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**COOK • INLET • KEEPER**

# **QUALITY ASSURANCE PROJECT PLAN**

**Lower Kenai Peninsula  
Watershed Health Project**

**Second Edition  
June, 2000**



**QUALITY ASSURANCE PROJECT PLAN**

*for*

**LOWER KENAI PENINSULA  
WATERSHED HEALTH PROJECT**

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**HOMER SOIL & WATER CONSERVATION DISTRICT  
*and*  
U. S. ENVIRONMENTAL PROTECTION AGENCY  
REGION 10  
*and*  
STATE OF ALASKA  
DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
Division of Air and Water Quality**

**June, 2000**

**APPROVALS:**

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## ACKNOWLEDGEMENTS

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**3. DISTRIBUTION LIST:**

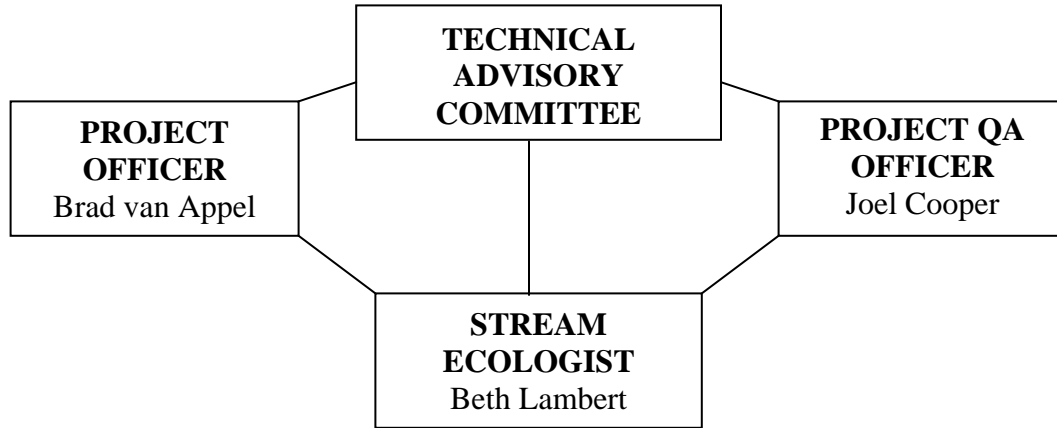
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Lower Kenai Peninsula Watershed Health Project Technical Advisory Committee (Committee Members listed in Appendix A)	

Other interested parties may review this plan at the Keeper office and/or purchase a copy for the cost of production and shipping by writing Cook Inlet Keeper at P.O. Box 3269, Homer, Alaska 99603, by calling 907/235-4068, or by e-mailing a request to [beth@inletkeeper.org](mailto:beth@inletkeeper.org)

#### 4. PROJECT / TASK ORGANIZATION

Figure F-1 ORGANIZATIONAL CHART



#### Responsibilities of Cook Inlet Keeper Personnel

Brad van Appel, Project Officer, Cook Inlet Keeper  
Responsible for overall project management and grant implementation.

Joel Cooper, Project QA Officer, Cook Inlet Keeper  
Responsible for technical support and overall quality assurance.

Beth Lambert, Project Stream Ecologist, Cook Inlet Keeper  
Responsible for preparation of sampling plan, sample collection and testing, data management and analysis, quality control and production of reports.

In addition to the personnel listed above, the Lower Kenai Peninsula Watershed Health Project is guided by a Technical Advisory Committee (TAC) made up of professionals representing various federal, state and local agencies and diverse scientific backgrounds. See Appendix A for a complete list of TAC members.

Collected data will be provided in report form to the Homer Soil and Water Conservation District and will be made available to all interested government agencies and citizens. Primary data users are the Homer Soil and Water Conservation District, Cook Inlet Keeper and local, state and federal agencies involved in support of this project.



## **5. PROBLEM IDENTIFICATION / BACKGROUND**

Current and potential changes in land use and management within the Deep Creek, Stariski Creek, Ninilchik River and Anchor River watersheds are having an unknown impact on water quality.

No one can say for sure whether pollution and human impacts are directly harming the resources of these rich watersheds. While a great deal of information has been collected by government agencies (USGS in particular), the fact remains that there is not enough baseline data available to determine the effects of point and non-point source pollution on the water quality and habitat of these streams.

The streams of the lower Kenai Peninsula support multi-million dollar sport and commercial fisheries, and provide important subsistence resources for native and other groups. Citizens, industry and resource managers need a comprehensive and ongoing inventory of water quality in order to track changes and understand impacts. Only with this kind of information can we make economically and environmentally sound decisions.

Many state and federal agencies lack the resources to conduct thorough water quality monitoring at a representative number of sites over an extended period. The Lower Kenai Peninsula Watershed Health Project collects accurate baseline data in a cost effective manner for the benefit of local citizens and government agencies alike.

## **6. PROJECT / TASK DESCRIPTION**

The water quality monitoring component of the Lower Kenai Peninsula Watershed Health Project has been designed with the goal of collecting, compiling, and analyzing baseline water quality data that will “meet evaluation and assessment requirements of state and federal agencies” (Ashton 1998). Sampling sites, sampling schedules and testing parameters have been selected with the objective of inventorying water quality and characterizing the environmental “health” of Ninilchik River, Deep Creek, Stariski Creek, and Anchor River watersheds.

Water quality monitoring began in August of 1998. Since then, Keeper’s Stream Ecologist has been collecting water samples at two sites on Stariski Creek; three sites in both the Deep Creek and Ninilchik River watersheds; and four sites in the Anchor River watershed (see Appendix B for site map). More sites are visited during the summer months than during the winter months to allow for difficulties of winter monitoring. Samples are collected and tested at all twelve sites every six weeks during the summer months of May through October. In addition, each site is visited at least once during a high flow period. During the winter months of November through April, a minimum of six sites are visited each month. Sites are visited in order of priority and ease of access, with lower sites first, middle sites second, and upper sites third. Water at each sampling site is tested for the following parameters: temperature, pH, dissolved oxygen, conductivity, total dissolved solids, suspended solids, settleable solids, apparent color, turbidity, nitrogen-ammonia, nitrogen-nitrate, orthophosphate, total phosphorus, discharge and stage. Fecal coliform and total coliform screening tests are also performed during each sampling event.

The Stream Ecologist also records observational data and photographs each site as part of each sampling event. These visual and other observations complement the quantitative physical and chemical data collected at each established monitoring site.

Data collected are entered in a Microsoft Access database. Testing procedures are designed to detect subtle changes over time and space and results will be compared to state and federal water quality criteria as well as previously collected data. This data are made available to the Homer Soil and Water Conservation District and all parties represented on the Technical Advisory Committee. The project's first annual report, *A Preliminary Water Quality Assessment of Lower Kenai Peninsula Salmon Streams* was produced in January of 2000 (Cook Inlet Keeper, 2000). Reports will be produced annually throughout the life of the project.

The Lower Kenai Peninsula Watershed Health Project is currently funded only through June of 2000. Additional funding is anticipated so that the project can be extended indefinitely.

**Table T-1: ANNUAL SCHEDULE OF TASKS**

<b>MAJOR TASK CATEGORIES</b>	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
monthly testing	X	X	X	X	X	X	X	X	X	X	X	X
data entry				X	X	X	X	X	X	X		
draft analysis report						X	X	X	X	X	X	
final analysis report												X*

\* Annual reporting cycle began in 1999. The first annual report was released in January 2000; subsequent reports will be produced in July of each year.

## 7. DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

Table T-2 shows the objectives for precision and accuracy for each parameter tested. In each case the sampling matrix is water. Objectives for precision, accuracy, representativeness, comparability and completeness are also summarized in this section. These Data Quality Objectives (DQOs) have been established to ensure that the project meets its overall objectives as described in Section 6, above – collecting baseline water quality data that will meet requirements of state and federal agencies and detecting subtle changes over time and space. Project DQOs may be revised in the future if funding becomes available for methods and equipment with finer detection limits or for testing additional parameters, or if the Technical Advisory Committee 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 T-2: DATA QUALITY OBJECTIVES**

Parameter	Method	Range	Detection Limits	Precision	Accuracy	Calibration Method	Container	Minimum Sample Size (mL)	Preservation	Maximum Storage Recommended/Regulatory
Temperature	Thermometer (2550) <sup>a</sup>	0 to +40.0°C	0.1°C	±0.5°C	±0.5°C	NIST Certified Thermometer	P <sup>b</sup> , Glass	Not Available	Analyze immediately	stat/stat
pH	Electrometric (4500-H) <sup>a</sup>	0 to 14.00 pH units	0.01 units	±0.02 units	±0.05 units	Two Buffer Calibration	P, Glass	50	Analyze immediately	2h/stat
Dissolved Oxygen	Membrane Electrode (4500-O G) <sup>a</sup>	0 to 19.99 Milligrams per liter (mg/L)	0.1 mg/l	±0.05 mg/l	±0.1 mg/l	Saturated Air Calibration	Glass	300	Analyze immediately	0.5h/stat
Conductivity	Conductivity (2510 B) <sup>a</sup>	0 to 199,900 Micro-Siemens/cm (µS/cm)	0.0700µS/cm	±0.5%	±0.5%	Cell Constant Adjustment Calibration Method	P, Glass	500	Refrigerate (Storage @4°C, in the dark)	28d/28d
Total Dissolved Solids	Conductivity Meter <sup>i</sup>	0 to 19,900 mg/L	3 significant digits	±1%	±1%	Cell Constant Adjustment Calibration Method	P, Glass	200	Refrigerate (4°C)	7d/2-7d
Suspended Solids	Photometric (8006) <sup>ci</sup>	0 to 750 mg/L	Not Available	Not Available <sup>j</sup>	Not Available <sup>j</sup>	Not Available	P, Glass	200	Refrigerate (4°C)	7d/2-7d
Turbidity	Nephelometric (2130 B) <sup>a</sup>	0.00 to 1100 Nephelometric Turbidity Units (NTU)	NTU Report to Nearest 0 to 1.0 then 0.05 NTU 1.0 to 4.0 then 1 NTU 4.0 to 10 then 5 NTU 10 to 40 then 10 NTU 40 to 100 then 50 NTU 100 then 100 NTU	±2% for readings below 100 NTU ±3% above 100 NTU	±2% for readings below 100 NTU ±3% above 100 NTU	Standard Solutions (NTU)	P, Glass	100	Analyze same day; store in dark up to 24h, refrigerate (4°C)	24 h/48 h
Settleable Solids	Imhoff Cone Standard Method (2540 F) <sup>a</sup>	0.1 to 1.0 mL/mL	0.1 mL/L	Not Available	Not Available	Not Applicable	P, Glass	1000	Refrigerate (4°C)	7d/7d
Color, Apparent	Platinum-Cobalt Standard Method (8025) <sup>c</sup>	0 to 500 units Platinum-Cobalt	Not Available	Not Available <sup>j</sup>	Not Available <sup>j</sup>	Standard Solution Method	P, Glass	500	Refrigerate (4°C)	48h/48h
Nitrogen, Ammonia	Nessler (8038) <sup>cd</sup>	0 to 2.5 mg/L NH <sub>3</sub> -N	0.06 mg/L	±0.015 mg/L	±0.015 mg/L	Standard Solution Method	P,G	100	Analyze as soon as possible or add H <sub>2</sub> SO <sub>4</sub> to pH <2, refrigerate (4°C)	28d/28d

**Table T-2: DATA QUALITY OBJECTIVES**

Parameter	Method	Range	Detection Limits	Precision	Accuracy	Calibration Method	Container	Minimum Sample Size (mL)	Preservation	Maximum Storage Recommended/Regulatory
Nitrogen, Nitrate	Cadmium Reduction (8192) <sup>c</sup>	0 to 0.40 mg/L NO <sub>3</sub> -N	0.01 mg/L	±0.010mg/L	±0.010mg/L	Standard Solution Method	P, Glass	100	Analyze as soon as possible or refrigerate (4°C)	48h/48h (28d for chlorinated samples)
Orthophosphate	Ascorbic Acid (8048) <sup>cd</sup>	0 to 2.5 mg/L PO <sub>4</sub> <sup>3-</sup>	0.01 mg/L	±0.02mg/L	±0.02mg/L	Standard Solution Method	Glass (A) <sup>g</sup>	100	Analyze immediately or filter immediately and refrigerate (4°C)	48h/N.S.
Total Phosphorus	Acid Persulfate Digestion Method (8190) <sup>cdh</sup>	0 to 2.5 mg/L PO <sub>4</sub> <sup>3-</sup>	0.01 mg/L	±0.02mg/L	±0.02mg/L	Standard Solution Method	Glass (A) <sup>g</sup>	100	adjust pH to 2 with sulfuric acid and refrigerate (4°C)	28d
Coliforms (Total & E. coli)	Chromogenic agents in medium, detects E. coli & total coliform 0 to 60 CFU	Number of colony forming units (CFU) per 100 ml	1 CFU	Not Available <sup>j</sup>	Not Available <sup>j</sup>	Send water sample split to EPA/ADEC Certified Lab	P, Glass	100	Refrigerate. Below 10°C	6h

<sup>a</sup> Standard Methods for the Examination of Water and Wastewater, 19<sup>th</sup> Edition. 1995

<sup>b</sup> Plastic (polyethylene or equivalent)

<sup>c</sup> Hach Water Analysis Handbook, 3<sup>rd</sup> Edition, 1997

<sup>d</sup> Adapted from Standard Methods for the Examination of Water and Wastewater. USEPA Accepted Method

<sup>e</sup> USEPA Approved Method, Federal Register, 44(85) 25505 (May1, 1979)

<sup>f</sup> Procedure is equivalent to USEPA method 365.2 and Standard Method 4500-P-E

<sup>g</sup> Rinsed with 1+1 HNO<sub>3</sub>

<sup>h</sup> Procedure is equivalent to USEPA method 365.2 and Standard Method 4500-P B,5 & P E

<sup>i</sup> Total dissolved solids and total suspended solids methods may not be comparable to EPA methods or Standard Methods 2540C and 2540D, and resulting data can not be compared to State Water Quality Criteria

<sup>j</sup> For methods where achievable QC criteria are not available, precision and accuracy will be determined and reported as part of the project measurements

**Table T-3: DATA QUALITY OBJECTIVES FOR STREAM DISCHARGE AND STAGE**

Parameter	Method	Instrument	Units	Rating Limits	Calibration Method
Discharge	Current-Meter Method	Price AA Current Meter	Feet <sup>3</sup> /Sec	0.25 to 8.0 feet/second	Spin Test
Discharge	Current-Meter Method	Pygmy Current Meter	Feet <sup>3</sup> /Sec	0.25 to 3.0 feet/second	SpinTest
Stage	Gauge Reading	Staff Gauge	Water Level in Feet	Not Applicable	Measurement
Stage (Crest)	Gauge Reading	Crest Gauge	Highest Water Level in Feet	Not Applicable	Measurement

**Precision**

Precision is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of methods. In this project replicate sample analysis will be performed at each site. The Project QA Officer will perform replicate sample analysis on one split sample from each site through the course of a year and one split sample from each site will be sent to and outside, EPA approved laboratory each year. Variation of duplicate values for each parameter must not exceed the range of precision specified in Tables T-2. All results will be recorded in field data sheets and lab logbooks, however results which fall outside the specified range will not be entered into the project data system. Additional field sampling events may be scheduled in cases where data quality objectives are not met.

