Kenai River Water Quality Monitoring

Multi-Agency Baseline and Metals (Zn/Cu)

V. 2. Updated April 2019
V. 3. Updated April 2020

Original Version Prepared by:
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Prepared for:
STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Water
Water Quality Standards and Restoration

A1. Title and Approval Page

Title: Kenai River Water Quality Monitoring: Multi-Agency Baseline and Metals

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ACKNOWLEDGEMENTS

This document was originally developed by the Kenai Watershed Forum and was modeled and adapted, with permission, from Quality Assurance Project Plans (QAPP) produced by the Cook Inlet Keeper of Homer, Alaska. Portions of the Cook Inlet Keeper QAPP were adapted from similar plans developed by The Friends of Casco Bay (Maine) and Texas Watch. The United States Environmental Protection Agency (EPA), the Alaska Department of Environmental Conservation (ADEC), the United States Geological Survey (USGS), and the National Marine Fisheries Service / Auke Bay Laboratory (NMFS / ABL) also provided guidance and cooperation in helping both the Cook Inlet Keeper and the Kenai Watershed Forum develop and refine their QAPP.

A3. DISTRIBUTION LIST:

Signees (Project Manager, Project QA Officer, ADEC Project Manager and ADEC QA Officer) shall receive a copy of the QAPP and subsequent revisions. Offers for official copies of this QAPP and any subsequent revisions will be extended to individuals on the Distribution List.

Table 1. Distribution List

NAME	POSITION	AGENCY	DIVISION/BRANCH	CONTACT INFORMATION
Margaret Harings	Project Manager, QA Officer	KWF		(907) 260-5449 ext. 1207 maggie@kenaiwatershed.org
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Copies of this Quality Assurance Project Plan will be made available. Interested parties may request a digital copy from ADEC or KWF, or purchase a copy for the cost of production and shipping by writing the Kenai Watershed Forum, 44129 Sterling Highway, Soldotna, AK 99669 (907) 260-5449, www.kenaiwatershed.org.

A4. PROJECT / TASK ORGANIZATION

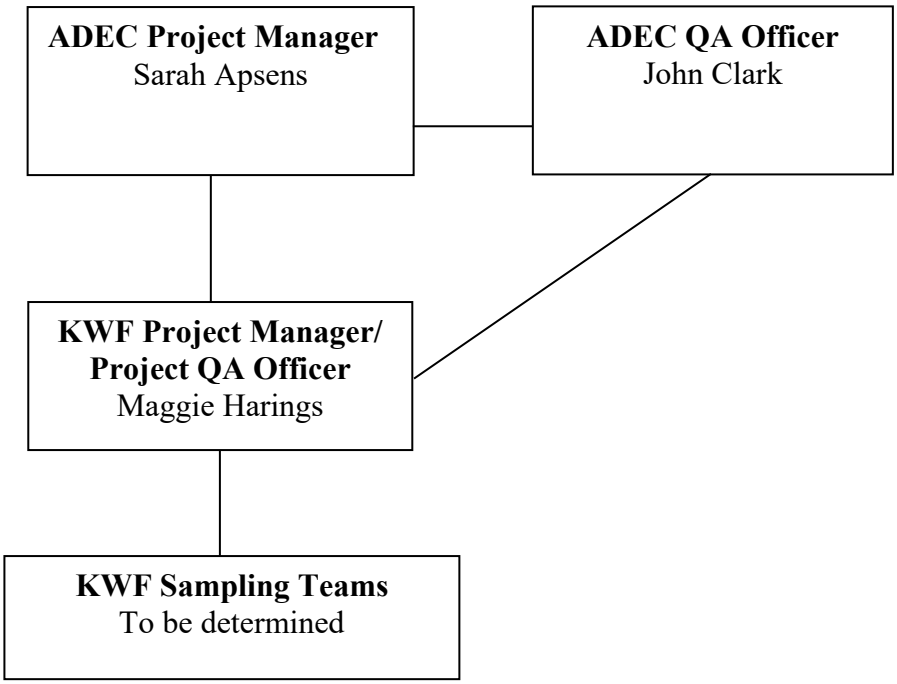

Figure 1. Project Management Organization

Key Contacts and Responsibilities

Sarah Apsens - ADEC Project Manager. Ms. Apsens will oversee the project for DEC, provide technical support, QAPP review, review of any proposed sampling plan modifications, and the review of all reports.

John Clark - ADEC Division of Water QA Officer. Mr. Clark will be responsible for the review/approval of the QAPP and oversight of QA activities ensuring collected data meets project's stated data quality goals. He will work with the ADEC project manager to provide recommendations and requirements to the contracting Project Manager.

Maggie Harings - Kenai Watershed Forum - Project Manager- Oversees the water quality monitoring efforts and projects conducted by the Kenai Watershed Forum. Provides and/or ensures adequate training is completed for each of the team members conducting water quality monitoring throughout the project. Has completed training in each of the monitoring elements outlined in the plan. Project Quality Assurance Officer - Supervises and trains water quality monitors. She is trained in Agency Baseline Sampling protocols. She is responsible for overall supervision of quality assurance and data entry.

Key Contacts and Personnel Continued:

Justin Nelson **-** SGS Environmental Laboratory Services (SGS) - Subcontractor for Kenai River Water Quality Assessment element of the project. Provides training of Agency Staff for data collection and oversees all analyses to be performed at SGS. This contract will be used to ensure proper sampling and analysis of water for 25 Kenai River Watershed sites to determine the water quality within the Kenai River Watershed.

James Trissel - City of Soldotna Wastewater Treatment Plant operator plays a significant role in the Kenai River Water Quality Assessment. Will work cooperatively with the Project QA Officer and will perform a variety of water quality analysis for the Kenai Watershed Forum.

Technical Advisory Committee - The technical advisory committee will review results obtained from the monitoring effort on an annual basis. The committee may at any time ask for additional information on any aspect of the project. If monitoring data raises a particular concern, the advisory committee will be asked to suggest and review any changes to the monitoring plan. KWF will not be bound to implement any changes, but will give serious consideration to their input and will follow the committee's wishes if feasible.

Field Monitoring Staff - Monitoring staff collect samples for the Kenai River Watershed Monitoring program. Monitoring staff are provided by the following Agencies/Organizations; Kenai Peninsula Borough, U.S. Fish and Wildlife Service, U.S. Forest Service, Alaska Department of Fish and Game, Alaska Department of Natural Resources, Alaska Department of Environmental Conservation, Cook Inlet Aquaculture Association. The Kenai Watershed Forum and any volunteers under direct supervision of Kenai Watershed Forum monitoring staff.

A5. PROBLEM DEFINITION/BACKGROUND AND PROJECT OBJECTIVE/S

The Kenai Watershed Forum's (KWF) water quality program is designed *to document the existing and changing conditions of water quality within the Kenai River Watershed by developing and maintaining baseline information*. It is the intent of the program to first identify and then address a wide range of activities that may contribute to nonpoint source pollution in the Kenai River Watershed. The baseline water-quality monitoring program is consistent with the recommendation 4.5.10.2.2 in the ***Kenai River Comprehensive Management Plan*** *(*see Appendix K*).* This recommendation was developed for Alaska State Parks and the ***Upper Kenai River Cooperative Plan*** *(see* Appendix K*)* as a partnership between Alaska State Parks, U.S. Fish and Wildlife Service and the U.S. Forest Service, Chugach National Forest. The State of Alaska does not currently operate a statewide ambient monitoring network due to the high operating costs to maintain such a system over large undeveloped areas. Historically, on the Kenai Peninsula There have been several water quality analyses conducted by the ADEC and ADF&G in the early 1990's *(see* Appendix K*).* Although these studies indicated that measured water quality parameters were within state and federal compliance standards, *impacts of development and recreational use were evident.* The ADF&G analyzed water quality monitoring at 17 sites located between the outlet of Kenai Lake and Cook Inlet in 1990/91. The ADF&G study recommended the continued sampling of critical water quality parameters (fecal coliform, hydrocarbon, metals, and nutrients) for the purpose of monitoring future impacts on the Kenai River. Representative sites were selected with the suggestion that they be monitored at least twice a year. It was also suggested that more intensive sampling be conducted in the Lower Kenai River, where concentrations of water quality contaminants were the highest priority and of greatest concern.

This type of baseline-monitoring program is needed to link the status and trends to an understanding of the natural and human factors that affect the water quality. The program is also necessary since many of the enforceable parameters rely on background or natural conditions. Without long-term data collection, it is impossible to know what the appropriate standards of enforcement are. This program must be integrated among many agencies that have differing objectives and must be long-term. The unique hydrologic features of the Kenai River, such as its glacier origin and two large lake systems, require an investigation that is designed to assess this watershed. However, the monitoring program must also be consistent with standard sampling and analysis protocols. This effort addresses these needs and implements methods to monitor changes to the Kenai River as the local population and recreational use increase. For more detailed information, see McCard, J.J. 2007, Water Quality Assessment of the Kenai River Watershed from July 2000 to July 2006, Kenai Watershed Forum internal publication.

A6. PROJECT / TASK DESCRIPTION

There are three project elements of the Kenai River Watershed Forum's Water Quality Monitoring Program described in this QAPP; A) Agency Baseline Monitoring Partnership. In V. 3. of this document the following elements were removed as they are not currently being conducted: 1) Collection of specified interval data with programmable Electronic Instruments, and 2) Stream Temperature Monitoring.

Continuous monitoring with electronic instruments was conducted by KWF in 2008 through 2012 on the lower Kenai River. Data was summarized in KWF 2012. Temperature monitoring was conducted in tributaries of the Kenai River by Cook Inlet Keeper (CIK) 2008 through 2012. Monitoring results were summarized in a series of working reports (CIK, 2009, 2010, 2012), and a synthesis report (CIK 2013). Detailed information about electronic instruments and stream temperature monitoring can be found in earlier versions of this QAPP (v.1 and v.2). Calibration information for the electronic instruments and temperatures monitors were retained in this version of the QAPP and can be found in the Appendices. Copies of the reports are available from DEC. These elements may be added to this QAPP in the future if needed.

In 2018, a zinc and copper monitoring project was added to the KWF Water Quality Monitoring Program (Task B). This Alaska Clean Waters Action (ACWA) grant funded project was designed to monitor copper and zinc levels in key locations on the Kenai River and its tributaries. This element was added in response to an observed increase in zinc and copper levels between 2014 and 2016 (KWF 2017, See Appendix K). This project is scheduled to occur in 2019 and 2020.

Task A) Agency Monitoring Partnership to develop a baseline for Nutrients, Dissolved Metals, Hydrocarbons, and Fecal Coliforms (Referred to as Agency Baseline hereafter).

Narrative Task Description

Work with the Kenai River Special Management Area Board and the agencies represented on that board to conduct sampling with the help of a professional environmental contractor.

Objectives:

- Develop a baseline data set to include, at a minimum, dissolved metals, hydrocarbons, and fecal coliforms,
- Work with the City of Soldotna to supplement this data with parameters that Soldotna's wastewater treatment plant can analyze. (i.e. – total suspended solids, pH, fecal coliforms, turbidity and specific conductance, etc.),
- Near concurrent sample collection at 25 sites located on the Kenai River main stem and tributaries throughout the Kenai River Watershed using federal, state and local agency personnel (See Table 6 for a narrative description of the 25sample sites),
- Attain high quality data by using a professional lab certified by ADEC for drinking water analysis,
- Sample each of the 25 sites at least 2 times per year as financial resources allow.

Data Collection

- Surface water quality parameters include; total metals, dissolved metals, petroleum hydrocarbons, fecal coliform, turbidity, specific conductance, temperature, nutrients,
- Physical parameters include; weather conditions, boat traffic, and air temperature

Schedule

- Data collection will occur in spring (April/May) and summer (July/August).

