMDL/TEL for arsenic (5.9 mg/kg) two out of four sampling events in 2004, and did not exceed the arsenic TMDL/TEL in 2015/2016 (Table C5). Sediments also exceeded the TMDL/TEL for cadmium (0.596 mg/kg) for three out of four sampling events in 2004 and 1 out four sampling events in 2015/2016 (Table C5). The TMDL/TEL for copper (35.7 mg/kg) was not exceeded in the 2004 sampling, but was exceeded for three out of four sampling events in 2015/2016 (Table C5). Sediments exceeded the TMDL/TEL for lead (35 mg/kg) for all four sampling events in 2004 and all four sampling events in 2015/2016 (Table C5). And sediments exceeded the TMDL/TEL for zinc (123 mg/kg) for four out of four sampling events in 2004 and three out of four sampling events in 2015/2016 (Table C4). The barium PRG (982 mg/kg) was exceeded during one of four sampling events in 2004, and did not exceed the barium PRG in 2015/2016 (Table C5). All other metals and BTEX samples were below the PRGs. BTEX was not sampled in soils at the Rail Yard in the 2015/2016 sample events, therefore no analysis was performed. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results.

Mercury was the only heavy metal that showed a significant difference between study years, even though the values did not exceed the TMDL/TEL or PRGs for the project. Mercury levels in sediments at the Rail Yard were significantly higher ($p = 0.02$) in 2015/2016 sampling event (mean = 0.12 mg/kg ± 0.02) than in 2004 (mean = 0.03 mg/kg ± 0.05). In 2015/2016 mercury was detected in all four samples, while in 2004 it was only detected in one sample.

4.2.6 Summary of Pullen Creek Sediment Tests

Arsenic, barium, chromium and ethylbenzene exceeded action levels for sediments in 2004, but did not in 2015/2016. There were no significant differences between study years for these contaminants. Cadmium, lead and zinc exceeded action levels for sediments in both the 2004 and 2015/2016 study years. There were no significant differences between study years for these contaminants. Table 5 summarizes the number of samples that exceeded the TMDL/TEL or PRGs for each site by study year. .

There was a significant difference for mercury in sediments at the Rail Yard site between study years. Mercury levels were significantly higher in the 2015/2016 study than in the 2004 study

(Table 6). There were no other significant differences between study years for any other contaminant in sediments.

Table 5. The number of times an action level for sediments was exceeded by an analyte at each Pullen Creek site by year. Blue text indicates an exceedance in Preliminary Remediation Goals set in 2004, and all other exceedances are to the TMDL/TEL from 2010. Sampling sites are abbreviated as PP (Pullen Pond), T1 (Tributary 1), FH (Fish Hatchery), T2 (Tributary 2) and RY (Rail yard).

	2004					2015/2016				
	PP	**T1**	**FH**	**T2**	**RY**	**PP**	**T1**	**FH**	**T2**	**RY**
Arsenic	1	1	1	2	2					
Barium	1	1	1	1	1					
Cadmium		2	2	3	3				1	1
Chromium			1							
Copper									1	3
Lead	4	4	4	4	4	1	4	4	4	4
Zinc	3	4	4	3	4	1	3	3	3	3
Ethylbezene	1									

Table 6. Significant differences between the 2004 study and the 2015/2016 study in contaminants detected in sediments on Pullen Creek, Alaska.

Location	Contaminant	2004	2015/2016	p-value
Rail Yard	Mercury	0.03 mg/kg ± 0.05	0.12 mg/kg ± 0.02	P = 0.02

4.3 Soils

Tables D1 - D5 in Appendix D summarize soil sampling results for the 2003, 2004 and 2015/2016 sampling events. Each table represents compiled data for the metals and BTEX analysis by sampling location. For soils, the TMDL/TELs do not apply; therefore data were compared back to the original PRGs set forth in the *"Pullen Creek Assessment"* (STC, 2005). Exceedances of the PRG are highlighted as blue text on Tables D1 - D5 (Appendix D).

4.3.1 Pullen Pond

At the Pullen Pond site, soils exceeded the PRG for arsenic (1.8 mg/kg) three out of four sampling events in 2004 and one out of four sampling events in 2015/2016 (Table D1). All other metals and BTEX results were below the PRGs. BTEX was not sampled in soils at Pullen Pond in the 2015/2016 sample events, therefore no analysis was performed. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results.

While arsenic exceeded the PRG more often in 2004, there was no significant difference in results between the two studies ($p = 0.13$). While neither lead nor mercury exceeded the PRGs, their levels were significantly different between years. Lead levels in soils at Pullen Pond were

significantly higher (p = 0.01) in 2015/2015 (mean = 145 mg/kg ±16) than in 2004 (mean = 81.9 mg/kg ± 27). Likewise, mercury levels were significantly higher (p = 0.001) in 2015/2016 (mean = 0.15 mg/kg ± 0.02) than in 2004 (mean = 0 mg/kg ± 0.03). In 2004, mercury was only detected in one sample, while in 2015/2016 it was detected in all four samples.

4.3.2 Tributary 1

At the Tributary 1 site, soils exceeded the PRG for arsenic (1.8 mg/kg) three out of four sampling events in 2004 and did not exceed the arsenic PRG in 2015/2016 (Table D2). Additionally, lead exceeded the PRG (400 mg/kg) in one sample event in 2004, but did not exceed the PRG in 2015/2016 (Table D2). All other metal results were below the PRGs, and BTEX was not sampled in soils at Tributary 1. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results.

Mercury and silver levels were both significantly different between years. Mercury levels in soils at Tributary 1 were significantly higher (p = 0.00005) in 2015/2016 (mean = 0.17 mg/kg ± 0.03) than in 2004 when mercury was not detected in any sample. The same trend was observed for silver (p = 0.000004; 2015/2016 mean = 0.33 mg/kg ± 0.04).

4.3.3 Fish Hatchery

At the Fish Hatchery site, soils exceeded the PRG for arsenic (1.8 mg/kg) for all sampling events (Table D3). Soils exceeded the PRG for cadmium (4.5 mg/kg) for one out of four sampling events in 2004, but did not exceed the PRG in 2015/2016 (Table D3). Additionally, soils exceeded the PRG for lead (400 mg/kg) for four of four sampling events in 2004 and two of three sampling events in 2015/2016 (Table D3). All other metal results were below the PRGs, and BTEX was not sampled in soils at the Fish Hatchery. The number of samples between study years was not equal, therefore a two-tailed t-test with unequal variance was performed on the metals results. There were no significant differences between study years for any metal analysis.

4.3.4 Tributary 2

At the Tributary 2 site, soils exceeded the PRG for arsenic (1.8 mg/kg) all four sampling events in 2004 and three of four sampling events in 2015/2016 (Table D4). Additionally, the barium PRG (982 mg/kg) was exceeded in one sampling event in 2004 (Table D4). All other metal results were below the PRGs, and BTEX was not sampled in soils at Tributary 2. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results. There were no significant differences between study years for in soils for heavy metals at Tributary 2.

4.3.5 Rail Yard

At the Rail Yard site, soils exceeded the PRG for arsenic (1.8 mg/kg) for all sampling events except one in the 2015/2016 sample year (Table D5). The barium PRG (982 mg/kg) was exceeded in one sample event in 2004. The chromium PRG (23 mg/kg) was exceeded in one sample event in 2015/2016 (Table D5). And the lead PRG (400 mg/kg) was exceeded in three

out of six samples in 2004 and four out of six samples in 2015/2016 (Table D5). All other metal results were below the PRGs (Table D5). BTEX was not sampled in soils at the Rail Yard in the 2015/2016 sample events, therefore no analysis was performed. The number of samples between study years are equal, therefore a two-tailed t-test with equal variance was performed on the metals results.

Mercury was significantly different between study years. Mercury levels in soils at the Rail Yard were significantly higher ($p = 0.005$) in 2015/2016 (mean = 0.36 mg/kg ± 0.18) than in 2004 (mean = 0.03 mg/kg ± 0.06). There were no other significant differences in contaminant levels between study years at the Rail Yard site on Pullen Creek.

4.3.6 Summary of Pullen Creek Soil Tests

Arsenic, barium, and lead all exceeded action levels for soils in both the 2004 and 2015/2016 study years. Additionally, chromium exceeded actions levels in 2015/2016. Table 7 summarizes the number of samples that exceeded the PRGs for each site by study year. There were no significant differences between study years in levels of contaminants that exceeded the action levels set forth in this analysis.

There was a significant difference for lead in soils at the Pullen Pond site between study years, even though the levels did not exceed the action level of 400 mg/kg (Table 8). Lead levels at Pullen Pond were significantly higher in 2015/2016 than in 2004 (Table 8). The same trend was true for mercury levels at Pullen Pond, which also did not exceed the action levels in the study (Table 7 and 8). At the Tributary 1 site, mercury and silver were both significantly higher in 2015/2016 than in 2004, although neither contaminant was detected in 2004 but were detected in 2015/2016 (Table 8). At the Rail Yard site, mercury was significantly lower in 2015/2016 than it was in 2004 (Table 8).

Table 7. The number of times an action level for soil was exceeded by an analyte at each Pullen Creek site by year. Blue text indicates an exceedance in Preliminary Remediation Goals set in 2004. Sampling sites are abbreviated as PP (Pullen Pond), T1 (Tributary 1), FH (Fish Hatchery), T2 (Tributary 2) and RY (Rail yard).

	2004					2015/2016				
	PP	**T1**	**FH**	**T2**	**RY**	**PP**	**T1**	**FH**	**T2**	**RY**
Arsenic	3	3	4	4	4	1		4	3	3
Barium				1	1					
Cadmium			1							
Chromium										1
Lead		1	4		3			2		

Table 8. Significant differences between the 2004 study and the 2015/2016 study in contaminants detected in soils in Pullen Creek, Alaska

Location	Contaminant	2004	2015/2016	p-value
Lead	Pullen Pond	81.9 mg/kg ± 27	145 mg/kg ±16	P = 0.01
Mercury	Pullen Pond	0 mg/kg ± 0.03	0.15 mg/kg ± 0.02	P = 0.001
Mercury	Tributary 1	0	0.17 mg/kg ± 0.03	p = 0.00005
Silver	Tributary 1	0	0.33 mg/kg ± 0.04	p = 0.000004
Mercury	Rail Yard	0.36 mg/kg ± 0.18	0.03 mg/kg ± 0.06	P = 0.005

4.4 Tissue

Table E1 in Appendix E summarizes the tissue sampling results for heavy metals for the 2004 and 2015/2016 sampling events. There were no action levels set for tissue data, therefore no comparisons back to PRGs were made. Given the low number of representative samples, a comparative analysis could not be conducted between functional feeding groups (predators vs. shredders) by study year. If predators from both studies were combined, and compared to combined shredders from both studies, there were no significant differences in detected contaminant levels between functional feeding groups. For each study year, the detected contaminants were compared back to the reference site (Nelson Slough). In 2004, chromium was significantly different (p = 0.05) between Pullen Creek (mean 1.5 ± 0.33) which had higher levels than Nelson slough (mean = 0.7 mg/kg ± 0.15). In 2015/2016, cadmium was significantly different (p = 0.03) between Pullen Creek (0.170 mg/kg ± 0.10) which had lower levels than Nelson Slough (mean = 0.5 mg/kg ± 0.05). Next, a comparison strictly between the two years, combining functional feeding groups, showed significant differences in contaminant levels in macroinvertebrates for copper and selenium. Copper was significantly higher (p = 0.0005) in 2004 (mean = 18.9 mg/kg ± 0.94) than in 2015/2016 (mean = 4.3 mg/kg ± 0.50). Selenium was also significantly higher (p = 0.002) in 2004 (mean = 2.4 mg/kg ± 0.17) than in 2015/2016 (mean = 0.33 mg/kg ± 0.05).

5.0 Discussion

The ADEC established TMDLs for some heavy metals in sediments of Pullen Creek in 2010. The TMDLs were developed using data collected in 2004 for the STC 2005 *Pullen Creek Assessment* project, as well as follow up sampling conducted by Tetra Tech, Inc. (2009) in order to develop the TMDL. The TMDL was required, after Pullen Creek was continually listed on the State of Alaska's Impaired Waterbody List. The TMDL included cadmium, copper, lead and zinc for Pullen Creek. The document also recommends that TELs from National Oceanic and Atmospheric Administration (NOAA) (2008) *Screening Quick Reference Tables* (Buchman, 2008) be used for metal contaminants in sediments that were not included in the TMDL (i.e. arsenic, chromium, and mercury).

Objective 1 of this study was to compare data back to action levels set for in STC's 2015 QAPP. The action levels were incorrect in the QAPP and the corrected action levels were included in this document in Section 2.3. It was determined in the QAPP, that if contaminant levels

exceeded the TMDLs in sediments, that STC would report these to the ADEC for them to take action as they see fit under the TMDL (Appendix A). If any of the remaining data exceed TELs or PRGs, then STC would meet with ADEC to determine together courses of action. ADEC would maintain regulatory authority (Appendix A).

Cadmium, copper, lead and zinc all exceeded sediment TMDLs in the 2015/2016 study year. There were no significant differences between study years (2004 vs 2015/2016) for the level detected for cadmium, copper, lead and zinc. However, the number of detections for each contaminant was less in the current study than in the 2004 study (Table 5). The recommended implementation of the TMDL for sediments was by allowing for natural attenuation over time. Since the TMDL was developed in 2010, there have been at least four projects along Pullen Creek that disturbed sediments. It is unknown if the BMPs outlined in the *Pullen Creek Waterbody Recovery Plan: Best Management Practices* (STC, 2006) and TMDL were followed during the course of construction for the projects, or what the extent of ADEC participation in these projects has been.

Tables 5 and 7 summarize the number of times a contaminant exceeded an action level. There were more exceedances in 2004 than in 2015/2016 for both sediments and soils. However, there were no significant differences in any contaminant level that exceeded an action level between study years. Arsenic, barium, chromium and ethylbenzene in sediments and barium in soils only exceeded action levels in 2004, and did not exceed actions in 2015/2016. Therefore there might not be a continued concern for these contaminants in sediments, as they may be reducing over time. Other sediment exceedances were covered by the TMDL discussed above.

Exceedances to action levels for soils included arsenic and lead in both study years, barium and cadmium in the 2004 study and chromium in the 2015/2016 study. It is generally believed that contaminated bank soils adjacent to Pullen Creek may be contributing to contaminated sediments in the stream bed from erosion and/or run off (ADEC, 2010, STC, 2006). While the *Pullen Creek Waterbody Recovery Plan: Best Management Practices* (BMP) and the TMDL implementation did not recommend excavation and remediation of bank soils, both documents outlined recommendations for minimizing potential inputs. These BMPs for contaminants in soils should be revisited when STC and ADEC meet to discuss potential courses of action for reducing arsenic and lead in soils associated with Pullen Creek.

Objective 2 of this study was to determine if there were significant differences between study years in contaminants detected on Pullen Creek. Table 6 and 8 summarize these results for sediment and soils respectively. In all cases except for mercury levels in soils at the Rail Yard, the contaminant levels found in 2015/2016 were higher than in 2004. Results for mercury and silver may be skewed, based on varied laboratory detection levels. As an example, in 2004 the Method Detection Limits for mercury in soils and sediments was 0.2 mg/kg for the laboratory that performed the analysis for three out of the four sampling events. Therefore, these results, which were reported as not detected, may have been present below 0.2 mg/kg but were recorded

as 0.0 mg/kg for the analysis. The fourth sampling event in 2004 was subbed to a laboratory which was able to perform the analysis with a much lower Method Detection Limit (unknown because the laboratory was subcontracted), which provided detection levels that could be used in statistical t-test used in the analysis. In 2015/2016 the reporting limit was 0.04 mg/kg, so the laboratory was able to report levels between 0.04 mg/kg and 0.2 mg/kg (and above). As shown in Tables 6 and 8, the means used for the t-test fall within this range. The same issue holds true for silver, therefore the significant differences between years for mercury and silver should not hold much stake in being an issue for Pullen Creek.

While the Method Detection Limits for lead between the two studies is also different (1.0 mg/kg in 2004 and 0.2 mg/kg in 2015/2016), lead was detected in every soil sample and every sediment sample at each location for both study years at levels above 1.0 mg/kg, therefore the statistical t-test results would not be skewed by non-detects. There was a significant difference in lead levels at the Pullen Pond site between study years, and the levels were higher in 2015/2016 than in 2004 (Table 8). The levels detected did not, however, exceed the PRGs for either year. These results suggest that lead in soils should be looked at closer, and the likelihood of lead in soils contributing to lead levels in sediments should be considered when discussing the lead TMDL exceedances for sediments.

Overall, the current study does not show much improvement over the past ten years for contaminants in sediments and soils associated with Pullen Creek. Monitoring efforts should continue more frequently, in order to capture whether or not construction projects on Pullen Creek are affecting continued exceedances of TMDLs for sediments. Additionally, education with local governments and entities with respect to implementation of the TMDL and BMPs, may help assure that BMPs are followed in the hopes of allowing natural attenuation over time to reduce contaminant levels.

6.0 Acknowledgements

This project was funded by the Environmental Protection Agency Indian General Assistance Program to the Skagway Traditional Council. We would like to thank the residents and landowners with the Pullen Creek watershed for access to sampling sites. We would like to thank Cathy Needham of Kai Environmental Consulting Services for providing a technical background in revising the QAPP, collecting water samples and conducting the comparative analysis. Rachel Ford, who held a joint position between STC and the TIWC, provided project management, assistance with QAPP revisions and served as the field technician for the project. We would like to thank John Hudson with the U.S. Fish and Wildlife Service for providing information regarding projects they funded on Pullen Creek. We would also like to thank Michelle Davis, Raymond Wu and the 2015 STC Tribal Council for approving and supporting this project which would give much needed insight into the current conditions of Pullen Creek. Finally, we would like to thank all unmentioned supporters of this project who made this project possible. Gunalchéesh.

7.0 References

Alaska Department of Environmental Conservation (ADEC), 2010. Total Maximum Daily Loads (TMDLs) for Metals in the Waters of Pullen Creek in Skagway, Alaska.

Buchman, M.F. 2008. *NOAA Screening Quick Reference Tables*. NOAA OR&R Report 08-1. National Oceanic and Atmospheric Administration, Office of Response and Restoration Division, Seattle, WA.

Skagway Traditional Council (STC), 2005. Pullen Creek Assessment. Prepared for Alaska Department of Environmental Conservation, Alaska Clean Water Action Plan. Grants NP-04-08 and NP-05-17.

Skagway Traditional Council (STC), 2006. Pullen Creek Waterbody Recovery Plan, Best Management Practices. Prepared for Alaska Department of Environmental Conservation, Alaska Clean Water Action Plan. Grants NP-04-08 and NP-05-17.

Skagway Traditional Council (STC), 2015. Pullen Creek Assessment Project Quality Assurance Project Plan. Prepared for the Environmental Protection Agency, Indian General Assistance Program (IGAP), revised on June 15, 2015.

Taiya Inlet Watershed Council (TIWC), 2006. Pullen Creek Action Plan. Funded by the U.S. Fish and Wildlife Service Coastal Conservation Program.

Tetra Tech, Inc., 2009. Evaluation of Metals and Petroleum Derivatives in Skagway Harbor and Pullen Creek Sediments and Surface Waters. Prepared for the Alaska Department of Environmental Conservation and the Environmental Protection Agency Region X.