Replicate test are performed routinely for total and fecal coliform: 1ml, 3ml and 5ml samples are analyzed during each monitoring event and results are compared for consistency. If all three samples test high for coliform the Stream Ecologist may return to the sampling site to perform additional tests and/or split a sample for replicate analysis by an outside, EPA approved lab.

**Accuracy**

Accuracy is a measure of confidence that describes how close a measurement is to its “true” value. In this project, accuracy is measured by comparative sampling and the use of standard solutions. Accuracy requirements and calibration procedures are presented in Tables T-2 and T-3 and in Section 16 of this document.

**Representativeness**

Representativeness is the extent to which measurements actually represent the true environmental condition. Representativeness of data collected is considered in project design and sampling site selection. Sampling sites were selected to be representative of a particular reach and not targeted to one specific point source or outfall. Sites were selected on the upper, middle and lower reaches of each stream. A handheld GPS will be used to find sites with known Latitude and Longitude coordinates and to identify coordinates of newly established sites.

## **Comparability**

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling and analytical methods and units of reporting with comparable sensitivity helps ensure comparability. For most parameters included in this project, Keeper has selected testing methods that are taken from *Standard Methods for the Examination of Water and Wastewater, 19<sup>th</sup> Edition, 1995*, and/or have been approved or accepted by USEPA. Efforts will be made to duplicate the methods 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. In this project completeness will be 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. The project design calls for sampling and testing to be performed at all twelve sites every six weeks May through October, with an additional sample taken at each site during a high flow period. Samples are collected at a minimum of six sites each month from November through April. Our completeness goals vary from site to site based on the ease of access during winter months. We expect to reach the four lower sites at least 11 times each year; the middle sites nine times each year; and the upper sites seven times each year.

## **8. TRAINING REQUIREMENTS / CERTIFICATION**

This section as it is outlined in the USEPA's The Volunteer Monitor's Guide to Quality Assurance Project Plans does not apply to this project. In lieu of training requirement information, the qualifications of the Project Stream Ecologist are outlined in Appendix K, in the form of a resume.

## **9. DOCUMENTATION AND RECORDS**

Field data gathered during this project are recorded on Field Data Sheets (see Appendix C) and Discharge Data Sheets (see Appendix D) as well as in field and laboratory logbooks. The Stream Ecologist will complete each data sheet using the decimal points provided to enter data to the appropriate number of significant digits. Any equipment or procedural problems will be recorded in the "Comments and Observations" section of the data sheet. Information from this form will then be entered into Cook Inlet Keeper's monitoring data system. Original copies of all data sheets will be kept on file at the Keeper office indefinitely.

Monitoring equipment and supplies are inspected upon receipt and again before each sampling event, and an Equipment/Supply Inspection Form (see Appendix E) will be kept up to date. All electronic meters will be calibrated before every sampling event and calibrations will be documented in field and laboratory logbooks, as will the maintenance history of each instrument.

During the course of this project there will be occasion for sending replicate samples to an EPA certified laboratory. When this is necessary sample bottles will be labeled using the label shown in Section 12 and a chain of custody form will be used (see Appendix G).

## 10. SAMPLING PROCESS DESIGN

### Sample Site Selection

In order to meet the objectives described in Section 6, the project's design called for selecting four sampling sites on each of the four streams to be studied. Three of these sites were to become monitoring stations and the fourth was to be designated as an alternate site. The following criteria (Ashton 1998) were considered in site selection.

- **Private property access** - if a site requires entering or crossing private property the landowner will be involved in the site selection process and permission will be obtained in writing prior to using the site for sampling.
- **Historical data** – special consideration is given to sites where water quality data has previously been collected.
- **Parameters previously measured** – consideration is given to which of the parameters previously measured at each site coincide with the parameters to be measured in this project.
- **Representativeness** - sampling sites should be located to be representative of a particular reach and not targeted to one specific point source or outfall.
- **Logistical access** – consideration is given to site proximity and accessibility
- **Actual field checks** - each sites is to be visited prior the start of sampling to verify accessibility, representiveness, safety, and appropriateness.

Historical water quality data on the four streams has been collected and summarized in Appendix G. These data, along with the other criteria listed above, were reviewed by the Technical Advisory Committee (TAC) and potential sites were ranked using a site selection matrix. Sites were ranked using a 1 to 3 scale, with one being the highest and three being the lowest (Appendix I).

The TAC decided that project objectives would be better served by altering the original study design. It was noted that the Anchor River watershed is quite large and contains at least two important tributaries while the Stariski Creek watershed is considerably smaller and contains no significant tributaries. In light of this, one site was removed from Stariski Creek and a site was added to the Anchor River drainage. In August 1999, the Upper Anchor River monitoring station was changed from its original location at the headwaters to Beaver Creek, a small tributary that is more accessible (Appendix B).

Each site has been assigned a site number and is identified by its latitude, longitude and elevation as determined using a GIS mapping program and data from previous sampling. Site locations will be verified on site using GPS equipment.

## **Sampling Parameters**

As described in Section 6, testing parameters were selected based on their usefulness in inventorying water quality and projecting the general "health" of the water bodies in question. Consideration was also given to data collected by previous studies on these streams and to the costs related to testing each parameter as related to available funding. The parameters to be tested are listed in Tables T-2 and T-3.

## **Sampling Frequency**

The original plan called for sampling at all stations twice a month May through October and once a month November through April. In the fall of 1999, this schedule was amended to include monitoring at a minimum of six sites each month during the winter. In the spring of 2000, the plan was amended further to take samples at all monitoring stations every six weeks from May through October, with an additional sample taken from each site during a high flow event.

Given the climate of Southcentral Alaska, it is likely that some sites may not be reasonably accessible on the scheduled sampling date. The Stream Ecologist will make efforts to reschedule samplings as weather allows, but this may not always be possible.

## **Site Safety Plans**

Safety is a priority at all times for Cook Inlet Keeper staff and volunteers. Sampling sites were selected, in part, because they are safely accessible. The Stream Ecologist visited each selected site before sampling began to locate the safest access route and identify potential hazards. Permission from landowners was obtained prior to the first sampling event. The Project Stream Ecologist is accompanied at all times by a volunteer field assistant. A cell phone is also made available for use.

In winter months the Stream Ecologist and volunteer assistant will exercise caution in sampling sites with no direct road or winter trail access and will not sample when weather conditions are extreme. Sampling may, at times, require that holes be chopped and maintained in ice-covered fresh water sites, but sampling will not be conducted when thin ice prevents safe access.

The Stream Ecologist and volunteer assistants will use rubber gloves and goggles or eye glasses at all times during sampling and analysis. When wading is required, personnel will wear chest waders or hip boots. Personnel are trained to dress appropriately for weather and to be prepared for variable conditions which may require wearing extra layers of warm clothing and waterproof gear during all seasons.



## **11. SAMPLING METHODS REQUIREMENTS**

### **Cleaning Glassware and Plasticware**

All glassware and plasticware will be cleaned using the following procedure unless otherwise noted:

1. Wash glassware and plasticware with phosphate-free detergent and rinse with tap water.
2. Rinse with 10% hydrochloric acid (HCl).
3. Rinse four times with deionized water.

### **Collection and Preservation of Samples**

Method 1060, Collection and Preservation of Samples (Standard Methods, 19<sup>th</sup> Edition) will be followed for sample collection and preservation. Sample container, sample size, preservation, and maximum storage requirements for each parameter are listed in Table T-2.

A grab sample will be collected manually at each site. The sample will be taken in the middle of the main channel and at mid depth. Three 1 liter samples (polyethylene container), and one 500ml sample (glass container rinsed with 1=1 HNO<sub>3</sub>) will be collected. All containers and equipment used will be pre-rinsed three times with sample water before they are used for testing.

Note: Sample water contained in the 500ml glass container rinsed with 1=1 HNO<sub>3</sub> will be used for Orthophosphate and Total Phosphorus tests only. Nitrogen Nitrate and Nitrogen Nitrite tests will be performed only on samples held in containers which have not been exposed to HNO<sub>3</sub>.

## **12. SAMPLE HANDLING AND CUSTODY REQUIREMENTS**

Most testing procedures in this project will be conducted by the Stream Ecologist in the field or in the laboratory; however, the study design calls for an annual analysis for nutrients, suspended solids and coliform bacteria to be performed at an EPA certified laboratory for one sample from each site. Sample splits will also be sent to an EPA certified laboratory, at the discretion of the Stream Ecologist, whenever values for a particular parameter fall outside the expected range. The Project QA Officer will also receive one split sample per month for replicate analysis. Whenever a sample is transported from the field (whether to the Keeper lab or an outside lab) the sample bottle will be labeled using the Sample Container Label shown in figure F-2. When samples are to be sent to an outside laboratory or submitted to the Project QA Officer for analysis they will be handled using the following chain of custody procedure:

- Samples will be labeled (see Figure F-2) and logged in a notebook upon collection.
- In the field, samples will be the responsibility of, and will stay with the Stream Ecologist.
- Once samples have been collected they will be returned to the Keeper office and logged in for temporary storage.
- Samples will be refrigerated to maintain preservation temperature given in Table T-2.

- The Stream Ecologist will then be responsible for transporting samples to an EPA certified laboratory or turning them over to the Project QA Officer for analysis.
- The Project QA Officer or personnel from the certified lab will record the date and time the sample is received.
- At this point the sample will become the responsibility of the certified laboratory or the Project QA Officer and will be subject to their sample custody and quality control procedures.
- After samples are analyzed, laboratory information will be added to the label.
- The Sample Custody Form (see Appendix G) will be used to record all transport and storage information.
- When samples are to be delivered to the Alaska Department of Environmental Conservation (ADEC), an official State of Alaska ADEC sample collection form will be used as the 'chain of custody' document.

**Figure F-2: SAMPLE CONTAINER LABEL**

<b>COOK INLET KEEPER</b>	
Sample ID: _____	<b>Phone (907) 235-4068</b>
<b>Field Information:</b>	Type of Sample: _____
Site #: _____ Location: _____	Sample Number ___ of ___
Preservation Method: _____ Gear: _____	Date: __/__/__
Time: _____ AM PM	Monitor Name: _____
Phone: _____	Monitor Signature: _____
<b>Lab Information:</b>	
Date: __/__/__	Time: _____ AM PM Phone: _____
Analyst: _____	Signature: _____

### 13. ANALYTICAL METHODS REQUIREMENTS

Documentation of methods used along with range, detection limits, precision and accuracy information is provided in Tables T-2 and T-3. Listed below are the apparatus, reagents, procedures and quality control for analysis of each parameter.

#### **Water Temperature**

Water temperature will be measured with a LaMotte DO 4000, Dissolved Oxygen Meter. The meter specifications for temperature are as follows: range 0°C to 40°C, accuracy ±0.5°C, and precision ±0.01°C. For procedure see Dissolved Oxygen.

Note: If additional funding becomes available, temperature may also be collected using a data logger placed in the stream. Required information will be submitted for approval prior to incorporation of this method.

## Quality Control

DO Meter temperature probe will be calibrated using a NIST certified thermometer before and after each day of sampling. Readings will be compared for two different temperature solutions within the 0°C to 40°C range. Results will be recorded in the laboratory analysis logbook. If calibration readings taken after sampling vary from those taken prior to sampling by more than the accuracy objectives specified in Table T-2 test results will be recorded in field and lab logbooks, but will not be entered into the project data system and additional field sampling may be scheduled.

### **pH: pH Value (4500-H<sup>+</sup>)**

## Apparatus

100ml beaker, Hach EC10pH/mV/Temp Meter (Model 5005). The meter specifications are as follows:

**pH:** range 0 to 14.00, accuracy  $\pm 0.02$ pH, resolution 0.01 pH

**Millivolt:** range -1600 to +1600, accuracy  $\pm 0.02$ mV, resolution 0.1 mV

**Temperature:** range -5.0°C to 105.0°C, accuracy  $\pm 1.0$ °C, resolution 0.1°C

The electrode is a silver/silver chloride reference element. Electrolyte gel (KCL) for the reference half cell is dispensed past the reference element to the reference junction using a miniature pump built into the electrode body.

## Reagents

Buffer solutions of pH 4.01 and 7.00 and Potassium Chloride Reference Electrolyte Cartridge.

## Procedure

1. Calibrate pH meter using two buffer calibration procedure (see Section 16) prior to going into the field.
2. Pour 100ml of sample into beaker.
3. Rinse probe thoroughly with de-ionized water and blot dry.
4. Press dispenser button once (it will click).
5. Inspect end of electrode for presence of gel. If gel is not oozing from tube, press dispenser button again.
6. Immerse probe into sample. Be sure entire sensing end is submerged and there are no air bubbles under electrode.
7. Allow meter to reach equilibrium, and record pH.
8. Press mode key and toggle to temperature mode, allow meter to reach equilibrium and record temperature.
9. Rinse probe thoroughly with de-ionized water and blot dry.
10. Repeat with a second sample portion to confirm successive readings within  $\pm 0.05$  pH unit range.