Task B) Evaluate dissolved metal (Zinc and Copper) concentrations

Narrative Task Description:

Assess zinc, copper and hardness levels in the Kenai River mainstem and key tributaries to determine spatiotemporal variations.

Objectives:

- Collect metals data at four Kenai River tributaries and four main stem sites to elucidate potential water quality standard exceedances for dissolved metals.
- Identify sources of zinc and copper within the Kenai River watershed.
- Develop a GIS database of potential sources of dissolved metals in the Kenai River watershed.

Data Collection:

- Collect water samples at four tributaries and three main stem Kenai River sites and analyze for copper and zinc. Tributary sites include: Slikok Creek, Moose River, Non-Name Creek, and Soldotna Creek. Main stem sites include: River Mile (RM) 19, RM 50, RM 70.

- Simultaneously collect water samples for hardness (calcium and magnesium) at the four tributary and three main stem Kenai River sites.
- Conduct a georeferenced photographic reconnaissance mission on key tributaries and main stream sites to identify potential sources of dissolved metals

Schedule:

- Sampling will occur twice per year during ice-free months. Sampling for metals and hardness will occur simultaneously
- Sampling will occur once in spring (May) and once in summer (July/August), in close temporal proximity to the multi-agency baseline monitoring sampling.

A7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT OF DATA

Data Quality Objectives (DQOs) for this program have been established to ensure that the data meets its overall objectives as described in A6, above – establishing a basic water quality inventory and detecting significant changes and trends. Tables 1 through 4 show objectives for detectability, precision and accuracy for each parameter tested by all possible methods used by both the Agency Baseline. DQOs are also included for automated multiprobes for general reference and potential future monitoring . In each case the sampling matrix is the water body of interest. Table 5 shows the objectives for the Stream Temperature monitoring. Objectives for precision, accuracy, representativeness, comparability and completeness are also summarized below. Project DQOs may be revised in the future if funding becomes available for additional training and equipment or if the project manager determines that different objectives would be more effective in meeting program objectives. Any changes in DQOs will be submitted to USEPA and ADEC for approval before implementation.

Table 2. Data Quality Objectives for Electronic Instruments

PARAMETER	METHOD/RANGE	UNITS	SENSITIVITY	PRECISION	ACCURACY
pH	SM H^+ B-2000, Hydrolab pH probe on Minisonde 0-14	Standard pH units	0.01 units	±0.2 units	±0.2 units
Turbidity	ISO 7027, Self Cleaning Turbidity Hydrolab Minisonde 5 0-3000 NTU	Nephelometric Turbidity Units (NTU)	0.1 0-400 NTU 1.0 400-3000 NTU	±5 NTU	±5% 0-100 NTU ±5% 100-400 NTU ±5% 400-3000 NTU
Turbidity (Soldotna Lab)	EPA 180.1 Rev 2.0, Hach 2100 P 0-1000 NTU	Nephelometric Turbidity Units	0.010-9.99 NTU 0.1 10-100 NTU 1 100-1000 NTU	±5 NTU	±5% 0-500 NTU ±5% 500-1000 NTU
Water Temperature	SM 2550 B-2000, YSI Model 30, 55, and 95 -5 to 95, -5 to +45, and -5 to +45	Degrees Celsius (C)	0.1, 0.2, and 0.1	±0.1, ±0.2, and ±0.2	±0.1, ±0.2, and ±0.2 C
Conductance	EPA 120.1, Hydrolab probe on Minesonde 0-100 mS/cm	Micro-Siemens/cm (µS/cm) (converted to 25 C)	4 digits	±0.001 units	2% full Scale
Dissolved Oxygen	SM 4500 O C-2000, Micro Winkler Titration 0 to 20 mg/L	Milligrams per liter (mg/L)	0.1 mg/L	±0.9 mg/L	±0.3 mg/L
Dissolved Oxygen (Winkler used for calibration)	ASTM D888-09 (A), Hydrolab LDO probe on Minisonde 0 to 50 mg/L	Milligrams per liter (mg/L)	0.01 mg/L	NA	±0.2 mg/L

Table 3. Data Quality Objectives for Hydrocarbons Collected for Agency Baseline (Supplied by SGS)

PARAMETER	METHOD / RANGE	Sensitivity (MDL)	PQL	OVERALL PROJECT PRECISION	ACCURACY
Gasoline Range Organics (GRO)	AK101 by GCFID: 25-1,000,000,000	3.0 µg/L	5x MDL	20%	Calibration: ±25% Recovery: 60-120%
Diesel Range Organics (DRO)	AK102 by GCFID: 50-1,000,000	0.0065 mg/L	0.11 mg/L	20%	Calibration: ±25% Recovery: ±25%
Residual Range Organics (RRO)	AK103 by GCFID: 500-1,000,000	0.22 mg/L	0.54 mg/L	20%	Calibration: 75-105% Recovery: 60-120%
Benzene	EPA 602 by GC/PID: 1-1,000,000,000	0.074 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Ethylbenzene	EPA 602 by GC/PID: 1-1,000,000,000	0..088 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Toluene	EPA 602 by GC/PID: 1-1,000,000,000	0.078 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
m,p-Xylene (total)	EPA 602 by GC/PID: 1-1,000,000,000	0.20 µg/L	2.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
o-Xylene	EPA 602 by GC/PID: 1-1,000,000,000	0.20 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Xylenes (total)	EPA 602 by GC/PID: 1-1,000,000,000	0.82 µg/L	3.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Bromofluorobenzene (surrogate)	EPA 602 by GCPID	0.12 µg/L	0.50 µg/L	20%	Calibration: ±15% Recovery: ±30%

GCFID, gas chromatograph flame ionization detector
GCPID, gas chromatograph photo ionization detector
PQL, practical quantification limit
µg/L, micrograms per liter (parts per billion)
mg/L, milligrams per liter (parts per million)

Table 2. Continued.

PARAMETER	METHOD / RANGE	Sensitivity (MDL)	PQL	OVERALL PROJECT PRECISION	ACCURACY
Benzene	EPA 624	0.12 µg/L	0.40 µg/L	20%	±20.5%
Ethylbenzene	EPA 624	0.31 µg/L	1.0 µg/L	20%	±21%
Toluene	EPA 624	0.31 µg/L	1.0 µg/L	20%	±20.5%
m,p-Xylene (total)	EPA 624	0.620 µg/L	2.0 µg/L	20%	±20.5%
o-Xylene	EPA 624	0.31 µg/L	1.0 µg/L	20%	±22%
1,2-Dichloroethane-D4 (surrogate)	EPA 624				±18.5%
4-Bromofluorobenzene (surrogate)	EPA 624				±14.4%
Toluene D-8 (surrogate)	EPA 624				±11.5%

Table 4. Data Quality Objectives for Metals Collected for Agency Baseline (Supplied by SGS)

PARAMETER	METHOD	SENSITIVITY (MDL)	PQL	OVERALL PROJECT PRECISION	ACCURACY
Hardness	Calculated from Ca, total and Mg, total as $CaCO_3$ + $MgCO_3$				
Calcium, total	EPA 200.7	1.0 mg/L	4.0 mg/L	≤ 20 RPD	±21 % LCS
Iron, total	EPA 200.7	2.0 mg/L	8.0 mg/L	≤ 20 RPD	±49.5 % LCS
Magnesium, total	EPA 200.7	0.2 mg/L	2.0mg/L	≤ 20 RPD	±27 % LCS
Arsenic, dissolved	EPA 200.8	1.5 µg/L	5.0 µg/L	≤ 20 RPD	±15 % LFB
Cadmium, dissolved	EPA 200.8	0.15 µg/L	0.50 µg/L	≤ 20 RPD	±15 % LFB
Chromium, dissolved	EPA 200.8	0.78 µg/L	2.0 µg/L	≤ 20 RPD	±15 % LFB
Copper, dissolved	EPA 200.8	0.031µg/L	1.0 µg/L	≤ 20 RPD	±15 % LFB
Lead, dissolved	EPA 200.8	0.06 µg/L	0.2 µg/L	≤ 20 RPD	±15 % LFB
Zinc, dissolved	EPA 200.8	3.1 µg/L	10.0 µg/L	≤ 20 RPD	±15 % LFB

MDL, method detection limit
PQL, practical quantification limit
LCS, laboratory control sample
LFB, laboratory fortified blank
mg/L, milligrams per liter (ppm)
µg/L, micrograms per liter (ppb)
RPD, relative percent difference

Table 5. Data Quality Objectives for Nutrients, Fecal Coliform, and Total Suspended Solids (Supplied by Analytica Group F.C., and SGS)

PARAMETER	METHOD	SENSITIVITY (MDL)	PQL	OVERALL PROJECT PRECISION	ACCURACY
Phosphorous, total	SM21 4500-P-B,E	0.01 mg/L	0.02 mg/L	≤ 25 RPD	±25 % LFB
Nitrates (NO_2 + NO_3)	SM21 4500-NO3-F	0.05 mg/L	0.20 mg/L	≤ 25 RPD	±10 % LCS
Suspended solids, total	SM21-2540-+D	0.31 mg/L	1.0 mg/L	≤5 RPD	±25 %
Fecal coliform	SM 9222D-1997 – membrane filtration	1.0 cfu/100 ml	1.0 cfu/100 ml	**	**

MDL, method detection limit
PQL, practical quantification limit
mg/L, milligrams per liter (ppm)
cfu/100 ml, colony forming units per 100 milliliters
RPD, relative percent difference
LFB, laboratory fortified blank
LCS, laboratory control sample
* depends on dilution: filter 100 ml, <1/0; filter 50 ml, <2
** control checks of sterility, temperature

Table 6. Data Quality Objectives for Stream Temperature Monitoring (From Cook InletKeeper)

PARAMETER	METHOD	RESOLUTION/LIMIT (°C)	EXPECTED RANGE(°C)	ACCURACY	PRECISION	COMPLETENESS
AIR TEMPERATURE	SM 2550 B-2000, HOBO TIDBIT V2	0.16	-5 TO 37	± 0.2°C	±0.4C	90%
WATER TEMPERATURE	HOBO WATER TEMP PROV2	0.02	0 TO 50	±0.2 @ 0 TO 50°C	±0.4C	90%

Detectability is the ability of the method to reliably measure a pollutant concentration above background. ADEC DOW uses two components to define detectability: method detection limit (MDL) and practical quantification limit (PQL) or reporting limit (RL).

- The MDL is the minimum value which the instrument can discern above background but no certainty to the accuracy of the measured value. For field measurements the manufacturer's listed instrument detection limit (IDL) can be used.
- The PQL or RL is the minimum value that can be reported with confidence (usually some multiple of the MDL).

Note: The measurement method of choice should at a minimum have a practical quantification limit or reporting limit 3 times more sensitive than the respective ADEC WQS and/or permitted pollutant level (for permitted facilities).

Sample data measured below the MDL is reported as ND or non-detect. Sample data measured ≥ MDL but ≤ PQL or RL is reported as estimated data. Sample data measured above the PQL or RL is reported as reliable data unless otherwise qualified per the specific sample analysis.

Precision

Precision is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of methods. It applies to analytical lab techniques and field replicates. Precision is expressed in terms of the relative percent difference (RPD) between two measurements (A and B).

For field measurements, precision is assessed by measuring replicate (paired) samples at the same locations and as soon as possible to limit temporal variance in sample results. Field and laboratory precision is measured by collecting blind (to the laboratory) field replicate or duplicate samples. For paired and small data sets project precision is calculated using the following formula:

$$RPD = \frac{A - B * 100}{(A + B)/2}$$

For larger sets of paired precision data sets (e.g. overall project precision) or multiple replicate precision data, use the following formula:

$$RSD = 100 * (\frac{Standard\ Deviation}{Mean})$$

Replicate samples will be taken as described in section B5. Goals for precision are described for each element of the monitoring effort in Tables 1 through 5.