APPENDIX A

Pullen Creek Assessment Project
Quality Assurance Project Plan (2015)

This page intentionally left blank

Quality Assurance Project Plan

Pullen Creek Assessment Project

performed by

SKAGWAY TRADITIONAL COUNCIL

under

ENVIRONMENTAL PROTECTION AGENCY

INDIAN GENERAL ASSISTANCE PROGRAM (IGAP)

GROUP A: PROJECT MANAGEMENT

A1 - Title and Approval Sheet

Title: Pullen Creek Assessment Project (2015)

Organization: Skagway Traditional Council (STC)

Approving Officials:

Position	Person	Signature	Approval Date
STC Project Manager: Phone: 907-983-4068 administrator@skagwaytraditional.org	Sara Kinjo-Hischer		
STC Quality Assurance Manager: Phone: 907-723-4436 cathy@kaienvironmental.com	Cathy Needham		
EPA Project Officer: Phone: 907-271-3434 Davis.MichelleV@epa.gov	Michelle Davis		
EPA Quality Assurance Officer: Phone: 206-553-1413 Wu.Raymond@epa.gov	Raymond Wu		
ADEC Project Contact: Phone: 907-465-5023 Gretchen.Pikul@alaska.gov	Gretchen Pikul		

A2 - Table of Contents

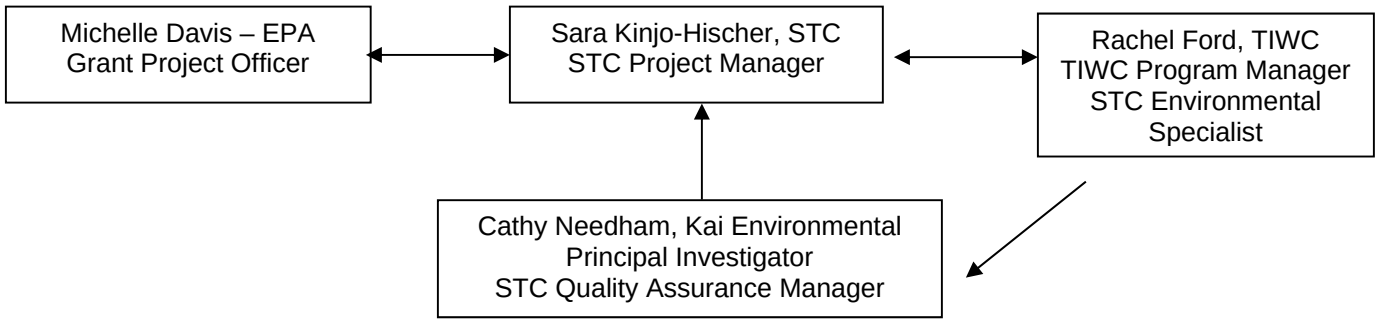
A3 - Distribution List

The following individuals and organizations will receive copies of the approved QAPP and any subsequent revisions.

Individual	Organization
Sara Kinjo-Hischer	Skagway Traditional Council
Cathy Needham	Kai Environmental Consulting Services
Michelle Davis	Environmental Protection Agency
Raymond Wu	Environmental Protection Agency
Gretchen Pikul	Alaska Department of Environmental Conservation
Rachel Ford	Taiya Inlet Watershed Council

A4 - Project/Task Organization

The project team organization is shown in the following organization chart. The specific roles and responsibilities of each person are described below.



Sara Kinjo-Hischer, Skagway Traditional Council – Project Manger
Ms. Kinjo-Hischer will be responsible for overall project management. She will be the primary contact person in charge of the project. She will coordinate work contracted to Kai Environmental. She will assist on an as needed basis in field data collection, will mediate between the contractor and the Taiya Inlet Watershed Council and will be responsible in assuring all work plan deliverables are submitted to EPA.

Michelle Davis, Environmental Protection Agency (EPA) – Grant Project Officer
Ms. Davis will be the primary agency contact between EPA and the Skagway Traditional Council. She will be responsible for assuring that all deliverables are completed and all contractual terms are fulfilled.

Cathy Needham, Kai Environmental Consulting Services
Ms. Needham will serve as the principal investigator under contract with the Skagway Traditional Council for the Pullen Creek Assessment Project. Ms. Needham will be responsible for collecting all scientific data, developing an environmental assessment and providing technical assistance to STC in reporting requirements. Ms. Needham will also serve as the STC Quality

Assurance Project Manager and assure that the project meets the quality assurance defined in this QAPP.

Rachel Ford, Taiya Inlet Watershed Council and Skagway Traditional Council
Ms. Ford will provide guidance, technical, and field assistance to Ms. Needham for data collection. She will also help mediate between STC and TIWC to assure that needs of both organizations are met. Documents produced in the project will be provided to the Taiya Inlet Watershed Council, to be used as guiding documents for future work on Pullen Creek.

Gretchen Pikul, Alaska Department of Environmental Conservation

Ms. Pikul will serve as the point of contact for the State of Alaska Department of Environmental Conservation (ADEC). ADEC has been involved in the recovery of Pullen Creek from the State of Alaska's 303(d) Impaired Waterbody List. Ms. Pikul will review the final project report and disseminate information within the State of Alaska Division of Water as needed.

A5 - Problem Definition/Background

Pullen Creek, located in the heart of the City of Skagway, is listed on the State of Alaska's 2010 Section 303(d) impaired waterbody list for metal contamination. It is currently listed as a Category 4(a) waterbody, indicating a Total Maximum Daily Load (TMDL) is not needed or has been approved. Trace metals have been found associated with the creek, and Skagway Harbor, and are believed to have originated from an ore transfer facility and its railroad. In 2004 and 2005, the Skagway Traditional Council led the Pullen Creek Assessment Project, which included contaminant testing for metal, in order to provide baseline data to determine if a TMDL was needed. This current study, 10 years after the initial baseline study, is intended to determine if contaminants are still present in Pullen Creek, or if restoration efforts, community stormwater education and natural attenuation in the past 10 years have mitigated the previously detected results.

Pullen Creek is 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 re-assessment for Pullen Creek is needed, to identify and prioritize water quality and habitat restoration efforts that may still be needed.

The objective of this project is to determine if previous restoration efforts have assisted in recovering pollution in Pullen Creek, and if not, what new restoration measures may be applied. This comparative analysis to previously collected data 10 years ago will be based upon information provided by this project including water quality data collection, flow information, and sediment loading, all from Pullen Creek. No evaluation by ADEC was conducted for Pullen Creek, when it was originally placed on Alaska's 1996 Section 303(d) list for metal contamination, thus resulting in the waterbody being carried over onto the 1998 Section 303(d) list. The Skagway Traditional Council (STC) will continue collecting the data necessary for agencies to evaluate the water quality problems with Pullen Creek.

A6 - Project/Task Description

This Quality Assurance Project Plan (QAPP) was originally approved in January, 2004 for the purpose of supporting sampling activities and data collection on Pullen Creek, in Skagway Alaska by the Skagway Traditional Council. Previously, the primary task was to sample for heavy metals, BTEX hydrocarbon, Tentatively Identified Compounds (TIC) contaminants in water, sediments and bank soils of Pullen Creek. Additional tasks included: basic water quality sampling, discharge data collection and sedimentation sampling. Basic water quality parameters included temperature, dissolved oxygen, pH and conductivity. Discharge measurements were taken according to USGS sampling procedures. Sedimentation sampling included analysis for Total Suspended Solids and pebble counts in Pullen Creek. Sampling events took place at 5 sampling locations along the creek (Appendix A). The 2004 QAPP was amended in 2005 to incorporate added tasks. This included biological sampling. Macroinvertebrates from Pullen Creek were collected and analyzed for heavy metal compounds. The 2005 amended QAPP may be found in Appendix B.

The current primary task is to replicate the previous study, as best possible, in order to conduct a comparative analysis between the previous dataset and the current dataset, so that the water quality conditions may be evaluated as to whether they have improved or if additional remedial actions are needed.

A7 - Quality Objectives and Criteria for Measurement Data

The project data quality objectives are to collect all data within accepted accuracy needed to continue a baseline of information regarding watershed processes at Pullen Creek, and to conduct a comparative analysis of data collected 10 years prior. The data quality objectives of data collected and analyzed for heavy metals, BTEX hydrocarbons, Total Suspended Solids and TIC on water sediment and bank soils will be in accordance to SGS Environmental Services laboratory. A change in laboratories was necessary, as the previously used laboratory Shoalwater Bay Laboratory is no longer in business. The heavy metal analysis on biological tissue will be in accordance with ALS Environmental. ALS bought out Columbia Analytical Services (CAS), the laboratory used in the previous study. The data quality objectives for basic water quality will be within the parameters of the YSI multi-probe meter (Appendix C) and the quality objectives for discharge and pebble counts will be in accordance to the procedures defined in this QAPP. All data will be used for a 10 year comparative analysis in an environmental assessment document for Pullen Creek, and used by the Skagway Traditional Council on future restoration work on Pullen Creek.

Precision

Precision is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of methods All analytical tests performed by accredited laboratories, using standards EPA methods, will comply with duplicate, blank, spike and replicate requirements in accordance with approved internal laboratory QA/QC procedures. Each Field Sampling event will include a replicate sample for all analytes following rinse with de-ionized water. All results will be recorded in field and lab

logbooks; however, results which fall outside the specified range will not be entered into the project data system.

Accuracy

Accuracy is a measure of confidence that describes how close a measurement is to its "true" value. In this project, accuracy is measured by duplicate sampling and the use of standards in calibrating the YSI 556 Multi-parameter meter.

Representativeness

Representativeness is the extent to which measurements actually represent the true environmental condition. Representativeness of data collected is assured by the location of sampling sites and use of EPA Standard Method 1060 A & B for acquisition of representative grab samples.

Comparability

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling and analytical methods and units of reporting with comparable sensitivity ensures comparability. All results produced under this QAPP will be reported in metrics common to water quality regulations specific to each parameter. Additionally, both the field and laboratory methods included in this QAPP are common to watershed monitoring efforts in similar ecosystems throughout Southeast Alaska and statewide.

Completeness

Completeness is the comparison between the amounts of usable data collected versus the amount of data called for in the sampling plan. In this STC Project, completeness is measured as the percentage of total samples collected and analyzed as a whole and compared to the goals set out by the project design. To measure completeness the primary number of samples collected will be divided by the useable number of samples submitted to ADEC with a goal of 85% completeness.

A8 - Special Training Requirements/Certification

All data collected by Kai Environmental will be conducted and/or overseen by Cathy Needham. Ms. Needham has a Master's of Science degree in Zoology (emphasis in Marine Ecology) and has had on-the-job training by U.S. Geological Survey personnel, and Tribal Water Resources training. Ms. Needham led the previous Pullen Creek Assessment Project in 2004/2005. She is a qualified trainer for Tribal environmental personnel to meet EPA certification requirements to sample under EPA approved QAPPs.

A9 - Documentation and Records

The current QAPP will be maintained at the offices of the Project Manager and the offices of the STC Quality Assurance Manager. Any changes necessitated by unforeseen conditions will be transmitted by fax or e-mail to the EPA Project Officer, EPA Quality Assurance Officer, and the ADEC Project Officer.

Laboratory data from SGS Environmental Services and ALS Environmental will be entered into

an Excel spreadsheet and stored on the Skagway Traditional Council computer network. Data will also be stored on a compact disc, and housed at STC and off-site with the STC Quality Assurance Manager.

Field data (including: basic water quality, discharge and pebble count data) will also be entered into an Excel spreadsheet and stored on the STC computer network, saved to a compact disc and be stored at STC and off-site with the STC Quality Assurance Manager.

All hardcopies of data for this project will be filed and stored at STC for a minimum of 10 years. Photocopies of laboratory data and field data sheets will be stored off-site with the STC Quality Assurance Manager.

GROUP B: MEASUREMENT/DATA ACQUISITION

B1 - Sampling Process Design (Experimental Design)

Water, sediment and bank soils collected under this QAPP will be taken at five sampling locations along Pullen Creek (Appendix A). Sampling events will occur in February, May, August and November of each calendar year it is funded. Sampling locations were chosen to give geographical spread along Pullen Creek, and also to account for tributaries. Sampling locations will be: Pullen Pond, the confluence to Tributary 1, the confluence to Tributary 2, the Jerry Meyers Fish Hatchery and at the headwaters at the White Pass rail yard (Appendix A).

Water, sediment and bank soil sampling for laboratory analysis will be collected at each sampling site by Kai Environmental personnel and field assistants from Skagway Traditional Council and the Taiya Inlet Watershed Council (see Sampling Matrix in Appendix D). Prepared sampling bottles and sampling jars will be sent to Kai Environmental prior to each sampling event. Collected water, sediment and bank soil samples will be sent to analytical laboratories for analysis of heavy metals, BTEX hydrocarbons, Tentatively Identified Compounds (TIC) and Total Suspended Solids.

After each site collection of water, sediment and bank soil samples, the sampling crew will measure basic water quality parameters (temperature, DO, pH and conductivity) with the YSI 556 Multiparameter meter. Next, they will measure discharge using methods developed by the U.S. Geological Survey, and finally conduct pebble counts of bed substrate. Each sample site will include analyses of heavy metals in sediment, heavy metals in bank soil, BTEX hydrocarbons in water and suspended sediment. In addition, Pullen Pond and the railyard headwaters will include analysis of heavy metals in water and BTEX hydrocarbons in sediment. The TIC test will only be conducted at one sample site, Pullen Pond. This will occur during both sampling events and will act to screen for presence of analytes not included in this QAPP.

During the May sampling event, macroinvertebrate will be sampled from two locations on Pullen Creek. Samples will be collected from the Pullen Pond site and from the confluence of Tributary 1 (the same locations used in collecting water, sediment and bank soils). Macroinvertebrates will be sampled by Kai Environmental personnel. Prepared sampling bottles and sampling jars will

be sent to Kai Environmental prior to the sampling event. Collected tissue will be sent to ALS Environmental Inc. for analysis of heavy metals on tissue.

B2- Sampling Methods and Requirements

Water, sediment and bank soil sampling events have been scheduled for summer (August 2015), fall (November 2015) , winter (February 2016) and spring (May 2016), to capture seasonal variation in flow regimes and potential non-point source contaminants released throughout the year. Each sampling location will be re-located from previous GPS points, and will be flagged and an updated GPS reference point will be taken. At the sampling location, a tape measure will be run across the creek, marking the transect where the samples will be collected. Water samples will first be collected into a 16 oz. Nalgene© bottle at the thalweg as described in EPA Standard Method 1060 A & B. Prior to each sample the sampling bottle will be rinsed 3 times in the water to be sampled. Water will be decanted from the Nalgene© into the appropriately labeled bottle provided by the laboratory. A composite of sediment will be collected along the transect line, where sediment is present. Using a stainless steel hand trowel, sediment will be excavated from within 2 cm of surface, placed into a stainless steel bowl, mixed and then approximately 40 grams of material will be placed into the labeled sampling jar. Bank soil will be collected adjacent to the creek, on the railway side. The top 2 inches of soil will be removed using a stainless steel hand trowel and using a second decontaminated stainless steel spoon, approximately 40 grams of soil will be excavated and placed into the labeled sampling jar.

Sampling equipment and supplies will be decontaminated initially and not re-used between composite samples. Fifteen stainless steel spoons and bowls will be decontaminated and packaged prior to the sampling events and each used for one composite sample at one sample site. These will be decontaminated using the following procedure. First, wash spoons and bowls with laboratory-grade detergent and clean water, with a triple clean water rinse (distilled water). Then rinse with methanol or acetone, followed by methylene chloride or hexane (Capillary GC Pesticide Residue Grade or equivalent). Project Quality Assurance Manager will ensure that solvents are not expired and are disposed of properly. All sampling equipment decontamination will occur prior to sampling at the Kai Environmental office in Juneau, Alaska.

Once all samples are collected from the 5 sampling locations, the coolers will be packed with ice packs, the chain-of-custody will be filled out and placed into the coolers and the custody seals will be placed on the coolers, which will be shipped back to the laboratories for analysis (see analytical requirements below).

Basic water quality data will be taken at each sampling location using a YSI 556 Multiparameter meter. pH and conductivity will be calibrated prior to field work. At each sampling location, DO will be calibrated using the saturated air method. The YSI 556 probe will be submersed in the water, and measurements will be recorded onto data sheets (Appendix E).

Discharge will be measured equipment and protocols developed by the U.S. Geological Survey (Rantz and Others, 1983). A Global Flow meter on a wading rod will be used to measure depth along the above mentioned tape (measures width). Velocity at different widths will be taken and recorded onto data sheets, and discharge will be calculated after sampling is complete.

Pebble counts will be conducted along 5 transects across the creek. The first transect will be along the above mentioned tape. Two transect lines will be laid upstream, 1 and 2 meters from the original transect. Two transect lines will be laid downstream, 1 and 2 meters from the original transect line. Along each transect, 25 sediment particles will be collected using "boot-tip" procedures outlined in "Aquatic Ecosystem Management Handbook" (2001). Each particle will be measured along the intermediate axis and recorded.

A sampling event for testing heavy metals in tissues has been scheduled for May of 2016. Macroinvertebrates were chosen to represent the tissue sample, because they were the only organism with a life history specific to Pullen Creek. The May event represents the timeframe of when macroinvertebrates are most abundant in Southeast Alaska streams (Bogan, personal communication). Macroinvertebrates will be collected from two sites on Pullen Creek which are also used for collecting water, sediment and bank soils: below Pullen Pond and at the confluence of Tributary 1. Sites were chosen to match the available substrate needed to support invertebrate communities. In the previous 2005 Pullen Creek study, macroinvertebrates were sampled and tested for heavy metals in a reference stream at Nelson Slough. This current study will compare the 2016 results back to the data taken in 2005.

Collection of macroinvertebrates will follow methods developed by the Environment and Natural Resources Institute (ENRI) (2004) entitled "Alaska Volunteer Biological Montoring and Assessment Protocols". At each site, macroinvertebrates will collected from a 25 meter reach, using a 350 µ mesh D-frame dip net. Samples will be collected for biomass, so they will be collected across all habitats (not preselected habitats as indicated in the ENRI methods). Macroinvertebrates will be transferred from the D-frame dip net into white trays that were previous decontaminated using methods described above. Using decontaminated forceps, macroinvertebrates will be sorted into two functional feeding groups (scrappers/shredders and filterers) and placed in separate labeled sampling jars. Approximately 3-4 grams of tissue will be collected for each functional feeding group at each sampling site.

Once all samples are collected, the coolers will be packed with ice packs, the chain-of-custody will be filled out and place into the coolers and the custody seals will be placed on the coolers, which will be shipped back to the laboratories for analysis (see analytical requirements below).

The STC Quality Assurance Manager is responsible for any corrective action taken. Corrective actions may include re-location of sampling sites, omission of analytic due to physical constraints, use of sampling location which does not represent the characteristics of a later scour pool, equipment failure, etc. If need for corrective action is identified, the EPA Quality Assurance Officer may be consulted and corrective actions determined prior to continued sampling efforts.

B3 - Sample Handling and Custody Requirements

All field sampling for heavy metals, BTEX and Total Suspended Solids will be carried out by Kai Environmental personnel. Samples will be taken from the creek and placed into sampling bottles provided by the analytical laboratories and in accordance with their internal QA/QC. The

bottles will be labeled and packed into laboratory provided shipping cooler, along with ice packs. Chain-of-custody forms (Appendix F) for each laboratory will be filled out and also placed into the shipping coolers. The shipping coolers will be sealed with a custody seal, and sent from Juneau, Alaska to the appropriate laboratory.

There are no custody requirements basic water quality parameters, discharge and pebble count sampling as these methods allow data to be immediately available and recorded directly onto field data sheets (Appendix E). These field data sheets will include no erasures and will originals will remain in the custody of Kai Environmental until issuance of a final report when all project information will be supplied to STC.

B4 - Analytical Methods Requirements

The following table details the EPA Methods used by the laboratories on the soil, sediment and water samples:

Analysis	Laboratory	EPA Method
Heavy metals	SGS Environmental Services	200.8, 245.1, 6020A, 7471B
BTEX hydrocarbons	SGS Environmental Services	8260B
TIC	SGS Environmental Services	8270 SIMS
Suspended Solids	SGS Environmental Services	2540

Heavy metals analysis on biological tissue will be performed by ALS Environmental, using EPA methods 200.8 and 7471B.

Responsibility for corrective action during laboratory analyses falls on the laboratory Quality Assurance Officer. If data do not meet quality objectives of this QAPP (Appendix C) or internal QA/QC of the laboratory, the laboratory Quality Assurance Manager will notify the Project Quality Assurance Manager to resolve data quality objectives. Turnaround time for the laboratory results, from sample submission to delivery of results, will be as quick as practical, with all turnaround being completed within 60 days. There are no analytical method requirements for basic water quality, discharge or pebble counts.

B5 - Quality Control Requirements

Quality control of laboratory performance on analytical tests will be in accordance with the SGS Environmental Services Laboratory Quality Assurance Manual (2014) and the Quality Assurance Manual for ALS Environmental (2015). A copy of each manual is on file with the STC Quality Assurance Manager. SGS Environmental Services Laboratory and ALS Environmental are all certified to perform the EPA standard methods included in this QAPP and have demonstrated adherence to strict laboratory protocols.