## Quality Control

The pH meter will be calibrated (see Section 16) with known buffer solutions prior to each day of sampling and again after sampling is completed. The results will be recorded in the laboratory analysis logbook. Analysis will be performed twice on each sample. If results vary by more than 0.02 pH units, a third test will be performed. If no two successive readings fall within the  $\pm 0.02$  unit precision objective, equipment will be re-calibrated and the procedure will be repeated. All results will be recorded in field and lab logbooks, however only final determined value will be entered into the project data system. If calibration readings taken after sampling vary from those taken prior to sampling by more than the accuracy objectives specified in Table T-2 test results will be recorded in field and lab logbooks, but will not be entered into the project data system and additional field sampling may be scheduled.

## **Dissolved Oxygen: Membrane Electrode Method (4500-O G)**

### Apparatus

LaMotte DO 4000 Dissolved Oxygen Meter. The meter specifications are as follows:

**Oxygen Concentration:** Range 0 to 19.99ppm O<sub>2</sub>. Accuracy 5% of reading or 0.10ppm (whichever is greater) when taken within 5°C of the calibration point temperature.

Precision 0.01ppm.

**% Saturation:** Range 0 to 199% saturation. Precision 1% for water saturation.

**Temperature:** Range 0°C to 40°C. Accuracy  $\pm 0.5^\circ\text{C}$ . Precision  $\pm 0.01^\circ\text{C}$ .

### Procedure

1. Calibrate DO meter (see Section 16).
2. Press °C button.
3. Lower probe into stream to mid depth and allow display to stabilize and record temperature.
4. Press O<sub>2</sub> button.
5. Set “SALINITY COMP” knob to the salinity of sample water.
6. Gently raise and lower probe several times to remove air bubbles. Continue to raise and lower to avoid oxygen starvation at membrane.
7. Wait until display stabilizes, then take reading as ppm dissolved O<sub>2</sub>.
8. Press “%SAT” button.
9. Continue to raise and lower probe to avoid oxygen starvation at membrane.
10. Wait until display stabilizes, then take reading as % Saturation.
11. Repeat procedure to confirm successive readings within  $\pm 0.10$  mg/L.

### Quality Control

The DO meter will be calibrated (see Section 16) prior to each use. The results will be recorded on the field data sheet. Analysis will be performed in situ twice at each sampling event. If results vary by more than 0.10 mg/l, a third test will be performed. If no two successive readings

fall within the  $\pm 0.10$ mg/l precision objective, equipment will be re-calibrated and the procedure will be repeated. All results will be recorded in a field logbook, however only the final determined value will be entered into the project data system.

### **Conductivity: Laboratory Method (2510 B)**

#### **Apparatus**

100mL Beaker and Hach CO150 Conductivity Meter, Model 50150. The meter specifications are as follows:

**Conductivity:** Range 0 to 19,999  $\mu$ S. Accuracy  $\pm 0.5\%$  of full scale of reading within each range, maximum. Cell Constant Range 0.07 to 14.99. Cell Constant Resolution 0.0700, 1.000, 10.00

**Salinity:** Range 0.0 to 80.0 ppt. Accuracy  $\pm 0.1\%$ . Resolution 0.1%.

**Total Dissolved Solids:** Range 0 to 19900 mg/L. Accuracy  $\pm 1\%$  RSD, 5 to 70°C, Resolution 3 significant digits.

**Temperature:** Range  $-10.0^{\circ}\text{C}$  to  $+110.0^{\circ}\text{C}$ . Accuracy  $\pm 1.0^{\circ}\text{C}$ . Resolution  $0.1^{\circ}\text{C}$ . The probe is a temperature compensated cell and has the following specifications:

**Cell Constant:** 1.0 ( $\pm 10\%$ )

**Range:** 1.0  $\mu$ S-100mS

**Temperature:** 0-80°C

#### **Reagents**

De-ionized Water and Standard Potassium Chloride (KCl) Solution, 0.0100M.

#### **Procedure**

1. Calibrate the Conductivity Meter using the Cell Constant Adjustment Calibration Method (see Section 16).
2. Pour 100ml of sample into beaker and place on magnetic stirrer.
3. Press mode key to place meter in Conductivity mode.
4. Immerse probe and allow meter to reach equilibrium
5. Record reading in mS or  $\mu$ S
6. Rinse probe thoroughly with de-ionized water before continuing to next sample.
7. Repeat with a second sample portion to confirm successive readings within  $\pm 1.0\%$ .

#### **Quality Control**

The Conductivity Meter will be calibrated by the Cell Constant Adjustment Calibration Method (see Section 16) prior to each use. The results of calibration will be recorded in the laboratory analysis logbook. Analysis will be performed twice on each sample. If results vary by more than 1.0%, a third test will be performed. If no two successive readings fall within the  $\pm 1.0\%$  precision objective, equipment will be re-calibrated and the procedure will be repeated. All results will be recorded in the lab logbook, however only the final determined value will be entered into the project data system.

## **Total Dissolved Solids**

### Apparatus

Hach CO150 Conductivity Meter, Model 50150 (see conductivity for specifications) and 100ml beaker

### Reagents

De-ionized Water, Standard Potassium Chloride (KCl) Solution, 0.0100M, Sodium Chloride Standard Solution

### Procedure

1. Calibrate Conductivity Meter (see Section 16).
2. Pour 100ml of sample into beaker and place on magnetic stirrer.
3. Press mode key to place meter in Total Dissolved Solids mode.
4. Immerse probe and allow meter to reach equilibrium.
5. Record reading in mg/L.
6. Rinse probe thoroughly with de-ionized water before continuing to next sample.
7. Repeat with a second sample portion to confirm successive readings within  $\pm 1\%$ .

Note: Total dissolved solids method may not be comparable to EPA methods or Standard Methods 2540C, and resulting data can not be compared to State Water Quality Criteria. If additional funding becomes available, the project may incorporate method 2540 C Total Dissolved Solids Dried at 108°C (Standard Methods, 19<sup>th</sup> Edition) into the plan. Required information will be submitted for approval prior to incorporation of this method.

### Quality Control

The Conductivity Meter will be calibrated by the Cell Constant Adjustment Calibration Method (see Section 16) prior to each use. A Sodium Chloride Standard Solution with a conductivity value in the same range of the sample will also be measured. The results will be recorded in the laboratory analysis logbook. Analysis will be performed twice on each sample. If results vary by more than 1.0%, a third test will be performed. If no two successive readings fall within the  $\pm 1.0\%$  precision objective, equipment will be re-calibrated and the procedure will be repeated. All results will be recorded in the lab logbook, however only the final determined value will be entered into the project data system

## Suspended Solids: Photometric Method (8006)

### Apparatus

Hach DR/2010 Spectrophotometer, Blender, 500ml graduated cylinder, 25ml pipet, pair of 25ml matched sample cells, 600ml beaker

### Procedure

1. Enter the stored program number for suspended solids. Press **630 ENTER**.
2. Rotate wavelength dial until small display shows: **810 nm**. When correct wavelength is dialed in, display will quickly show: **Zero Sample** then: **mg/l suspended solids**.
3. Blend 500ml of sample in blender at high speed for exactly 2 minutes.
4. Pour sample into 600ml Beaker.
5. Stir sample and immediately pour 25ml of blended sample into a sample cell.
6. Fill a sample cell with 25ml of deionized water (blank).
7. Place blank in cell holder. Close light shield.
8. Press **ZERO**. Display will show: **Zeroing**, then **0 mg/l suspended solids**.
9. Swirl prepared sample cell to remove any gas bubbles and uniformly suspend any residue.
10. Place prepared sample into cell holder. Close light shield. Press read, then record reading in **mg/l suspended solids**.
11. Repeat with a second sample portion to confirm reading.

Note: Total suspended solids method may not be comparable to EPA methods or Standard Methods 2540D, and resulting data can not be compared to State Water Quality Criteria. If additional funding becomes available, the project may incorporate method 2540 D Total Suspended Solids Dried at 103-105°C (Standard Method, 19<sup>th</sup> Edition) into the plan. Required information will be submitted for approval prior to incorporation of this method.

### Quality Control

Analysis will be performed twice on each sample. Precision and accuracy objectives will be determined and reported as part of the project measurements.

## Turbidity: Nephelometric Method (2130)

### Apparatus

Sample Cell, LaMotte 2020 Turbidimeter. The meter specifications (range, detection limits, precision, and accuracy) are listed in Table T-2.

### Reagents

1. Turbidity Standard 10 NTU
2. Turbidity Standard 1.0 NTU

## Procedure

1. Calibrate Turbidimeter (see Section 16).
2. Gently agitate sample. Wait until air bubbles disappear then rinse a sample cell with a portion of sample.
3. Fill sample cell to neck by carefully pouring sample down the side of tube to avoid creating bubbles.
4. Cap cell and wipe dry with a lint-free tissue.
5. Open 2020 lid. Align indexing arrow on cell with indexing arrow on meter. Insert cell into chamber.
6. Close lid. Push READ button and record NTU units.
7. Repeat with a second sample portion to confirm successive readings within  $\pm 2\%$  for readings below 100 NTU and  $\pm 3\%$  for readings above 100 NTU.

Note: If sample is higher than 1100 NTU, it must be diluted and retested.

## Quality Control

The Turbidimeter will be calibrated (see Section 16) prior to each use. The results will be recorded in the laboratory analysis logbook. Analysis will be performed twice on each sample. If results vary by more than 2% for readings below 100 NTU or 3% for readings above 100 NTU, a third test will be performed. If no two successive readings fall within the  $\pm 2\%$  for readings below 100 NTU or  $\pm 3\%$  for readings above 100 NTU precision objective, equipment will be re-calibrated and the procedure will be repeated. All results will be recorded in the lab logbook, however only the final determined value will be entered into the project data system.

## **Color, Apparent: APHA Platinum-Cobalt Standard Method (8025)**

### Apparatus

Hach DR/2010 Spectrophotometer, pair of 25ml matched sample cells.

### Reagents

De-ionized Water, Color Standard Solution (500 platinum-cobalt units)

### Procedure

1. Fill a sample cell (blank) with 25ml of filtered de-ionized water.
2. Enter stored program for true color. Press **120 ENTER**. Display will show: **Dial nm to 455**.
3. Rotate wavelength dial until display shows: **455 nm**. When correct wavelength is dialed in, display will quickly show: **Zero Sample**, then: **Units PtCo APHA**.
4. Fill second sample cell with 25ml of sample.



5. Place blank into cell holder. Close light shield. Press **ZERO** and wait until display shows **0. Units PtCo APHA**.
6. Place sample into cell holder. Close light shield. Press **READ** then record results in **Units PtCo APHA**.

### Quality Control

Accuracy will be checked using the Standard Solution Method. A platinum-cobalt standard solution of known concentration will be read using the above procedure after sample analysis. The results will be recorded into the laboratory analysis logbook. Precision and accuracy objectives will be determined and reported as part of the project measurements.

## **Nitrogen, Ammonia: Nessler Method (8038)**

### Apparatus

Hach DR/2010 Spectrophotometer, two 25 ml graduated mixing cylinders, a matched pair 25 ml sample cells.

### Reagents

Nessler Reagent, Mineral Stabilizer, Polyvinyl Alcohol Dispersing Agent, de-ionized water, Nitrogen Ammonia Standard Solution.

### Analysis Procedure

1. Enter stored program number for Ammonia Nitrogen (NH<sub>3</sub>-N). Press **380 ENTER**.
2. Rotate wavelength dial to **425 nm**.  
*Note: This test is sensitive to the wavelength setting. To assure accuracy run test using a 1.0mg/L standard solution and deionized water blank. Repeat steps 10 through 12 at slightly different wavelengths, setting the dial from higher to lower values, until the correct result is obtained. The wavelength should be 425 ±2nm. Always set this wavelength by approaching from high to low values.*
3. Fill a 25ml mixing graduated cylinder with sample to the 25ml mark.
4. Fill another 25ml mixing graduated cylinder (blank) with deionized water.
5. Add 3 drops of mineral stabilizer to each cylinder. Invert several times to mix.
6. Add 3 drops of Polyvinyl Alcohol Dispersing Agent to each cylinder. Invert several times to mix.
7. Pipet 1.0 ml of Nessler Reagent into each cylinder. Stopper. Invert several times to mix.  
*Note: A yellow color will develop if ammonia is present. (The reagent will cause a faint yellow color in the blank.)*
8. Press **SHIFT TIMER**. A one minute reaction period will begin.  
*Note: Continue to step 9 while timer is running.*
9. Pour each solution into a sample cell.
10. When timer beeps, display will show mg/L NH<sub>3</sub>-N Ness. Place blank into cell holder and close shield.

11. Press **ZERO**. Wait until display shows **0.00 mg/L NH<sub>3</sub>-N**.
12. Place prepared sample into cell holder. Press **READ** then record result in mg/L NH<sub>3</sub>-N.

### Quality Control

Accuracy will be checked using the Standard Solution Method. A 1.0mg/l Nitrogen Ammonia Standard Solution will be read using the above procedure after sample analysis. The results will be recorded in the laboratory analysis logbook.

## **Nitrogen, Nitrate: Cadmium Reduction Method (8192)**

### Apparatus

Hach DR/2010 Spectrophotometer, 50ml graduated mixing cylinder, matched pair 25ml sample cells, No.1 polyethylene stopper

### Reagents

NitriVer 3 nitrite reagent Powder Pillows, NitriVer 6 nitrate reagent Powder Pillows, Nitrite Standard Solution

### Procedure

1. Enter stored program number for low range nitrate nitrogen (NO<sub>3</sub>-N). Press **351 ENTER** wait for display to show **Dial nm to 507**, then rotate wavelength dial to **507 nm**.
2. Fill a 50ml mixing graduated cylinder to the 30ml mark with sample.
3. Add contents of one NitraVer 6 Nitrate Reagent powder Pillow to cylinder. Stopper.  
*Note: Determine a reagent blank for each new lot of reagent powder pillows. Repeat steps 3-13, using deionized water as the sample. Subtract this value from each result obtained with this lot of reagent.*
4. Press: **SHIFT TIMER**. A three-minute reaction period will begin. Shake cylinder continuously during this period.  
*Note: Shaking time and technique influence color development. For more accurate results, analyze a standard solution several times and adjust the shaking time to obtain the correct result.*
5. Press: **SHIFT TIMER**. A two-minute period allows the cadmium to settle. When the timer beeps, pour 25 ml of sample from cylinder into a sample cell.  
*Note: Do not transfer any cadmium particles.*
6. Add contents of one NitriVer 3 Nitrite reagent Powder Pillow to sample cell (prepared sample). Stopper and shake to dissolve.
7. Press: **SHIFT TIMER** and a 10-minute reaction time will begin. When timer beeps, display will show **mg/L N NO<sub>3</sub><sup>-</sup> LR**.
8. Fill another sample cell with 25ml of Sample (blank). Place blank into cell holder and close lid. Press **ZERO** and wait until display shows **0.00 mg/L NO<sub>3</sub><sup>-</sup>-N LR**.
9. Within 10 minutes after timer beeps, remove stopper from prepared sample. Place prepared sample into cell holder and close lid.
10. Press: **READ** and record the result in mg/L NO<sub>3</sub><sup>-</sup>-N LR.