Accuracy

Accuracy is a measure of confidence that describes how close a measurement is to its "true" value. Methods to determine and assess accuracy of field and laboratory measurements include, instrument calibrations, various types of QC checks (e.g., sample split measurements, sample spike recoveries, matrix spike duplicates, continuing calibration verification checks, internal standards, sample blank measurements (field and lab blanks), external standards), performance audit samples (DMRQA, blind Water Supply or Water

Pollution PE samples from A2LA certified, etc. Accuracy is usually assessed using the following formula:

$$Accuracy = \frac{Measured\ Value}{True\ Value} * 100$$

Representativeness

Representativeness is the extent to which measurements actually represent the true environmental condition. Representativeness will not be routinely monitored throughout the project, but is incorporated when necessary in interpreting the data. It is obvious that water flowing past a given location on land or in the water column, particularly in the Kenai River, is constantly changing in response to dynamic inflow, tidal cycle, weather, etc. Regular periodic collection of data from any given location can help develop a better understanding of the variance associated with time series measurements of selected environmental variables. Representativeness for any given location, area, and region within the Kenai River Watershed will be more defined as historical water data is collected and compared at each site over time.

Comparability

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling, analytical methods and units of reporting with comparable sensitivity helps ensure comparability. The Kenai Watershed Forum has selected testing methods that are EPA-approved and/or currently being employed by other water quality monitoring programs throughout the country. All monitors are trained to follow the same standard protocol for each parameter within the respective monitoring elements described in this document. As the program expands, site selection will favor locations where previous water quality monitoring has taken place. Efforts will be made to duplicate the effort of past studies where possible.

Completeness

Completeness is the comparison between the amount of usable data collected versus the amount of data called for in the sampling plan. Completeness is measured as the percentage of total samples collected and analyzed as a whole and for individual parameters and sites as compared to the goals set out by the project design. We can measure completeness by two mechanisms: 1) the primary number of samples collected divided by the useable number of samples submitted to ADEC with a goal of 85% completeness and, 2) a secondary completeness measured by the planned number of samples divided by the useable samples with a goal of 60%.

$$\frac{T - (I + NC)}{Completeness} * (100\%) = T$$

Where T = Total number of expected measurements

I = Number of invalid results

NC = Number of results not produced (e.g., spilled sample, etc.) or rejected during data validation.

A8. TRAINING REQUIREMENTS

Agency Baseline monitoring

Training workshops are held for all monitors from the various agencies on how to collect water samples and secure them for transportation to the Soldotna Wastewater Treatment Plant. Training sessions occur the day preceding each sampling event (See Appendix B, Agency Baseline Monitoring Procedures). Monitors are also instructed on how to complete the Agency Baseline Field Data Sheet (Appendix C*)* to provide added information on sample conditions at the site. Training is performed by SGS staff and/or the KWF QA Officer. The KWF QA Officer will conduct an audit of 10% of the agency monitors to ensure they are following proper sampling procedures and data sheets are completed correctly. Both the KWF QA Officer and SGS staff will be available to aid by cell phone during the sampling period. The ADEC QA Officer is available for questions. When samples are brought to the Soldotna Wastewater Treatment Plant, we will review their sampling procedure and data collection to insure completeness and accuracy. A standard chain of custody form supplied by SGS is used to track the samples from the field to the lab. All training workshops are documented by the KWF QA Officer and stored in digital and hardcopy versions at the KWF office for no less than 10 years.

Kenai Tributary Metals (Zn/Cu) Monitoring
Personnel participating in metals sampling will receive instruction from the KWF Program Manager/QA Officer prior to conducting field work. Monitors are instructed on how to complete the Metals Monitoring field sheet (Appendix C). The KWF Project QA officer is responsible for a 10% audit of the monitors. The ADEC QA Officer is available for questions. A standard chain of custody form supplied by SGS is used to track the samples from the field to the lab. All trainings and workshops are documented by the KWF Project QA officer and stored in digital hardcopy versions at the KEF office for no less than 5 years.

A9. DOCUMENTATION AND RECORDS

The field logbook will be a 3-ring binder containing individual field forms and chain-of-custody forms. Please see Forms 6.2 and 6.3 of Appendix C for examples of these documents.

All field activities and observations will be noted during fieldwork. The descriptions will be clearly written with enough detail so that participants can reconstruct events later if necessary. Field logs and data sheets will describe any changes that occur at the site, in particular, personnel and responsibilities or deviations from the QAPP as well as the reasons for the changes. Requirements for entries will include the following:

- Entries will be made legibly with black (or dark) waterproof ink.
- Corrections will be made by drawing a single line through the original entry allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.
- Unbiased, accurate language will be used.

- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself). Each consecutive day's first entry will be made on a new, blank page.
- The date and time, will appear on each page.
- Names of person(s) conducting the monitoring will be recorded on each data sheet.

Agency Baseline
All data gathered in the field will be recorded on site at the time sampling occurs using the Agency Baseline Field Data Sheet (Appendix C). This form is then returned to the Soldotna Wastewater Treatment Plant, along with the water samples collected in the field, where the Project QA Officer and the Project Manager check the data as described in sections B9 & B10 of this plan. The Project Manager enters data into a computer database after the Project QA officer has approved them for entry. Original copies of all data sheets are kept on file at the Kenai Watershed Forum office indefinitely.

Results for parameters analyzed at the Soldotna Wastewater Treatment Plant on the sampling event day will be recorded on the Agency Baseline Lab Test Results form (Appendix D). SGS will provide results from their analyses on their data sheets. Sample analytical results will include all method, SOP and QAPP required quality control sample results including their acceptance criteria limits in order for project staff and ADEC to perform tertiary data validation/verification of analytical results. All data will be entered into the KWF database which is accessible in-house.

Hard copies of all data sheets will be kept at the KWF office for 10 years and at SGS lab for 5 years.

Kenai Metals (Zn/Cu) Monitoring
All data gathered in the field will be recoded on the site at the time of sapling using the field data sheet (Appendix C). The field data forms will be reviewed by the KWF Project Manager/QA Officer. The Project Manager will enter field data and results from SGS into an ADEC provided data template (AWQMS) after data has passed the QA check. Hard copies of data sheets will be kept at the KWF office for 5 years.

B1. SAMPLING PROCESS DESIGN

Agency Baseline
In order to obtain useful baseline inventory and monitoring information as described in Section A5 (Problem Definition/Background), it is critical to select sampling sites that are representative of the various hydrologic, geographic, biologic, land use, and other conditions within the watershed. Because of the variability and distribution of human population densities in the Kenai River Watershed, site selection should ensure a balance between more impacted and less impacted areas. Finally, to maintain agency involvement, it is important to select monitoring sites in which agency monitors can work and fund the project within the area that is managed by their particular agency.

Applying the above criteria, the Kenai Watershed Forum has established 25 sites along the Kenai River and several of its tributaries. Sites were also selected based on a previous water-quality monitoring project performed by the Alaska Department of Fish and Game in 1990.

Each site is given a name and identified by river mile and a location description, as well as by its latitude, longitude and elevation as determined using USGS 1:63,360 scale topographical maps and on site GPS readings. See Table 6 for Agency Baseline sampling locations. Site selection for future monitoring within the basin will be based on similar factors.

As described in Section A6 (Project Objectives/Task Description), testing parameters are selected based on their usefulness in inventorying water quality and projecting the general "health" of the water bodies in question.

Surface water grab samples will be taken at all 25 stations during July/August when the river is heavily used and is at high flow and then again during April/May breakup when the river is at low flow. The sampling for the Kenai River Metals Monitoring project will occur 2019-2020 once during the spring and again during mid-summer when the river is experiencing heavy use.

Agencies that have received training and are supplying staff to conduct monitoring include:

- Alaska Department of Natural Resources
- Alaska Department of Fish and Game
- Alaska Department of Environmental Conservation
- U.S. Fish and Wildlife Service
- City of Kenai
- City of Soldotna
- U.S Forest Service
- Kenai Peninsula Borough
- Cook Inlet Aquaculture Association

The 25sampling stations where water samples will be taken were selected by first incorporating the 17 sites used during the ADF&G 1990/91 Water Quality study with the addition of four additional sites in the estuary portion of the river and Juneau Creek. The selected sites with GPS coordinates are listed in Table 6.

Metals (Cu/Zn) Monitoring

The Kenai River Metals specific sites were selected based historic levels of copper and zinc as well as their differing proximity to anthropogenic influences. The Skilak Lake and Jims Landing were chosen as they are located upstream of anthropogenic influences in the Kenai River watershed and will provide relative background levels for the Kenai River main stem.

Table 7. Sampling Locations for Agency Baseline and Kenai Metals (Cu/Zn) Monitoring

KENAI RIVER STATIONS	RIVER MILE	LATITUDE	LONGITUDE
City of Kenai Boat Dock	1.5	60.543680	-151.222940
Cunningham Park	6.5	60.540810	-151.182780
Upstream of Beaver Creek Mouth	10.1	60.539279	-151.142263
The Pillars Park	12.5	60.533743	-151.099258
Poacher's Cove	18	60.502005	-151.106973
Soldotna Bridge	21	60.476634	-151.082099
Swiftwater Park	23	60.480338	-151.030847
Morgan's Landing	31	60.498284	-150.863121
Bing's Landing	40	60.515441	-150.702069
Upstream of Dow Island	43	60.489844	-150.636905
Skilak Lake Outflow	50	60.467517	-150.507789
Jim's Landing	70	60.481392	-150.115020
Kenai Lake Bridge	82	60.49200	-149.81087
TRIBUTARY STATIONS			
"No Name" Creek	0	60.550888	-151.268417
Beaver Creek	10	60.548029	-151.143240
Slikok Creek	19	60.482318	-151.127053
Soldotna Creek	22	60.483364	-151.057656
Funny River	30	60.489963	-150.860982
Moose River	36	60.536870	-150.754724
Killey River	44	60.481518	-150.632498
Russian River	74	60.484622	-149.993955
Juneau Creek	79.5	60.489	-149.877
TRIBUTARY STATIONS (ZINC AND COPPER)			
“No Name” Creek Tributary	0	60.5783	-151.2680
Beaver Creek Tributary	10	60.6409157	-150.0843424
Slikok Creek Confluence (Mainstem)	19	60.482307	-151.126077
Slikok Creek Tributary	19	60.4019	-151.148
Soldotna Creek Tributary	22	60.551328	-150.959186
Skilak Lake Outlet (Mainstem)	50	60.468253	-150.509082
Jims Landing (Mainstem)	70	60.481351	150.115484

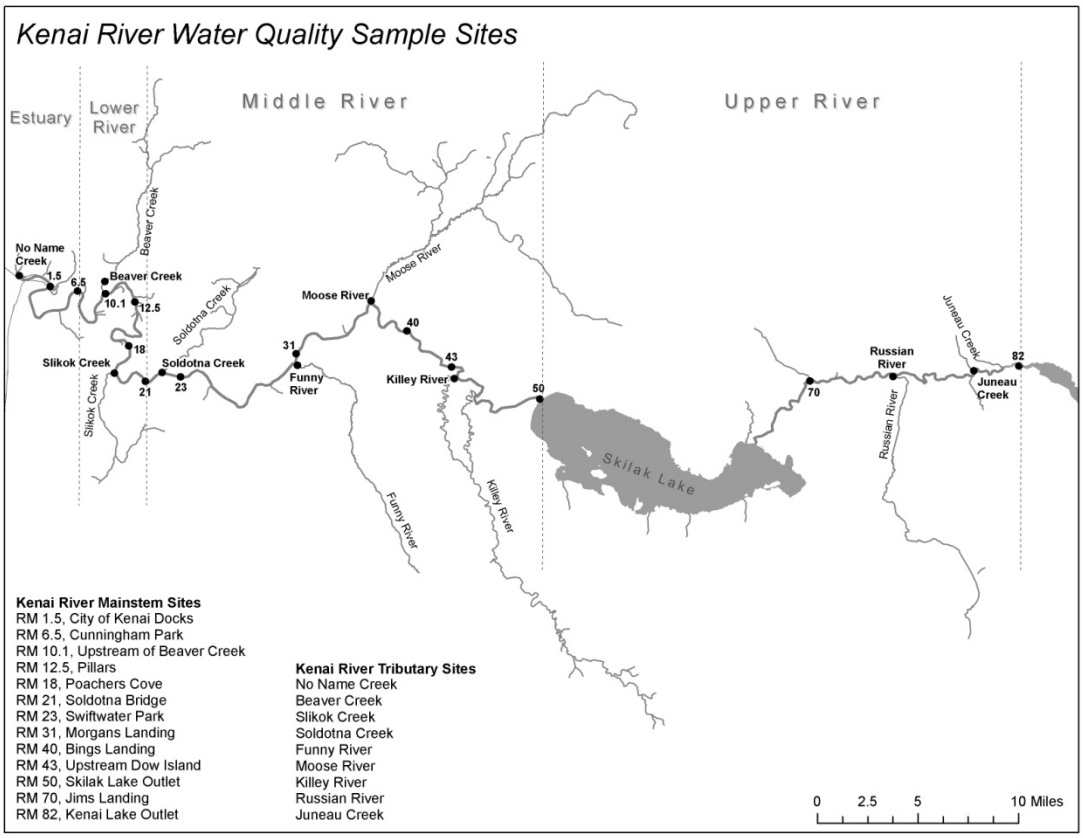

Figure 2. Map of the multi-agency baseline sample locations and the Kenai River watershed.