SGS Environmental Services Laboratory performs initial and continuing instrument calibrations as prescribed in each EPA standard method cited (see table in section B4). Method blanks, matrix spikes, duplicates and laboratory control spikes will also be performed by the laboratory

in accordance to EPA standard methods (see table in section B4). Instrument detection limits and method detection limits are determined semi-annually as outlined in the EPA standard methods. Coolers containing sampling bottles will be shipped from the laboratory to Juneau for sample collection. Each cooler will contain a trip blank and a temperature blank. In addition, one blind field blank per cooler containing multiple samples will be prepared by the sampling crew and returned with the cooler of samples for laboratory analysis.

ALS Environmental performs daily calibrations of equipment for use in heavy metal analysis. Method blanks, matrix spikes and laboratory duplicates are run with each batch of 20 samples (or less). Coolers containing sampling bottles will be shipped to Juneau for sample collection. Each cooler will contain a temperature blank. Trip blanks, field blanks and field duplicates are not required.

The YSI 556 Multiparameter meter will be calibrated prior to each sampling event in accordance with calibration procedures provided in the user manual (2015). Each sampling event will include 5 sampling locations. At each sampling location field measurements will be gathered in duplicate, relying on de-ionized water to clean the sensors between measurements. To ensure resolution of data, following each sampling event the calibration procedure will be performed. Any deviation from the data quality objectives will be documented and sites will be re-sampled.

Variation of duplicate values for each parameter must not exceed the range of precision and accuracy specified in the data quality objectives table (Appendix C). Field data that do not meet project accuracy and precision objectives will be omitted from reporting and replicated.

B6 - Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The testing, inspection and maintenance of SGS Environmental Services Laboratory and ALS Environmental instrument/equipment used for testing heavy metals, BTEX and suspended sediment will be in accordance to each laboratories accreditation and QA/QC procedures. Laboratory sampling kits will be inspected prior to sampling by STC Quality Assurance Manager. If any tampering or transport damage is observed, the kit will be returned and another sent to replace it.

The YSI 556 meter, used to collect basic water quality parameters, will be calibrated as described below. A general visual inspection of the meter will take place prior to each use. Maintenance of the meter will occur on an as needed basis. If instrument failure occurs during a sampling event all field data will be omitted and replicated once proper functioning is ensured in accordance with the data quality objectives of this QAPP. All field equipment maintenance is the responsibility of STC Quality Assurance Manager.

The flow meter used for measuring discharge is tested, inspected and maintained by Kai Environmental personnel, according to procedures outlined in “Measurement and Computation of Stream Flow” (Rantz and Others, 1983). The meter will be visually inspected and calibrated by Kai Environmental, prior to field use. There are no instruments or equipment used for pebble counts

B7 - Instrument Calibration and Frequency

There is no field instrument calibration for water, sediment, bank soil, or biological tissue sampling to be analyzed for heavy metals, BTEX hydrocarbons, or Total Suspended Solid. In addition, there is no instrument calibration for pebble counts. Calibration of equipment used for laboratory analysis will be under the guidance of each individual laboratory accreditation and QA/QC procedures common to the EPA standard methods included in this QAPP.

Calibration of the YSI 556 water quality meter will be conducted prior to each field day use and recorded on the data sheet used in this study (Appendix E). Calibration methods will be in accordance to procedures outlined by the YSI 556 Multiparameter Meter Operating Manual (2015). The pH probe will be calibrated to two known calibration standards: pH 4 and pH 7. The conductivity probe will be calibrated to a known standard of 49 µS . The dissolved oxygen probe will be calibrated prior to each measurement, using the saturated-air method. Calibration of the YSI 556 Multiparameter Meter will be initialed on each data sheet and conducted immediately prior to the sampling event. Following each sampling event the calibration procedure will be performed again and results compared to data quality objectives. If results are not within data quality objectives, the sampling event will be repeated. Documentation of this calibration process is limited to the initials of STC Quality Assurance Manager on data sheets, documenting calibration has occurred.

Calibration of the discharge measuring equipment will be in accordance with calibration methods outlined in "Measurements and Computation of Stream Flow" manual (Rantz and Others, 1983). The flow meter will be spin tested prior to each field day.

B8 - Inspections/Acceptance Requirements for Supplies and Consumables

Supplies and consumables used by Kai Environmental include water sampling bottles and equipment from analytical lab, calibration fluids, and personal field gear. All supplies and consumables received by Kai Environmental will be inspected by Kai Environmental personnel for tampering and/or equipment deficiencies. Any tampering or defective products will be sent back to the analytical lab/manufacturer and will be replaced. Due to the limited chronological scope of this QAPP, long term record keeping for calibration solutions will be omitted. Calibration solutions will be procured by Kai Environmental prior to the sampling event and will not near their expiration during the project term. The STC Quality Assurance Manager will maintain records for all supplies and ensure use of standards that have not expired.

B9 - Data Acquisition Requirements (Non-direct Measurements)

The study area is defined by the boundaries of Pullen Creek. Sampling locations were chosen from existing maps from Alaska Department of Fish and Game personnel and were the site sampled in the 2004/2005 study. The information will be compiled and used in the environmental assessment report to document past work and conditions on Pullen Creek. Notes will be made to differentiate data collected under this QAPP, and information gathered as complimentary data. There are no non-direct measurements that will be gathered which may influence project data acquisition requirements. These non-direct measurements may provide

insight to results from this QAPP which impact management of Pullen Creek. Criteria for the usability of non-direct measurements will be determined by the STC and are not a component of this QAPP.

B10 - Data Management

Data provided by the laboratories will be photocopied and housed at the Skagway Traditional Council and off-site at Kai Environmental. Data will be entered into Excel spreadsheets, burned to a compact disc and stored with hardcopy data.

Data sheets for water quality, discharge measurements and pebble counts are attached to the QAPP (Appendix E). Data sheets will be photocopied and filed at Skagway Traditional Council and off-site at Kai Environmental. All data will be entered into Excel spreadsheets and copied onto compact disc and stored at STC and Kai Environmental.

GROUP C: ASSESSMENT/OVERSIGHT

C1 - Assessments and Response Actions

No formal statistical analysis of data will be done for this study. A comparative analysis of current data, to data collected in the 2004/2005 study will occur. All data collected will be reviewed and compiled into tables, in a format to include sampling event comparisons, by the Kai Environmental personnel. The compiled data will be incorporated into the "Pullen Creek Assessment Document" and will also be available for review by the Taiya Inlet Watershed Council. The information from this study will be used by the STC to create recommendations and priorities for future work on Pullen Creek.

The following table represents Threshold Effects Level (TEL) from the Total Maximum Daily Loads (TMDLs) for metals in sediments from Pullen Creek, which were set in May of 2010. The table also includes the original Preliminary Remediation Goals (PRGs) set by Skagway Traditional Council in the original 2004/2005 study. The levels set in this table are considered the action levels for the current project. The TELs for sediments will take first priority and exceedances to these levels will be reported to the ADEC, for them to take action as they see fit under the TMDL. The original PRGs will apply to the remainder of the data, and if there are exceedances to in water, soil or sediments to a set PRG, STC will meet with ADEC to determine together courses of actions. ADEC maintains regulatory authority.

	TMDL TEL Sediments (mg/kg)	Soil/Sediments PRG (mg/kg)	Water PRG (mg/L)
Arsenic (As)	5.9	1.8	0.05
Barium (Ba)	n/A	982	2.00
Cadmium (Cd)	0.596	4.5	0.005
Chromium (Cr)	37.3	23	0.10
Lead (Pb)	35	400	0.015
Mercury (Hg)	0.174	1.24	N/A
Selenium (Se)	N/A	3	0.05
Silver (Ag)	N/A	19	0.18
Zinc	123	N/A	N/A
	Soil/Sediments PRG (mg/kg)	**Water PRG (mg/L)**	
Benzene	0.02	0.005	
Ethylbenzene	5.00	0.7	
Toluene	4.80	1.0	
Xylenes (Total)	69.00	10.0	

Corrective actions under this Quality Assurance Project Plan will be taken by the Project Manager, in coordination with the Project Quality Assurance Officer.

C2 - Reports to Management

Progress reports will be prepared quarterly by the Project Manager. These reports will summarize project progress and will include the results of data collection during the period. Progress reports will be sent to the EPA Project Officer. Any discrepancies with project data quality objectives will be resolved by the Project Quality Assurance Manager. If objectives cannot be resolved, the STC Quality Assurance Manager will author a Quality Assurance Performance Audit to recommend corrective action for approval by Project Quality Assurance Officer.

Project Manager and STC Quality Assurance Manager will present all final data to EPA for review prior to issuance of draft reports. All data collected will also be integrated into the Pullen Creek Environmental Assessment report. A draft report will be provided to the Taiya Inlet Watershed Council and ADEC for review. A final report will be printed and distributed to ADEC, TIWC and other agencies interested in receiving a copy of the report.

GROUP D: DATA VALIDATAION AND USABILITY

D1 - Data Review, Validation, and Verification Requirements

All data will be reviewed, validated and verified by STC's Quality Assurance Manger, Cathy

Needham. Questionable data will be flagged and discussed with the EPA Project Officer as to whether it should be discounted. If the data is not discounted, a flag with a noted concern will be incorporated into the reporting.

D2 - Validation and Verification Methods

Data received by analytical laboratories will be visually reviewed and compared back to the laboratories detection and reporting limits (Appendix A). If questions arise, an independent data review will be conducted by Kai Environmental staff. If the question is not resolved, then the question will be brought to the EPA Project Officer for reconciliation. The data will either be discounted or it will remain flagged with a noted question.

There are no validation or verification methods for data collected in the field.

D3 - Reconciliation with User Requirements

The project objectives include establishing a baseline of information regarding potential contaminants in Pullen Creek. In addition, existing information on Pullen Creek will be gathered and all data will be incorporated into a final Pullen Creek Watershed Assessment document. The document will then be used by the Skagway Traditional Council and the Taiya Inlet Watershed Council to guide future work on Pullen Creek. Finally, the data collected under this QAPP can be used at the discretion of the EPA Project Officer in determining if TMDL's need to be established for Pullen Creek.

REFERENCES:

YSI Environmental (2015). YSI 556 Multi Probe Meter Operations Manual, accessed 2015 at https://www.ysi.com/File%20Library/Documents/Manuals/655279-YSI-556-Operations-Manual-RevD.pdf

Quality Assurance Manual (2015). ALS Environmental, Kelso, updated 6/1/15, review number 24.0, 182 pp.

Quality Assurance/ Quality Control Manual for SGS North America, Inc. (2014), updated October, 2014.

Rantz, S.E., and Others (1983). Measurement and Computation of Stream Flow; volume 1 Measurement of Stage and Discharge; volume 2 Computation of Discharge.

Appendix A: Map of Pullen Creek Sample Locations

This page intentionally left blank

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).

*Lat/Long Coordinates: Site 1 = 59.451919; -135.317586 Site 2 = 59.453424; -135.314292 Site 3 = 59.456544; -135.309362
Site 4 = 59.461764; -135.302946 Site 5 = 59.466343; -135.298332

This page intentionally left blank

Appendix B: 2005 Quality Assurance Project Plan

For Pullen Creek Watershed Assessment Project

This page intentionally left blank

Quality Assurance Project Plan

Pullen Creek Assessment Project

performed by

SKAGWAY TRADITIONAL COUNCIL

under

Department of Environmental Conservation

Alaska Clean Water Action Grant

Grant #:NP-04-08

GROUP A: PROJECT MANAGEMENT

A1 - Title and Approval Sheet

Title: Pullen Creek Assessment Project

Organization: Skagway Traditional Council (STC)

Approving Officials:

Position	Person	Signature	Approval Date
STC Project Manager:	Lance Twitchell		
STC Quality Assurance Manager:	Cathy Needham		
ADEC Project Officer:	Lori Sowa		
ADEC Quality Assurance Officer:	Jim Gendron		

A2 - Table of Contents

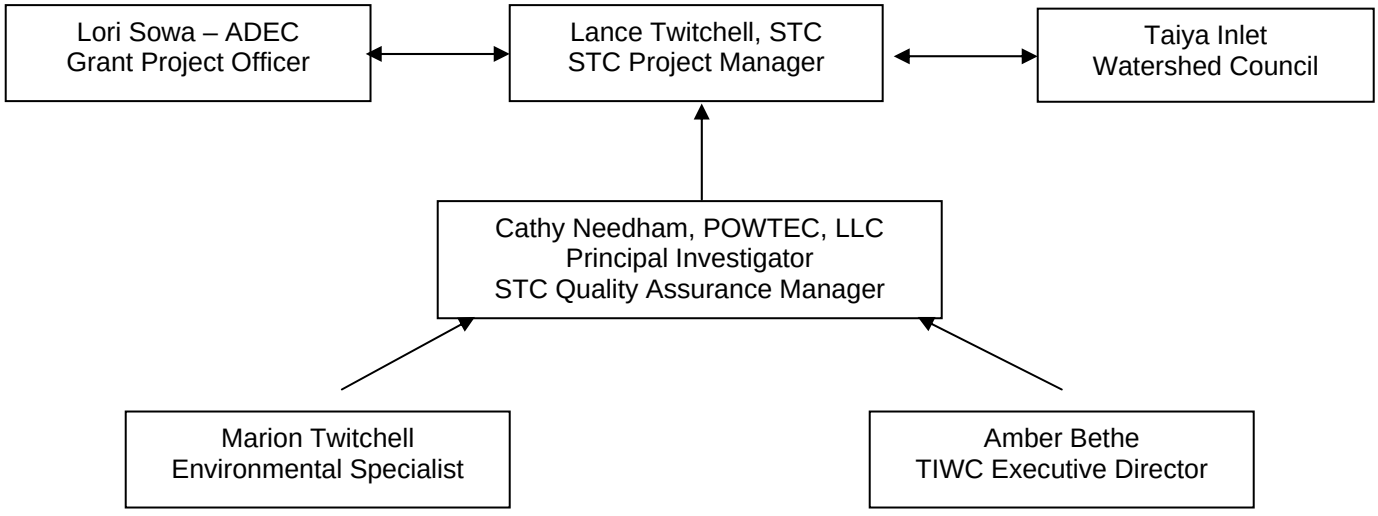
A3 - Distribution List

The following individuals and organizations will receive copies of the approved QAPP and any subsequent revisions.

Individual	Organization
Lance Twitchell	Skagway Traditional Council
Cathy Needham	POWTEC, LLC
Lori Sowa	Alaska Department of Environmental Conservation
Jim Gendron	Alaska Department of Environmental Conservation
Amber Bethe	Taiya Inlet Watershed Council

A4 - Project/Task Organization

The project team organization is shown in the following organization chart. The specific roles and responsibilities of each person are described below.



Lance Twitchell, Skagway Traditional Council – Project Manger

Mr. Twitchell will be responsible for overall project management. He will be the primary contact person in charge of the project. He will coordinate work contracted to POWTEC, LLC. He will assist on an as needed basis in field data collection, will mediate between the contractor and the Taiya Inlet Watershed Council and will be responsible in assuring all work plan deliverables are submitted to ADEC.

Lori Sowa, Alaska Department of Environmental Conservation (ADEC) – Grant Project Officer

Ms. Sowa will be the primary agency contact between ADEC and the Skagway Traditional Council. She will be responsible for assuring that all deliverables are completed and all contractual terms are fulfilled.

Cathy Needham, POWTEC, LLC

Ms. Needham will serve as the principal investigator under contract with the Skagway Traditional Council for the Pullen Creek Assessment Project. Ms. Needham will be responsible for developing a monitoring strategy, collecting all scientific data, developing an environmental assessment and providing technical assistance to STC in reporting requirements. Ms. Needham will also serve as the STC Quality Assurance Project Manager and assure that the project meets the quality assurance defined in this QAPP.

Taiya Inlet Watershed Council

The Taiya Inlet Watershed Council will be responsible for providing guidance and technical assistance for the project. Documents produced in the project will be provided to the Taiya Inlet Watershed Council, to be used as guiding documents for future work on Pullen Creek.

Marion Twitchell, Skagway Traditional Council

Ms. Twitchell will provide field assistance to Ms. Needham for data collection. She will also assist in local records search and provide traditional local knowledge to be incorporated into project reports.

Amber Bethe, Taiya Inlet Watershed Council

Ms. Bethe will provide field assistance to Ms. Needham for data collection. Ms. Bethe will aso help mediate between the Skagway Traditional Council and the Taiya Inlet Watershed Council to assure that needs of both organizations are met.

A5 - Problem Definition/Background

Pullen Creek, located in the heart 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 its 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.

Pullen Creek is 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 water quality and habitat restoration efforts.

The objective of this project is to determine what restoration measures will be needed to recover this polluted waterbody. This determination will be based upon information provided by this project including water quality data collection, flow information, and sediment loading, all from Pullen Creek. No evaluation by ADEC was conducted for Pullen Creek, when it was placed on Alaska's 1996 Section 303(d) list for metal contamination, thus resulting in the waterbody being carried over onto the 1998 Section 303(d) list. The Skagway Traditional Council (STC) will begin collecting the data necessary for agencies to evaluate the water quality problems with Pullen Creek.

A6 - Project/Task Description

This Quality Assurance Project Plan (QAPP) was approved in January, 2004 for the purpose of supporting sampling activities and data collection on Pullen Creek, in Skagway Alaska by the Skagway Traditional Council. The primary task will continue to be sampling for heavy metals, BTEX hydrocarbon, Tentatively Identified Compounds (TIC) contaminants in water, sediments and bank soils of Pullen Creek. Additional tasks include: basic water quality sampling, discharge data collection and sedimentation sampling. Basic water quality parameters will include temperature, dissolved oxygen, pH and conductivity. Discharge measurements will be taken according to USGS sampling procedures. Sedimentation sampling will include analysis for Total Suspended Solids and pebble counts in Pullen Creek. Sampling events will occur in early and late Spring of 2004, and there will be 5 sampling locations along the creek (Appendix A).

This QAPP is being revised in April of 2005 to include biological sampling, which was not a part of the original scope of work. Macroinvertebrates from Pullen Creek will be collected and analyzed for heavy metal compounds. Additional data collected during biological sampling will be a volunteer level rapid bioassessment, using protocols developed by the Environment of Natural Resouce Institute (April, 2004).

A7 - Quality Objectives and Criteria for Measurement Data

The project data quality objectives are to collect all field data within accepted accuracy needed to establish a baseline of information regarding watershed processes at Pullen Creek. The data quality objectives of data collected and analyzed for heavy metals, BTEX hydrocarbons and TIC on water sediment and bank soils will be in accordance to Shoalwater Bay Laboratory QA/QC (Appendix B). Total Suspended Solids analysis will be in accordance with Analytica Alaska, Inc. laboratory (Appendix B). The heavy metal analysis on biological tissue will be in accordance with Columbia Analytical Services. The data quality objectives for basic water quality will be within the parameters of the HACH multi-probe meter (Appendix B) and the quality objectives for discharge and pebble counts will be in accordance to the procedures defined in this QAPP. All data will provide a baseline of data which can be used in an environmental assessment document for Pullen Creek, and used by the Taiya Inlet Watershed Council and the Skagway Traditional Council on future restoration work on Pullen Creek.

Precision

Precision is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of methods All analytical tests performed by accredited laboratories, using standards EPA methods, will comply with duplicate, blank, spike and replicate requirements in accordance with approved internal laboratory QA/QC procedures. Each Field Sampling event will include a replicate sample for all analytes following rinse with de-ionized water. All results will be recorded in field and lab logbooks; however, results which fall outside the specified range will not be entered into the project data system.

Accuracy

Accuracy is a measure of confidence that describes how close a measurement is to its "true" value. In this project, accuracy is measured by duplicate sampling and the use of standards in calibrating the HACH Hydrolab Minisonde 4A.

Representativeness

Representativeness is the extent to which measurements actually represent the true environmental condition. Representativeness of data collected is assured by the location of sampling sites and use of EPA Standard Method 1060 A & B for acquisition of representative riparian grab samples.