### Quality Control

Accuracy will be checked using the Standard Solution Method. A 0.20 mg/L Nitrate Nitrogen Standard Solution will be read using the above procedure after sample analysis. The results will be recorded in the laboratory analysis logbook.

### **Orthophosphate: Ascorbic Acid Method (8048)**

#### Apparatus

Hach DR/2010 Spectrophotometer, 10ml cell riser, matched pair of 10ml sample cells

#### Reagents

PhosVer 3 Phosphate Reagent Powder Pillows,  $\text{PO}_4^{3-}$  Standard Solution

#### Procedure

1. Enter stored program number for reactive phosphorus ascorbic acid method, powder pillows. Press: **490 ENTER** and wait until display shows **Dial nm to 890**.
2. Rotate wavelength dial until small display shows : **890 nm** and wait until display shows **mg/L  $\text{PO}_4^{3-}$ PV**.
3. Insert a 10ml cell riser into cell compartment.
4. Fill a 10ml sample cell with 10ml of sample.
5. Add the contents of PhosVer 3 Phosphate Powder Pillow for 10ml sample to cell (prepared sample). Swirl immediately to mix.  
*Note: A blue color will form if phosphate is present.*
6. Press: **SHIFT TIMER**. A two-minute reaction period will begin.
7. Fill a second 10ml sample cell with 10ml of sample (blank). When timer beeps, place blank into cell holder and close lid.
8. Press: **ZERO** and wait until the display shows **0.00 mg/L  $\text{PO}_4^{3-}$ PV**. Place prepared sample into cell holder and close lid.  
*Note: Run a reagent blank for this test. Use deionized water in place of the sample in steps 4 and 7. Subtract this result from all test results run with this test lot of Phos Ver 3*
9. Press **READ** and record result as mg/L  $\text{PO}_4^{3-}$ .

### Quality Control

Accuracy will be checked using the Standard Solution Method. A 2.0 mg/L  $\text{PO}_4^{3-}$  Standard Solution will be read following the above procedure after sample analysis. The results will be recorded in the laboratory analysis logbook.

## **Total Phosphorus: Acid Persulfate Digestion Method (8190)**

### Apparatus

Hach DR/2010 Spectrophotometer, matched pair of 25 ml sample cells, 25 ml graduated cylinder, 50ml erlenmeyer flask.

Note: Rinse all glassware with 1:1 hydrochloric acid solution. Rinse again with deionized water.

### Reagents

Potassium Persulfate Powder Pillows, Sodium Hydroxide solution-5.0 N, Sulfuric acid Solution-5.25 N, deionized water, boiling chips

### Procedure

1. Measure 25ml of sample into a 50ml erlenmeyer flask using a graduated cylinder.
2. Add contents of one potassium Persulfate Powder Pillow. Swirl to mix
3. Add 2.0ml of 5.25 N Sulfuric Acid Solution. Add several boiling chips.
4. Place flask on stove or hot plate. Boil for 30 minutes. Cool sample to room temperature.  
Note: *Sample should be concentrated to less than 20ml for best recovery. After concentration, maintain the volume near 20ml by adding small amounts of deionized water. Do not exceed 20 ml.*
5. Add 2.0ml of 5.0 N Sodium Hydroxide Solution. Swirl to mix. Pour sample into a 25ml graduated cylinder. Use deionized water from rinsing the flask to return volume to 25ml. Perform reactive phosphorus test.  
Note: *Use a 10-minute reaction period when determining total phosphorus following the acid-persulfate digestion. Use stored program number for the reactive phosphorus ascorbic acid method used above .*

### Quality Control

Accuracy will be checked using the Standard Solution Method. A 2.0mg/L  $\text{PO}_4^{3-}$  Standard Solution will be read following the above procedure after sample analysis. The results will be recorded in the laboratory analysis logbook.

## **Fecal and Total Coliform Bacteria**

Analysis is conducted using the Coliscan screening technique developed by Micrology Laboratories.<sup>1</sup> Holding time is recorded for all samples; data from samples with a holding time of greater than 6 hours will not be compared with data from samples held for less than 6 hours.

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<sup>1</sup> Micrology Laboratories LLC. 1996. Coliscan™**Easygel**™- Procedures & Detection of Waterborne Coliforms and Fecal Coliforms, 6p. RCS, Goshen, Indiana

## Apparatus

petri dishes, 10ml pipet

## Reagents

Coliscan Easygel medium

## Procedure

1. Mark lids of 2 bottles of Coliscan Easygel™ with the numbers 1, 3, and 5.
2. Use sterile pipet to measure 1ml sample and deposit into Easygel™ bottle marked as 1.
3. Draw and deposit 3ml sample into bottle of Easygel™ marked with a 3. Repeat process by drawing and depositing 5 ml sample into the bottle marked 5.
4. Mark lids (larger half) of three pretreated petri dishes with date, name and number of sampling site, and amounts 1ml, 3 ml and 5 ml.
5. Match bottles of Coliscan-water mixture to petri dishes marked with same number. One at a time, pour each bottle of Coliscan-water mixture into bottom half of respective petri dish.
6. Cover dishes with designated lids and swirl liquid so that it covers entire bottom of dish.
7. Place petri dishes containing Coliscan-water mix in warm place and incubate for 48 hours.  
*Note: Sample temperature is maintained between 30°C and 37°C (85°F-99°F) during incubation. (Coliscan samples can also be incubated at room temperature, but an additional 24 hours must be added to incubation time.)*
8. After 30 to 40 minutes gel will set. When this occurs invert petri dishes and continue incubating.
9. After 48 hours have past, count number of purple colonies that have formed in petri dish. Record as fecal coliform (*E.coli*) count for this sample.
10. Next, count number of pink or red colonies and add this to fecal coliform count. Record as total coliform count.

Note: Fecal and Total Coliform method is not the specified EPA or Standard Methods procedure to verify State Water Quality Criteria.

## Quality Control

Precision and accuracy objectives will be determined and reported as part of the project measurements by comparing results obtained from testing 1ml, 3ml and 5ml samples (precision) and by comparing results from sample splits sent to an outside EPA approved laboratory to those obtained using the above method (accuracy).

## **Settleable Solids (APHA 2540 F)**

### Apparatus

Imhoff cone

### Procedure

Fill an Imhoff cone to the 1-L mark with a well-mixed sample. Settle for 45 minutes, gently agitate sample near the sides of the cone with a rod or by spinning, settle 15 minutes longer, and record volume of settleable solids in the cone as milliliters per liter. If the settled matter contains pockets of liquid between large settled particles, estimate volume of these and subtract from the volume of settled solids. The practical lower limit of measurement depends on sample composition and generally is in the range of 0.1 to 1.0 mL. When a separation of settleable and floating materials occurs, do not estimate the floating material as settleable matter. Replicates are usually not required.

## **Stream Discharge: Current Meter Method**

A current-meter measurement is the summation of the products of the subsection areas of the stream cross section and their average velocities.

### Apparatus

Price AA current meter, Pygmy current meter, wading rod, ear phones, stop watch, tagged measuring line, discharge data sheet, meter rating tables

### Procedure

1. The first, and one of the most important steps, is the selection of a reach of stream for making a discharge measurement. Velocities within a natural stream channel are not always uniform nor parallel to the channel bottom and stream banks. Current meters do not measure vertical velocities which are created by obstructions to flow, e.g. large boulders, logs, etc. So it is important to select the best reach using the following criteria:
  - a. A straight reach with the threads of velocity parallel to each other (observable as smooth laminar flow without turbulent, choppy, or wavy water areas),
  - b. Stable streambed free of scattered boulders, weeds, and protruding obstructions such as logs which would create turbulence, or vertical velocity threads.

A long straight pool area provides the best stream reach. After selecting the best reach then select a cross section to make your measurements. Normally, the best cross section location is near the outlet of the pool where velocities are parallel and consistent. (Caution: avoid cross sections with backwater eddies near the banks.)

2. String a fiberglass measuring tape across the stream at right angles to the direction of flow (not necessarily at a right angle to the channel). Determine the width of the stream and divide the width into 20 to 30 partial sections or cells. The width of the cells should be smaller or more numerous toward the center of the stream as the depth and velocities increase. The best data set is one in which no partial section contains more than 5 percent of the total discharge.
3. Examine the cross section to determine the approximate average depth. If the average depth is greater than 1.5 feet, then a Price AA current-meter should be used. If the average depth is less than 1.5 feet then a Pygmy current-meter should be used. Use the Price AA meter at depths as shallow as 0.5 foot, but no shallower.
4. Assemble the Price AA or Pygmy meter and fins onto a top setting wading rod, loosen the vane retention nut on the bottom of the Price AA meter or remove and replace the shipping pin on the Pygmy meter, oil the cup pivot bearing and upper gear assembly with WD-40, and spin test (see instrument calibration) the meter by spinning the cups and timing them until they stop utilizing a stop watch. Record the time on the front of the data form.

*Note: It is wise to spin test all instruments in the office before leaving for the field. Use of oil other than very light solvent types like WD-40 will cause significant errors in velocity measurements because heavier oils jell in cold water.*

5. On the front page of the Discharge Data Sheet (see Appendix D) write the site name and location, date, name of monitor, type of meter used, spin test times, meter serial number, description of the weather including precipitation and temperature range for the past 48 hours, present air and water temperature, and other observations in the “Remarks” section (e.g. glacial, bank full, soft muddy bottom, etc.).
6. On the second page, first line, record which side of the stream you are starting from as you look downstream and the distance from the beginning of the measuring tape to the waters edge. The measuring tape should run from high water mark to high water mark. Along with noting which side of the stream you begin from note the distance from the end of the tape to the waters edge, e.g. REW 3.7 is right edge of water at 3.7 feet. The water depth will be “0” (zero) at the water edge.
7. Move out to the next increment of measurement and place the top-setting wading rod so the base plate rests on the streambed. The depth is read from the incremented hexagonal main rod. Units are 1/10 foot, half-foot increments are marked by double lines, and each whole foot increment is marked with triple lines. Record the distance along the tape and the water depth onto the data form.
8. If the depth is greater than 0.5 foot and less than 2.5 feet, set the meter depth by adjusting the wading rod. Align the appropriate whole foot mark (located on the round rod) with the appropriate 1/10 foot mark (located on the handle).

9. It is important to stand at full arms length behind and to one side of the wading rod and current meter when measuring velocities. Never stand directly behind the instrument because the resistance between you and the water decreases the velocity of the water in the immediate area of your body.
10. Count the number of revolutions for at least 40 seconds. Start the stop watch on the count of zero. From the rating table, note the revolution increments across the top of the table. As soon as 40 seconds has passed stop at the next revolution increment shown on the top of the table, e.g. 20, 25, 30, 40, etc. revolutions. Example, at 40 seconds you count 21 revolutions, continue counting until you reach 25 revolutions and stop the stop watch on the count "25". Record both the time and number of revolutions in the columns labeled REVOLUTIONS and TIME on the data form.
11. If the water depth is greater than 2.5 feet then two velocity measurements must be taken, one at 0.2 of the depth and one at 0.8 of the depth. Using the wading rod the two settings are obtained by dividing the water depth by 2 (0.2 depth) and multiplying the water depth by 2 (0.8 depth) and setting these values on the wading rod as described in step 8 above. Example, if the depth is 2.8 feet set the wading rod at 1.4 ft. (for 0.2 depth) and 5.6 ft. (for 0.8 depth), respectively. Count the number of revolutions over time for both setting and record these on the data form.

*Note: The average of these two velocities will be used to calculate the discharge for this cell.*

12. Move out to the next increment along the fiberglass tape and repeat steps 7 through 11. Repeat these steps until you reach the opposite water edge.
13. Sometimes irregularities in the channel configuration cause the direction of the flow at one or more increments along the transect to be at an angle other than 90 degrees. When this occurs an Angle Coefficient correction factor must be used to normalize the velocity vector. Measure the cosine of the horizontal angle by the origin point (0) located on the left margin of page 2 of the Discharge Data Sheet. With the right edge of the discharge note form read the angle coefficient from the top, bottom, or the first column of the form. Multiply the measured velocity by the angle coefficient to determine the normalized velocity vector. Write this corrected velocity in column 10 labeled "Adjusted for Horizontal. Angle".
14. After you note "LEW" or "REW", distance along the tape, and the depth "0" record the total distance to the high water line along the stream bank or width of floodplain.
15. When finished with all depth/velocity measurements, spin test the current meter again and record the time on the data form, dry the meter, oil the pivot bearing and upper gear assembly, tighten the shipping nut (Price AA) to raise the cups off of the pivot pin or remove and replace pivot pin (Pygmy) with the shipping pin, and place the current meter into the case before moving to another site).



## Stage

### Apparatus

#### Crest-Stage Gauge

Note: A crest-stage gauge provides a record of the peak stages of stream rises, and those stages can be used with observer's routine readings.

### Procedure

1. Setup crest-staff gauge into a streambed location where water flows permanently.
2. Read water level of stream on staff gauge and record stream height.
3. Remove top end cap and take out dowel.
4. Use scaled staff gauge to measure level of cork powder ring and record crest height.
5. Wipe off cork powder and replace dowel. Add more cork powder when needed.

## **14. QUALITY CONTROL REQUIREMENTS**

Sample splits will be taken from each site during the first sampling cycle of the project. These splits will be sent to an EPA certified laboratory for replicate analysis of nitrogen-ammonia, nitrogen-nitrate, orthophosphate, total phosphorus, suspended solids, fecal coliform and total coliform measurements. Throughout the project sample splits will be sent to an EPA certified laboratory whenever values for a particular parameter fall outside the expected range. The Project QA Officer will perform replicate analysis for all parameters (excluding temperature, pH, ORP, DO, discharge and stage) on one split sample per month. These splits will be taken from a different randomly selected site each month. The sample handling and custody procedures described in Section 12 will be strictly adhered to for all split samples. Variation of duplicate values for each parameter must not exceed the range of precision and accuracy specified in Table T-2. Any problems found with data collected are noted on the Field Data Sheet as well as in laboratory and field logbooks. Any changes to data are initialed by the Project QA Officer and the Stream Ecologist. Data that do not meet project accuracy and precision objectives are not entered in the project data system and will not be used in project reports.