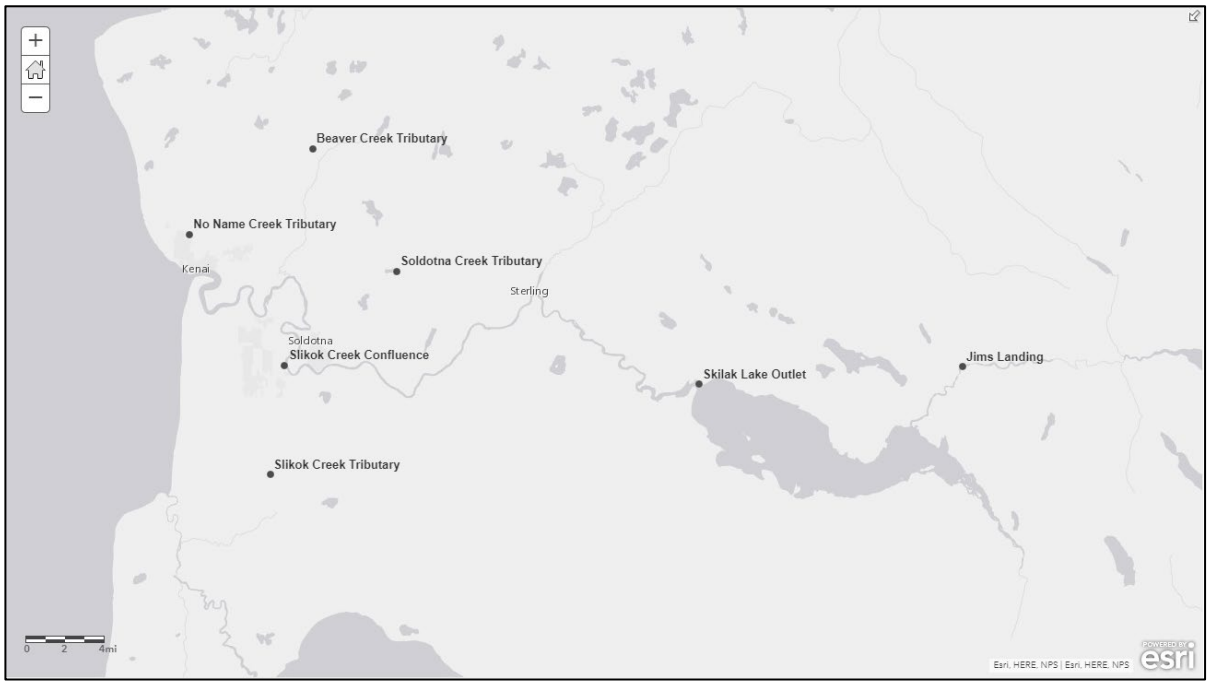

Figure 3. Map of the Kenai tributaries and mainstem metals monitoring project.

The City of Soldotna Wastewater Treatment Plant has the capability and equipment to test the following parameters and will do so as time allows and staffs are available and willing to donate time:

- ❖ Turbidity
- ❖ Conductivity
- ❖ pH
- ❖ Total Suspended Solids
- ❖ Fecal Coliform

SGS will be under contract for a more intensive analysis of water quality parameters including:

- ◊ Hydrocarbons
- ◊ Trace Metals
- ◊ Total Phosphorous
- ◊ Nitrates
- ◊ Fecal Coliform (when the City of Soldotna cannot provide this analysis)

Agency representatives receive training on sampling techniques directly from the SGS and the KWF Quality Assurance Officer on the day prior to sampling. Each team receiving training will be assigned from 1 to 5 sites to collect multiple water samples. These samples will be taken directly to the City of Soldotna Wastewater Treatment for partial analysis within the capacity of the Soldotna Wastewater treatment plant. Remaining samples will be sent to SGS for the more specific analysis as described above. For the zinc and copper-specific sampling events throughout 2019-2020, all samples will be shipped directly to SGS.

B2 SAMPLING METHODS REQUIREMENTS

Agency Baseline

The Project QA Officer is responsible for making sure written instructions are provided to each of the monitoring teams during the training that occurs on the day prior to sampling. Sample containers with unique sample numbers will be provided to the sampling teams. These containers are to be filled following the aforementioned instruction sheet. Collection techniques will be demonstrated and monitors will be able to practice sampling under the supervision of the project QA Officer on the day prior to collection. Agency Baseline Monitoring Procedures are included in Appendix B.

Surface water samples will be taken at all 25 stations during July when the river is heavily used and is at high flow and then again during April breakup when the river is at low flow. Monitors will face upstream while collecting water samples. Monitors will take water samples by inverting the bottles to six inches below water line then turning the bottle upright to collect the sample at that water level. They will ensure that they are not downstream of any boats or other river obstacles that may be adding concentrated products into the water column. Samples collected in the main stem of the Kenai River, unless otherwise noted on the data collection sheet for safety reasons, will be collected at least 10 feet away from the riverbank. Samples from a tributary stream will be collected upstream of the mixing zone with the Kenai River.

Each sample bottle will be labeled with a unique sample number, sample site name, analysis to be performed, date and time, and initials of the person collecting the sample. SGS will provide and prepare all uncontaminated testing sample bottles for each site and will be available at the Soldotna Wastewater Treatment Plant to accumulate all water samples as the Monitors bring them into the Treatment Lab and document and prepare samples for immediate travel to their Anchorage laboratory. See Section B3, Sampling Handling and Custody Requirements, for details on how the samples will be prepared and handled for transport.

The recommended time for sampling is morning so that samples can be analyzed in the early afternoon at the Soldotna Wastewater Treatment Plant and prepared for travel and subsequent analysis at the SGS in Anchorage the following day. At the sampling stations located in the tidal areas of the Kenai River, samples will be taken during outgoing tide to obtain river water rather than tidally influenced salt water.

Table 8. Preservation and Holding Times for Sample Analysis

Analyte	Matrix	Container	Necessary Volume	Preservation and Filtration	Holding Time
BTEX	Water	VOA amber vials w/septa	3x40mL vials	HCl to pH < 2; 0-≤6°C, do not freeze; no headspace	14 days
Phosphorus, total	Water	HDPE	125ml	H_2SO_4 to pH < 2; 0-6°C, do not freeze	28 days
–Nitrates (NO_2 + NO_3)	DW/W	HDPE	60 ml	H_2SO_4 to pH < 2; chill recommended	28 days

Analyte	Matrix	Container	Necessary Volume	Preservation and Filtration	Holding Time
Fecal Coliform	Water	PA	125 ml	• 1 ml of 10% sodium thiosulfate, • ≤10°C, do not freeze	<8 hours sample collection to sample incubation.
TSS	Water	P, FP, G		• Cool ≤6°C • do not freeze	7 days
Dissolved Metals	Water	HDPE	250 ml	• field filtration w/0.45 µm filter within 15 min of collection followed by • HNO_3 to pH<2	6 months
Total Metals	Water	HDPE	250 ml	$HNO_3$to pH<2 at time of collection	6 months
Turbidity	Water	P, FP, G	250 ml	•Cool ≤6°C •do not freeze	48 hours

PA, P, FP, G PA is any sterizable (autoclavable) plastic, "P" is polyethylene, "FP" is fluoropolymer, "G" is glass
HDPE, VOA HDPE is "high-density polyethylene", VOA is "volatile organic analysis"

Copper and Zinc Monitoring

The Project QA Officer is responsible for making sure written instructions are provided to each of the monitoring teams during the training that occurs on the day prior to sampling. Sample containers with unique sample numbers will be provided to the sampling teams. These containers are to be filled following the aforementioned instruction sheet. Collection techniques will be demonstrated and monitors will be able to practice sampling under the supervision of the project QA Officer on the day prior to collection. Agency Baseline Monitoring Procedures are included in Appendix B.

Surface water samples will be taken at all stations once in spring (April/May) after breakup and in summer (July/August_ when the river is heavily used. Monitors will face upstream while collecting water samples. Monitors will take water samples by inverting the bottles to six inches below water line then turning the bottle upright to collect the sample at that water level. They will ensure that they are not downstream of any boats or other river obstacles that may be adding concentrated products into the water column. Samples collected in the main stem of the Kenai River, unless otherwise noted on the data collection sheet for safety reasons, will be collected at least 10 feet away from the riverbank.

Each sample bottle will be labeled with a unique sample number, sample site name, analysis to be performed, date and time, and initials of the person collecting the sample. SGS will provide and prepare all uncontaminated testing sample bottles for each site. The Project QA officer is responsible for acquiring these bottles prior to sampling. See Section B3, Sampling Handling and Custody Requirements, for details on how the samples will be prepared and handled for transport.

The recommended time for sampling is morning so that samples can prepared for travel and subsequent analysis at the SGS in Anchorage within holding time (e.g., 6hr for fecal coliform, 6 months for most metals). At the sampling stations located in the tidal areas of the

Kenai River, samples will be taken during outgoing tide to obtain river water rather than tidally influenced saltwater.

B3. SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Agency Baseline and Metals Monitoring

- Samples will be labeled (see Figure 4) and logged on the Agency Baseline Field Data Sheet (Appendix C).
- In the field, samples will be collected and stored in insulated ice chests containing freezable gel packs to hold samples at 4 degrees C (plus or minus 2 degrees C) until delivered to the lab. Temperature in transit will be monitored with a temperature blank with an objective of maintaining 4 degrees centigrade plus or minus 2 degrees centigrade. Once collected, samples are the responsibility of the monitors, and will stay in their possession until delivered to Soldotna Wastewater Treatment Plant. Samples collected specifically for zinc and copper assessments throughout 2019-2020 will be flown directly to SGS where they will be chilled.
- Once samples have been delivered to the Soldotna Wastewater Treatment Plant they undergo initial analysis; KWF staff analyzes samples for conductivity, pH, and turbidity, while the Soldotna Wastewater Treatment Plant lab technicians analyze samples for total suspended solids, and fecal coliform bacteria.
- A portion of the samples will also be prepared for travel to SGS for further analysis. Samples will be repacked in insulated ice chests and kept in chilled condition with freezable ice packs. Temperature in transit will be monitoring with a temperature blank with an objective of maintaining 4 degrees centigrade plus or minus 2 degrees centigrade.
- An SGS Chain of Custody Form will be used to record all transport and storage information.
- Each sample bottle will be labeled with a unique sample number, sample site name, analysis to be performed, date and time, and initials of the person collecting the sample. Samples specifically sent in during zinc and copper monitoring will utilize labels sent by SGS.