Comparability

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling and analytical methods and units of reporting with comparable sensitivity ensures comparability. All results produced under this QAPP will be reported in metrics common to water quality regulations specific to each parameter. Additionally, both the field and laboratory methods included in this QAPP are common to watershed monitoring efforts in similar ecosystems throughout Southeast Alaska and statewide.

Completeness

Completeness is the comparison between the amounts of usable data collected versus the amount of data called for in the sampling plan. In this STC Project, completeness is measured as the percentage of total samples collected and analyzed as a whole and compared to the goals set out by the project design. To measure completeness the primary number of samples collected will be divided by the useable number of samples submitted to ADEC with a goal of 85% completeness.

A8 - Special Training Requirements/Certification

All data collected by POWTEC, LLC will be conducted and/or overseen by Cathy Needham. Ms. Needham has a Master's of Science degree in Zoology (emphasis in Marine Ecology) and has had on-the-job training by U.S. Geological Survey personnel, and Tribal Water Resources training. Ms. Needham also has experience leading the Peterson Creek Monitoring and Assessment project (2002), using the same sampling methods that will be used in the Pullen Creek Assessment Project. No certifications are required for this project.

A9 - Documentation and Records

The current QAPP will be maintained at the offices of the Project Manager and the offices of the STC Quality Assurance Manager. Any changes necessitated by unforeseen conditions will be transmitted by fax or e-mail to the ADEC Project Officer, ADEC Quality Assurance Officer, and the Taiya Inlet Watershed Council

Laboratory data from Shoalwater Bay Laboratory, Analytica Alaska, Inc. and Columbia Analytical Services will be entered into an Excel spreadsheet and stored on the Skagway Traditional Council computer network. Data will also be stored on a compact disc, and housed at STC and off-site with the STC Quality Assurance Manager. Data from the laboratories will be entered into ADEC's STORET database by ADEC personnel.

Field data (including: basic water quality, discharge and pebble count data) will also be entered into an Excel spreadsheet and stored on the STC computer network, saved to a compact disc and be stored at STC and off-site with the STC Quality Assurance Manger, and will be entered into ADEC's STORET database by ADEC personnel.

All hardcopies of data for this project will be filed and stored at STC for a minimum of 10 years. Photocopies of laboratory data and field data sheets will be stored off-site with the STC Quality Assurance Manager.

GROUP B: MEASUREMENT/DATA ACQUISITION

B1 - Sampling Process Design (Experimental Design)

Water, sediment and bank soils collected under this QAPP will be taken at five sampling locations along Pullen Creek (Appendix A). Sampling events will occur in February, May, August and November of each calendar year it is funded. Sampling locations were chosen to

give geographical spread along Pullen Creek, and also to account for tributaries. Sampling locations will be: Pullen Pond, the confluence to Tributary 1, the confluence to Tributary 2, the Jerry Meyers Fish Hatchery and at the headwaters at the Whitepass rail yard (Appendix A).

Water, sediment and bank soil sampling for laboratory analysis will be collected at each sampling site by POWTEC, LLC personnel and field assistants from Skagway Traditional Council and the Taiya Inlet Watershed Council (see Sampling Matrix in Appendix C). Prepared sampling bottles and sampling jars will be sent to POWTEC, LLC prior to each sampling event. Collected water, sediment and bank soil samples will be sent to analytical laboratories for analysis of heavy metals, BTEX hydrocarbons, Tentatively Identified Compounds (TIC) and Total Suspended Solids.

After each site collection of water, sediment and bank soil samples, the sampling crew will measure basic water quality parameters (temperature, DO, pH and conductivity) with the HACH Hydrolab. Next, they will measure discharge using methods developed by the U.S. Geological Survey, and finally conduct pebble counts of bed substrate. Each sample site will include analyses of heavy metals in sediment, heavy metals in bank soil, BTEX hydrocarbons in water and suspended sediment. In addition, Pullen Pond and the railyard headwaters will include analysis of heavy metals in water and BTEX hydrocarbons in sediment. The TIC test will only be conducted at one sample site, Pullen Pond. This will occur during both sampling events and will act to screen for presence of analytes not included in this QAPP.

In May, 2005, macroinvertebrate will be sampled from two locations on Pullen Creek. Samples will be collected from the Pullen Pond site and from the confluence of Tributary 1 (the same locations used in collecting water, sediment and bank soils). Macroinvertebrates will be sampled by POWTEC, LLC personnel. Prepared sampling bottles and sampling jars will be sent to POWTEC, LLC prior to each sampling event. Collected tissue will be sent to Columbia Analytical Services Inc. for analysis of heavy metals.

B2- Sampling Methods and Requirements

Water, sediment and bank soil sampling events have been scheduled for winter (February), spring (May), summer (August) and fall (November) to capture seasonal variation in flow regimes and potential non-point source contaminants released throughout the year. Each sampling location will be flagged and a GPS reference point will be taken. While sample sites have been selected, some refinement in this selection will occur during the first sampling event. This will include preference for sites exhibiting the physical characteristics of a lateral scour pool. This physical feature will offer both sediment deposits and fast flowing water needed for the sampling methods. At the sampling location, a tape measure will be run across the creek, marking the transect where the samples will be collected. Water samples will first be collected into a 16 oz. Nalgene© bottle at the thalweg as described in EPA Standard Method 1060 A & B. Prior to each sample the sampling bottle will be rinsed 3 times in the water to be sampled. Water will be decanted from the Nalgene© into the appropriately labeled bottle provided by the laboratory. A composite of sediment will be collected along the transect line, where sediment is present. Using a stainless steel hand trowel, sediment will be excavated from within 2 cm of surface, placed into a stainless steel bowl, mixed and then approximately 40 grams of material

will be placed into the labeled sampling jar. Bank soil will be collected adjacent to the creek, on the railway side. The top 2 inches of soil will be removed using a stainless steel hand trowel and using a second decontaminated stainless steel spoon, approximately 40 grams of soil will be excavated and placed into the labeled sampling jar.

Sampling equipment and supplies will be decontaminated initially and not re-used between composite samples. Fifteen stainless steel spoons and bowls will be decontaminated and packaged prior to the sampling events and each used for one composite sample at one sample site. These will be decontaminated using the following procedure. First, wash spoons and bowls with laboratory-grade detergent and clean water, with a triple clean water rinse (distilled water). Then rinse with methanol or acetone, followed by methylene chloride or hexane (Capillary GC Pesticide Residue Grade or equivalent). Project Quality Assurance Manager will ensure that solvents are not expired and are disposed of properly. All sampling equipment decontamination will occur prior to sampling at the POWTEC, LLC office in Juneau, Alaska.

Once all samples are collected from the 5 sampling locations, the coolers will be packed with ice packs, the chain-of-custody will be filled out and place into the coolers and the custody seals will be placed on the coolers, which will be shipped back to the laboratories for analysis (see analytical requirements below).

Basic water quality data will be taken at each sampling location using a HACH Hydrolab. pH and conductivity will be calibrated prior to field work. At each sampling location, DO will be calibrated using the saturated air method. The Hydrolab probe will be submersed in the water, and measurements will be recorded onto data sheets (Appendix E).

Discharge will be measured equipment and protocols developed by the U.S. Geological Survey (Rantz and Others, 1983). A pygmy meter on a wading rod will be used to measure depth along the above mentioned tape (measures width). Velocity at different widths will be taken and recorded onto data sheets, and discharge will be calculated after sampling is complete.

Pebble counts will be conducted along 5 transects across the creek. The first transect will be along the above mentioned tape. Two transect lines will be laid upstream, 1 and 2 meters from the original transect. Two transect lines will be laid downstream, 1 and 2 meters from the original transect line. Along each transect, 25 sediment particles will be collected using “boot-tip” procedures outlined in “Aquatic Ecosystem Management Handbook” (2001). Each particle will be measured along the intermediate axis and recorded.

A sampling event for testing heavy metals in tissues has been scheduled for May of 2005. Macroinvertebrates were chosen to represent the tissue sample, because they were the only organism with a life history specific to Pullen Creek. The May event represents the timeframe of when macroinvertebrates are most abundant in Southeast Alaska streams (Bogan, personal communication). Macroinvertebrates will be collected from two sites on Pullen Creek which are also used for collecting water, sediment and bank soils: below Pullen Pond and at the confluence of Tributary 1. Sites were chosen to match the available substrate needed to support invertebrate communities. A third site will also be sampled, to collect macroinvertebrate tissue from a stream to be considered a reference site. Nelson Slough, located outside of the Skagway

Valley and near Dyea, will serve as the reference stream. While Nelson Slough is the most comparable stream to Pullen Creek in the area (Hahr and Kirkpatrick, personal communication). Nelson Slough is a slow-moving tributary to the Taiya River, provides like-substrate to Pullen Creek and also has a large run of Pink Salmon.

Collection of macroinvertebrates will follow methods developed by the Environment and Natural Resources Institute (ENRI) (2004) entitled "Alaska Volunteer Biological Montoring and Assessment Protocols". At each site, macroinvertebrates will collected from a 25 meter reach, using a 350 µ mesh D-frame dip net. Samples will be collected for biomass, so they will be collected across all habitats (not preselected habitats as indicated in the ENRI methods). Macroinvertebrates will be transferred from the D-frame dip net into white trays that were previous decontaminated using methods described above. Using decontaminated forceps, macroinvertebrates will be sorted into two functional feeding groups (scrappers/shredders and filterers) and placed in separate labeled sampling jars. Approximately 3-4 grams of tissue will be collected for each functional feeding group at each sampling site.

Once all samples are collected, the coolers will be packed with ice packs, the chain-of-custody will be filled out and place into the coolers and the custody seals will be placed on the coolers, which will be shipped back to the laboratories for analysis (see analytical requirements below).

The STC Quality Assurance Manager is responsible for any corrective action taken. Corrective actions may include re-location of sampling sites, omission of analytic due to physical constraints, use of sampling location which does not represent the characteristics of a later scour pool, equipment failure, etc. If need for corrective action is identified, the ADEC Quality Assurance Officer may be consulted and corrective actions determined prior to continued sampling efforts.

B3 - Sample Handling and Custody Requirements

All field sampling for heavy metals, BTEX and Total Suspended Solids will be carried out by POWTEC, LLC personnel. Samples will be taken from the creek and placed into sampling bottles provided by the analytical laboratories and in accordance with their internal QA/QC. The bottles will be labeled and packed into laboratory provided shipping cooler, along with ice packs. Chain-of-custody forms (Appendix D) for each laboratory will be filled out and also placed into the shipping coolers. The shipping coolers will be sealed with a custody seal, and sent from Juneau, Alaska to the appropriate laboratory.

There are no custody requirements basic water quality parameters, discharge and pebble count sampling as these methods allow data to be immediately available and recorded directly onto field data sheets (Appendix E). These field data sheets will include no erasures and will originals will remain in the custody of POWTEC LLC. until issuance of a final report when all project information will be supplied to STC.

B4 - Analytical Methods Requirements

The following table details the EPA Methods used by the laboratories on the soil, sediment and water samples:

Analysis	Laboratory	EPA Method
Heavy metals	Shoalwater Bay Laboratory	200.9, 208.2, 245.1,289.2, 7081, 7951
BTEX hydrocarbons	Shoalwater Bay Laboratory	8260A
TIC	Shoalwater Bay Laboratory	Modified 8270 (for non-target analytes)
Suspended Solids	Analytica Alaska, Inc.	160.2

Heavy metals analysis on biological tissue will be performed by Columbia Analytical Services, using EPA methods 200.8, 6010B, and 7740

Responsibility for corrective action during laboratory analyses falls on the laboratory Quality Assurance Officer. If data do not meet quality objectives of this QAPP (Appendix B) or internal QA/QC of the laboratory, the laboratory Quality Assurance Manager will notify the Project Quality Assurance Officer to resolve data quality objectives. Turnaround time for the laboratory results, from sample submission to delivery of results, will be as quick as practical, with all turnaround being completed within 90 days. There are no analytical method requirements for basic water quality, discharge or pebble counts.

B5 - Quality Control Requirements

Quality control of laboratory performance on analytical tests will be in accordance with the Shoalwater Bay Laboratory Quality Assurance Manual (2003), the Quality Assurance Manual for Analytica Alaska, Inc. Southeast Division (2003) and the Quality Assurance Manaul for Columbia Analytical Serivces (r. 14, 2005). A copy of each manual is on file with the STC Quality Assurance Officer. Shoalwater Bay Laboratory, Analytica Alaska Inc., and Columbia Analytical Services are all certified to perform the EPA standard methods included in this QAPP and have demonstrated adherence to strict laboratory protocols.

Shoalwater Bay Laboratory performs initial and continuing instrument calibrations as prescribed in each EPA standard method cited (see table in section B4). Method blanks, matrix spikes, duplicates and laboratory control spikes will also be performed by the laboratory in accordance to EPA standard methods (see table in section B4). Instrument detection limits and method detection limits are determined semi-annually as outlined in the EPA standard methods. Coolers containing sampling bottles will be shipped from the laboratory to Skagway for sample collection. Each cooler will contain a trip blank and a temperature blank. In addition, one blind field blank per cooler containing multiple samples will be prepared by the sampling crew and returned with the cooler of samples for laboratory analysis.

Analytica Alaska, Inc. performs daily calibration of equipment used for Total Suspended Solid analysis. Method blanks, matrix spikes, laboratory duplicates and laboratory control spikes are

performed in accordance to EPA method 160.2. Coolers containing sampling bottles will be shipped to Skagway for sample collection. Each cooler will contain a temperature blank. Trip blanks, field blanks and field duplicates are not required for Total Suspended Solid analysis.

Columbia Analytical Services performs daily calibrations of equipment for use in heavy metal analysis. Method blanks, matrix spikes and laboratory duplicates are run with each batch of 20 samples (or less). Coolers containing sampling bottles will be shipped to Skagway for sample collection. Each cooler will contain a temperature blank. Trip blanks, field blanks and field duplicates are not required.

The HACH Hydrolab Minisonde 4A will be calibrated prior to each sampling event in accordance with calibration procedures provided in (Appendix F). Each sampling event will include 5 sampling locations. At each sampling location field measurements will be gathered in duplicate, relying on de-ionized water to clean the sensors between measurements. To ensure resolution of data, following each sampling event the calibration procedure will be performed. Any deviation from the data quality objectives will be documented and sites will be re-sampled. Variation of duplicate values for each parameter must not exceed the range of precision and accuracy specified in the data quality objectives table (Appendix B). Field data that do not meet project accuracy and precision objectives will be omitted from reporting and replicated.

B6 - Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The testing, inspection and maintenance of Shoalwater Bay Laboratory, Analytica Alaska, Inc., and Columbia Analytical Services instrument/equipment used for testing heavy metals, BTEX and suspended sediment will be in accordance to each laboratories accreditation and QA/QC procedures. Laboratory sampling kits will be inspected prior to sampling by STC Quality Assurance Manager. If any tampering or transport damage is observed, the kit will be returned and another sent to replace it.

The HACH Hydrolab, used to collect basic water quality parameters, will be calibrated as described below. A general visual inspection of the meter will take place prior to each use. Maintenance of the meter will occur on an as needed basis. If instrument failure occurs during a sampling event all field data will be omitted and replicated once proper functioning is ensured in accordance with the data quality objectives of this QAPP. All field equipment maintenance is the responsibility of STC Quality Assurance Manager.

The pygmy meter used for measuring discharge is tested, inspected and maintained by the U.S. Geological Survey, according to USGS procedures outlined in “Measurement and Computation of Stream Flow” (Rantz and Others, 1983). The meter will be visually inspected and calibrated by POWTEC, LLC., prior to field use. There are no instruments or equipment used for pebble counts

B7 - Instrument Calibration and Frequency

There is no field instrument calibration for water, sediment, bank soil, or biological tissue sampling to be analyzed for heavy metals, BTEX hydrocarbons, or Total Suspended Solid. In

addition, there is no instrument calibration for pebble counts. Calibration of equipment used for laboratory analysis will be under the guidance of each individual laboratory accreditation and QA/QC procedures common to the EPA standard methods included in this QAPP.

Calibration of the HACH water quality meter will be conducted prior to each field day use and recorded on the data sheet used in this study (Appendix E). Calibration methods will be in accordance to procedures outlined by the HACH Hydrolab Operating Manual (2001). The pH probe will be calibrated to two known calibration standards: pH 4 and pH 7. The conductivity probe will be calibrated to a known standard of 49 µS . The dissolved oxygen probe will be calibrated prior to each measurement, using the saturated-air method. Ice-bath calibration will be used for calibration of a NIST thermometer and Hydrolab temperature sensor. Refer to Appendix F for detailed calibration procedures for pH and Conductance.

Calibration of the HACH Hydrolab Minisonde 4A will be initialed on each data sheet and conducted immediately prior to the sampling event. Following each sampling event the calibration procedure will be performed again and results compared to data quality objectives. If results are not within data quality objectives, the sampling event will be repeated. Documentation of this calibration process is limited to the initials of STC Quality Assurance Manager on data sheets, documenting calibration has occurred.

Calibration of the discharge measuring equipment will be in accordance with USGS calibration methods outlined in their "Measurements and Computation of Stream Flow" manual (Rantz and Others, 1983). The pygmy flow meter will be spin tested prior to each field day.

B8 - Inspections/Acceptance Requirements for Supplies and Consumables

Supplies and consumables used by POWTEC, LLC include water sampling bottles and equipment from analytical lab, calibration fluids, and personal field gear. All supplies and consumables received by POWTEC, LLC will be inspected by POWTEC, LLC personnel for tampering and/or equipment deficiencies. Any tampering or defective products will be sent back to the analytical lab/manufacturer and will be replaced. Due to the limited chronological scope of this QAPP, long term record keeping for calibration solutions will be omitted. Calibration solutions will be procured by POWTEC, LLC prior to the sampling event and will not near their expiration during the project term. The STC Quality Assurance Manager will maintain records for all supplies and ensure use of standards that have not expired.

B9 - Data Acquisition Requirements (Non-direct Measurements)

The study area is defined by the boundaries of Pullen Creek. Sampling locations were chosen from existing maps from Alaska Department of Fish and Game personnel. Existing information on Pullen Creek will be collected from the community, to be integrated into an environmental assessment report. This information will include (but is not limited to) past geo-reference points for the creek, water quality information, fish habitat information, fish abundance information, and fish passage information. The information will be compiled and used in the environmental assessment report to document past work and conditions on Pullen Creek. Notes will be made to differentiate data collected under this QAPP, and information gathered as complimentary data.

There are no non-direct measurements that will be gathered which may influence project data acquisition requirements. These non-direct measurements may provide insight to results from this QAPP which impact management of Pullen Creek. Criteria for the usability of non-direct measurements will be determined by the STC and are not a component of this QAPP.

B10 - Data Management

Data provided by the laboratories will be photocopied and housed at the Skagway Traditional Council and off-site at POWTEC, LLC. Data will be entered into Excel spreadsheets, burned to a compact disc and stored with hardcopy data.

Data sheets for water quality, discharge measurements and pebble counts are attached to the QAPP (Appendix E). Data sheets will be photocopied and filed at Skagway Traditional Council and off-site at POWTEC, LLC. All data will be entered into Excel spreadsheets and copied onto compact disc and stored at STC and POWTEC, LLC.

All data will also be entered into the Alaska Department of Environmental Conservation's STORET database.

GROUP C: ASSESSMENT/OVERSIGHT

C1 - Assessments and Response Actions

No formal statistical analysis of data will be done for this study. All data collected will be reviewed and compiled into tables, in a format to include sampling event comparisons, by the POWTEC, LLC personnel. The compiled data will be incorporated into the "Pullen Creek Assessment Document" and will also be available for review by the Taiya Inlet Watershed Council. The information from this study will be used by the Taiya Inlet Watershed Council to create recommendations and priorities for future work on Pullen Creek. The baseline data may also be used at the discretion of the ADEC Project Officer to determine if TMDL's need to be established for Pullen Creek.

Corrective actions under this Quality Assurance Project Plan will be taken by the Project Manager, in coordination with the Project Quality Assurance Officer.

C2 - Reports to Management

Progress reports will be prepared quarterly by the Project Manager. These reports will summarize project progress and will include the results of data collection during the period. Progress reports will be sent to the ADEC Project Officer. Any discrepancies with project data quality objectives will be resolved by the Project Quality Assurance Manager. If objectives cannot be resolved, the STC Quality Assurance Manager will author a Quality Assurance Performance Audit to recommend corrective action for approval by Project Quality Assurance Officer.