Quality control procedures are also built in to the testing methods for each parameter. See quality control headers for each parameter in Section 13.

## **15 INSTRUMENT / EQUIPMENT TESTING, INSPECTION AND MAINTENANCE**

All equipment, meters, kits and supplies will be checked upon receipt by the Stream Ecologist to ensure that operations are within technical specifications before use. Each reagent will be dated with the expiration date. An Equipment/Supply Inspection Form (Appendix E) which includes reagent expiration dates will be completed and kept on file at the Keeper office. This form will be updated each time new or replacement equipment or reagents are received.

Before each sampling event the Stream Ecologist will inspect all equipment for damage. All meters will be inspected and calibrated prior to use and results will be recorded in field and laboratory logbooks. Chemicals will be checked for expiration date, sufficient quantity and discoloration. All testing equipment is to be clean and in good working order before it is used for monitoring. (See Section 11 for cleaning procedures for glassware and plasticware). If any equipment or chemical reagent is found to be defective in any way, it will be replaced and the Equipment/Supply Inspection Form will be updated.

A supply of replacement equipment and reagents is kept in the laboratory. This supply includes extras of commonly lost or broken equipment and enough reagents to perform all scheduled analysis procedures for at least three months. Reagent stocks are rotated out every four to six months or according to manufacturer's recommendation.

Routine maintenance for all meters will be conducted according to schedules and procedures described in manuals provided by the manufacturers and a maintenance log will be kept for each instrument.

## **16. INSTRUMENT CALIBRATION PROCEDURES**

Listed below are the calibration procedures for each instrument used. Field calibration will be performed on the following equipment: Hach EC10pH/mV/Temp Meter, Model 5005 for the parameters of pH and ORP; LaMotte DO-4000 Dissolved Oxygen Meter; Price AA and Pygmy Discharge Meters. Field calibration of these instruments will be recorded in a field log. Lab calibrations for all other instruments will be documented in the laboratory analysis logbook.

### **Thermometer and Temperature Probes**

Thermometer and temperature probes will be calibrated using a NIST certified thermometer prior to each day of sampling.

### **EC10pH/mV/Temp Meter (Model 5005)**

#### **pH Two Buffer Calibration Method**

1. Choose either, 4.01 and 7.01, or 7.01 and 10.01 buffers, whichever is closest to expected sample range and allow them to warm to room temperature (~ 25°C).
2. Press **MODE** key until pH mode indicator is displayed.
3. Place electrode into either 4.01, 7.01 or 10.01 buffer. (It is preferable to start with 7.01 buffer).
4. Press **CAL** key. **CALIBRATE** will be displayed above main field. After current calibration slope is displayed, **P1** will be displayed in lower field. **P1** indicates meter is ready to accept first buffer point. Make sure electrode is in correct buffer.
5. When electrode is stable, meter will beep and **READY** will be displayed along with temperature-corrected value for buffer (flashing). Press **YES** key to accept this point.

6. Display will remain fixed momentarily then **P2** will be displayed in lower field. Meter is now ready for second buffer.
7. Rinse electrode(s) and place in second buffer. Wait for a stable pH reading (meter will beep) and for **READY** to be displayed. Press **YES** key to accept second point.

### **DO 4000 Dissolved Oxygen Meter**

#### **Saturated Air Calibration Method**

Note: It is very important that membrane be completely dry before starting air calibration. Vigorously shake probe several times to remove water droplets from membrane. However, calibration must be done in humid not dry air.

1. Hold probe several inches above water surface.
2. Set “**SALINITY COMP**” knob to 0. Press “**% SAT**” button. Wait for display to stabilize.
3. Adjust “**SLOPE**” control until display reads 100. Meter is now calibrated for use.

### **CO150 Conductivity Meter, Model 50150**

#### **Cell Constant Adjustment Calibration Method**

1. Initiate calibration by pressing **CAL** key once. Latest cell constant will be displayed, as well as “**CALIBRATE**” annunciation, at top of center of display.
2. Estimate cell constant (on probe) of cell in use and enter value by scrolling each digit with **ARROW** key, then accepting value by pressing **YES** key.
3. Place conductivity cell in standard.
4. Make sure meter is in conductivity measurement mode. Compare displayed value of standard to its specified value at sample temperature.
5. If correct standard value is not displayed, calculate correction factor in displayed value from step 4.  $\text{Correction Factor} = \text{Standard Value} / \text{Displayed Value}$ .
6. Return to step 1, and multiply cell constant by factor obtained in step 5.
7. Repeat steps 2 through 6 until the accuracy listed in Table T-2 is obtained.

### **2020 Turbidimeter**

1. Select a standard in range of sample to be tested.
2. Fill a sample cell with standard, cap and wipe clean with lint-free cloth.
3. Align indexing arrow mark on tube with indexing arrow mark on meter, and insert tube into chamber.
4. Close lid and push the **READ** button. If displayed value is not same as value of reactive standard (within specification limits), continue with standardization procedure.
5. Push **CAL** button and adjust display until value of standard is displayed.
6. Push **CAL** button again to memorize standardization. Once display stops flashing calibration will be complete.

## Hach DR/2010 Spectrophotometer

### Sample Cell Matching

Sample cells shipped with DR/2010 are matched and distortion-free. Nicks and scratches from normal use can cause an optical mismatch between two sample cells and introduce error in test results. This type of error can sometimes be avoided by optically re-matching sample cells as follows:

1. Turn instrument on and select **Constant-On** mode. Wait 5 minutes for lamp to warm up.
2. Enter stored program for absorbance. Press **0 ENTER**. Display will show: **Abs**.
3. Rotate wavelength dial until small display shows 510nm or wavelength commonly used.
4. Pour at least 25ml (10ml for 10ml cells) of deionized water into each of two sample cells.
5. Place one sample cell into cell holder. Orient fill mark to left. Close light shield.
6. Press: **ZERO**. Display will show: **0.000 Abs**.
7. Place other sample cell in cell holder using same orientation as in step 5. Close light shield.
8. Wait about 3 seconds for reading to stabilize. Record result.

Two sample cells are matched when their absorbance readings are within 0.002 Abs of each other. If cells do not match, there are two alternative options to purchasing a new set.

- a. If more than two sample cells are on hand, repeat steps 7-8 for with these cells to determine if any match original cell. If two cells match, mark them appropriately and keep them as a set.
- b. As a last option, change orientation of cells to find a matched configuration. Repeat steps above for two sample cells, placing both cells in cell compartment with fill marks facing forward. If absorbance reading of second cell is within +/- 0.002 Abs, the cells can be used as a matched set in that particular orientation. All future work with this particular set would require same orientation. If necessary, repeat matching process with different orientations as needed.

If the sample cells cannot be matched within +/-0.002 Abs, they may still be used by compensating for the difference. For example, if second cell reads 0.003 absorbance units higher than first cell, correct future readings (when using these two cells) by subtracting 0.003 absorbance units (or equivalent concentration) from reading. Likewise, if second cell reads -.003 absorbance units, add value to reading.

### Lamp Calibration Adjustment

1. Empty cell compartment and close cover. Adjust wavelength to approximately 850 nm.
2. Verify instrument is in **Constant On** mode by pressing **SHIFT, SETUP**, then press **DOWN ARROW** key twice. If lamp is in **Constant On** mode, go to Step 3. If it is in **Momentary** mode, put instrument in **Constant On** mode by pressing **ENTER**, then press **UP ARROW** key to toggle to **Constant On**. Press **ENTER** again.
3. While still in Setup Menu, press **UP ARROW** key to scroll to adjust nm and press **ENTER**. Display will show: **Peak Filter**. Press **ENTER** again. Display will show: **Zero Required**.

4. Press **ENTER** key. Display will show: **100.0% T Peak Filter**.
5. Place calibration filter into sample compartment with tab aligned to right. Close cover.
6. Using wavelength control on side of instrument, slowly adjust wavelength dial counterclockwise (decreasing wavelength) while observing transmittance reading in display. Record wavelength (nm) where % transmittance reading is greatest. Turn wavelength dial back in other direction to at least 10nm higher than value recorded above. Again adjust wavelength dial counterclockwise slowly while watching % transmittance display. Stop exactly on peak (highest) transmittance value. You may now just adjust calibration.

Note: Repeat Step 6 as needed until you have stopped dialing exactly on peak transmittance reading when approaching from higher wavelength side (counterclockwise direction).

7. With peak transmittance determined in Step 6 displayed, press **ENTER**. Display shows **ARE YOU SURE?**
8. Press **ENTER**. A good adjustment gives momentary display of **Completed** with **808** in **nm** field, then reverts to **Enter Program #** display.

### Current Meters

#### Price AA Meter Spin Test

1. Protect meter from any wind and spin meter.
2. Meter should spin for at least 1.5 minutes.
3. If meter does not pass test, repair and or replace necessary parts and perform test again before using meter for measurement.

#### PricePygmy Meter Spin Test

1. Protect meter from any wind and spin meter.
2. Meter should spin for at least 0.5 minutes.
3. If meter does not pass test, repair and or replace necessary parts and perform test again before using meter for measurement.

### Crest-Staff Gauge

Calibrate gauge by measuring difference between lowest point on streambed and zero point on staff gauge scale. Gauge will be calibrated yearly, and after severe episodes of erosion or deposition.

### Coliscan

The accuracy of coliscan testing kits is verified when samples are split and sent to an outside, EPA approved laboratory for replicate analysis. Split samples from each site will be sent for outside analysis during the initial sampling cycle of the project and annually thereafter. Splits

will also be sent for replicate analysis at the discretion of the Stream Ecologist whenever coliform readings for a particular site are higher than expected levels.

## **17. INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES**

Monitoring equipment and supplies are ordered from LaMotte Chemical Co., the Hach Co. and Micrology Laboratories, and are inspected upon arrival by the Stream Ecologist. Each reagent will be marked with an expiration date. An Equipment/Supply Inspection Form, (see Appendix E) which includes reagent expiration dates will be completed and kept on file at the Keeper office. Broken bottles and reagents or instruments that do not meet project standards are shipped back to the manufacturer for replacement.

## **18. DATA ACQUISITION REQUIREMENTS**

Required longitude and latitude information for monitoring sites is derived by using USGS topographic maps at 1:63,360 and confirmed by using GPS coordinates taken at the site by the Stream Ecologist. Sites are plotted and spatially checked using a Geographic Information System (GIS) computer mapping program (ArcView). This information is used to identify monitoring sites and assign site numbers for entry into the monitoring data system.

Historical water quality data on the four streams were collected and summarized in Appendix H. These data were utilized in the site selection process. Additional water quality, fish and wildlife habitat, physical stream characteristics, and other data pertaining to the four watersheds will be gathered and utilized in writing the annual report. Historical data will be analyzed to assess direct comparability and may be qualified or excluded from trend analyses in annual reports.

Water quality data will be evaluated by comparison to standards taken from the water quality index developed by the National Sanitation Foundation and state and federal water quality standards as applicable.

## **19. DATA MANAGEMENT**

Test procedures for all parameters will be documented in field and laboratory logbooks. Test results will be recorded on the Field Data Sheets (Appendix C). All observational data, water quality data and field measurements will be recorded at the time of sampling and analysis. Data sheets will be signed by the Stream Ecologist and by any assistant who participates in sampling or analysis.

Data sheets will be reviewed for precision, completeness, anomalous data, and general problems by the Project QA Officer. Data that appear to be in error or don't fall within the expected range will be brought to the attention of the Stream Ecologist for evaluation. The Project QA Officer and the Stream Ecologist will then check testing equipment and review procedures. If no procedural or equipment error can be identified a split sample may be taken from the site in question and sent for analysis at an outside, EPA certified lab.

Any problems found with data collected are noted on the Field Data Sheet as well as in lab and field logbooks. Any changes to data will be initialed by the Project QA Officer and the Stream Ecologist. Data that do not meet project accuracy and precision objectives are not entered in the project data system and will not be used in project reports.

After review, data will be entered into the monitor data system. This system is accessed by a network of PC's in the Keeper office and consists of a relational database in MS Access. As an additional quality control, the system is designed to flag values which do not fall within the normal expected range for each parameter.

Data will be compiled quarterly by the Stream Ecologist and reviewed for precision, accuracy and completeness by the Project QA Officer and the Project Officer. The Stream Ecologist produced a complete report summarizing all collected data in the winter of 2000 (see Section 21) and in the summer of each year thereafter. Computer data records as well as original data sheets will be maintained at the Keeper office indefinitely.

## **20. ASSESSMENTS AND RESPONSE ACTIONS**

As described in Section 14, the QA Officer will perform replicate analysis of split samples from one randomly selected site per month. If variation of duplicate values exceeds the range for precision and accuracy specified in Table T-2, the data will not be entered in the project data system and will not appear in project reports. If such variation occurs more than once in a six month period for the same parameter, the Stream Ecologist and the Project QA Officer will jointly review the methods used for testing that parameter and inspect and re-calibrate the equipment. If errors are found to be the result of equipment failure, the equipment at fault will be either repaired or replaced before further testing can continue. If equipment failures occur more than once in a six month period, inspection, calibration and maintenance will be scheduled more frequently.

Only EPA certified outside laboratories will be used for replicate sample analysis and a copy of the lab's QC protocols will be requested and kept on file at the Keeper office.

As described in Section 19, the Stream Ecologist will produce quarterly data reports. These reports will be reviewed by the Project QA Officer and the Project Officer for accuracy, precision and completeness. If errors are discovered in data entry or management they will be corrected. If problems with data entry or management persist, procedures will be reviewed and revised accordingly.

The Technical Advisory Committee will also review quarterly data reports as well as reviewing this QAPP and the overall project design annually and may suggest procedural refinements or additional testing procedures. These may include new parameters to be measured or changes to procedures. Any such changes will be subject to EPA and ADEC approval. The project is open to EPA or ADEC system audits at their discretion.