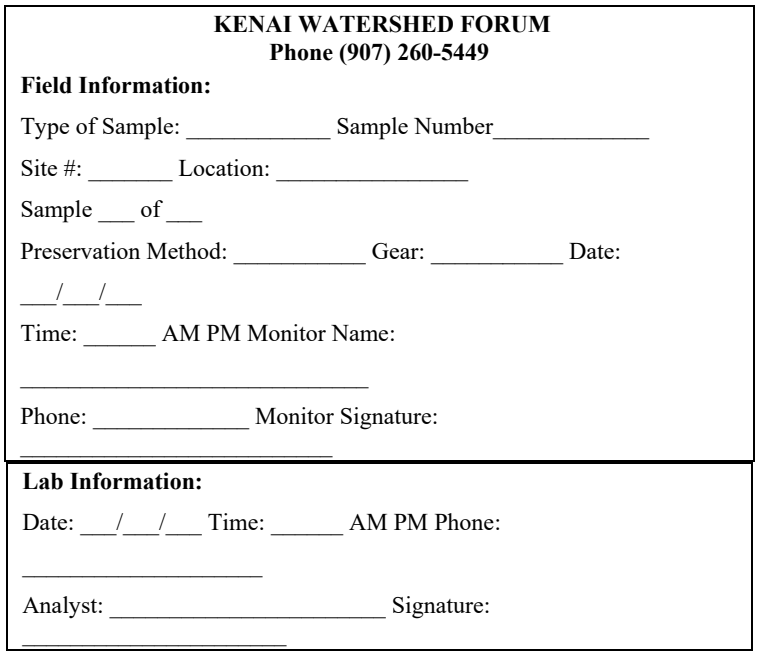

Figure 4. Sample Container Label

B4. ANALYTICAL METHODS REQUIREMENTS

Monitoring shall be conducted in accordance with EPA-approved analytical procedures and in compliance with 40 CFR Part 136, *Guidelines Establishing Test Procedures for Analysis of Pollutants*. Documentation of methods used, along with precision and accuracy and detectability information is provided in Tables 1, 2, 3 and 4. For each sample collected, the method used is recorded in the data.

Under direction of the Project Manager, project staff will ensure that all equipment and sampling kits used in the field and laboratories use EPA CWA approved methods. The project's QA officer will verify that only EPA CWA approved methods (or in specific incidences ADEC DOW pre- approved methods) are used.

Agency Baseline
Soldotna Wastewater Treatment Lab will analyze samples for Turbidity, Total Suspended Solids, conductivity, pH, and Fecal Coliforms. SGS will perform laboratory analysis of water quality beyond the capacity of the Soldotna Wastewater Treatment Plant. Their Quality Management Plan is on file with the ADEC QA Officer.

Metals Monitoring
SGS will perform laboratory analysis of water quality. Their Quality Management Plan is on file with the ADEC QA Officer.

B5. QUALITY CONTROL REQUIREMENTS

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the monitoring project's data quality objectives. This information is summarized in Tables 11 and 12.

B.5.1 Field Quality Control (QC) Measures

QC measures in the field include but are not limited to:

- Adherence to documented procedures and the comprehensive documentation of sample collection information included in the field data sheets.
- A rigidly enforced chain-of-custody program will ensure sample integrity and identification. The chain-of-custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.
- Proper cleaning of sample containers and sampling equipment.
- Maintenance, cleaning and calibration of field equipment/kits per the manufacturer's and/or laboratory's specification, and field SOPs.
- Chemical reagents and standard reference materials used prior to expiration dates.
- Ensuring that field sample collection containers seals remain unbroken until sampling is conducted.
- Proper field sample collection and analysis techniques.
- Correct sample labeling and data entry.
- Proper sample handling and shipping/transport techniques.
- Field replicate samples (blind to the laboratory). A minimum of 10% of the field samples will be duplicated with a replicate sample. Two replicate samples will be collected during the spring Monitoring event and again during the summer Monitoring event. The replicate samples will be rotated among the 7 teams of monitors.
- Field replicate measurements. 10% of the instrument multi-day deployments are duplicated using two instruments side by side. Comparison of the two data sets is to be reported in an annual summary to demonstrate comparability.

Table 9. Field Quality Control Samples. Table contains information for Hydrolabs and stream temperature monitoring for general reference.

Field Quality Control Sample	Measurement Parameter	Frequency of Occurrence	QC Acceptance Criteria Limits
Temperature Blank	BTEX, P (Total), NO_3+NO_2, TSS, Turbidity	1/cooler/shipment	≤ 6°C
	Fecal Coliforms		≤ 10°C
Trip Blank	BTEX	1/cooler/shipment	≤ BTEX MDL (see Table 2
[a]Field Replicate (Blind to Lab)	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca_{total},Fe_{total}, Mg_{total}, $As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$, P_{total},NO_2 + NO_3,	10%	See Section A7 Tables 2, 3 and 4 analyte-specific precision criteria
Field Replicate Measurement	Hydrolab (pH, Turbidity, Water Temperature, Specific Conductance, DO)	2/each hydrolab deployment (beginning and end) and at least 10% sample data collected	See Section A7 Table 1analyte-specific precision criteria
Field Replicate Measurement (Stream Temperature Monitoring)	Air and Water Temperature	2/each deployment (beginning and end) and at least 10% sample data collected	
Calibration Verification Check Standards	Hydrolab (pH, Turbidity, Specific Conductance, DO)	1/deployment after stream retrieval	See Table 1analyte-specific accuracy criteria

[a] Two replicate samples will be collected during the spring Monitoring event and again during the summer Monitoring event. The replicate samples will be rotated among the 7 teams of monitors.

Table 10. Field/Laboratory Quality Control Samples

Field/Lab Quality Control Sample	Measurement Parameter	Frequency of Occurrence	QC Acceptance Criteria Limits
Temperature Blank	BTEX, Phosphorous (Total), NO_3+NO_2, TSS, Turbidity	1/cooler/shipment	≤ 6°C
	Fecal Coliforms		≤ 10°C
Trip Blank	BTEX	1/cooler/shipment	≤ BTEX MDL (see Table 2
Field Replicate (Blind to Lab)	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca_{total},Fe_{total}, Mg_{total}, $As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$, P_{total},NO_2 + NO_3,	10%	See Section A7 Tables 2, 3 and 4 analyte-specific precision criteria
Lab blank	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca_{total},Fe_{total}, Mg_{total}, $As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$, P_{total},NO_2 + NO_3, TSS, Turbidity, Fecal Coliforms		≤ MDL (see Tables 1, 2, 3and 4)
Lab Fortified Blank	DRO, GRO, RRO,		Calibration: ±25%
	Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene		Calibration: ±15%
	Ca_{total},Fe_{total}, Mg_{total}		Calibration: ±15%
	$As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$,		Calibration: ±15%
	P_{total}		Calibration: ±15%
	NO_2 + NO_3		Calibration: ±15%
Lab Calibration Standard (LCS) and Continuing Lab Calibration Standard (CCS)	DRO, GRO, RRO , , ,		Calibration: ±25%
	Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene,		Calibration: ±15%
	Ca_{total},Fe_{total}, Mg_{total}		Calibration: ±15%
	$As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$		Calibration: ±15%
	P_{total}		Calibration: ±15%
	NO_2 + NO_3		Calibration: ±15%

Field/Lab Quality Control Sample	Measurement Parameter	Frequency of Occurrence	QC Acceptance Criteria Limits
	Turbidity		Calibration: ±15%
Matrix Spike	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca_{total},Fe_{total}, Mg_{total}, $As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$, P_{total},$NO_2 + NO_3$,		Calibration: ±15%
Matrix Spike Duplicate	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca_{total},Fe_{total}, Mg_{total}, $As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$, P_{total},$NO_2 + NO_3$,		Calibration: ±15%
Lab Duplicate Sample	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca_{total},Fe_{total}, Mg_{total}, $As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$, P_{total},$NO_2 + NO_3$, Turbidity, TSS		Calibration: ±15%
External QC Check Standard	Turbidity,		Calibration: ±15%
	TSS		Calibration: ±15%
Internal Standard/Surrogate Standard	BTEX		Calibration: ±15%
	$As_{dissolved}$, $Cd_{dissolved}$, $Cr_{dissolved}$, $Cu_{dissolved}$, $Pb_{dissolved}$, $Zn_{dissolved}$		Calibration: ±15%

If analytical sample results exceed state water quality standards the KWF will do the following:

- For the biannual water quality monitoring events in April and July, KWF will collect another sample as soon as possible to confirm the original findings if funding is available. Ideally, samples would be collected at the original sample location and one above and below the original location.
- Flag the data, validate it, notify ADEC as soon as feasible and summarize it in the final report.
- Flag the data, validate it, and use the information to help determine where and what to sample for in the future.
- Prior to the public release of any data, KWF will inform ADEC of KWF's intention to report the data. KWF will work closely with the ADEC project manager to ensure an accurate and consistent message will be delivered.

B6. INSTRUMENT / EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

Agency Baseline and Metals Monitoring

Training is conducted by the QA Officer and/or SGS staff. The trainers describe the proper handling and maintenance of sample bottles and, once the water samples were taken, how to handle the samples while in transit to the Soldotna Wastewater Treatment Plant. The only field analysis performed by monitors is in-situ temperature. Proper equipment handling and maintenance is also emphasized when each monitor picks up his/her sample kit assembled by SGS. Monitors are asked to contact the Project QA Officer immediately upon receipt if any sample bottles, caps, labeling material, data sheets, etc. are not included in the kit.

All equipment, and kits are checked upon receipt by the Project QA Officer to ensure that all equipment is in working order and the kit was complete. Before each sampling event, Monitors are asked to inspect all kits for completeness. Kits are also inspected when Monitors bring them in with water samples to the Soldotna Wastewater Treatment Plant. SGS will provide extra sampling bottles in case some are missing in the kits.

B7. INSTRUMENT CALIBRATION PROCEDURES

Field instruments will be calibrated or verified within calibration tolerances prior to using the instruments. Calibrations will be in accordance with the respective EPA CWA approved method against standards of known traceability and within stated certification (expiration) dates. Calibrations, etc. will be documented as previously described.

Contracted and sub-contracted laboratories will follow the calibration procedures found in its QAP and the laboratory's SOPs. Specific calibration procedures for regulated pollutants will be in agreement with the respective EPA Approved CWA method of analysis. Field and/or laboratory calibration records will be made available to ADEC upon request.

Agency Baseline

Included as Appendix H to this document.

Note: YSI meters are calibrated to the manual specifications for each model listed. YSI meters are only used to collect temperature data. For specific zinc and copper assessments, YSI meters will be used to collect air and water temperature data. The YSI Temperature Meter QA form (KWF: WQ FORM 5) is found in Appendix I.

B8. INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES

Agency Baseline and Metals Monitoring

Monitoring supplies are provided by SGS. The lead contact at SGS has the responsibility of ordering equipment and supplies. All sample containers, tubing, filters, etc. provided by SGS will be certified clean for the analyses of interest. KWF team will take note of the information on the certificate of analysis that accompanies sample containers to ensure that they meet the specifications and guidance for contaminant-free sample containers for the analyses of interest. The project QA Officer has the responsibility to ensure that adequate supplies are available and being used at the time of sampling.

B9. DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT MEASUREMENTS

Applies to all elements of the monitoring effort

Weather data downloaded or purchased through the National Oceanic and Atmospheric Administration (NOAA) web site (http://www.ncdc.noaa.gov/oa/ncdc.html) also will be used and assumed accurate. Stream discharge data may be obtained from the U.S. Geological Survey (USGS) and will be assumed to be accurate.