Project Manager and STC Quality Assurance Manager will present all final data to ADEC for review prior to issuance of draft reports. All data collected will also be integrated into the Pullen Creek Environmental Assessment report. A draft report will be provided to the Taiya Inlet Watershed Council and ADEC for review. A final report will be printed and distributed to ADEC, TIWC and other agencies interested in receiving a copy of the report.

GROUP D: DATA VALIDATAION AND USABILITY

D1 - Data Review, Validation, and Verification Requirements

All data will be reviewed, validated and verified by STC's Quality Assurance Manger, Cathy Needham. Questionable data will be flagged and discussed with the ADEC Project Officer as to whether it should be discounted. If the data is not discounted, a flag with a noted concern will be incorporated into the reporting.

D2 - Validation and Verification Methods

Data received by analytical laboratories will be visually reviewed and compared back to the laboratories detection and reporting limits (Appendix A). If questions arise, an independent data review by POWTEC, LLC. employee Elijah Donat. If the question is not resolved, then the question will be brought to the ADEC Project Officer for reconciliation. The data will either be discounted or it will remained flagged with a noted question.

There are no validation or verification methods for data collected in the field.

D3 - Reconciliation with User Requirements

The project objectives include establishing a baseline of information regarding potential contaminants in Pullen Creek. In addition, existing information on Pullen Creek will be gathered and all data will be incorporated into a final Pullen Creek Watershed Assessment document. The document will then be used by the Skagway Traditional Council and the Taiya Inlet Watershed Council to guide future work on Pullen Creek. Finally, the data collected under this QAPP can be used at the discretion of the ADEC Project Officer in determining if TMDL's need to be established for Pullen Creek.

REFERENCES:

Hydrolab Corporation (2001). Water Quality Monitoring System, Operation Manual (Revision B. Austin Texas, www.hydrolab.com

Quality Assurance Manual for Analytica Alaska, Inc. Southeast Division (2003)

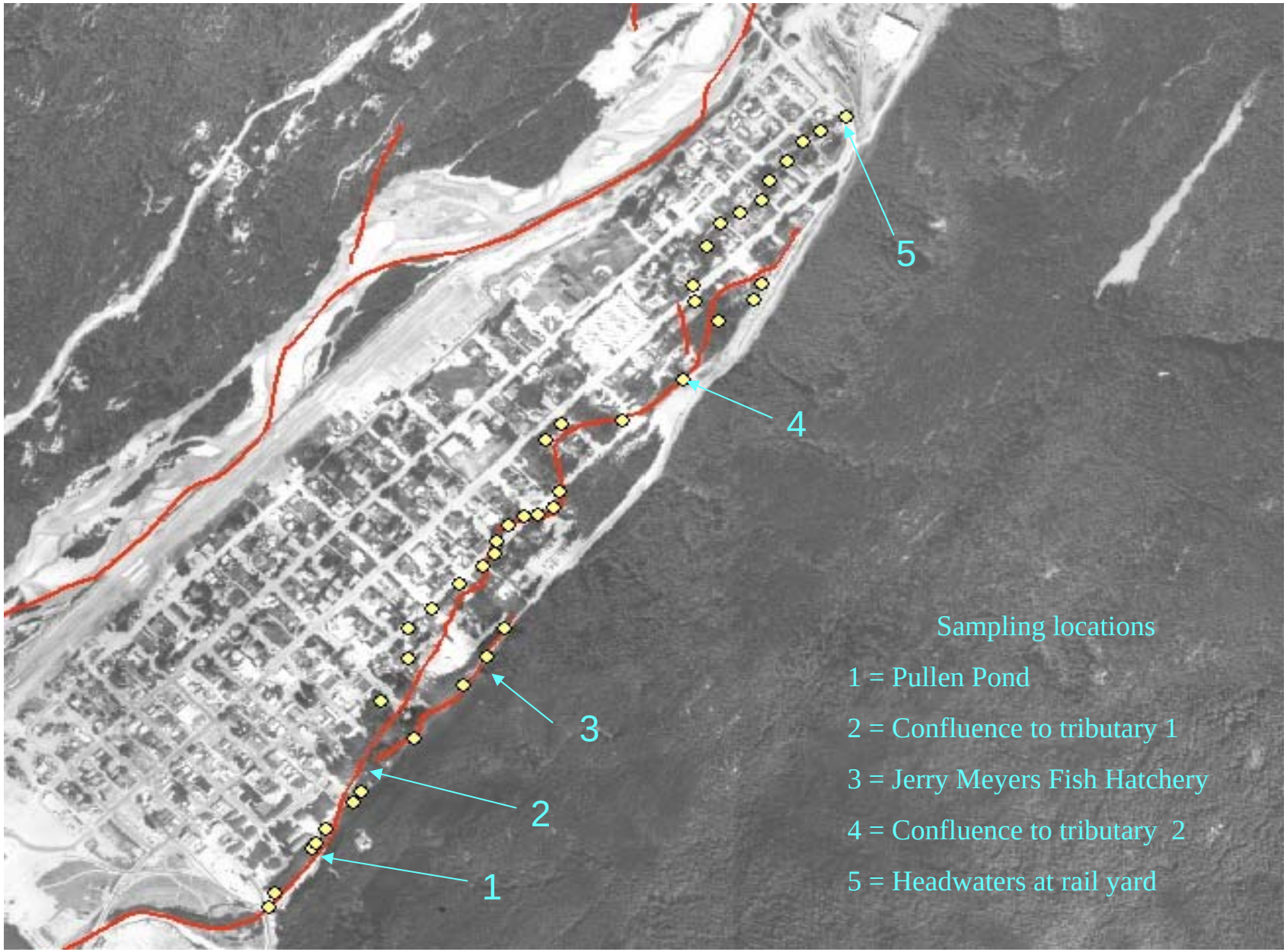
Rantz, S.E., and Others (1983). Measurement and Computation of Stream Flow; volume 1 Measurement of Stage and Discharge; volume 2 Computation of Discharge.

Shoalwater Tribe Environmental Laboratory, Quality Assurance Manual (2003). Tokeland, WA.

USDA Forest Service Region 10 (2001). FSH 2090.21 Aquatic Habitat Management Handbook – Chapter 20 – Fish and Aquatic Stream Habitat Survey.

Appendix A: Map of Pullen Creek

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).



Appendix B: Data Quality Objectives

Data Quality Objectives for Water Quality Measurements

Parameter	Method/Range	Units	Sensitivity / Method Detection Limit	Precision	Accuracy	Calibration Method	Sample Preservation and Storage
pH	Hydrolab pH probe on Minesonde and Datasonde 0-14	Standard pH units	0.01 units	±0.2 units	±0.2 units	Appendix Hydrolab calibration	Analyze sample immediately. Sample Preservation not needed
Conductance	Hydrolab probe on Minesonde and Datasonde 0-100 mS/cm	Micro-Siemens/cm (µS/cm) (converted to 25 C)	4 digits	+0.001 units	2% full Scale	Appendix Hydrolab calibration	Analyze sample immediately. Sample Preservation not needed
Dissolved Oxygen	Hydrolab DO probe Datasonde and Minesonde 4a instruments 0 to 50 mg/L	Milligrams per liter (mg/L)	0.01	NA	±0.2 mg/L	Saturated air method	Analyze sample immediately. Sample Preservation not needed
Temperature	Thermometer –5.0 + 50.0 °C	Degrees Celsius (°C)	0.5 °	±1.0 °C (b)	±0.5 °C (b)	NIST Certified Thermometer Ice Bath Calibration Method	Analyze sample immediately. Sample Preservation not needed
Heavy metals (Shoalwater Bay Laboratory)							
Arsenic	200.9	µg/L	0.5	Ave RSD - ± 1.1	Ave % R – 104 %	200.9	28 days from collection
Barium	208.2	µg/L	2	N/A	N/A	208.2	4^0 C ± 2^0 C
Cadmium	200.9	µg/L	0.05	Ave RSD - ± 0.16	Ave % R – 98 %	200.9	4^0 C ± 2^0 C
Chromium	200.9	µg/L	0.1	Ave RSD - ± 0.37	Ave % R – 100 %	200.9	4^0 C ± 2^0 C
Copper	200.9	µg/L	0.7	N/A	N/A	200.9	4^0 C ± 2^0 C
Mercury	245.1	µg/L	0.2	Ave RSD - ± 0.16	Ave % R – 88 %	245.1	4^0 C ± 2^0 C
Lead	200.9	µg/L	0.7	Ave RSD - ± 0.22	Ave % R – 92 %	200.9	4^0 C ± 2^0 C
Selenium	200.9	µg/L	0.6	Ave RSD - ± 0.50	Ave % R – 97 %	200.9	4^0 C ± 2^0 C
Silver	200.9	µg/L	0.5	Ave RSD - ± 0.67	Ave % R – 99 %	200.9	4^0 C ± 2^0 C
Zinc	289.2	µg/L	0.5	N/A	N/A	289.2	4^0 C ± 2^0 C
				Ave RSD = Average Standard Deviation	Ave % R = Average Percent Recovery		
BTEX (Shoalwater Bay Laboratory)							28 days from collection
Benzene	8260A	µg/L	0.4	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Toluene	8260A	µg/L	0.4	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Ethyl benzene	8260A	µg/L	0.6	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Xylenes	8260A	µg/L	0.5	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C

Data Quality Objectives for Water Quality Measurements (con't)

SEDIMENT (Analytica Inc.)							
Total Suspended Solids	160.2	mg/L	4	0-10 mg/L 30 10-100 mg/L 20 >100mg/L 10	20%	Internal Standard Analyses	4° C +/- 2°C 7 days from collection;5 days from receipt at laboratory
Tentatively Identified Compounds (Shoalwater Bay Laboratory)	Modified 8270 for non target analytes	µg/L		Since Tentatively Identified Compounds (TIC) s are an estimated concentration, no precision data is available.	Since Tentatively Identified Compounds (TIC) s are an estimated concentration, no accuracy data is available.	Internal Standard	4^0 C ± 2^0 C. 7 days from collection

Data Quality Objectives for Sediment and Soil Measurements

Parameter	Method/Range	Units	Sensitivity / Method Detection Limit	Precision	Accuracy	Calibration Method	Sample Preservation and Storage
RCRA Metals (Shoalwater Bay Laboratory)							28 days from collection
Arsenic	200.9	mg/kg	2	Ave RSD - ± 1.1	Ave % R – 104 %	200.9	Keep at 4^0 C ± 2^0 C
Barium	7081	mg/kg	2	N/A	N/A	208.2	Keep at 4^0 C ± 2^0 C
Cadmium	200.9	mg/kg	0.1	Ave RSD - ± 0.16	Ave % R – 98 %	200.9	Keep at 4^0 C ± 2^0 C
Chromium	200.9	mg/kg	1	Ave RSD - ± 0.37	Ave % R – 100 %	200.9	Keep at 4^0 C ± 2^0 C
Copper	200.9	mg/kg	1	N/A	N/A	200.9	Keep at 4^0 C ± 2^0 C
Mercury	7471A	mg/kg	0.2	Ave RSD - ± 0.16	Ave % R – 88 %	245.1	Keep at 4^0 C ± 2^0 C
Lead	200.9	mg/kg	1	Ave RSD - ± 0.22	Ave % R – 92 %	200.9	Keep at 4^0 C ± 2^0 C
Selenium	200.9	mg/kg	10	Ave RSD - ± 0.50	Ave % R – 97 %	200.9	Keep at 4^0 C ± 2^0 C
Silver	200.9	mg/kg	0.2	Ave RSD - ± 0.67	Ave % R - 99 %	200.9	Keep at 4^0 C ± 2^0 C
Zinc	7951	mg/kg	0.5	N/A	N/A	206.2	Keep at 4^0 C ± 2^0 C
				Ave RSD = Average Standard Deviation	Ave % R = Average Percent Recovery		
B-TEX (Shoalwater Bay Laboratory)							7 days from collection
Benzene	8260A	µg/kg	50	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C
Toluene	8260A	µg/kg	50	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C
Ethyl benzene	8260A	µg/kg	75	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C
Xylenes	8260A	µg/kg	63	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C

Data Quality Objectives for Biological Tissue

Parameter	Method/Range	Units	Method Reporting Limit	Method Detection Limit	Precision	Matrix Spike Recovery (% Rec)	Prep Method	Sample Preservation and Storage
RCRA Metals (Columbia Analytical Services)								28 days from collection
Arsenic	200.8	mg/kg	0.5	0.03	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Barium	200.8	mg/kg	0.05	0.02	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Cadmium	200.8	mg/kg	0.02	0.006	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Chromium	6010B	mg/kg	0.5	0.5	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Copper	200.8	mg/kg	0.1	0.09	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Mercury	7471A	mg/kg	0.02	0.002	30	70-130	Method	Keep at 4^0 C ± 2^0 C
Lead	200.8	mg/kg	0.02	0.007	30	60-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Selenium	7740	mg/kg	1	1	30	60-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Zinc	200.8	mg/kg	0.5	0.06	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C

Appendix C: Sampling Matrix

Table 2. Matrix of sampling design for Pullen Creek, located in Skagway, Alaska.

	Pullen Creek					Nelson Slough
	site 1	site 2	site 3	site 4	site 5	reference
Sediment						
Heavy metals	x	x	x	x	x	-
BTEX	x	-	-	x	-	-
Bank Soil						
Heavy metals	x	x	x	x	x	-
Water						
Heavy metals	x	-	-	x	-	-
BTEX	x	x	x	x	x	-
Suspended Sediment	x	x	x	x	x	-
TIC	x	-	-	-	-	-
Tissue						
Heavy metals	x	x	-	-	-	x
Basic Water Quality	x	x	x	x	x	x
Discharge	x	x	x	x	x	x
Pebble counts	x	x	x	x	x	-

Site 1 = Pullen Pond; Site 2 = Confluence to tributary 1; Site 3 = Jerry Meyers Fish Hatchery; Site 4 = Confluence to tributary 2; Site 5 = Headwaters at railyard

Appendix D: Chain of Custody Form

Shoalwater Tribe Environmental Research Laboratory

P.O. Box 130, 4166 Hwy 105 So.
Tokeland, WA 98590
(360) 267-3101 x21, FAX (360) 267-1097

Chain of Custody Number: _____

Chain of Custody / Analytical Request Form

Date: _____ Page ____ of ____

Customer Info: Contact Name: _____ Telephone: _____ Fax: _____

Company Name: _____ Address: _____ City, State, Zip _____

Billing Info: P.O. # _____ Address: _____ City, State, Zip _____

Sampled By: _____ E-mail Receipt Info?: _____

Special Instructions:

Customer Sample I.D.	Date Taken	Time Taken	# of Cont.	Cont. Type*	Sample Matrix	Pre-served	Requested Analysis: Semivolatiles	Volatiles	Carbaryl	Anions	Coliform (P/A)	Mercury		Comments and QA Level Needed	Assigned STERL Sample ID #

Requested Turn-around
□ Standard (10 working days)
□ Rush (specify):

*CG = Clear Glass, AG = Amber Glass, P = Plastic, M = Metal FW=Fresh Water, SW = Sea Water, Sed = Sediment, Tis = Tissue

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____

(Signature/Affiliation) (Signature/Affiliation)

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____

(Signature/Affiliation) (Signature/Affiliation)

Laboratory Comments:

ANALYTICA
GROUP
www.analyticagroup.com

811 W. 8th Ave.
Anchorage, AK 99501
(907) 258-2155
FAX: (907) 258-6634

5438 Shaune Drive
Juneau, AK 99801
(907) 780-6668
FAX: (907) 780-6670

12189 Pennsylvania Street
Thornton, CO 80241
(303) 469-8868
FAX: (303) 469-5254

LGN:
Quote:
Project ID #:

Chain of Custody Record / Analysis Request

Company Name:	Project Name:	Date Collected	Time collected	Maxtix	# Containers																										MS / MSD	Preserved?	Highly Concentrated?	LAB ID
Company Address:	Report To:																																	
	Invoice To:																																	
Telephone:	P.O. Number																																	
Fax:																																		
Email:																																		
Sample ID																																		

COMMENTS

- ❑ *10 Business Days*
- ❑ *15 Business Days*
- ❑ *other:_____ # Business Days*

(Prior Authorization Required.)

RELINQUISHED BY SAMPLER:	*RECEIVED BY:*	*RELINQUISHED BY:*	*RECEIVED BY:*	*Cooler Receipt Information*
Signature:	*Signature:*	*Signature:*	*Signature:*	*Temp Received:_____ °C*
Printed Name:	*Printed Name:*	*Printed Name:*	*Printed Name:*	*Temp Received:_____ °C*
Firm:	*Firm:*	*Firm:*	*Firm:*	*Coolers:_____*
				Seals:_____
Date/ Time:	*Date/ Time:*	*Date/ Time:*	*Date/ Time:*	*Means of Delivery / Way Bill #*

Columbia Analytical Services INC.
An Employee-Owned Company

CHAIN OF CUSTODY

Sediment and Tissue Chemistry

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • FAX (360) 636-1068

SR#:_____

PAGE _____ OF _____ COC #_____

PROJECT NAME

PROJECT NUMBER

PROJECT MANAGER

COMPANY/ADDRESS

PHONE # FAX #

SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Metals (list below)	☐ Total Volatile Solids ☐ Total Solids	TOC (ASTM D4129M) ☐ Lipids	Grain size - PSEP / ASTM D422	Sulfide ☐ Total (9030M) ☐ Water Soluble	AVS / SEM	Ammonia ☐ Total (350.1m) ☐ Pore water	Pesticides (8081)	PCBs (8082) ☐ Aroclors ☐ Congeners	Semivolatiles (GC/MS SIM) ☐ PAHs ☐ Phthalates ☐ Phenols ☐ PSEP	Organotin - Sediment ☐ Mono ☐ Di ☐ Tri ☐ Tetra	Organotin - Pore water ☐ Mono ☐ Di ☐ Tri ☐ Tetra	Volatiles (8260)	TRPH 8015 / 418.1						REMARKS

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # _____

Bill To: _____

_____

_____

TURNAROUND REQUIREMENTS

_____ 24 hr. _____48 hr.

_____5 Day

_____ Standard (10-15 working days)

_____ Provide FAX Results

_____

Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn

CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

Appendix E: Field Data Sheet

Pullen Creek Watershed Assessment
Skagway Traditional Council
Data Collection Sheet

Sampling Date: _____ **Sampling Location:** _____ **Primary Sampler:** _____ **Field Assistants:** _____ _____	**Calibration (date/initials):** HACH Hydrolab (pH/Conductivity): _____ Dissolved Oxygen: _____ USGS pygmy meter: _____	**Water Quality Samples** RCRA Metals □ BTEX □ Suspended Solids □

Basic Water Quality (HACH Hydrolab)

Temperature: _____ °C

Dissolved Oxygen _____ mg/l

pH _____

Conductivity _____ µS/l

NOTES:

Pebble Counts

	T1	T2	T3	T4	T5
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Measure intermediate axis in mm

NOTES:

Discharge

Start Point	Width	Depth	Revol-utions	Sec-onds	Velo-city	Area	Dis-charge

NOTES:

Appendix F: HACH Hydrolab Calibration Procedure

Standard Calibration Procedure for Hydrolab Minisonde 4 ™

Notes:

- Always wear gloves and other protective clothing when handling chemicals.
- Temperature cannot be calibrated.
- For all sensors, use a two-point calibration. Confirm accuracy with a third concentration if desired.
- All calibrations require the use of the Minisonde 4 calibration cup.
- Discard all calibration solutions (including deionized water) after they have been used.
- All procedures (except turbidity) allow 500 ml of calibration solution for each calibration point. Turbidity can be done with 400 ml using a stir bar and stir plate.

pH:

Reagents needed:

500 ml pH 4 buffer
500 ml pH 7 buffer
500 ml pH 10 buffer
Deionized water

Procedure:

1) Attach DS4 calibration cup.
2) Thoroughly rinse the sensors with deionized water. Discard the liquid. Repeat.
3) Rinse sensors with a small amount of pH 7 buffer. Discard the liquid. Repeat.
4) Fill calibration cup with pH 7 buffer until the D.O membrane is submerged.
5) Allow several minutes for readings to stabilize on the Surveyor display.
6) On surveyor, select “Setup/Cal.” Then select “Calibrate,” and then “Sonde.”
7) A menu will appear on the surveyor. It will display parameters to be calibrated as well as units for each parameter. Select “pH : pH units.”
8) Enter the standard value (in this case “7.00”) *Important: press “Done” when you have entered the value.*
9) Discard pH 7 solution. Thoroughly rinse calibration cup with deionized water. Discard liquid and rinse again.
10) Repeat steps 3-8 for pH 10 buffer.
11) Confirm calibration by thoroughly rinsing calibration cup. Fill with pH 4 buffer. Return to the main screen of the Surveyor, where real-time data is displayed. Observe value for pH. If value is between 3.8 and 5.2 pH units, calibration is complete. If not, repeat procedure with both pH 7 and pH 10 buffer until calibration is successful.