## **21. REPORTS**

All reports are distributed in draft form to the TAC for review. A Preliminary Water Quality Assessment of Lower Kenai Peninsula Salmon Streams was released in January 2000 after extensive review by the TAC. Reports will be produced annually throughout the life of the project. Annual reports will include:

- review of quality assurance protocols;
- spreadsheets detailing all data collected;
- graphs depicting test results for each parameter at each site;
- comparisons to State and Federal Water Quality Criteria
- review of historical data from each site;
- discussion of discernable trends;
- photographs of each sampling site;
- aerial photos of the four watersheds;
- GIS maps showing land use and other relevant information;
- conclusions with recommendations for future monitoring efforts.

This report will be provided to the Homer Soil and Water Conservation District for distribution at their discretion. Copies will also be provided to the USEPA and the ADEC and to members of the project's Technical Advisory Committee.

## **22. DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS**

All data collected are reviewed quarterly by the Project QA Officer and the Project Officer to determine if the data meet QAPP objectives. Decisions to reject or qualify data are made jointly by the Project QA Officer and the Stream Ecologist.

## **23. VALIDATION AND VERIFICATION METHODS**

Field data sheets must be filled out completely and signed by the Stream Ecologist at the time of sampling and analysis. The Project QA Officer will review each data sheet for precision, missing or illegible information, errors in calculation and values outside of the expected range and initial each data sheet upon completing this review. Any questionable data will be brought to the attention of the Stream Ecologist for resolution according to the guidelines outlined in Sections 19. Any changes made to data will be initialed by both the Project QA Officer and the Stream Ecologist and any action taken as a result of the data review will be specifically recorded on the data sheet. Data will then be entered into the monitoring data system, which is designed to flag any values which fall outside of the expected range for each parameter.

The Project Officer will compare quarterly data reports to original field data sheets to ensure accurate data entry and initial each data sheet to verify that review. The Project QA officer will review quarterly reports to again check that data accuracy precision and completeness objectives are being met. The Project QA Officer will also review and initial equipment maintenance logs, sample custody forms and equipment/supply inspection forms on a quarterly basis



The final Water Quality Status Summary Report will include discussion of any data quality problems. Members of the Technical Advisory Committee will be asked to review this report and offer suggestions for programmatic improvements.

#### **24. RECONCILIATION WITH DATA QUALITY OBJECTIVES**

Calculations and determinations for precision and completeness will be made by the Project QA Officer during the quarterly review process (see Sections 19, 22 & 23). Verification of data accuracy will be made by the Project QA Officer during monthly quality control checks; as described in Sections 14 & 20, replicate analysis will be performed at these times and values recorded by the Stream Ecologist will be compared with those obtained by the Project QA Officer.

Results of precision, accuracy and completeness calculations will be included in quarterly reports to the TAC and in the annual Water Quality Status Summary Report along with discussion of any measures taken to resolve quality assurance problems.

If data quality indicators do not meet project specifications (see Table T-2) data will not be entered in the project data system and will not be used in annual reports. 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. If the problem is found to be procedural error, the Project QA Officer and the Stream Ecologist will jointly review the methods used. If accuracy and precision goals are frequently not being met QC procedures will be reviewed and, subject to USEPA and ADEC approval, may be revised.

If failure to meet project objectives is found to be unrelated to equipment, methods, or procedural error, project specifications may be revised. Revisions to this QAPP will be submitted to the designated ADEC and USEPA quality assurance officers for approval.



# **APPENDIX A**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **Technical Advisory Committee**

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# **APPENDIX B**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **Sampling Site Map**





**Insert map here**



# **APPENDIX C**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **FIELD DATA SHEET**

**p. 1 field data sheet**

**page 2 field data sheet**



# **APPENDIX D**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **Equipment & Supply**

#### **INSPECTION FORM**

## COOK INLET KEEPER

### EQUIPMENT AND SUPPLY INSPECTION FORM

Date: \_\_\_\_\_ Initials: \_\_\_\_\_

Parameter	Component	In Kit	Condition	Batch/Lot #	Expire Date	Date Replaced	New Exp. Date
<b>Temperature</b>	Hach DO 4000 dissolved oxygen meter						
	thermometer						
<b>pH</b>	magnetic Stirrer						
	beaker, 100 ml						
	EC10pH/m/Temp meter, model 5005						
	buffer solution: pH 4						
	buffer solution: pH 7						
	buffer solution: pH 10						
	potassium chloride reference electrolyte cartridge						
<b>Oxidation-Reduction Potential</b>	(same as pH)						
	Standard Redox Solution						
<b>Dissolved Oxygen</b>	LaMotte DO 4000 dissolved oxygen meter						
<b>Conductivity</b>	CO150 conductivity meter, model 50150						
	beaker, 100 ml						
	de-ionized water						
	(standard KCl soln, 0.0100M)						
<b>Total Dissolved Solids</b>	Hach CO150 conductivity meter, model 50150						
	beaker, 100 ml						
	standard KCl soln, 0.0100M						
	NaCl standard soln.						
<b>Suspended Solids</b>	Hach DR/2010 spectrophotometer						
	blender						
	graduated cylinder, 500 ml						
	pipet, 25 ml						
	pair of matched sample cells, 25 ml						
<b>Salinity</b>	CO150 conductivity meter, model 50150						
	beaker, 100 ml						
	de-ionized water						
	standard KCl soln, 0.0100M						
<b>Turbidity</b>	sample cell						
	2020 turbidimeter						
	turbidity standard 10 NTU						
	turbidity standard 1 NTU						



Date:

Initials:

Parameter	Component	In Kit	Condition	Batch/Lot #	Expire Date	Date Replaced	New Exp. Date
<b>Color, Apparent</b>	Hach DR/2010 spectrophotometer						
	pair of matched sample cells, 25 ml						
	color standard solution						
<b>Nitrogen, Ammonia</b>	Hach DR/2010 spectrophotometer						
	pair of matched sample cells, 25 ml						
	2 graduated mixing cylinders, 25 ml						
	nessler reagent						
	mineral stabilizer						
	polyvinyl alcohol dispersing agent						
	de-ionized water						
	N-NH <sub>3</sub> standard solution						
<b>Nitrogen, Nitrite</b>	Hach DR/2010 spectrophotometer						
	pair of matched sample cells, 10 ml						
	cell riser, 10 ml						
	polyethylene stopper, #1						
	NitriVer 3 nitrite reagent powder pillows						
	nitrite stock solution						
	de-ionized water						
<b>Nitrogen, Nitrate</b>	Hach DR/2010 spectrophotometer						
	pair of matched sample cells, 25 ml						
	graduated cylinder, 50 ml						
	polyethylene stopper, #1						
	NitriVer 3 nitrite reagent powder pillows						
	NitriVer 6 nitrite reagent powder pillows						
	nitrate standard solution						
<b>Ortho-Phosphate</b>	Hach DR/2010 spectrophotometer						
	cell riser, 10 ml						
	pair of matched sample cells, 25 ml						
	PhosVer 3 phosphate reagent powder pillows						
	PO <sub>4</sub> <sup>3-</sup> standard solution						
<b>Total Phosphorous</b>	DR/2010 spectrophotometer						
	pair of matched sample cells, 25 ml						
	graduated cylinder, 25ml						

	erelenmeyer flask, 50ml						
	potassium persulfate powder pillows						
<b>Parameter</b>	<b>Component</b>	<b>In Kit</b>	<b>Condition</b>	<b>Batch/Lot #</b>	<b>Expire Date</b>	<b>Date Replaced</b>	<b>New Exp. Date</b>
<b>Total Phosphorus</b>	sodium hydroxide soln, 5.0N						
	sulfuric acid soln, 5.25N						
	de-ionized water						
<b>Total and Fecal Coliform</b>	petri dishes						
	pipet, 10ml						
	Coliscan Easygel medium						
<b>Discharge</b>	Price AA meter						
	Pygmy Meter						
	wading rod						
	ear phones						
	stop watch						
	measured tagged line						
	discharge data sheet						
	meter rating tables(AA & Pygmy)						
<b>Stage</b>	Crest-stage gauge						
<b>Acids</b>	Hydrochloric Acid						
	Nitric Acid						

Inspected by: \_\_\_\_\_

Date: \_\_\_\_\_

# **APPENDIX E**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **Sample Chain of Custody Form**



<b>Cook Inlet Keeper</b>					<b>Sample ID#</b>		<b>CHAIN OF CUSTODY RECORD</b>			<b>Page ___ of ___</b>		
<b>PROJECT:</b>					<b>COLLECTOR(S):</b> <i>(Signatures)</i>							
<b>LOCATION:</b>												
<b>DISTRIBUTION:</b>					· ORIGINAL - To accompany all samples				· COPY - To Program Coordinator			
Station Number	Replicate	Date	Time	Sample Type	Container		Preservative	Analysis Required	Due Date	Remarks	Results of Analysis	
					Vol.	Type						
<b>Relinquished by:</b> <i>(Signature)</i>				<b>Received by:</b> <i>(Signature)</i>				<b>Date</b>	<b>Time</b>	<b>Method of Shipment:</b>		
<b>Relinquished by:</b> <i>(Signature)</i>				<b>Received by:</b> <i>(Signature)</i>				<b>Date</b>	<b>Time</b>			
<b>Relinquished by:</b> <i>(Signature)</i>				<b>Received by:</b> <i>(Signature)</i>				<b>Date</b>	<b>Time</b>	<b>Destination:</b>		
<b>Dispatched by:</b> <i>(Signature)</i>				<b>Date</b>	<b>Time</b>	<b>Received for Laboratory by:</b> <i>(Signature)</i>				<b>Date</b>	<b>Time</b>	



# **APPENDIX F**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **HISTORICAL DATA COLLECTED**

Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
01-HS	15239805	Anchor River near Homer	59.8089	151.3975
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
02-HS	15239807	Anchor River tributary at mouth near Homer	59.8097	151.3989
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
03-HS	15239810	Anchor River above Beaver Creek near Homer	59.7528	151.5086
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
04-HS	15239818	Beaver Creek near Bald Mountain near Homer	59.7497	151.3289
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
05-HS	15239820	Beaver Creek near Homer	59.7456	151.4556



<b>Parameter</b>	<b>Years</b>
Temperature (Deg. C)	1970
Discharge (Ft <sup>3</sup> /Second)	1970
Color (Platinum Cobalt Units)	1970
Specific Conductance (US/CM)	1970
Drainage Area (SQ. MI.)	1970
pH (Standard Units)	1970
Carbon Dioxide Dissolved (MG/L as CO <sub>2</sub> )	1970
Alkalinity WAT WH TOT FET (MG/L as CaCO <sub>3</sub> )	1970
Bicarbonate Water WH FET Field (MG/L as HCO <sub>3</sub> )	1970
Carbonate Water WH FET Field (MG/L as CO <sub>3</sub> )	1970
Nitrogen-Nitrate Dissolved (MG/L as N)	1970
Hardness Total (MG/L as CaCO <sub>3</sub> )	1970
Hardness Noncarb WH TOT FLD (MG/L as CaCO <sub>3</sub> )	1970
Calcium Dissolved (MG/L as Ca)	1970
Magnesium Dissolved (MG/L as Mg)	1970
Sodium Dissolved (MG/L as Na)	1970
Sodium Adsorption Ratio	1970
Sodium Percent	1970
Potassium Dissolved (MG/L as K)	1970
Chloride Dissolved (Mg/L as Cl)	1970
Sulfate Dissolved MG/L as SO <sub>4</sub>	1970
Fluoride Dissolved (MG/L as F)	1970
Silica Dissolved (MG/L as SiO <sub>2</sub> )	1970
Solids, Sum of Constituents, Dissolved (MG/L)	1970
Solids Dissolved (Tons/Day)	1970
Solids Dissolved (Tons/AC-FT)	1970
Nitrogen-Nitrate, Dissolved (MG/L as NO <sub>3</sub> )	1970
Manganese (UG/L as Mn)	1970
Iron (UG/L as Fe)	1970

Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
06-HS	15239822	Beaver Creek at mouth near Homer	59.7525	151.5081
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
07-HS	15239840	Anchor River above Twitter Creek near Homer	59.7189	151.6419
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
08-HS	15239845	Twitter Creek near Lookout Mountain near Homer	59.7000	151.4772
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
09-HS	15239850	Bridge Creek near Homer	59.6794	151.5458
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1970,	
Discharge (Ft3/Second)			1970-71,74	
Color (Platinum Cobalt Units)			1970-71,74	
Specific Conductance (US/CM)			1970-71,74	
pH (Standard Units)			1970-71	

<b>Parameter</b>	<b>Years</b>
Carbon Dioxide Dissolved (MG/L as CO2)	1970-71
Alkalinity WAT WH TOT FET (MG/L as CaCO3)	1970-71,74
Bicarbonate Water WH FET Field (MG/L as HCO3)	1970-71,74
Carbonate Water WH FET Field (MG/L as CO3)	1970-71,74
Nitrogen-Nitrate Dissolved (MG/L as N)	1970-71
Cyanide Total (MG/L as CN)	1971
Hardness Total (MG/L as CaCO3)	1970-71,74
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)	1970-71,74
Calcium Dissolved (MG/L as Ca)	1970-71,74
Magnesium Dissolved (MG/L as Mg)	1970-71,74
Sodium Dissolved (MG/L as Na)	1970-71,74
Sodium Adsorption Ratio	1970-71,74
Sodium Percent	1970-71,74
Potassium Dissolved (MG/L as K)	1970-71,74
Chloride Dissolved (Mg/L as Cl)	1970-71,74
Sulfate Dissolved MG/L as SO4	1970-71,74
Fluoride Dissolved (MG/L as F)	1970-71,74
Silica Dissolved (MG/L as SiO2)	1970-71,74
Solids, Sum of Constituents, Dissolved (MG/L)	1970-71,74
Solids Dissolved (Tons/Day)	1970-71
Solids Dissolved (Tons/AC-FT)	1970-71,74
Nitrogen-Nitrate, Dissolved (MG/L as NO3)	1970-71
Manganese (UG/L as Mn)	1970-71,74
Iron (UG/L as Fe)	1970-71
Arsenic Dissolved (UG/L as As)	1970-71,74
Barium Dissolved (UG/L as Ba)	1970-71,74
Cadmium Dissolved (UG/L as Cd)	1970-71,74
Copper Dissolved (UG/L as Cu)	1970-71,74
Iron Total Recoverable (UG/L as Fe)	1971
Lead Dissolved (UG/L as Pb)	1970-71,74
Manganese, Total Recoverable (UG/L as Mn)	1971
Nickel Dissolved (UG/L as Ni)	1971
Silver Dissolved (UG/L as Ag)	1970-71,74