B10. DATA MANAGEMENT

The success of a monitoring project relies on data and their interpretation. It is critical that data be available to users and that these data are:

- Of known quality,
- Reliable,
- Aggregated in a manner consistent with their prime use, and
- Accessible to a variety of users.

Quality Assurance/Quality Control (QA/QC) of data management begins with the raw data and ends with a defensible report, preferably through the computerized messaging of raw data.

Data management encompasses and traces the path of the data from their generation to their final use or storage [e.g., from field measurements and sample collection/recording through transfer of data to computers (laptops, data acquisition systems, etc.), laboratory analysis, data validation/verification, QA assessments and reporting of data of known quality to the ADEC Division of Water Project Manager. Data management also includes/discusses the control mechanism for detecting and correcting errors.

Various people are responsible for separate or discrete parts of the data management process:

- The sampling team is responsible for field measurements/sample collection and recording of data and subsequent shipment of samples to laboratories for analyses. They assemble data files, which includes raw data, calibration information and certificates, QC checks (routine checks), data flags, sampler comments and meta data where available. These files are assembled and forwarded for secondary data review by the sampling manager or supervisor.
- Laboratories are responsible for complying with the data quality objectives specified in the QAPP and as specified in the laboratory QAP and method specific SOPs. Validated sample laboratory data results with respective analytical method QA/QC results and acceptance criteria are reported to the sampling manager or project supervisor.
- Secondary reviewers (sampling coordinator/supervisor/project supervisor) are responsible for QA/QC review, verification and validation of field and laboratory data and data reformatting as appropriate for reporting to STORET, AQMS, , and reporting validated data to the project manager.
- The project QA officer is responsible for performing routine independent reviews of data to ensure the monitoring projects data quality objectives are being met. Findings and recommended corrective actions (as appropriate) are reported directly to project management.
- The project manager is responsible for final data certification

- ADEC DOW Project Manager/WQAO conducts a final review (tertiary review) and submits the validated data to STORET, AQMS.

B.10.1 Data Storage and Retention

Data management files will be stored as described below and in Section A9, Documents and Records. Laboratory records must be retained by the contract laboratory for a minimum of five years.

Agency Baseline and Metals Monitoring

All data are reviewed by the Project QA Officer and the Project Manager before data are accepted. Data will be entered into a customized, AWQMS-compatible, template in Microsoft Excel.. Data will be reviewed to determine if water quality problems exist and any values exceed water quality standards. Data files are backed up on KWF server.

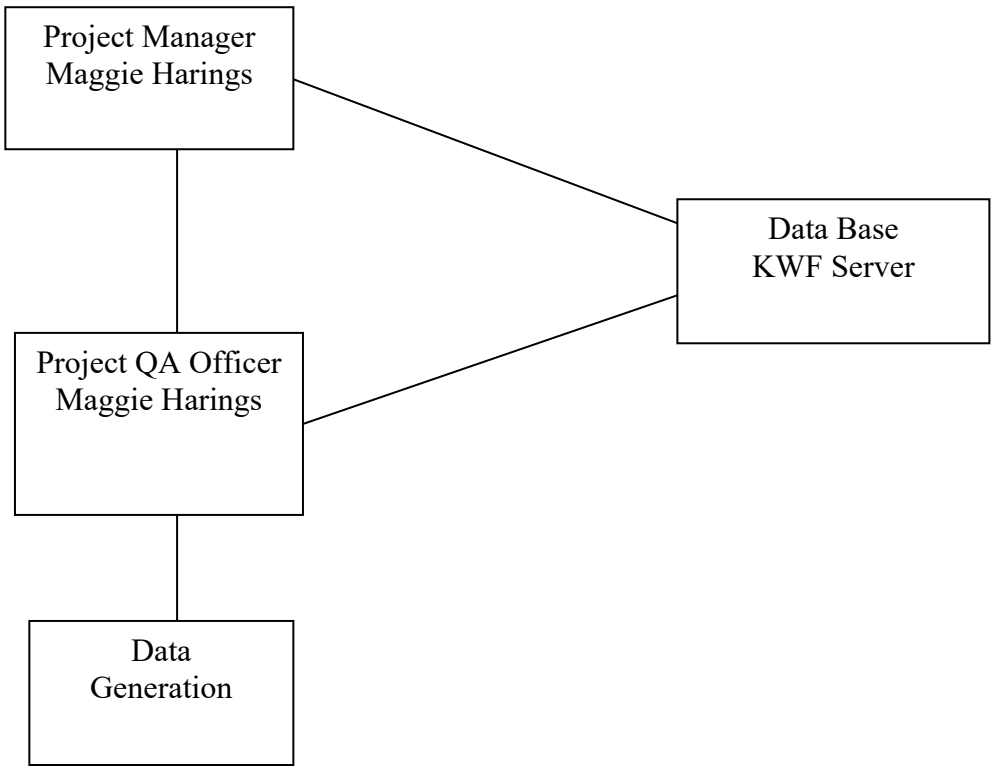

Figure 5. Data Management Flow Chart

C1. ASSESSMENTS AND RESPONSE ACTIONS

Assessments are independent (of management) evaluations of the monitoring project that are performed by the Project's QA Officer or his/her designee. For this project assessments include the following:

Field Assessments (each pollutant)

- Precision (replicate) sample measurements. Precision criteria are specified in Section A7, Tables 1 and 5.
- On-site observation of field monitoring operations. Surveillance - The project QA Officer will spot check monitoring teams at two sampling locations (10%) to observe sample collection. If sampling technique problems are observed, corrective action will be taken immediately to resolve the problem. Observations of problems and corrective actions will be included in a corrective action report (reporting errors observed and actions taken to correct errors).

Field samples collected for subsequent laboratory analysis (each pollutant)

- Blind replicate samples for each pollutant to be measured. Precision criteria are specified in Section A7, Tables 2, 3 and 4.
- Matrix spike duplicates (MSD) (assesses total measurement bias for project – both precision and accuracy). Frequency of MSDs is usually specified by the analytical method. Accuracy and precision of criteria for each pollutant and analytical method are specified in the project's MQO table, see section A7.
- Matrix spike (MS) assess project accuracy are specified in the project's MQO table, see section A7.

On-Site Assessments

- Inspection of field monitoring operations for compliance with QAPP requirements - The QA Officer will spot check monitoring teams at two sampling locations (10%) to observe sample collection. If sampling technique problems are observed, corrective action will be taken immediately to resolve the problem. Observations of problems and corrective actions will be included in a corrective action report (reporting errors observed and actions taken to correct errors).
- Audit of project field measurement data results.

Project Data Assessments

- QA review (verification and validation) of Monitoring Data. Recommended QA coverage is 100% QA for data entered by hand. A 10% QA is recommended for data copy/pasted or downloaded from a database.
- Calculation of monitoring project's overall achieved precision, accuracy and data completeness compared to QAPP defined precision, accuracy and data completeness goals.

Agency Baseline and Metals Monitoring

As described in Section B10, all data are reviewed by the Project QA Officer and the Project Manager before data are accepted and submitted to a database. If problems are discovered with data quality or management, it is the responsibility of both the Project Manager and the Project QA Officer to address them in a timely manner.

Procedures for inspection, acceptance, calibration and maintenance of equipment and supplies are described in detail in Sections B6, B7 and B8. If problems with data quality are traceable to equipment failure, inspection, calibration and maintenance will be scheduled more frequently.

The Technical Advisory Committee (Appendix A) will review this QAPP and the overall project design bi-annually and may suggest procedural refinements or additional testing procedures. This may include new parameters to be measured or changes to procedures currently in use. Any such changes will be subject to EPA and ADEC approval. The project is open to EPA or ADEC system audits at their discretion.

Data that has been validated and appears not to meet state water quality standards will be flagged and pointed-out both to ADEC and EPA as well as members of the Kenai River Special Management Area Board. When conducting assessments specifically for zinc and copper, exceedances in levels of these dissolved metals will be addressed with ADEC.

C2. QA REPORTS to Management

Annually a QA summary report will be produced and submitted to the Project Manager, ADEC Project Manager and ADEC QA Officer. QA summary report to include the following:

- A written summary stating whether the project-specific data quality objectives (and specifically project Measurement Quality Objectives were met, specified in section A7 of each QAPP). If not, what parameters failed, what data was affected and what corrective actions were taken to return the monitoring network to pre-approved project data quality objectives.
- Precision assements and Precision Table listing for each analyte--
  - All field replicate sample pairs (even if sample values are qualified).
  - Sample collection date of respective field replicate sample pairs.
  - Calculated individual precision of each paired field replicate where both values ≥ analyte specific practical quantification limit/reporting limit (PQL or RL). Use algorithm below.
  - Calculated overall precision project precision where both values ≥ analyte specific PQL or RL. Use algorithm below.
  - QAPP specified Precision Measurement Quality Objective (MQO)
- Accuracy (Assessment-- Accuracy Table listing for each analyte measured where sample spike recoveries are required by analytical method and project specific QAPP) the following:
  - Sample spiked and unspiked results
  - Date of analysis of sample and spiked sample
  - Per cent (%) sample spike recovery
  - Sample unspiked and spike duplicate results
  - Date of analysis of dup sample and dup spiked sample
  - % sample spike duplicate recovery
  - Sample spiked duplicate RPD
  - QAPP specified Accuracy MQO

    Note: Accuracy for spiked sample results is determined by calculation per

cent (%) spike recovery from sample spikes and duplicate sample spikes using the following algorithm:

% spike recovery = (spike concentration - sample conc.)/spike conc. X 100

- Data Completeness Assessment—Data Completeness Table listing each analyte measured the following: following:
  - Number of samples scheduled to be collected/analyzed as specified in the QAPP.
  - Number of samples collected/analyzed and reported as valid data.
  - QAPP required Data Completeness requirement.

Agency Baseline
A comprehensive report will be produced every 5 years. An open data report will be produced within one year of data collection. The open data reports will be available on line through a link at http://www.kenaiwatershed.org. The Program Manager is responsible for report production and distribution. Summaries of all reports, highlighting the assessment results, and project status will be made available to the local public through the Kenai River Center and Kenai Watershed Forum web centers and at the local public libraries.

Metals Monitoring
Reports will be written per the requirements of the funding source. For ADEC Alaska Clean Waters Action Grants (ACWA) this includes a progress report, and a final report. The draft final report will be submitted to ADEC for review and revisions. KWF will complete any recommended revisions and submit the final report to ADEC for approval.

D1. DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS

The Project Manager and the Quality Assurance Officer will conduct data review and validation. This process for data review is described under Sections B10 and A7. Data that are obtained using equipment that has been stored and calibrated correctly and that meets the accuracy, precision and QC limits will be used. Data that does not meet the accuracy, precision and QC limits may be used if justification is reasonable, data is qualified with data use limitations applied and with ADEC project manager/ADEC Water QA Officer concurrence.

D2. VALIDATION AND VERIFICATION METHODS

Project QA Officer and Project Manager will conduct data validation and verification. Project QA Officer and Project Manager review data and flag, but not delete, any values which fall outside of the expected range for each parameter. Errors in data entry will be corrected and inconsistencies will be flagged for further review.

The Project QA Officer is responsible for ensuring that maintenance and calibration records show all monitoring equipment in use to be in compliance with the requirements of this QAPP (see Sections B6, B7, & B8). If data quality questions cannot be adequately resolved, data will not be entered into any database without being flagged as questionable. The Project QA Officer will arrange for corrective measures (i.e. monitor re-training, equipment re-calibration, etc.).