Conductivity

Reagents and supplies needed:

300 ml of 1000 μs/cm conductivity standard: use to create

500 ml of 300 μS/cm conductivity standard
500 ml of 150 μS/cm conductivity standard
Lint free cloth or compressed air

Procedure for creating conductivity 150 μS/cm and 300μS/cm standards:

1) For all procedures, rinse all glassware with deionized water
2) Obtain 1000μS/cm standard, purchased from reputable dealer, such as YSI-3167. Check expiration dates for standard.
3) Use a graduated cylinder to measure out 300 ml of 1000μS/cm conductivity standard
4) Place into a 1L volumetric flask.
5) Fill the 1L volumetric flask with 700 ml of deionized water to create one liter of 300 μS/cm conductivity standard. Label standard as 300μS/cm conductivity standard, date and initial.
6) Measure 250 ml of the 300μS/cm conductivity standard in a volumetric flask, pour this 250 ml into a 500 ml volumetric flask.
7) In a 500 ml volumetric flask add 250mL of deionized water to 250ml of the 300μS/cm conductivity standard. Label standard as 150μS/cm conductivity standard, date and initial.

Procedure for calibration of conductivity probe:

1) Thoroughly rinse the sensors with deionized water. Discard the liquid. Repeat.
2) Thoroughly dry the conductivity sensor (located inside the D.O. probe). Use compressed air or lint-free wipes.
3) On surveyor, select “Setup/Cal.” Then select “Calibrate,” and then “Sonde.”
4) A menu will appear on the surveyor. It will display parameters to be calibrated as well as units for each parameter. Select “SpCond : μS/cm”
5) The conductivity sensor should remain dry. Enter standard as 0. *Important: press “Done” when you have entered the value.*
6) Fill calibration cup with high-end conductivity standard (300 μS/cm) until the D.O. membrane is submerged.
7) Allow several minutes for readings to stabilize on the Surveyor display.
8) On surveyor, select “Setup/Cal.” Then select “Calibrate,” and then “Sonde.”
9) A menu will appear on the surveyor. It will display parameters to be calibrated as well as units for each parameter. Select “SpCond : μS/cm”
10) Enter value for high-end standard (300 μS/cm). Press “Done.”
11) Calibration complete. You may check accuracy with the 150 μS/cm standard (or another salinity concentration between 0 and the high-end value) by filling the calibration cup with the 150 μS/cm solution and observing the Surveyor’s main screen. If value displayed for SpCond is between 142.5 and 157.5 (within 5 % of expected value), calibration is complete.

Appendix C: Data Quality Objectives

This page intentionally left blank

Data Quality Objectives for Water Quality Measurements

Parameter	Method/Range	Units	Meter Detection Limit	Precision	Accuracy	Calibration Method	Sample Preservation and Storage
pH	YSI 556 0 to 14	Standard pH units	0.01	±0.2 units	±0.2 units	YSI calibration	Analyze immediately
Conductance	YSI 556 0-100 µS/cm	Micro-Siemens/cm (µS/cm)	0.001	±0.001 units	2% full Scale	YSI calibration	Analyze immediately
Dissolved Oxygen	YSI 556 0 to 50 mg/L	Milligrams per liter (mg/L)	0.01	±0.2 units	±0.2 units	Saturated air method	Analyze immediately
Temperature	YSI 556 -5 to 45 °C	Degrees Celsius (°C)	0.5	±0.15 °C (b)	±0.15 °C	Thermometer Ice Bath Calibration	Analyze immediately
Heavy metals			**Laboratory Reporting Limit**				
Arsenic	200.8	µg/L	5.0	Ave RSD - ± 1.1	Ave % R – 104 %	200.8	28 days from collection
Barium	208.2	µg/L	3.0	N/A	N/A	208.2	4^0 C ± 2^0 C
Cadmium	200.8	µg/L	0.5	Ave RSD - ± 0.16	Ave % R – 98 %	200.8	4^0 C ± 2^0 C
Chromium	200.8	µg/L	2.0	Ave RSD - ± 0.37	Ave % R – 100 %	200.8	4^0 C ± 2^0 C
Copper	200.8	µg/L	1.0	N/A	N/A	200.8	4^0 C ± 2^0 C
Mercury	245.1	µg/L	0.2	Ave RSD - ± 0.16	Ave % R – 88 %	245.1	4^0 C ± 2^0 C
Lead	200.8	µg/L	0.2	Ave RSD - ± 0.22	Ave % R – 92 %	200.8	4^0 C ± 2^0 C
Selenium	200.8	µg/L	5.0	Ave RSD - ± 0.50	Ave % R – 97 %	200.8	4^0 C ± 2^0 C
Silver	200.8	µg/L	1.0	Ave RSD - ± 0.67	Ave % R – 99 %	200.8	4^0 C ± 2^0 C
Zinc	200.8	µg/L	5.0	N/A	N/A	289.2	4^0 C ± 2^0 C
BTEX			**Laboratory Reporting Limit**				28 days from collection
Benzene	8260A	µg/L	0.4	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Toluene	8260A	µg/L	1.0	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Ethyl benzene	8260A	µg/L	1.0	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Xylenes	8260A	µg/L	2.0	± 20 %	95 % Recovery	Internal Standard Analyses	4^0 C ± 2^0 C
Total Suspended Solids	2540	mg/L	0.5	0-10 mg/L 30 10-100 mg/L 20 >100mg/L 10	20%	Internal Standard Analyses	4° C +/- 2°C 7 days from collection;5 days from receipt at laboratory
Tentatively Identified Compounds (PAH SIMS)	Modified 8270 for non target analytes	µg/L	-	Estimated concentration, no precision data is available.	Estimated concentration, no accuracy data is available.	Internal Standard	4^0 C ± 2^0 C. 7 days from collection

Ave RSD = Average Standard Deviation; Ave % R = Average Percent Recovery

Data Quality Objectives for Sediment and Soil Measurements

Parameter	Method/Range	Units	Laboratory Reporting Limit	Precision	Accuracy	Calibration Method	Sample Preservation and Storage
RCRA Metals							28 days from collection
Arsenic	6020A	mg/kg	1.0	Ave RSD - ± 1.1	Ave % R – 104 %	200.8	Keep at 4^0 C ± 2^0 C
Barium	6020A	mg/kg	0.3	N/A	N/A	208.2	Keep at 4^0 C ± 2^0 C
Cadmium	6020A	mg/kg	0.2	Ave RSD - ± 0.16	Ave % R – 98 %	200.8	Keep at 4^0 C ± 2^0 C
Chromium	6020A	mg/kg	0.4	Ave RSD - ± 0.37	Ave % R – 100 %	200.8	Keep at 4^0 C ± 2^0 C
Copper	6020A	mg/kg	0.6	N/A	N/A	200.8	Keep at 4^0 C ± 2^0 C
Mercury	6020A	mg/kg	0.04	Ave RSD - ± 0.16	Ave % R – 88 %	245.1	Keep at 4^0 C ± 2^0 C
Lead	6020A	mg/kg	0.2	Ave RSD - ± 0.22	Ave % R – 92 %	200.8	Keep at 4^0 C ± 2^0 C
Selenium	6020A	mg/kg	1.0	Ave RSD - ± 0.50	Ave % R – 97 %	200.8	Keep at 4^0 C ± 2^0 C
Silver	6020A	mg/kg	0.2	Ave RSD - ± 0.67	Ave % R - 99 %	200.8	Keep at 4^0 C ± 2^0 C
Zinc	6020A	mg/kg	2.5	N/A	N/A	206.2	Keep at 4^0 C ± 2^0 C
B-TEX			**Laboratory Reporting Limit**				7 days from collection
Benzene	8260A	µg/kg	12.5	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C
Toluene	8260A	µg/kg	25	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C
Ethyl benzene	8260A	µg/kg	25	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C
Xylenes	8260A	µg/kg	50	± 30 %	± 90 %	Internal Standard Analyses	Keep at 4^0 C ± 2^0 C

Ave RSD = Average Standard Deviation; Ave % R = Average Percent Recovery

Data Quality Objectives for Biological Tissue

Parameter	Method/Range	Units	Method Reporting Limit	Method Detection Limit	Precision	Matrix Spike Recovery (% Rec)	Prep Method	Sample Preservation and Storage
RCRA Metals								28 days from collection
Arsenic	200.8	mg/kg	0.5	0.03	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Barium	200.8	mg/kg	0.05	0.02	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Cadmium	200.8	mg/kg	0.02	0.006	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Chromium	200.8	mg/kg	0.5	0.5	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Copper	200.8	mg/kg	0.1	0.09	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Mercury	7471B	mg/kg	0.02	0.002	30	70-130	Method	Keep at 4^0 C ± 2^0 C
Lead	200.8	mg/kg	0.02	0.007	30	60-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Selenium	200.8	mg/kg	1	1	30	60-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C
Zinc	200.8	mg/kg	0.5	0.06	30	70-130	3050B/PSEP	Keep at 4^0 C ± 2^0 C

Appendix D: Sampling Matrix

Table 2. Matrix of sampling design for Pullen Creek, located in Skagway, Alaska.

	Pullen Creek					Nelson Slough
	site 1	site 2	site 3	site 4	site 5	reference
Sediment						
Heavy metals	x	x	x	x	x	-
BTEX	x	-	-	x	-	-
Bank Soil						
Heavy metals	x	x	x	x	x	-
Water						
Heavy metals	x	-	-	x	-	-
BTEX	x	x	x	x	x	-
Suspended Sediment	x	x	x	x	x	-
TIC	x	-	-	-	-	-
Tissue						
Heavy metals	x	x	-	-	-	x
Basic Water Quality	x	x	x	x	x	x
Discharge	x	x	x	x	x	x
Pebble counts	x	x	x	x	x	-

Site 1 = Pullen Pond; Site 2 = Confluence to tributary 1; Site 3 = Jerry Meyers Fish Hatchery; Site 4 = Confluence to tributary 2; Site 5 = Headwaters at railyard

Appendix E: Field Data Sheet

Pullen Creek Watershed Assessment
Skagway Traditional Council
Data Collection Sheet

Sampling Date: _____
Sampling Location: _____
Primary Sampler: _____
Field Assistants: _____
_____

Calibration (date/initials):
YSI 556
(pH/Conductivity): _____
Dissolved Oxygen: _____
USGS pygmy meter: _____

Water Quality Samples
RCRA Metals □
BTEX □
Suspended Solids □

Basic Water Quality (YSI)

Air Temperature: _____ °C
Water Temperature: _____ °C
Dissolved Oxygen _____ mg/l
pH _____
Conductivity _____ µS/l

NOTES:

Pebble Counts

	T1	T2	T3	T4	T5
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Measure intermediate axis in mm

NOTES:

S = sand
Si = silt
W = wood
W = wood
D = detritus
G = garbage

Appendix F: Chain of Custody

SGS North America Inc.
CHAIN OF CUSTODY RECORD

Locations Nationwide

Alaska	Maryland
New Jersey	New York
North Carolina	Indiana
West Virgina	Kentucky

www.us.sgs.com

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Page ___ of ___

1

CLIENT:

CONTACT: PHONE NO:

PROJECT NAME: PROJECT/ PWSID/ PERMIT#:

REPORTS TO: E-MAIL:

INVOICE TO: QUOTE #: P.O. #:

2 3

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Preserv-ative Used: TYPE C = COMP G = GRAB M = Multi Incre-mental Soils											REMARKS/ LOC ID

5

Relinquished By: (1)	Date	Time	Received By:
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received For Laboratory By:

4

DOD Project? YES NO

Cooler ID: _____

Data Deliverable Requirements:

Requested Turnaround Time and-or Special Instructions:

Temp Blank °C: _____

or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

(See attached Sample Receipt Form)

[ ] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

http://www.sgs.com/terms_and_conditions.htm

APPENDIX B

Tables B1 –B6
Water Sampling Results

This page intentionally left blank

Table B1. Results of water sampling for contaminants at the Pullen Pond site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2004				2015/2016					
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond
DATE OF SAMPLE:		11/20/2003	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	8/19/2015	11/9/2015	2/2/2016	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		PPW1_N20/03	PPWM2	PPWM3	PPWM4	PPWM5	PC01WA	PC01WA	PC01WA	PC01W	PC01W DUP	PC01WAMS01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-01A	40226-05	40519-09	40902-04	41117-04	1154715001	1154715015	1156684006	1160540001	1160540006	1162456011
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	8/21/2015	11/12/2015	2/5/2016	2/5/2016	5/18/2016
DATE ANALYZED		12/4/2003	4/29/2004	5/26/2004	9/21/2004	12/8/2004	8/27/2015	8/27/2016	11/16/2015	2/23/2016	2/24/2016	5/27/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Water PRG											
Arsenic (As)	**50.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium (Ba)	**2000.0**	45.9	77	ND	1200.0	0.0460	42.9	42.9	50.60	56.20	54.8	35.3
Cadmium (Cd)	**5.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium (Cr)	**100.0**	ND	1.6	ND	1.6	ND	0.918J	0.879J	2.14	ND	ND	ND
Copper (Cu)	**1300.0**	-	-	-	-	ND	0.638J	0.78J	-	-	-	ND
Lead (Pb)	**15.0**	0.168	ND	ND	ND	ND	1.24	1.8	ND	0.484	0.431	ND
Mercury (Hg)	**1.2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium (Se)	**50.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver (Ag)	**180.0**	1.01	1.01	0.6	ND	ND	ND	ND	ND	ND	ND	ND
Zinc (Zn)	**11000.0**		ND	ND	ND	0.0030	3.84J	5.07	ND	ND	ND	ND

		2003	2004				2015/2016			
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond
DATE OF SAMPLE:		11/20/2003	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		PPW1_N20/03	PPWB2B	PPWB3A	PPWB4A	PPWB5A	PC01WA	PC01WA	PC01W	PC01WABT01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-01A	40226-06	50519-10	40902-05	41117-05	1154725001	1156684006	1160540001	1162456001
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/17/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/2/2003	2/26/2004	5/20/2004	9/14/2004	11/18/2004	8/29/2015	11/13/2015	2/15/2016	5/26/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Water PRG									
Benzene	**5**	ND	ND	ND	ND	ND	ND	ND	0.560	ND
Ethylbenzene	**700**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**1000.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	**10.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	-	-	ND	ND	ND	ND	ND	ND	ND	ND

Table B2. Results of water sampling for contaminants at the Tributary 1 site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2004			2015/2016			
LOCATION OF SAMPLE: DESCRIPTION OF LOCATION:		**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**
DATE OF SAMPLE:		5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		T1WB3A	T1WB4A	T1WB5A	PC02WA	PC02WA	PC02W	PC02WABT01-03
TESTING LABORATORY		Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		40519-21	40902-10	4117-22	1154715002	1156684007	1160540002	1162456002
DATE RECEIVED:		5/19/2004	9/2/2004	11/17/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		5/20/2004	9/14/2004	11/18/2004	8/29/2015	11/13/2015	2/15/2016	5/26/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Water PRG							
Benzene	**5**	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**700**	ND	ND	ND	ND	ND	ND	ND
Toluene	**1000.0**	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	**10.0**	ND	ND	ND	ND	ND	ND	ND
o-Xylene	-	ND	ND	ND	ND	ND	ND	ND

Table B3. Results of water sampling for contaminants at the Fish Hatchery site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003
LOCATION OF SAMPLE:		**Pullen Creek**
DESCRIPTION OF LOCATION:		**Fish Hatchery**
DATE OF SAMPLE:		11/20/2003
TYPE OF SAMPLE:		Water
SAMPLE ID:		FHW1_N20/03
TESTING LABORATORY		Analytica, Inc.
LABORATORY SAMPLE ID:		J0311126-03A
DATE RECEIVED:		11/22/2003
DATE ANALYZED		12/4/2003
CONCENTRATION UNITS:		ug/L
	Water PRG	
Arsenic (As)	**50.0**	ND
Barium (Ba)	**2000.0**	40.5
Cadmium (Cd)	**5.0**	ND
Chromium (Cr)	**100.0**	ND
Copper (Cu)	**1300.0**	-
Lead (Pb)	**15.0**	ND
Mercury (Hg)	**1.2**	ND
Selenium (Se)	**50.0**	-
Silver (Ag)	**180.0**	0.601
Zinc (Zn)	**11000.0**	-

		2003	2004				2015/2016			
LOCATION OF SAMPLE:		**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**
DATE OF SAMPLE:		11/20/2003	2/24/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		FHW1_N20/03	FHWB2A	FHWB3B	FHWB4A	FHWB5A	PC03WA	PC03WA	PC03W	PC03WABT01-03
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-03A	40226-21A	40519-26	40902-14	41117-14	1154725003	1156684008	1160540003	1162456003
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/17/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/4/2003	2/26/2004	5/20/2004	9/14/2004	11/18/2004	8/29/2015	11/13/2015	2/15/2016	5/26/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Water PRG									
Benzene	**5.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**700.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**1000.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	**10.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	**-**	-	ND	ND	ND	ND	ND	ND	ND	ND

Table B4. Results of water sampling for contaminants at the Tributary 2 site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2015/2016	
LOCATION OF SAMPLE:		**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**
DATE OF SAMPLE:		11/20/2003	8/20/2015	11/10/2015
TYPE OF SAMPLE:		Water	Water	Water
SAMPLE ID:		T2W1_N20/03	PC04WA	PC04WA
TESTING LABORATORY		Analytica, Inc.	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-05A	1154725004	1156684009
DATE RECEIVED:		11/22/2003	8/21/2015	11/12/2015
DATE ANALYZED		12/4/2003	8/27/2015	11/16/2015
CONCENTRATION UNITS:		ug/L	ug/L	ug/L
	Water PRG			
Arsenic (As)	**50.0**	ND	ND	ND
Barium (Ba)	**2000.0**	50.1	57.2	59.3
Cadmium (Cd)	**5.0**	ND	ND	ND
Chromium (Cr)	**100.0**	0.148	0.778J	ND
Copper (Cu)	**1300.0**	-	ND	-
Lead (Pb)	**15.0**	ND	0.0830J	ND
Mercury (Hg)	**1.2**	ND	ND	ND
Selenium (Se)	**50.0**	ND	ND	ND
Silver (Ag)	**180.0**	0.530	ND	ND
Zinc (Zn)	**11000.0**	-	ND	ND

		2003	2004				2015/2016			
LOCATION OF SAMPLE:		**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**	**Confluence of Tributary Two**
DATE OF SAMPLE:		11/20/2003	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/20/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		T2W1_N20/03	T2WB2A	T2WB3A	T2WB4A	T2WB5A	PC04WA	PC02WA	PC04W	PC04WABT01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-05A	40226-9A	40519-12	40902-18	41117-18	1154725004	1156684007	1160540004	1162456005
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/17/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/4/2003	2/26/2004	5/20/2004	9/14/2004	11/18/2004	8/29/2015	11/13/2015	2/15/2016	5/26/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Water PRG									
Benzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**700**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**1000.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	**10.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	-		ND	ND	ND	ND	ND	ND	ND	ND