<b>Parameter</b>				<b>Years</b>	
Zinc Dissolved (UG/L as ZN)				1970-71,74	
Selenium Dissolved (UG/L as SE)				1970-71,74	
Methylene Blue Active Substance (MG/L)				1970-71,74	
Phosphate Ortho, Dissolved (MG/L as PO4)				1974	
Phosphorus Ortho, Dissolved (MG/L as P)				1974	
Nitrogen NO2+NO3 Dissolved (MG/L as N)				1974	
Iron Dissolved (UG/L as FE)				1974	
Chromium Dissolved (UG/L as CR)				1974	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
10-HS	15239880	Twitter Creek near Homer	59.7150	151.6294	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1970-72, 1978-80	
Discharge (Ft3/Second)				1970-72, 1978-80	
Specific Conductance (US/CM)				1970-72, 1978-80	
Drainage Area (SQ. MI.)				1970-72, 1978-80	
Color (Platinum Cobalt Units)				1970-72	
pH (Standard Units)				1970-72	
Carbon Dioxide Dissolved (MG/L as CO2)				1970-72	
Alkalinity WAT WH TOT FET (MG/L as CaCO3)				1970-72	
Bicarbonate Water WH FET Field (MG/L as HCO3)				1970-72	
Carbonate Water WH FET Field (MG/L as CO3)				1970-72	
Nitrogen-Nitrate Dissolved (MG/L as N)				1970-71	
Hardness Total (MG/L as CaCO3)				1970-72	
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)				1970-72	
Calcium Dissolved (MG/L as Ca)				1970-72	
Magnesium Dissolved (MG/L as Mg)				1970-72	
Sodium Dissolved (MG/L as Na)				1970-72	
Sodium Adsorption Ratio				1970-72	
Sodium Percent				1970-72	
Potassium Dissolved (MG/L as K)				1970-72	
Chloride Dissolved (Mg/L as Cl)				1970-72	
Sulfate Dissolved MG/L as SO4				1970-72	

<b>Parameter</b>		<b>Years</b>		
Fluoride Dissolved (MG/L as F)		1970-72		
Silica Dissolved (MG/L as SIO2)		1970-72		
Solids, Sum of Constituents, Dissolved (MG/L)		1970-72		
Solids Dissolved (Tons/Day)		1970-72		
Solids Dissolved (Tons/AC-FT)		1970-72		
Nitrogen-Nitrate, Dissolved (MG/L as NO3)		1970-71		
Manganese (UG/L as MN)		1970-71		
Iron (UG/L as FE)		1970		
Iron Total Recoverable (UG/L as FE)		1971-72		
Manganese, Total Recoverable (UG/L as MN)		1971-72		
Phosphate Ortho, Dissolved (MG/L as PO4)		1972		
Phosphorus Ortho, Dissolved (MG/L as P)		1972		
Nitrogen NO2+NO3 Dissolved (MG/L as N)		1972		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
11-HS	15239970	North Fork Anchor River above Chakok River near Anchor Point	59.7947	151.7294
<b>Parameter</b>		<b>Years</b>		
Temperature (Deg. C)		1978-80		
Discharge (Ft3/Second)		1978-80		
Specific Conductance (US/CM)		1978-80		
Drainage Area (SQ. MI.)		1978-80		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
12-HS	15239980	Chakok River near Anchor Point	59.8008	151.7308
<b>Parameter</b>		<b>Years</b>		
Temperature (Deg. C)		1978-80		
Discharge (Ft3/Second)		1978-80		
Specific Conductance (US/CM)		1978-80		
Drainage Area (SQ. MI.)		1978-80		

Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
13-HS	152399990	North Fork Anchor River at mouth at Anchor Point	59.7733	151.8311
Parameter			Years	
Temperature (Deg. C)			1951, 1978-80	
Discharge (Ft <sup>3</sup> /Second)			1952, 1978-80	
Color (Platinum Cobalt Units)			1952, 1978-80	
Specific Conductance (US/CM)			1952, 1978-80	
pH (Standard Units)			1951-53	
Carbon Dioxide Dissolved (MG/L as CO <sub>2</sub> )			1951-53	
Alkalinity WAT WH TOT FET (MG/L as CaCO <sub>3</sub> )			1951-53	
Bicarbonate Water WH FET Field (MG/L as HCO <sub>3</sub> )			1951-53	
Carbonate Water WH FET Field (MG/L as CO <sub>3</sub> )			1951-53	
Nitrogen-Nitrate Dissolved (MG/L as N)			1951-53	
Hardness Total (MG/L as CaCO <sub>3</sub> )			1951-53	
Hardness Noncarb WH TOT FLD (MG/L as CaCO <sub>3</sub> )			1951-53	
Calcium Dissolved (MG/L as Ca)			1951-53	
Magnesium Dissolved (MG/L as Mg)			1951-53	
Sodium Dissolved (MG/L as Na)			1953	
Sodium Adsorption Ratio			1953	
Sodium Percent			1953	
Potassium Dissolved (MG/L as K)			1953	
Chloride Dissolved (Mg/L as Cl)			1951-53	
Sulfate Dissolved MG/L as SO <sub>4</sub>			1951-53	
Fluoride Dissolved (MG/L as F)			1952	
Silica Dissolved (MG/L as SiO <sub>2</sub> )			1951-53	
Solids, Sum of Constituents, Dissolved (MG/L)			1951-53	
Solids Dissolved (Tons/Day)			1952	
Solids Dissolved (Tons/AC-FT)			1951-53	
Nitrogen-Nitrate, Dissolved (MG/L as NO <sub>3</sub> )			1951-53	
Iron (UG/L as Fe)			1951-53	
Drainage Area (SQ. MI.)			1951, 1953, 1978-79	
Sodium + Potassium Dissolved (MG/L)			1951-52	

<b>Parameter</b>				<b>Years</b>	
Solids , Residues at 180 Deg. C Dissolved				1952	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
14-HS	152399900	Anchor River near Anchor Point	59.7472	151.7531	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1966-73, 1978-80	
Discharge (Ft3/Second)				1966-73, 1978-80, 1995	
Color (Platinum Cobalt Units)				1966-68, 1970, 1995	
Specific Conductance (US/CM)				1966-73, 1978-80, 1995	
pH (Standard Units)				1966-68, 1970, 1995	
Carbon Dioxide Dissolved (MG/L as CO2)				1966-68, 1970, 1995	
Alkalinity WAT WH TOT FET (MG/L as CaCO3)				1966-68, 1970, 1995	
Bicarbonate Water WH FET Field (MG/L as HCO3)				1966-68, 1970, 1995	
Carbonate Water WH FET Field (MG/L as CO3)				1966-68, 1995	
Nitrogen-Nitrate Dissolved (MG/L as N)				1966-68, 1970, 1995	
Hardness Total (MG/L as CaCO3)				1966-68, 1970, 1995	
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)				1966-68, 1970, 1995	
Calcium Dissolved (MG/L as Ca)				1966-68, 1970,	
Magnesium Dissolved (MG/L as Mg)				1966-68, 1970	
Sodium Dissolved (MG/L as Na)				1966-68, 1970, 1995	
Sodium Adsorption Ratio				1966-68, 1970, 1995	
Sodium Percent				1966-68, 1970, 1995	
Potassium Dissolved (MG/L as K)				1966-68, 1970, 1995	
Chloride Dissolved (Mg/L as Cl)				1966-68, 1970, 1995	
Sulfate Dissolved MG/L as SO4				1966-68, 1970, 1995	
Fluoride Dissolved (MG/L as F)				1966-68, 1970	
Silica Dissolved (MG/L as SiO2)				1966-68, 1970, 1995	
Solids, Sum of Constituents, Dissolved (MG/L)				1966-68, 1970, 1995	
Solids Dissolved (Tons/Day)				1966-68, 1970	
Solids Dissolved (Tons/AC-FT)				1966-68, 1970, 1995	
Nitrogen-Nitrate, Dissolved (MG/L as NO3)				1966-68, 1970	
Manganese (UG/L as Mn)				1970	
Iron (UG/L as Fe)				1966-68, 1970	

<b>Parameter</b>		<b>Years</b>		
Drainage Area (SQ. MI.)		1966-73, 1978-80, 1995		
Nitrogen, Nitrate Total (MG/L)		1968		
Turbidity		1973		
Sediment Suspended (Mg/L)		1968-73		
Sediment Discharge Suspended (T/Day)		1968-73		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
15-HS	594600151492000	Anchor River above north Fork at Anchor Point	59.7667	151.8222
<b>Parameter</b>		<b>Years</b>		
Temperature (Deg. C)		1953		
Discharge (Ft3/Second)		1953		
Color (Platinum Cobalt Units)		1953		
Specific Conductance (US/CM)		1953		
pH (Standard Units)		1953		
Carbon Dioxide Dissolved (MG/L as CO2)		1953		
Alkalinity WAT WH TOT FET (MG/L as CaCO3)		1953		
Bicarbonate Water WH FET Field (MG/L as HCO3)		1953		
Carbonate Water WH FET Field (MG/L as CO3)		1953		
Nitrogen-Nitrate Dissolved (MG/L as N)		1953		
Hardness Total (MG/L as CaCO3)		1953		
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)		1953		
Calcium Dissolved (MG/L as Ca)		1953		
Magnesium Dissolved (MG/L as Mg)		1953		
Sodium Dissolved (MG/L as Na)		1953		
Sodium Adsorption Ratio		1953		
Sodium Percent		1953		
Potassium Dissolved (MG/L as K)		1953		
Chloride Dissolved (Mg/L as Cl)		1953		
Silica Dissolved (MG/L as SiO2)		1953		
Solids, Sum of Constituents, Dissolved (MG/L)		1953		
Solids Dissolved (Tons/AC-FT)		1953		
Nitrogen-Nitrate, Dissolved (MG/L as NO3)		1953		
<b>Parameter</b>		<b>Years</b>		



Iron (UG/L as FE)				1953
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
16-HS	15240000	Anchor River at Anchor Point	59.7725	151.8347
Parameter			Years	
Temperature (Deg. C)			1951-54, 1957-61, 1966, 1979-80, 1989	
Discharge (Ft <sup>3</sup> /Second)			1953-55, 1957-66, 1978, 1989	
Color (Platinum Cobalt Units)			1952-61, 1963-66, 1978	
Specific Conductance (US/CM)			1952-61, 1963-66, 1978-79, 1989	
pH (Standard Units)			1951-61, 1963-66	
Carbon Dioxide Dissolved (MG/L as CO <sub>2</sub> )			1951-1958	
Alkalinity WAT WH TOT FET (MG/L as CaCO <sub>3</sub> )			1951-66, 1978-79	
Bicarbonate Water WH FET Field (MG/L as HCO <sub>3</sub> )			1951-66, 1978-79	
Carbonate Water WH FET Field (MG/L as CO <sub>3</sub> )			1951-66, 1979	
Nitrogen-Nitrate Dissolved (MG/L as N)			1951-66, 1978-79	
Hardness Total (MG/L as CaCO <sub>3</sub> )			1951-66, 1978-79	
Hardness Noncarb WH TOT FLD (MG/L as CaCO <sub>3</sub> )			1951-66, 1978-79	
Calcium Dissolved (MG/L as Ca)			1951-66, 1978-79	
Magnesium Dissolved (MG/L as Mg)			1951-66, 1978-79	
Sodium Dissolved (MG/L as Na)			1952-66, 1978-79	
Sodium Adsorption Ratio			1952-66, 1978-79	
Sodium Percent			1952-66, 1978-79	
Potassium Dissolved (MG/L as K)			1952-66, 1978-79	
Chloride Dissolved (Mg/L as Cl)			1951-66, 1978-79	
Silica Dissolved (MG/L as SiO <sub>2</sub> )			1951-66, 1979	
Solids, Sum of Constituents, Dissolved (MG/L)			1951-66, 1979	
Solids Dissolved (Tons/AC-FT)			1952-66, 1979	
Nitrogen-Nitrate, Dissolved (MG/L as NO <sub>3</sub> )			1952-66, 1979	
Iron (UG/L as FE)			1951-66, 1979	
Phosphate Ortho, Dissolved (MG/L as PO <sub>4</sub> )			1959-60, 1978	
Phosphorus Ortho, Dissolved (MG/L as P)			1978-79	
Solids , Residues at 180 Deg. C Dissolved			1953-66, 1979	
Sodium + Potassium Dissolved (MG/L)			1951, 1979	

<b>Parameter</b>				<b>Years</b>	
Sediment Suspended (Mg/L)				1953-54	
Sediment Discharge Suspended (T/Day)				1953-54	
Iron Dissolved (UG/L as FE)				1979	
Iron Total Recoverable (UG/L as FE)				1979	
Phosphorus Dissolved (MG/L)				1978-79	
Iron Suspended Recoverable((UG/L as FE)				1979	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
17-HS	15240200	Stariski Creek near Ninilchik	59.9186	151.6497	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1978-80	
Discharge (Ft3/Second)				1978-80	
Specific Conductance (US/CM)				1978-80	
Drainage Area (SQ. MI.)				1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
18-HS	15240300	Stariski Creek near Anchor Point	59.8525	151.7881	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1951, 1978-80	
Discharge (Ft3/Second)				1978-80	
Color (Platinum Cobalt Units)				1951-52, 1967, 1978	
Specific Conductance (US/CM)				1951-52, 1956, 1978-80	
pH (Standard Units)				1951-52, 1956, 1967	
Carbon Dioxide Dissolved (MG/L as CO2)				1951-52, 1956, 1967	
Alkalinity WAT WH TOT FET (MG/L as CaCO3)				1951-52, 1956, 1967, 1978-79	
Bicarbonate Water WH FET Field (MG/L as HCO3)				1951-52, 1956, 1967, 1978-79	
Carbonate Water WH FET Field (MG/L as CO3)				1951-52, 1956, 1967, 1979	
Nitrogen-Nitrate Dissolved (MG/L as N)				1951-52, 1967, 1978	
Hardness Total (MG/L as CaCO3)				1951-52, 1956, 1967, 1978-79	
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)				1951-52, 1956, 1967, 1978-79	
Calcium Dissolved (MG/L as Ca)				1951-52, 1956, 1967, 1978-79	
Magnesium Dissolved (MG/L as Mg)				1951-52, 1956, 1967, 1978-79	
Sodium Dissolved (MG/L as Na)				1956, 1967, 1978-79	