Laboratory Quality Control (QC) Measures

Laboratory QC includes the following:

- Laboratory instrumentation calibrated with the analytical procedure.
- Laboratory instrumentation maintained in accordance with the instrument manufacturer's specifications, the laboratory's QAP and Standard Operating Procedures (SOPs).
- Matrix spike/matrix spike duplicates, sample duplicates, calibration verification checks, surrogate standards, external standards, etc. per the laboratory's QAP and SOPs.
- Specific QC activities prescribed in the project's QAPP.
- Laboratory data verification and validation prior to sending data results to ADEC and/or permitted facility.

Contracted laboratories will provide analytical results after verification and validation by the laboratory QA Officer. The laboratory must provide all relevant QC information with its summary of data results so that the project manager and project QA officer can perform field data verification and validation and review the laboratory reports. The Project Manager reviews these data to ensure that the required QC measurement criteria have been met. If a QC concern is identified in the review process, the Project Manager and Project QA Officer will seek additional information from the contracted laboratory to resolve the issue/s and take appropriate corrective action.

D3. RECONCILIATION WITH DATA QUALITY OBJECTIVES

The Project QA Officer and/or the Project Manager will compare the results and associated variability, accuracy, precision, and completeness with project objectives. If data quality indicators do not meet program specifications (see Tables 1, 2, 3, 4 and 5) data will not be entered in the data system. The cause of failure will be evaluated. If the cause is found to be equipment failure, calibration and maintenance procedures will be reassessed and improved. In some cases accuracy project criteria may be modified with prior approval by ADEC project management and ADEC Water QA Officer. In this case the justification for modification, problems associated with collecting and analyzing data, as well as potential solutions will be reported.

If failure to meet program specifications is found to be unrelated to equipment, methods, or monitor error, specifications may be revised. Revisions to this QAPP will be submitted to the designated state ADEC and federal EPA, Region 10 Quality Assurance Officers for approval.

APPENDIX A

Kenai Watershed Forum
Technical Advisory Committee

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Phone: 907-262-4205

APPENDIX B
KENAI RIVER BASELINE MONITORING PROCEDURES

*GPS Coordinates at each sampling location

*Photograph at each location with sign indicating sampling location

*Collect sample only from respective creek or river

*Cell phone turned on

***Label sample bottles with River Mile (RM). (i.e. RM 10 for River Mile 10 rather than Beaver Creek)**. Duplicates are indicated by using the abbreviation DUP, as in RM 10 DUP.

SAMPLE COLLECTION

At the Site, make a judgment call as to whether the site is representative.

1. Is the river bottom stirred up?
2. Is there a moose carcass just upstream?
3. Are boats close?

Collection Location

1. Samples collected in the mainstem of the river should be collected at least ten feet from the riverbank.
2. Samples collected from tributaries should be collected upstream of the mixing zone with the mainstem.

Immediately Prior to Taking the Samples

1. Complete the fields on the bottle labels for TIME AND INITIALS.
2. Use the SAME TIME for all sample containers.
3. INITIALS should be those of the team leader.
4. Deploy water and air thermometers, take readings before you leave the site
5. Put on clean gloves.

Ensure that the inside of the bottle caps are not contaminated.

Do not put bottle caps in your pocket.
Do not touch inside of cap or bottle.

Collect the "Fecal Coliform" sample first.

1. ***1.*** Record sampling time on the bottle.
2. ***2.*** The Fecal Coliform bottle is 100 ml clear plastic bottle with white powder (sodium thiosulfate-fixing agent) and a ***labeled paper seal over the lid.***
3. Carefully open the container, keeping the lid in one hand and the bottle in the other hand.
4. *Do not touch the inside of the bottle or lid.*
5. Always collect samples facing upstream with the flow of the river coming at you.

6. Fill the sample bottle with one smooth motion to just over the 100 ml mark. It is necessary to leave some room in the bottle because it will have to be inverted 25 X in the lab.
7. Place sealed bottle in cooler with ice.

Dissolved Metals - Filtered (125 ml plastic bottle) red sticker (HNO3-nitric acid) – Please note, only sites *including and downstream* of RM 30 will sample for dissolved metals. Exception: zinc and copper-specific assessments throughout 2019-2020.

1. Record sampling time on the bottle.
2. Do not rinse this sample bottle.
3. 2. Use the large, 1-liter TSS (Total Suspended Solids) bottle as the collection vessel.
4. Fill the TSS bottle with sample water using the following procedure.
    a. Face upstream with the flow of the river coming at you.
    b. Remove the lid, turn the bottle upside down, go to a depth of 6", and allow the bottle to fill, remove the bottle from the water, and discard a small amount so that the fluid level reaches the shoulder of the bottle.
6. Condition the syringe and plunger by rinsing 3 times with sample water from the TSS bottle.
7. Fill the syringe from the TSS bottle.
8. Attach filter to syringe (screws on).
9. Air locks hamper flow rates. To eliminate, point the syringe upward until liquid starts to exit the filter.
10. Slowly squirt the syringe water into the "Dissolved metals" bottle. You will have to fill the syringe several times to filter enough water to fill the bottle. If the sample is very turbid and you are unable to force any more water through the filter, you will have to replace the filter.
11. Once the bottle has been filled to the shoulder, cap it and place the bottle in cooler with ice.

BTEX-Purgeable Aromatics (three - 40 ml brown glass vials preserved with Hydrochloric Acid -HCl) *Please note, only RM 1.5, 6.5, 40 and 43 will sample for BTEX and only during summer sampling events!*

For BTEX-Volatile Organics Compounds (VOC)- it is critically important to NOT have any air bubbles (or headspace) in the vials after sampling.

1. Record sampling time on the bottle.
2. Do not rinse these vials.
3. Fill the 1 L TSS bottle with sample water:
    a. Face upstream with the flow of the river coming at you.
    b. Remove the lid, turn the bottle upside down, go to a depth of 6", and allow the bottle to fill, remove the bottle from the water, and discard a small amount so that the fluid level reaches the shoulder of the bottle.
4. Carefully fill all three 40 ml vials until a mound of water (meniscus) is formed on top of the vial. ***Do not overflow the vials excessively as they contain Hydrochloric Acid (HCl) as a preservative.***
5. Cap the vials and place in cooler with ice.

- **Special note concerning the collection of BTEX samples.**

1. Sampling Teams using a boat

   a. Have a designated driver and only the driver handles gas can and drives the motor.
   b. Boat driver does not handle BTEX Bottles.
2. All Teams
   a. If you filled up a vehicle with gas the day of sampling, do not handle the BTEX vials.
   b. Avoid handling or contact with all chemicals and/or solvents.

Total metals (250 ml plastic bottle); red sticker (HNO3-nitric acid)

1. Record sampling time on the bottle.
2. Do not rinse this bottle.
3. Remove the cap, fill the bottle to the shoulder with sample water from the TSS bottle, and replace the cap.
4. Place bottle in cooler with ice.

Nitrate+Nitrite/Total Phosphorus (250 ml plastic bottle); yellow sticker (H2SO4-sulfuric acid)

1. Record sampling time on the bottle.
2. Remove the cap, fill the bottle to the shoulder with sample water from the TSS bottle, and replace the cap.
3. Place bottle in cooler with ice.

"TSS"-Total Suspended Solids (1 L plastic bottle)

1. Record sampling time on the bottle.
2. Fill the TSS bottle as outlined in the "Dissolved Metals" Section.
3. Cap the bottle and place bottle in cooler with ice.

Appendix C

Kenai River Watershed Water Quality Monitoring Field Data Form KWF-WQ Form 6.1

	Low Tide			River			Air temp.	Weather	Boat traffic	Photos	Water Temp	GPS coord	
Date	Time	Agency	Initials	Mile	Location	Location of sample	Fahrenheit	S/R/C	L/M/H	Y/N	Centigrade	Latitude Longitude	Comments

Take all samples upstream from your position in the river

sunny low yes
rainy medium no
cloudy high

Verify GPS Datum:_____ YSI: Handheld Thermometer Serial Number_____

Team Members:_____

Samples Submitted By:_____ Date:_____ Time:_____

Samples Received By:_____ Date:_____ Time:_____

Notes: On sampling day measure water temperature with YSI digital thermometer.
Turn in samples at Soldotna Water Treatment Plant Lab.
River Mile is the location on the main stem of the Kenai River or where the tributary enters the Kenai River.

Kenai River Watershed Water Quality Monitoring Field Data Form KWF-WQ (Zinc, Copper) Form 6.2

Site ID:_____ **Date**:_____
Latitude: _____ **Time**:_____
Longitude:_____ **Initials**:_____

Samples

Sample ID:_____ **Field blank:** Y or N
Time: _____

Site photos, description

Site photo file names: _____
Camera used: _____

Site description (potential sources of pollution, boats in area, etc…):

Weather

Sky (circle option): sunny partly cloudy cloudy fog
Precipitation (circle option): raining drizzle none

Air temp:_____ F / C
Water temp:_____ F / C

Notes (overnight rain, water condition, etc…):

Tides (if applicable)

Low tide (time, height):_____
High tide (time, height):_____

Additional comments

Kenai River Watershed Water Quality Monitoring Field Data Form KWF-WQ (Zinc, Copper) Form 6.3

SGS North America Inc.
200 W. Potter Dr., Anchorage, AK 99518 (ph) 907-562-2343, (fax) 907-561-5301
3180 Peger Rd. Ste. 190, Fairbanks, AK 99709 (ph) 907-474-8656

Sample Kit Request

Kenai Watershed Forum Kenai Beach Study 2019_19000100

☐ **Client pickup Date:** _____ **Time:** _____

Be sure to ask if client will ship by ground (DOT) or air carrier (IATA)

☐ Deliver to client: _____
☐ Ship by/Air Carrier: _____
Airbill Number: _____
Date to ship by: _____
Notes: _____
Kit request taken by: _____ Date: _____
Kit prepared by: _____ Date: _____
Kit *(including lid tightness for pres'd bottles)* checked by: _____ Date: _____
Kit packed & shipped by: _____ Date: _____

Does a Profile exist in LIMS? If not, please send a request for new profile build.

Client Name: Kenai Watershed Forum
Ordered By: Margaret Harings Phone #: 907-260-5449
Email: maggie@kenaiwatershed.org
Project Name: Kenai Beach Study 2019 Project/Permit#:
Quote #: Profile #:
Delivery Address: 44129 Sterling Hwy, Soldotna, AK 99669

Filename: SKIT_Kenai Watershed Forum_Kenai Beach Study 201 *Required Items

No. Samples	Matrix	Analysis	Container Size & Type		Pres.	Bottle Lot #	Preservative Lot #	Hold Time	# QC Bottles	Total Bottles

☐ Pack for Shipping via *ground* (DOT)
☑ Pack for Shipping via *air carrier* (IATA)
☐ Temperature Blank (*circle one:* 120-ml OR 500-ml)
☐ Soil VOA Trip Blank - Lot#:
☐ Water VOA Trip Blank - Lot#:
☐ 524 VOA Trip Blank - Lot#:
☐ Low Level Mercury Trip Blank- Lot#:
☐ Coolers
☐ Gel Ice
☐ Bubble Wrap
☐ Labels
☐ Custody Seals
☐ SGS COCs - *Circle req'd forma* ☐ Blank COC ☐ DW COC ☐ COC initiated by PM (attached)
☐ Send additional instructions/documents *(Note to PM: Be sure to attach copy of requested form.)*

☐ Total # includes bottles for % Solids
☐ Track all Lot#? (Required for DOD)
☐ Foreign Soil

Other Notes/Reminders for Kit Prep:

RESULTS DUE WITHIN 36 HOURS OF RECIEPT AT LAB.
Please cc report to: sarah.apsens@alaska.gov

Attention Client/Sampler:

1. Do not rinse container; be aware of any acid preservative in container.
2. Fill container, but do not overfill (except volatile waters).
3. Label the container with your sample ID as well as the date/time of collection.
4. Fill out the Chain of Custody.
5. Add frozen gel packs or ice to your cooler & pack to prevent breakage.