Table B5. Results of water sampling for contaminants at the Rail Yard site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2004						2015/2016		
LOCATION OF SAMPLE:		Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard
DESCRIPTION OF LOCATION:		Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)
DATE OF SAMPLE:		11/21/2003	2/24/2004	5/17/2004	5/17/2004	8/31/2004	8/31/2004	11/15/2004	2/2/2016	5/16/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		HWW1_N20/03	HWWM2	HWWM3	HWWM3 DUP	HWWM4	HWWM4 DUP	HWWM5	PC05W	PC05WAMS01	PC05WAMS02
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-07C	40226-13	40519-17	40519-17 DUP	40902-23	40902-23 DUP	41117-11	1160540005	1162456012	1162456013
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	5/19/2004	9/2/2004	9/2/2004	11/19/2004	2/5/2016	5/18/2016	5/18/2016
DATE ANALYZED		12/4/2003	4/29/2004	5/26/2004	5/26/2004	9/21/2004	9/21/2004	12/8/2004	2/23/2016	5/27/2016	5/27/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L
	Water PRG										
Arsenic (As)	**50.0**	ND	ND	ND	ND	ND	ND	0.0002	ND	ND	ND
Barium (Ba)	**2000.0**	49.2	84	ND	ND	130	140	0.0520	54.9	55.7	56.7
Cadmium (Cd)	**5.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium (Cr)	**100.0**	0.189	0.63	ND	ND	0.7	0.5	ND	ND	ND	ND
Copper (Cu)	**1300.0**	-	-	-	-	-	-	0.0010	-	ND	ND
Lead (Pb)	**15.0**	0.181	ND	ND	ND	ND	ND	0.0010	ND	ND	0.257
Mercury (Hg)	**1.2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium (Se)	**50.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver (Ag)	**180.0**	0.489	ND	0.5	0.6	ND	ND	ND	ND	ND	ND
Zinc (Zn)	**11000.0**	-	ND	ND	ND	ND	ND	ND	ND	ND	ND

		2003	2004			2015/2016			
LOCATION OF SAMPLE:		Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard
DESCRIPTION OF LOCATION:		Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)
DATE OF SAMPLE:		11/20/2003	2/24/2004	8/31/2004	11/15/2004	8/20/2015	11/10/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Water	Water	Water	Water	Water	Water	Water	Water
SAMPLE ID:		HWW1_N20/03	HWWB2A	HHWB4A	HHWB5A	PC05WA	PC05WA	PC05W	PC05WABT01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-07C	40226-14A	40902-24	41117-12	1154725005	1156684010	1160540005	1162456006
DATE RECEIVED:		11/22/2003	2/26/2004	9/2/2004	11/17/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/4/2003	2/26/2004	9/14/2004	11/18/2004	8/29/2015	11/13/2015	2/15/2016	5/26/2016
CONCENTRATION UNITS:		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	Water PRG								
Benzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**700**	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**1000.0**	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	**10.0**	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene		-	ND	ND	ND	ND	ND	ND	ND

Table B6. Results of water sampling for contaminants at the Pullen Pond site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as red text. The abbreviation ND = no detection of the contaminant.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DATE OF SAMPLE:	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:	Water	Water	Water	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	PPWTC2	PPWTC3	PPWTC4	PPWTC5	PC01WA	PC01WA	PC01W	PC01WAPS01-2
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:	40226-17	40519-18	40902-07	41117-07	1154725001	1154725001	1160540001	1162456014
DATE RECEIVED:	2/26/2004	5/19/2004	9/2/2004	11/7/2004	8/21/2015	9/12/2015	2/5/2016	5/18/2016
DATE ANALYZED	3/4/2004	6/14/2004	12/3/2004	12/3/2004	8/25/2015	11/17/2015	2/10/2016	5/31/2016
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,2,4-Trichlorobenzene	ND	ND	ND	ND	-	-	-	-
1,2-Dichlorobenzene	ND	ND	ND	ND	-	-	-	-
1,3-Dichlorobenzene	ND	ND	ND	ND	-	-	-	-
1,4-Dichlorobenzene	ND	ND	ND	ND	-	-	-	-
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	-	-	-	-
2,4,5-Trichlorophenol	ND	ND	ND	ND	-	-	-	-
2,4,6-Trichlorophenol	ND	ND	ND	ND	-	-	-	-
2,4-Dichlorophenol	ND	ND	ND	ND	-	-	-	-
2,4-Dimethulphenol	ND	ND	ND	ND	-	-	-	-
2,4-Dinitrophenol	ND	ND	ND	ND	-	-	-	-
2,4-Dinitrotoluene	ND	ND	ND	ND	-	-	-	-
2,6-Dichlorophenol	ND	ND	ND	ND	-	-	-	-
2,6-Dinitrotoluene	ND	ND	ND	ND	-	-	-	-
2-Chloronapthalene	ND	ND	ND	ND	-	-	-	-
2-Chlorophenol	ND	ND	ND	ND	-	-	-	-
1-Methylnaphthalene	-	-	-	-	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	-	-	-	-
2-Nitroaniline	ND	ND	ND	ND	-	-	-	-
2-Nitrophenol	ND	ND	ND	ND	-	-	-	-
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	-	-	-	-
4-Bromophenyl phenyl ether	ND	ND	ND	ND	-	-	-	-
4-Chloro-3-methyl phenol	ND	ND	ND	ND	-	-	-	-
4-Chloroaniline	ND	ND	ND	ND	-	-	-	-
4-Chlorophenyl phenyl ether	ND	ND	ND	ND	-	-	-	-
4-Methylphenol	ND	ND	ND	ND	-	-	-	-
4-Nitroaniline	ND	ND	ND	ND	-	-	-	-
4-Nitrophenol	ND	ND	ND	ND	-	-	-	-
Acenaphthene	ND	ND	ND	ND	-	-	-	-
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Azobenzene	ND	ND	ND	ND	-	-	-	-
Benz[a]anthracene	ND	ND	ND	ND	ND	ND	ND	ND

Table B6 con't. Results of water sampling for contaminants at the Pullen Pond site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

LOCATION OF SAMPLE:	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Pond**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DATE OF SAMPLE:	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:	Water	Water	Water	Water	Water	Water	Water	Water
FIELD SAMPLE ID:	PPWTC2	PPWTC3	PPWTC4	PPWTC5	PC01WA	PC01WA	PC01W	PC01WAPS01-2
TESTING LABORATORY	Shoalwater	Shoalwater	Shoalwater	Shoalwater	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:	40226-17	40519-18	40902-07	41117-07	1154725001	1154725001	1160540001	1162456014
DATE RECEIVED:	2/26/2004	5/19/2004	9/2/2004	11/7/2004	8/21/2015	9/12/2015	2/5/2016	5/18/2016
DATE ANALYZED	3/4/2004	6/14/2004	12/3/2004	12/3/2004	8/25/2015	11/17/2015	2/10/2016	5/31/2016
CONCENTRATION UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzo[a]pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[b]fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[ghi]perylene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[k]fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	ND	ND	ND	ND	-	-	-	-
bis(2-chloroethyl)ether	ND	ND	ND	ND	-	-	-	-
bis(2-chloroisopropyl)ether	ND	ND	ND	ND	-	-	-	-
bis(2-Ethylhexyl) Phthalate = 6.0 ug/L	10	ND	ND	ND	-	-	-	-
Butyl Benzyl Phthalate	ND	ND	ND	ND	-	-	-	-
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	-	-	-	-
Dibez[a,h]anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl Phthalate	ND	ND	ND	ND	-	-	-	-
Dimethyl phthalate	ND	ND	ND	ND	-	-	-	-
di-n-Butyl Phthalate	ND	ND	ND	ND	-	-	-	-
di-n-octyl phthalate	ND	ND	ND	ND	-	-	-	-
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	-	-	-	-
Hexachlorobutadiene	ND	ND	ND	ND	-	-	-	-
Hexachlorocyclopentadiene	ND	ND	ND	ND	-	-	-	-
Hexachloroethane	ND	ND	ND	ND	-	-	-	-
Indeno[1,2,3-cd]pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	-	-	-	-
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	-	-	-	-
N-nitroso-di-n-propylamine	ND	ND	ND	ND	-	-	-	-
Pentachlorophenol = 1.0 ug/L	ND	77	ND	ND	-	-	-	-
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	-	-	-	-
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND

This page intentionally left blank

APPENDIX C

Tables C1 –C5
Sediment Sampling Results

This page intentionally left blank

Table C1. Results of sediment sampling for contaminants at the Pullen Pond site on Pullen Creek, Skagway, Alaska. Results are compared to Total Maximum Daily Loads (TMDL)/Threshold Effects Levels (TEL) and exceedances are shown in red text. Remaining results are compared back to Preliminary Remediation Goals (PRG)s and exceedances are shown in blue text. The abbreviation ND = no detection of the contaminant.

			2004				2015/2016			
LOCATION OF SAMPLE:			Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:			Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond
DATE OF SAMPLE:			2/24/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:			Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:			PPSDM2	PPSDM3	PPSDM4	PPSDM5	PC01SD	PC01SD	PC01SD	PC01SDMS01
TESTING LABORATORY			Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:			40226-03	40519-07	40902-02	41117-02	1154725007	1156684001	1160540012	1162456015
DATE RECEIVED:			2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED			4/29/2004	5/26/2004	9/21/2004	12/10/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	TMDL/TEL	**Sediment PRG**								
Arsenic (As)	**5.9**	**70**	13	0.8	2.9	2.4	1.15J	ND	ND	ND
Barium (Ba)	**N/A**	**982**	1290	250.0	394.0	168.0	169	120	98.2	121.0
Cadmium (Cd)	**0.596**	**6.6**	ND	ND	ND	2.1	0.240J	ND	ND	ND
Chromium (Cr)	**37.3**	**370**	20	5.5	3.6	7.3	6.32	4.52	2	4.40
Copper (Cu)	**35.7**	**N/A**	-	-	-	34.0	12.5	-	6.42	10.3
Lead (Pb)	**35**	**218**	422	80.0	52.8	113.0	57	21.4	25.0	33.5
Mercury (Hg)	**0.174**	**0.71**	ND	ND	ND	0.1	0.0312J	ND	ND	ND
Selenium (Se)	**N/A**	**3**	ND	ND	ND	ND	0.505J	ND	ND	ND
Silver (Ag)	**N/A**	**3.73**	1.2	ND	ND	ND	ND	ND	ND	ND
Zinc (Zn)	**123**	**410**	293	110.0	137.0	174.0	158	91.9	73.6	91.2

		2004				2005				
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DATE OF SAMPLE:		11/20/2003	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016	5/16/2016
TYPE OF SAMPLE:		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	SGS	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-02C	40519-08	40902-03	41117-03	1154725007	1156684001	1160540012	1162456015	1162456016
DATE RECEIVED:		11/22/2003	5/19/2004	9/2/2004	11/17/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016	5/18/2016
DATE ANALYZED		12/2/2003	5/25/2004	9/15/2004	11/19/2004	8/26/2015	11/18/2015	2/22/2016	5/28/2016	5/28/2016
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
	Soil PRG									
Benzene	**0.02**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**5.00**	0.012	ND	ND	77.4	ND	ND	ND	ND	ND
Toluene	**4.80**	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	**69.00**	0.05	ND	ND	20.1	ND	ND	ND	ND	ND
o-Xylene	**-**	-	ND	ND	12.6	ND	ND	ND	ND	ND

Table C2. Results of sediment sampling for contaminants at the Tributary 1 site on Pullen Creek, Skagway, Alaska. Results are compared to Total Maximum Daily Loads (TMDL)/Threshold Effects Levels (TEL) and exceedances are shown in red text. Remaining results are compared back to Preliminary Remediation Goals (PRG)s and exceedances are shown in blue text. The abbreviation ND = no detection of the contaminant.

			2004				2015/2016			
LOCATION OF SAMPLE: DESCRIPTION OF LOCATION:			**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**	**Pullen Creek Confluence of Tributary One**
DATE OF SAMPLE:			2/24/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:			Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:			T1SDM2	T1SDM3	T1SDM4	T1SDM5	PC02SD	PC02SD	PC02SD	PC02SDMS01
TESTING LABORATORY			Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:			40226-19	40519-20	40902-09	41117-21	1154725007	1156684002	1160540013	1162456018
DATE RECEIVED:			2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED			4/29/2004	5/26/2004	9/21/2004	12/13/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	TMDL/TEL	**Sediment PRG**								
Arsenic (As)	**5.9**	**70**	7.1	1.2	2.3	5.5	2.04	1.95	ND	ND
Barium (Ba)	**N/A**	**982**	1080	190.0	99.7	172.0	230	163	122	139
Cadmium (Cd)	**0.596**	**6.6**	0.7	ND	ND	3.1	0.176J	ND	ND	ND
Chromium (Cr)	**37.3**	**370**	12	5.5	2.7	12.0	9.11	8.16	2.88	6.65
Copper (Cu)	**35.7**	**N/A**	-	-	-	29.0	23.6	-	17.2	19.5
Lead (Pb)	**35**	**218**	263	75.0	60.7	108.0	79.4	58.8	59.6	80.9
Mercury (Hg)	**0.174**	**0.71**	ND	ND	ND	0.1	0.0293J	ND	ND	ND
Selenium (Se)	**N/A**	**3**	ND	ND	ND	ND	0.543J	ND	ND	ND
Silver (Ag)	**N/A**	**3.73**	ND	ND	ND	ND	ND	ND	ND	ND
Zinc (Zn)	**123**	**410**	551	240.0	179.0	353.0	170	172	81.7	150

Table C3. Results of sediment sampling for contaminants at the Fish Hatchery site on Pullen Creek, Skagway, Alaska. Results are compared to Total Maximum Daily Loads (TMDL)/Threshold Effects Levels (TEL) and exceedances are shown in red text. Remaining results are compared back to Preliminary Remediation Goals (PRG)s and exceedanees are shown in blue text. The abbreviation ND = no detection of the contaminant.

			2004				2015/2016			
LOCATION OF SAMPLE:			**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:			**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**	**Fish Hatchery**
DATE OF SAMPLE:			2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:			Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:			FHSDM2	FHSDM3	FHSDM4	FHSDM5	PC03SD	PC03SD	PC03SD	PC03SDMS01
TESTING LABORATORY			Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:			40226-16	40519-24	40902-13	41117-25	1154725010	1156684003	1160540014	1162456019
DATE RECEIVED:			2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED			4/29/2004	5/26/2004	9/21/2004	12/13/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	TMDL/TEL	**Sediment PRG**								
Arsenic (As)	**5.9**	**70**	19.2	3.4	4.8	4.5	3.32	2.63	ND	ND
Barium (Ba)	**N/A**	**982**	1340	180.0	180.0	172.0	295	187	104	264
Cadmium (Cd)	**0.596**	**6.6**	1.7	ND	ND	2.5	0.440J	0.567	ND	ND
Chromium (Cr)	**37.3**	**370**	43.5	14.0	7.1	11.2	10.2	9.78	1.96	5.85
Copper (Cu)	**35.7**	**N/A**	-	-	-	14.3	24.6 -		14.6	17.5
Lead (Pb)	**35**	**218**	207	98.0	64.4	70.0	80.8	49.0	36.5	55.3
Mercury (Hg)	**0.174**	**0.71**	ND	ND	ND	0.1	0.091J	ND	ND	ND
Selenium (Se)	**N/A**	**3**	ND	ND	ND	ND	0.869J	ND	ND	ND
Silver (Ag)	**N/A**	**3.73**	0.7	0.6	ND	ND	ND	ND	ND	ND
Zinc (Zn)	**123**	**410**	835	770.0	218.0	170.0	226	225	84.0	150

		2003
LOCATION OF SAMPLE:		**Pullen Creek**
DESCRIPTION OF LOCATION:		**Fish Hatchery**
DATE OF SAMPLE:		11/20/2003
TYPE OF SAMPLE:		Sediment
FIELD SAMPLE ID:		FHS1_N20/03
TESTING LABORATORY		Analytica, Inc.
LABORATORY SAMPLE ID:		J0311126-04C
DATE RECEIVED:		11/22/2003
DATE ANALYZED		12/8/2003
CONCENTRATION UNITS:		mg/Kg
	Soil PRG	
Benzene	**0.02**	ND
Ethylbenzene	**5.00**	ND
Toluene	**4.80**	ND
m,p-Xylene	**69.00**	ND
o-Xylene	-	-

Table C4. Results of sediment sampling for contaminants at the Tributary 2 site on Pullen Creek, Skagway, Alaska. Results are compared to Total Maximum Daily Loads (TMDL)/Threshold Effects Levels (TEL) and exceedances are shown in red text. Remaining results are compared back to Preliminary Remediation Goals (PRG)s and exceedances are shown in blue text. The abbreviation ND = no detection of the contaminant.

			2004				2015/2016			
LOCATION OF SAMPLE: DESCRIPTION OF LOCATION:			**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**
DATE OF SAMPLE:			2/24/2004	5/17/2004	8/31/2004	11/15/2004	8/20/2015	11/10/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:			Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:			T2SDM2	T2SDM3	T2SDM4	T2SDM5	PC04SD	PC04SD	PC04SD	PC04SDMS01
TESTING LABORATORY			Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:			40226-08	40519-28	40902-17	41117-17	1154725011	1156684004	1160540015	1162456021
DATE RECEIVED:			2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED			4/29/2004	5/26/2004	9/21/2004	12/10/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	TMDL/TEL	**Sediment PRG**								
Arsenic (As)	**5.9**	**70**	15	1.6	8.6	4.0	2.27	ND	ND	ND
Barium (Ba)	**N/A**	**982**	1070	200.0	248.0	136.0	287	182	74.8	164
Cadmium (Cd)	**0.596**	**6.6**	2.0	ND	1.0	3.1	0.675	0.407	ND	ND
Chromium (Cr)	**37.3**	**370**	32	5.6	14.0	4.3	8.85	6.86	3.61	8.60
Copper (Cu)	**35.7**	**N/A**	-	-	-	9.7	29.7	-	23.0	41
Lead (Pb)	**35**	**218**	373	66.0	232.0	53.0	88.6	44.1	53.1	77.7
Mercury (Hg)	**0.174**	**0.71**	ND	ND	ND	0.0	0.0509J	ND	ND	ND
Selenium (Se)	**N/A**	**3**	ND	ND	ND	ND	0.991J	ND	ND	ND
Silver (Ag)	**N/A**	**3.73**	0.9	ND	0.8	ND	0.226J	ND	ND	ND
Zinc (Zn)	**123**	**410**	913	200.0	565.0	91.0	251	153	105.0	200

		2003	2015/2016			
LOCATION OF SAMPLE: DESCRIPTION OF LOCATION:		**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**	**Pullen Creek Confluence of Tributary Two**
DATE OF SAMPLE:		11/20/2003	8/20/2015	11/10/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Sediment	Sediment	Sediment	Sediment	Sediment
TESTING LABORATORY		Analytica, Inc.	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-06C	1154725011	1156684004	1160540015	1162456021
DATE RECEIVED:		11/22/2003	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/8/2003	9/1/2015	11/18/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:		mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
	Soil PRG					
Benzene	**0.02**	ND	ND	ND	ND	ND
Ethylbenzene	**5.00**	ND	ND	ND	ND	ND
Toluene	**4.80**	0.027	ND	ND	ND	ND
m,p-Xylene	**69.00**	0.053	ND	ND	ND	ND
o-Xylene	-	-	ND	ND	ND	ND

Table C5. Results of sediment sampling for contaminants at the Rail Yard site on Pullen Creek, Skagway, Alaska. Results are compared to Total Maximum Daily Loads (TMDL)/Threshold Effects Levels (TEL) and exceedances are shown in red text. Remaining results are compared back to Preliminary Remediation Goals (PRG)s and exceedances are shown in blue text. The abbreviation ND = no detection of the contaminant.