Charges may be invoiced for bottles which are unused or improperly used.
If you have any questions concerning this sample kit, please contact your Project Manager for assistance. *Thank you.*

***This will email a copy of this form for confirmation to the client email and save the form to the network. This should not be used outside of SGS.**

Appendix D

AGENCY BASELINE LAB TEST RESULTS (KWF: WQ FORM 4)

DATE:_____

River Mile	Location	Temperature	Conductivity us/cm	pH	Turbidity NTU	Turbidity Check NTU	
0	No Name Creek						
1.5	Kenai Dock						
6.5	Cunningham Park						
10	Beaver Creek						
10.1	Kenai River						
12.5	Pillars						
18	Poachers Cove						
21	Soldotna Bridge						
23	Swiftwater Park						
19	Slikok Creek						
22	Soldotna Creek						
30	Funny River						
31	Morgan's Landing						
36	Moose River						
40	Bing's Landing						
43	Upstream Dow Island						
44	Mouth of Killey River						
50	Skilak Lake Outflow						
70	Jim's Landing						
74	Russian River						
79.5	Juneau Creek						
82	Kenai Lake Bridge						
DUP							
DUP							

ANALYSIS PERFORMED BY :_____

Appendix E

Hydrolab Downloads

Date	Hydrolab #	File Name	Data Lines	Notes

Appendix F

Minisonde Calibration Record (KWF-WQ Form 1)

Serial #_____ Performed By:_____

Date	Time	Parameter	Action	Standard	Temp	Reading	Over Std %	Under Std %	Correction %

Appendix G
STREAM TEMPERATURE MONITORING FIELD DATA SHEET

Stream Information

Stream Name:

_____

Field Crew: _____

Partner Organization:

_____

Site Description/Directions:

_____

_____

_____

Water Logger Information

Logger Type: _____ Serial #: _____

Date placed in stream: _____ Time placed in stream: _____

Instantaneous water temperature: _____ Time of measurement: _____

Air Logger Information

Logger Type_____ Serial #: _____

Date placed in riparian zone: _____ Time placed in riparian zone: _____

Instantaneous air temperature:_____ Time of measurement: _____

Site/Reach Information

Habitat type of water logger placement: (circle) riffle pool run other

Tethering/deployment method: (circle) rebar bank-secured cable sandbag other

Verified site is well mixed using: (circle) Hand-held thermometer Probe: _____

Channel depth (m) at logger_____ Channel width (m) at logger_____

Extent to which vegetation shades the logger: (circle) 0% 20% 40% 60% 80% 100%

Channel flow status: (circle) bank full 90-75% of channel filled 75-50% filled <50% filled

GPS Coordinates: _____N _____W

Elevation (m) _____

Photo Documentation

Photos taken on which camera?: _____ # of photos taken: _____

Description of photos:

Detailed sketch of site should include stream aspect, landmarks like large boulders or other markers to help locate the loggers, trails or other access points.

Other Comments and Observations:

Appendix H
Standard Calibration Procedure for Hydrolab Minisonde MS 5

Notes:

- Always use Standard Solutions that have not reached their expiration date.
- Always wear gloves and other protective clothing when handling chemicals.
- Temperature cannot be calibrated.
- For all sensors (except turbidity), use a two-point calibration. Confirm accuracy with a third concentration if desired.
- All calibrations require the use of the Minisonde 5 calibration cup.
- Discard all calibration solutions (including deionized water) after they have been used.

pH

Supplies Needed:

De-ionized water
Hach Buffer Solution pH 7.0 Cat. 22835-56
Hach Buffer Solution pH 4.0 Cat. 22834-56

Calibration can be performed in the calibration cup.

1. Start HyperTerminal.
2. Connect the multiprobe to a PC. Wait for HyperTerminal to establish communications with the sensor.
3. Rinse the sensors and calibration cup with turbid-free water (Deionized water) several times and dry with lint-free cloth and/or compressed air. Any residue or fluids left behind will affect calibration accuracy.
4. Put fresh pH 7.0 standard solution in calibration cup until the LDO sensor is submerged.
5. Allow readings to stabilize.
6. Click on the **Calibrate** tab and go through the following series of tabs and screens:
   pH/ORP
   pH units
   Standard (7.0)
7. "Calibration Complete" will display when calibration is successful.
8. "Calibration Failed" will display when calibration is not successful. Repeat procedure.
9. Repeat steps 3 through 6 with pH 4.0 standard except enter 4.0 rather than 7.0.
10. Check calibration with pH 7.0 standard.

Conductivity

Supplies needed:

De-ionized water
Hach Conductivity Standard Solution 0.100ms/cm Cat. 013610HY
Hach Conductivity Standard Solution 1.412ms/cm Cat. 013620HY
Balloons

Calibration can be performed in the calibration cup.

1. Cover pH sensor with a tight fitting balloon. This prevents solution in pH sensor from entering calibration cup.
2. Connect the multiprobe to a PC. Wait for HyperTerminal to establish communications with the sensor.
3. Rinse the sensors and calibration cup with turbid-free water (Deionized water) several times and dry with lint-free cloth and/or compressed air. Any residue or fluids left behind will affect calibration accuracy.
4. Thoroughly dry the conductivity sensor. Use compressed air and/or lint-free wipes.
5. Click on the **Calibrate** tab and go through the following series of tabs and screens:
   Cond
   SpCond:us/cm
   0
6. "Calibration Complete" will display when calibration is successful.
7. "Calibration Failed" will display when calibration is not successful. Repeat procedure.
8. Fill calibration cup with high-end conductivity standard (1,412 µS/cm) until the D.O. membrane is submerged.
9. Allow readings to stabilize.
10. Repeat step 4, except enter 1412 rather than 0.
11. You may check accuracy with the 100 µS/cm standard (or another salinity concentration between 0 and the high-end value) by filling the calibration cup with the 100 µS/cm solution and observing the reading. If value displayed is within 5 % of expected value, calibration is complete.

Turbidity

Supplies needed:

De-ionized water
Hach Company StablCal Standard 3,000NTU Cat. 28590-49
Hach Company StablCal Standard 1,000NTU Cat. 26606-49
Hach Company StablCal Standard 200NTU Cat. 26604-49
Hach Company StablCal Standard 100NTU Cat. 007308

Note: Do not shake the StablCal solutions prior to calibration, as this will introduce air bubbles, which will impact the calibration. The StablCal does need to be gently inverted 4-6 times to mix the solution.

Conduct calibration in following Sequence:
Calibration Point 1 (lowest standard)
Calibration Point 4 (highest standard)
Calibration Point 3 (2nd highest standard)
Calibration Point 2 (2nd lowest standard)

For Stormwater runoff monitoring use the following standards: 0.3 NTU (De-ionized water), 100 NTU, 1000 NTU and 3000 NTU.

For other applications use: 0.3 NTU (De-ionized water, 100 NTU, 200 NTU and 1000 NTU.

Calibration can be performed in the calibration cup.

1. Remove the wiper from the unit. Store the removed wiper in turbid-free water for reinstallation.
2. Start HyperTerminal.
3. Connect the multiprobe to a PC. Wait for HyperTerminal to establish communications with the sensor.
4. Rinse the sensors and calibration cup with turbid-free water (Deionized water) several times and dry with lint-free cloth and/or compressed air. Any residue or fluids left behind will affect calibration accuracy.
5. Fill the cup with StablCal standard, from 0 to 3000 NTU solution. To prevent excess bubbles, slowly pour the standard down the side of the cup. (Note: NTU readings may decrease as the solution settles. Be certain the solution has been sufficiently mixed by inverting gently several times. Use of a stir plate and stir bar will prevent settling.
6. Wait 30 seconds (minimum) for the NTU values to stabilize.
7. Click on the **Calibrate** tab and go through the following series of tabs and screens:

   Turbidity

   TurbSC: NTU

Calibration Point [1.0 thru 4.0]
Turbidity Standard (0.3 -3000 NTU)

8. For the “zero” point, Hach StablCal standard is listed at <0.1 NTU for controlled laboratory environments. Enter a value between 0.3 –0.6 for the “zero” point, depending on the cleanliness of the environment and cup. We have been using De-ionized water and a value of 0.3 NTU.
9. Rinse the calibration cup and the sensor twice with Deionized water between each calibration point and dry with a lint-free cloth and/or compressed air. Any residue or fluids left behind will affect the calibration accuracy. Repeat until all points are calibrated.
10. After a successful calibration, “Calibration completed!” will be displayed. If “Calibration Failed” appears, that point must be recalibrated.
11. Replace the wiper.

Dissolved Oxygen

Supplies needed:

Hydrolab Surveyor 4a
25' communication cable
LaMotte Dissolved Oxygen test kit (Code 5854-01)

This Calibration is normally done in the field.

***Determine the dissolved oxygen concentration of stream water using the Winkler DO titration methods outlined below**:*

Rinse water sample bottles 3 times. Completely submerge and fill 2 water sample bottles with water to be tested, individually cap them, invert sample to ensure there are no air bubbles in each.

Fixing the Sample:

1. Select one of two sample bottles,
2. Add 8 drops of Manganous Sulfate Solution,
3. Add 8 drops of Alkaline Potassium Iodide Azide,
4. Close lid and rock sample bottle gently until mixed (1-2 minutes). Then set aside to allow the flocculate to settle below the shoulder of the bottle.
5. Add 8 drops Sulfuric Acid,
6. Close lid, rock gently until the reagent and the precipitate have dissolved. A transparent-yellow to brown-orange color will develop. The darker the color, the higher the dissolved oxygen concentration. The sample is now "fixed" and can wait for up to 8 hours before determining DO by titration.
7. Repeat steps a-f for second sample bottle.

Sample Titration

1. Fill the titration tube carefully to the 20 ml line with solution from one of the sample bottle containing a "Fixed" sample. Make sure the meniscus is just level with the top of the 20 ml line.
2. Fill the titrator (plunger) with 10 mg of Sodium Thiosulfate "titrating solution." To fill the titrator, insert the titrator into the hole in the cap of the sodium thiosulfate bottle, invert the sodium thiosulfate bottle, purge and expel the air from the titrator, and slowly withdraw the plunger until the bottom of the plunger is opposite the zero mark on the scale.
3. Insert the tip of the Titrator into the opening of the titration tube cap. Slowly depress the plunger to dispense the titrating solution. Gently swirl to mix.
4. Continue carefully adding the titrating solution until the color changes to straw yellow. If the sample solution is already faint yellow, skip step 4 and go directly to step 5.
5. Remove the Titrator and cap. Add 8 drops of Starch Indicator Solution. The solution will turn dark bluish purple or almost black.
6. Replace the cap and Titrator, and continue titrating until the blue color JUST disappears.
7. Record the total amount of Sodium Thiosulfate used. If more than one plunger is required, be sure to add both amounts in determining the final DO value. Milliliters of titrant equals mg/l dissolved oxygen.

8. Repeat steps a through g for the other sample bottle. If the DO results from the two samples vary more than 0.6 mg/l , repeat the test.
9. Calculate the Average Dissolved Oxygen from the two samples.

Calibrate the MS 5 using the following procedure

1. Connect Minisonde 5 to Surveyor 4a with cable.
2. Record Barometric Pressure (BP) from Surveyor 4a.
3. Use the following sequence on Surveyor 4a to calibrate.
   Set/Cal
   Calibrate
   Sonde
   Scroll down to DO
   Select
   Enter Barometric Pressure Value
   Done
   Enter DO value from Winkler titration
   Done
4. "Calibration Successful!" will appear on the bottom of the screen.

Appendix I

YSI TEMPERATURE METER QA

DATE:_____ TIME:_____

CONDUCTED BY:_____

METER NUMBER	MODEL NUMBER	TEMPERATURE

Appendix J

Calibration Standards Record Form (KWF: WQ Form 2)

Date	Time	Action	Parameter	Concentration	Lot	Expiration

Appendix K
References:

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