			2004				2015/2016			
LOCATION OF SAMPLE:			Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater
DESCRIPTION OF LOCATION:			(State St.)	(State St.)	(State St.)	(State St.)	(State St.)	(State St.)	(State St.)	(State St.)
DATE OF SAMPLE:			2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/20/2015	11/10/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:			Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
SAMPLE ID:			HWSDM2	HWSDM3	HWSDM4	HWSDM5	PC05SD	PC05SD	PC05SD	PC05SDMS01
TESTING LABORATORY			Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:			40226-11	40519-15	40902-21	41117-09	1154725013	1156684005	1160540016	1162456025
DATE RECEIVED:			2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED			4/29/2004	5/26/2004	9/21/2004	12/10/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	TMDL/TEL	**Sediment PRG**								
Arsenic (As)	**5.9**	**70**	17.50	1.2	7.8	4.2	4.11	5.32	2.07	3.76
Barium (Ba)	**N/A**	**982**	1840	170.0	397.0	159.0	148	182	106	176
Cadmium (Cd)	**0.596**	**6.6**	1.6	ND	0.6	2.3	0.434J	0.729	ND	ND
Chromium (Cr)	**37.3**	**370**	30.6	6.9	14.0	12.0	17	16.0	5.89	13.5
Copper (Cu)	**35.7**	**N/A**	-	-	-	32.0	98.4	-	47.9	77.1
Lead (Pb)	**35**	**218**	633	130.0	159.0	123.0	207	236	124	184
Mercury (Hg)	**0.174**	**0.71**	ND	ND	ND	0.1	0.115	0.147	0.0959	0.127
Selenium (Se)	**N/A**	**3**	ND	ND	ND	ND	1.30J	ND	ND	ND
Silver (Ag)	**N/A**	**3.73**	2.40	ND	0.8	ND	0.946	1.41	0.756	0.540
Zinc (Zn)	**123**	**410**	557	160.0	145.0	139.0	178	222	111.0	178

		2003	2004		
LOCATION OF SAMPLE:		Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater	Pullen Creek Rail Yard Headwater
DESCRIPTION OF LOCATION:		(State St.)	(State St.)	(State St.)	(State St.)
DATE OF SAMPLE:		11/21/2003	5/17/2004	8/31/2004	11/15/2004
TYPE OF SAMPLE:		Sediment	Sediment	Sediment	Sediment
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay
LABORATORY SAMPLE ID:		J0311126-08C	40519-16	40902-22	41117-10
DATE RECEIVED:		11/22/2003	5/19/2004	9/2/2004	11/17/2004
DATE ANALYZED		12/8/2003	5/25/2004	9/15/2004	11/19/2004
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG				
Benzene	**0.02**	ND	ND	ND	ND
Ethylbenzene	**5.00**	ND	ND	ND	17.4
Toluene	**4.80**	0.015	ND	ND	ND
m,p-Xylene	**69.00**	0.030	22	25	24.65
o-Xylene	-	-	14	16.6	13.25

This page intentionally left blank

APPENDIX D

Tables D1 –D5
Soil Sampling Results

This page intentionally left blank

Table D1. Results of soil sampling for contaminants at the Pullen Pond site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2004				2015/2016			
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond	Pullen Pond
DATE OF SAMPLE:		11/20/2003	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:		PPS1_N20/03	PPSOM2	PPSOM3	PPSOM4	PPSOM5	PC01SO	PC01SO	PC01SO	PC01SOMS01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-02C	40226-02	40519-06	40902-01	40902-01	1154725006	1156684013	1160540007	1162456016
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/8/2003	4/29/2004	5/26/2004	9/21/2004	12/10/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG									
Arsenic (As)	**1.8**	0.550	3.7	4.4	1.5	14.0	1.64	2.25	ND	ND
Barium (Ba)	**982**	140	367	280.0	105.0	99.0	211	258	209	181.0
Cadmium (Cd)	**4.5**	0.0586	ND	ND	ND	1.5	0.273	ND	ND	ND
Chromium (Cr)	**23**	3.57	7.7	2.4	2.2	7.9	6.23	8.14	4.34	5.47
Copper (Cu)	**460**	-	-	-	-	28.0	39	-	23.0	30.6
Lead (Pb)	**400**	43.0	123.0	90.0	54.6	60.0	136	172	129	143
Mercury (Hg)	**1.24**	0.0692	ND	ND	ND	0.1	0.161	0.167	0.168	0.122
Selenium (Se)	**3**	0.246	ND	ND	ND	ND	ND	ND	ND	ND
Silver (Ag)	**19**	1.09	ND	ND	ND	ND	0.31	0.411	ND	ND
Zinc (Zn)	**8100**	-	85	130.0	49.3	63.0	136	102	72.4	77.2

		2003	2004
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Pullen Pond	Pullen Pond
DATE OF SAMPLE:		11/20/2003	2/23/2004
TYPE OF SAMPLE:		Soil	Soil
SAMPLE ID:		PPS1_N20/03	PPSDB2
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay
LABORATORY SAMPLE ID:		J0311126-02C	40226-04
DATE RECEIVED:		11/22/2003	2/26/2004
DATE ANALYZED		12/2/2003	3/1/2004
CONCENTRATION UNITS:		mg/Kg	mg/Kg
	Soil PRG		
Benzene	**0.02**	ND	ND
Ethylbenzene	**5.00**	0.012	ND
Toluene	**4.80**	ND	0.03
m,p-Xylene	**69.00**	0.05	ND
o-Xylene	-	-	ND

Table D2. Results of soil sampling for contaminants at the Tributary 1 site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2004				2015/2016			
LOCATION OF SAMPLE:		**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**	**Pullen Creek**
DESCRIPTION OF LOCATION:		**Confluence of Tributary One**	**Confluence of Tributary One**	**Confluence of Tributary One**	**Confluence of Tributary One**	**Confluence of Tributary One**	**Confluence of Tributary One**	**Confluence of Tributary One**	**Confluence of Tributary One**
DATE OF SAMPLE:		2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/19/2015	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:		T1SOM2	T1SOM3	T1SOM4	T1SOM5	PC02SO	PC02SO	PC02SO	PC02SOMS01
TESTING LABORATORY		Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		40226-18	40519-19	40902-08	41117-20	1154725009	1156684014	1160540008	1162456017
DATE RECEIVED:		2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		4/29/2004	5/26/2004	6/21/2004	12/10/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG								
Arsenic (As)	**1.8**	20	1.9	7.0	1.4	1.76	1.18	ND	1.47
Barium (Ba)	**982**	452	210.0	408.0	156.0	151	121	71.4	252.0
Cadmium (Cd)	**4.5**	0.9	ND	0.7	1.5	0.348	0.377	ND	0.426
Chromium (Cr)	**23**	13	5.1	6.1	5.4	8.07	7.18	4.24	8.19
Copper (Cu)	**460**	-	-	-	5.9	38.9	-	15.4	39.4
Lead (Pb)	**400**	346	340.0	438.0	18.0	284	310	199	331
Mercury (Hg)	**1.24**	ND	ND	ND	0.0	0.139	0.210	0.153	0.179
Selenium (Se)	**3**	ND	ND	ND	ND	ND	ND	ND	ND
Silver (Ag)	**19**	ND	ND	ND	ND	0.307	0.351	0.378	0.286
Zinc (Zn)	**8100**	317	1800.0	960.0	48.0	209	197	88.2	254

Table D3. Results of soil sampling for contaminants at the Fish Hatchery site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2004				2015/2016		
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Fish Hatchery	Fish Hatchery	Fish Hatchery	Fish Hatchery	Fish Hatchery	Fish Hatchery	Fish Hatchery	Fish Hatchery
DATE OF SAMPLE:		11/20/2003	2/24/2004	5/17/2004	8/31/2004	11/15/2004	11/9/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:		FHS1_N20/03	FHSOM2	FHSOM3	FHSOM4	FHSOM5	PC03SO	PC03SO	PC03SOMS01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-04C	40226-15	40519-23	40902-12	41117-24	1156684015	1160540009	1162456020
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/19/2004	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/8/2003	4/29/2004	5/26/2004	9/21/2004	12/13/2004	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG								
Arsenic (As)	**1.8**	4.27	8.2	3.0	12.0	5.8	6.46	1.82	3.69
Barium (Ba)	**982**	214	653	180.0	302.0	250.0	333	243	423
Cadmium (Cd)	**4.5**	0.627	1.3	ND	5.4	3.4	1.04	0.445	0.882
Chromium (Cr)	**23**	10.4	19.9	6.4	12.0	6.7	11.7	6.17	11.4
Copper (Cu)	**460**	-	-	-	-	115.0	-	51.4	131
Lead (Pb)	**400**	125	1240	620.0	1627.0	592.0	708	234	497.0
Mercury (Hg)	**1.24**	0.129	ND	ND	ND	0.2	0.187	0.0751	0.136
Selenium (Se)	**3**	1.30	ND	ND	ND	ND	ND	ND	ND
Silver (Ag)	**19**	1.42	2.1	ND	5.4	ND	1.16	0.711	0.723
Zinc (Zn)	**8100**	-	673	650.0	2554.0	373.0	364	212	495

		2003
LOCATION OF SAMPLE:		Pullen Creek
DESCRIPTION OF LOCATION:		Fish Hatchery
DATE OF SAMPLE:		11/20/2003
TYPE OF SAMPLE:		Soil
SAMPLE ID:		FHS1_N20/03
TESTING LABORATORY		Analytica, Inc.
LABORATORY SAMPLE ID:		J0311126-04C
DATE RECEIVED:		11/22/2003
DATE ANALYZED		12/8/2003
CONCENTRATION UNITS:		mg/Kg
	Soil PRG	
Benzene	**0.02**	ND
Ethylbenzene	**5.00**	ND
Toluene	**4.80**	ND
m,p-Xylene	**69.00**	ND
o-Xylene	-	-

Table D4. Results of soil sampling for contaminants at the Tributary 2 site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2004				2015/2016			
LOCATION OF SAMPLE:		Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek	Pullen Creek
DESCRIPTION OF LOCATION:		Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two	Confluence of Tributary Two
DATE OF SAMPLE:		11/20/2003	2/23/2004	5/17/2004	8/31/2004	11/15/2004	8/20/2015	11/10/2015	2/2/2016	5/16/2016
TYPE OF SAMPLE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:		T2S1_N20/03	T2SOM2	T2SOM3	T2SOM4	T2SOM5	PC04SO	PC04SO	PC04SO	PC04SOMS01
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		J0311126-06C	40226-07	40519-27	40902-16	41117-16	1154725012	1156684016	1160540010	1162456022
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	9/2/2004	11/19/2004	8/21/2015	11/12/2015	2/5/2016	5/18/2016
DATE ANALYZED		12/8/2003	4/29/2004	5/26/2004	9/21/2004	12/10/2004	8/28/2015	11/19/2015	2/22/2016	5/25-31/2016
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG									
Arsenic (As)	**1.8**	2.58	8.1	2.7	6.1	2.6	2.27	2.49	ND	2.33
Barium (Ba)	**982**	192	1060	290.0	250.0	133.0	151	218	101	201
Cadmium (Cd)	**4.5**	0.700	0.800	ND	ND	2.0	0.343	0.346	ND	0.360
Chromium (Cr)	**23**	8.03	6.2	3.6	7.2	7.9	4.85	3.34	2.28	7.59
Copper (Cu)	**460**	-	-	-	-	9.0	14.7		5.78	17
Lead (Pb)	**400**	123	116	54.0	129.0	33.0	69.2	55.1	34.4	106.0
Mercury (Hg)	**1.24**	ND	ND	ND	ND	0.1	0.06	ND	ND	0.0940
Selenium (Se)	**3**	0.686	ND	ND	ND	ND	0.560J	ND	ND	ND
Silver (Ag)	**19**	0.722	ND	ND	ND	ND	0.143J	ND	ND	ND
Zinc (Zn)	**8100**	-	263	94.0	179.0	109.0	76.1	124	45.2	104

		2003
LOCATION OF SAMPLE:		Pullen Creek
DESCRIPTION OF LOCATION:		Confluence of Tributary Two
DATE OF SAMPLE:		11/20/2003
TYPE OF SAMPLE:		Soil
SAMPLE ID:		T2S1_N20/03
TESTING LABORATORY		Analytica, Inc.
LABORATORY SAMPLE ID:		J0311126-06C
DATE RECEIVED:		11/22/2003
DATE ANALYZED		12/8/2003
CONCENTRATION UNITS:		mg/Kg
	Soil PRG	
Benzene	**0.02**	ND
Ethylbenzene	**5.00**	ND
Toluene	**4.80**	0.027
m,p-Xylene	**69.00**	0.053
o-Xylene	-	-

Table D5. Results of soil sampling for contaminants at the Rail Yard site on Pullen Creek, Skagway, Alaska. Results are compared to Preliminary Remediation Goals (PRG) and exceedances are shown as blue text. The abbreviation ND = no detection of the contaminant.

		2003	2004					
LOCATION OF SAMPLE:		Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard
DESCRIPTION OF LOCATION:		Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)
DATE OF SAMPLE:		11/21/2003	2/24/2004	5/17/2004	5/17/2004	8/31/2004	8/31/2004	11/15/2004
TYPE OF SAMPLE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil
SAMPLE ID:		HWS1_N21/03	HWSOM2	HWSOM3	HWSOM3	HWSOM4	HWSOM4	HWSOM5
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Shoalwater Bay	Edge Analytical
LABORATORY SAMPLE ID:		J0311126-08C	40226-10	40519-14	40519-14 Dup	40902-20	40902-20 Dup	41117-08
DATE RECEIVED:		11/22/2003	2/26/2004	5/19/2004	5/19/2004	9/2/2004	9/2/2004	11/19/2004
DATE ANALYZED		12/8/2003	4/29/2004	5/26/2004	5/26/2004	9/21/2004	9/21/2004	12/10/2004
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG							
Arsenic (As)	**1.8**	4.10	12.90	4.7	4.5	7.6	6.8	5.7
Barium (Ba)	**982**	301	1360	120.0	110.0	344.0	-	318.0
Cadmium (Cd)	**4.5**	0.534	2.8	ND	ND	2.3	2.3	3.5
Chromium (Cr)	**23**	16.7	19.8	11.0	3.7	15.0	15.0	12.0
Copper (Cu)	**460**	-	-	-	-	-	-	49.0
Lead (Pb)	**400**	291	520	740.0	640.0	358.0	-	168.0
Mercury (Hg)	**1.24**	0.193	ND	ND	ND	ND	ND	0.2
Selenium (Se)	**3**	0.655	ND	ND	ND	ND	ND	ND
Silver (Ag)	**19**	1.10	2.60	2.2	2.3	1.9	2.1	ND
Zinc (Zn)	**8100**	-	391	290.0	300.0	320.0	-	127.0

		2015/2016					
LOCATION OF SAMPLE:		Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard	Pullen Creek Rail Yard
DESCRIPTION OF LOCATION:		Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)	Headwater (State St.)
DATE OF SAMPLE:		8/20/2015	11/10/2015	2/2/2016	5/16/2016	5/16/2016	5/16/2016
TYPE OF SAMPLE:		Soil	Soil	Soil	Soil	Soil	Sediment
SAMPLE ID:		PC05SO	PC05SO	PC05SO	PC05SOMS01	PC05SOMS02	PC05SDMS01
TESTING LABORATORY		SGS	SGS	SGS	SGS	SGS	SGS
LABORATORY SAMPLE ID:		1154725014	1156684017	1160540011	1162456023	1162456024	1162456025
DATE RECEIVED:		8/21/2015	11/12/2015	2/5/2016	5/18/2016	5/18/2016	5/18/2016
DATE ANALYZED		8/28/2015	11/19/2015	2/22/2016	5/25-31/2016	5/25-31/2016	5/25-31/2016
CONCENTRATION UNITS:		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
	Soil PRG						
Arsenic (As)	**1.8**	5.63	5.71	ND	3.75	4.86	3.76
Barium (Ba)	**982**	215	233	85.7	220	204	176
Cadmium (Cd)	**4.5**	2.23	2.21	1.40	2.930	2.84	ND
Chromium (Cr)	**23**	29.3	22.6	7.31	16.20	20.3	13.5
Copper (Cu)	**460***	69.3	-	89.9	75	80.5	77.1
Lead (Pb)	**400**	456	438	195	481.0	616	184
Mercury (Hg)	**1.24**	0.577	0.221	0.126	0.437	0.462	0.127
Selenium (Se)	**3**	ND	ND	ND	ND	ND	ND
Silver (Ag)	**19**	2.08	1.96	1.21	2.61	2.91	0.540
Zinc (Zn)	**8100**	483	434	175	565	697	178

		2003	2004
LOCATION OF SAMPLE:		Pullen Creek Rail Yard	Pullen Creek Rail Yard
DESCRIPTION OF LOCATION:		Headwater (State St.)	Headwater (State St.)
DATE OF SAMPLE:		11/21/2003	2/24/2004
TYPE OF SAMPLE:		Soil	Soil
SAMPLE ID:		HWS1_N21/03	HWSDB2
TESTING LABORATORY		Analytica, Inc.	Shoalwater Bay
LABORATORY SAMPLE ID:		J0311126-08C	40226-12
DATE RECEIVED:		11/22/2003	2/26/2004
DATE ANALYZED		12/8/2003	3/1/2004
CONCENTRATION UNITS:		mg/Kg	mg/Kg
	Soil PRG		
Benzene	**0.02**	ND	ND
Ethylbenzene	**5.00**	ND	ND
Toluene	**4.80**	0.015	0.030
m,p-Xylene	**69.00**	0.030	ND
o-Xylene	-	-	0.020

This page intentionally left blank

APPENDIX E

Table E1
Tissue Sampling Results

This page intentionally left blank

Table E1. Results of tissue sampling for contaminants on Pullen Creek, Skagway, Alaska. Results are sorted by functional feeding group (shredders vs. predators), then by site. Nelson Creek was sampled as a reference site. The "bridge" is the footbridge located by Alaska Power and Telephone, Skagway, Alaska. The abbreviation ND = no detection of the contaminant.

LOCATION OF SAMPLE DESCRIPTION OF LOCATION	**Nelson Creek Above Bridge**	**Pullen Creek Pullen Pond**	**Pullen Creek Above Bridge**	**Pullen Creek Pullen Pond**	**Pullen Creek Above Bridge**
DATE OF SAMPLE	5/25/2005	5/23/2005	5/24/2005	5/18/2016	5/18/2016
TYPE OF SAMPLE	Shredders	Shredders	Shredders	Shedders	Shredders
SAMPLE ID:	NSABTM1-S	PCPPTM1-S	PCT1TM1-S	PC01TMSS	PC02TMSS
TESTING LABORATORY	Columbia Analytical	Columbia Analytical	Columbia Analytical	ALS Environmental	ALS Environmental
DATE RECEIVED	6/4/2005	6/4/2005	6/4/2005	5/20/2016	5/20/2016
DATE EXTRACTED	6/17/2005	6/17/2005	6/17/2005	6/22/2016	6/22/2016
CONCENTRATION UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As)	0.8	0.8	1.4	0.289	0.772
Barium (Ba)	315.0	181.0	393.0	85.1	77.0
Cadmium (Cd)	0.5	1.3	1.6	0.247	0.292
Chromium (Cr)	0.8	1.1	1.5	1.26	2.14
Copper (Cu)	10.5	18.0	18.5	4.10	5.00
Lead (Pb)	0.9	9.1	32.9	11.0	13.4
Mercrury (Hg)	-	-	-	0.0089	ND
Selenium (Se)	1.0	2.3	2.2	0.30	0.31
Zinc (Zn)	215.0	421.0	949.0	55.9	81.8

LOCATION OF SAMPLE DESCRIPTION OF LOCATION	**Nelson Creek Above Bridge**	**Pullen Creek Pullen Pond**	**Pullen Creek Pullen Pond**	**Pullen Creek Above Bridge**
DATE OF SAMPLE	5/25/2005	5/23/2005	5/18/2016	5/18/2016
TYPE OF SAMPLE	Predators	Predators	Predators	Predators
SAMPLE ID:	NSABTM1-P	PCPPTMI-P	PC01TMSP	PC02TMSP
TESTING LABORATORY	Columbia Analytical	Columbia Analytical	ALS Environmental	ALS Environmental
DATE RECEIVED	6/4/2005	6/4/2005	5/20/2016	5/20/2016
DATE EXTRACTED	6/17/2005	6/17/2005	6/22/2016	6/22/2016
CONCENTRATION UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic (As)	0.5	0.5	ND	0.134
Barium (Ba)	39.4	23.0	5.69	6.42
Cadmium (Cd)	0.4	0.3	0.0496	0.0915
Chromium (Cr)	0.5	1.9	0.243	0.531
Copper (Cu)	17.5	20.2	3.64	4.48
Lead (Pb)	0.3	2.0	0.648	2.14
Mercury (Hg)	-	-	0.0068	ND
Selenium (Se)	2.3	2.6	0.42	0.30
Zinc (Zn)	375.0	459.0	47.8	24.7