<b>Parameter</b>		<b>Years</b>		
Sodium Adsorption Ratio		1956, 1967, 1978-79		
Sodium Percent		1956, 1967, 1978-79		
Potassium Dissolved (MG/L as K)		1956, 1967, 1978-79		
Chloride Dissolved (Mg/L as CL)		1951-52, 1956, 1967, 1978-79		
Silica Dissolved (MG/L as SIO2)		1951-52, 1967, 1978		
Solids, Sum of Constituents, Dissolved (MG/L)		1951-52, 1956, 1967, 1978-79		
Solids Dissolved (Tons/AC-FT)		1951-52, 1967, 1978-79		
Nitrogen-Nitrate, Dissolved (MG/L as NO3)		1951-52, 1967		
Iron (UG/L as FE)		1951-52, 1956, 1978-79		
Iron Dissolved (UG/L as FE)		1978		
Iron Suspended Recoverable((UG/L as FE)		1978-79		
Phosphorus Dissolved (MG/L)		1978-79		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
19-HS	15240400	Happy Creek at Happy Valley	59.9378	151.7350
<b>Parameter</b>		<b>Years</b>		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
20-HS	15240600	Deep Creek above tributary 1 near Ninilchik	59.9419	151.2164
<b>Parameter</b>		<b>Years</b>		
Temperature (Deg. C)		1978-80		
Discharge (Ft3/Second)		1978-80		
Specific Conductance (US/CM)		1978-80		
Drainage Area (SQ. MI.)		1978-80		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
21-HS	15240700	Deep Creek tributary 1 at mouth near Ninilchik	59.9417	151.2175
<b>Parameter</b>		<b>Years</b>		
Temperature (Deg. C)		1978-80		
Discharge (Ft3/Second)		1978-80		

<b>Parameter</b>				<b>Years</b>	
Specific Conductance (US/CM)				1978-80	
Drainage Area (SQ. MI.)				1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
22-HS	15240800	Deep Creek above North Fork near Ninilchik	59.9822	151.2467	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1978-80	
Discharge (Ft3/Second)				1978-80	
Specific Conductance (US/CM)				1978-80	
Drainage Area (SQ. MI.)				1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
23-HS	15240900	North Fork Deep Creek at mouth near Ninilchik	59.9831	151.2478	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1978-80	
Discharge (Ft3/Second)				1978-80	
Specific Conductance (US/CM)				1978-80	
Drainage Area (SQ. MI.)				1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees	
24-HS	15241000	Deep Creek above South Fork near Ninilchik	59.9644	151.4894	
<b>Parameter</b>				<b>Years</b>	
Temperature (Deg. C)				1978-80	
Discharge (Ft3/Second)				1978-80	
Specific Conductance (US/CM)				1978-80	
Drainage Area (SQ. MI.)				1978-80	

Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
25-HS	15241100	South Fork Deep Creek at mouth near Ninilchik	59.9631	151.4889
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
26-HS	15241200	Deep Creek above tributary 2 near Ninilchik	60.0061	151.6239
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
27-HS	15241300	Deep Creek above tributary 2 at mouth near Ninilchik	60.0072	151.6231
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
28-HS	15241400	Clam Creek near Ninilchik	60.0108	151.6561
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	

Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
29-HS	15241500	Deep Creek near Ninilchik	60.0306	151.6806
Parameter			Years	
Temperature (Deg. C)			1953, 1957-68,178-80	
Discharge (Ft3/Second)			1952,1960-68, 1978-80	
Color (Platinum Cobalt Units)			1952-53,1955-58,1967-68,1978	
Specific Conductance (US/CM)			1952-53,1955-58,1964, 1967-68, 1978-80	
pH (Standard Units)			1952-53, 1955-58, 1967-68	
Carbon Dioxide Dissolved (MG/L as CO2)			1952-53, 1955-58, 1967-68	
Alkalinity WAT WH TOT FET (MG/L as CaCO3)			1952-53, 1955-58, 1967-68,1978-79	
Bicarbonate Water WH FET Field (MG/L as HCO3)			1952-53, 1955-58, 1967-68,1978-79	
Carbonate Water WH FET Field (MG/L as CO3)			1952-53, 1955-58, 1967-68	
Nitrogen-Nitrate Dissolved (MG/L as N)			1952-53, 1955-58, 1967-68	
Hardness Total (MG/L as CaCO3)			1952-53, 1955-58, 1967-68,1978-79	
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)			1952-53, 1955-58, 1967-68,1978-79	
Calcium Dissolved (MG/L as Ca)			1952-53, 1955-58, 1967-68,1978-79	
Magnesium Dissolved (MG/L as Mg)			1952-53, 1955-58, 1967-68,1978-79	
Sodium Dissolved (MG/L as Na)			1952-53, 1955-58, 1967-68,1978-79	
Sodium Adsorption Ratio			1952-53, 1955-58, 1967-68,1978-79	
Sodium Percent			1952-53, 1955-58, 1967-68,1978-79	
Potassium Dissolved (MG/L as K)			1952-53, 1955-58, 1967-68,1978-79	
Chloride Dissolved (Mg/L as Cl)			1952-53, 1955-58, 1967-68,1978-79	
Sulfate Dissolved MG/L as SO4			1952-53, 1955-58, 1967-68,1978-79	
Fluoride Dissolved (MG/L as F)			1952-53, 1955-58, 1967-68,1978-79	
Silica Dissolved (MG/L as SiO2)			1952-53, 1955-58, 1967-68,1978-79	
Solids, Sum of Constituents, Dissolved (MG/L)			1952-53, 1955-58, 1967-68,1978-79	
Solids Dissolved (Tons/Day)			1952,1967-68,1978-79	
Solids Dissolved (Tons/AC-FT)			1952-53, 1955-58, 1967-68,1978-79	
Nitrogen-Nitrate, Dissolved (MG/L as NO3)			1952-53, 1955-58, 1967-68	
Manganese (UG/L as Mn)			1956-58	
Iron Total Recoverable (UG/L as Fe)			1968, 1978-79	
Phosphate Ortho, Dissolved (MG/L as PO4)			1978	
Phosphorus Ortho, Dissolved (MG/L as P)			1978	

Parameter		Years		
Nitrogen NO2+NO3 Dissolved (MG/L as N)		1978-79		
Iron Dissolved (UG/L as FE)		1978-79		
Solids , Residues at 180 Deg. C Dissolved		1952, 1955, 1978-79		
Sodium + Potassium Dissolved (MG/L as NA)		1952, 1979		
Drainage Area (SQ. MI.)		1952-53, 1955-59, 1960-68,1978-80		
Sediment Suspended (Mg/L)		1959-68		
Sediment Discharge Suspended (T/Day)		1959-68		
Sed. Sup. Sieve Diam. % Finer than .062		1961,1963-64, 1966		
Sed. Sup. Sieve Diam. % Finer than .125		1961,1963-64, 1966		
Sed. Sup. Sieve Diam. % Finer than .250		1961,1963-64, 1966		
Sed. Sup. Sieve Diam. % Finer than .500		1961,1963-64, 1966		
Sed. Sup. Sieve Diam. % Finer than .004		1961,1963,1966		
Sed. Sup. Sieve Diam. % Finer than .008		1961,1963,1966		
Sed. Sup. Sieve Diam. % Finer than .016		1961,1963,1966		
Sed. Sup. Sieve Diam. % Finer than .031		1961,1963,1966		
Sed. Sup. Sieve Diam. % Finer than .002		1966		
Nitrogen, Nitrate Total (MG/L)		1968		
Agency Sampling Code		1978-79		
Maganese Dissolved (UG/L)		1978-79		
Phosphorus Dissolved (MG/L)		1979		
Iron Suspended Recoverable((UG/L as FE)		1979		
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
30-HS	15241510	Ninilchik River above tributary 1 at mouth near Clam Gultch	60.1653	151.3192
Parameter		Years		
Temperature (Deg. C)		1978-80		
Discharge (Ft3/Second)		1978-80		
Specific Conductance (US/CM)		1978-80		
Drainage Area (SQ. MI.)		1978-80		

Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
31-HS	15241520	Ninilchik River tributary 1 at mouth near Clam Gultch	60.1656	151.3192
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
32-HS	15241530	Ninilchik River above tributary 2 near Ninilchik	60.1069	151.4822
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
33-HS	15241540	Ninilchik River above tributary 2 at mouth near Ninilchik	60.1072	151.4825
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	



Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
34-HS	15241550	Ninilchik River above tributary 3 near Ninilchik	60.0567	151.5481
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
35-HS	15241570	Ninilchik River tributary 3 near Ninilchik	60.0908	151.3289
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
36-HS	15241590	Ninilchik River tributary 3 at mouth near Ninilchik	60.0572	151.5467
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1978-80	
Discharge (Ft3/Second)			1978-80	
Specific Conductance (US/CM)			1978-80	
Drainage Area (SQ. MI.)			1978-80	
Site No.	USGS Station No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
38-HS	15241600	Ninilchik River at Ninilchik	60.0489	151.6633
<b>Parameter</b>			<b>Years</b>	
Temperature (Deg. C)			1952-53,1957-58	
Discharge (Ft3/Second)			1952	
Color (Platinum Cobalt Units)			1952-53, 1955-58	
Specific Conductance (US/CM)			1952-53, 1955-58	
pH (Standard Units)			1952-53, 1955-58	

Carbon Dioxide Dissolved (MG/L as CO2)		1952-53, 1955-58		
Alkalinity WAT WH TOT FET (MG/L as CaCO3)		1952-53, 1955-58		
Bicarbonate Water WH FET Field (MG/L as HCO3)		1952-53, 1955-58		
Carbonate Water WH FET Field (MG/L as CO3)		1952-53, 1955-58		
Nitrogen-Nitrate Dissolved (MG/L as N)		1952-53, 1955-56		
Hardness Total (MG/L as CaCO3)		1952-53, 1955-56		
Hardness Noncarb WH TOT FLD (MG/L as CaCO3)		1952-53, 1955-56		
Calcium Dissolved (MG/L as Ca)		1952-53, 1955-56		
Magnesium Dissolved (MG/L as Mg)		1952-53, 1955-56		
Sodium Dissolved (MG/L as Na)		1952-53, 1955-56		
Sodium Adsorption Ratio		1952-53, 1955-56		
Sodium Percent		1952-53, 1955-56		
Potassium Dissolved (MG/L as K)		1952-53, 1955-56		
Chloride Dissolved (Mg/L as Cl)		1952-53, 1955-56		
Sulfate Dissolved MG/L as SO4		1952-53, 1955-56		
Fluoride Dissolved (MG/L as F)		1952-53, 1956		
Silica Dissolved (MG/L as SiO2)		1952-53, 1955-56		
Solids, Sum of Constituents, Dissolved (MG/L)		1952-53, 1955-56		
Solids Dissolved (Tons/Day)		1952		
Solids Dissolved (Tons/AC-FT)		1952-53, 1955-56		
Nitrogen-Nitrate, Dissolved (MG/L as NO3)		1952-53, 1955-56		
Manganese (UG/L as Mn)		1956		
Iron Total Recoverable (UG/L as Fe)		1952-53, 1955-56		
Solids , Residues at 180 Deg. C Dissolved		1952-53, 1955-58		
Sodium + Potassium Dissolved (MG/L as Na)		1952		
Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
39-HS	1	Ninilchik River	60.1238	151.4148
<b>Parameter</b>		<b>Years</b>		
Channel Characterization		1995		
Spawning Gravel		1995		

Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
40-HS	2	Ninilchik River	60.1093	151.4561
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	
Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
41-HS	3	Ninilchik River	60.0972	151.5110
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	
Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
42-HS	4	Ninilchik River	60.0592	151.5475
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	
Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
43-HS	5	Ninilchik River	60.0575	151.5435
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	
Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
44-HS	8	Clam Creek	59.9784	151.6464
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	

Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
45-HS	9	Clam Creek	59.9577	151.5892
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	
Site No.	Pentect Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
46-HS	16	Stariski Creek	59.9830	151.6467
<b>Parameter</b>			<b>Years</b>	
Channel Characterization			1995	
Spawning Gravel			1995	
Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
47-HS	1	Anchor River	59.7177	151.6450
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	
Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
48-HS	2	Stariski Creek	59.8510	151.7898
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	

Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
49-HS	3	Deep Creek 1	59.9797	151.4375
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	
Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
50-HS	4	Deep Creek 2	60.0317	151.6866
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	
Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
51-HS	5	Ninilchik River	60.0276	151.5975
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	

Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
52-HS	6	Beaver Creek	59.7507	151.4855
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	
Site No.	ENRI Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
53-HS	7	North Fork Anchor River	59.7725	151.8344
<b>Parameter</b>			<b>Years</b>	
Macro Invertebrates			1997	
pH			1997	
Dissolved Oxygen			1997	
Conductivity			1997	
Temperature			1997	
Physical Assessment			1997	
Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
54-HS	CIK-AR1050	Anchor River below North Fork Bridge	59.7727	151.8347
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1996,97	
Turbidity (JTUs)			1996,97	
Temperature (degrees C)			1996,97	
pH (colormetric)			1996,97	
Salinity (ppt 0/00)			1996,97	
Dissolved Oxygen (MG/L)			1996,97	
Conductivity (microsiemens/cm)			1996,97	
Oxidation-Reduction Potential (mV)			1996,97	

Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
55-HS	CIK-AR1035	Anchor River below North Fork road/ Sterling Highway	59.7115	151.6970
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1996,97	
Turbidity (JTUs)			1996,97	
Temperature (degrees C)			1996,97	
pH (colormetric)			1996,97	
Salinity (ppt 0/00)			1996,97	
Dissolved Oxygen (MG/L)			1996,97	
Conductivity (microsiemens/cm)			1996,97	
Oxidation-Reduction Potential (mV)			1996,97	
Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
56-HS	CIK-AR1010	Anchor River just above old Sterling Highway near town	59.7727	151.8467
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1996-98	
Turbidity (JTUs)			1996-98	
Temperature (degrees C)			1996-98	
pH (colormetric)			1996-98	
Salinity (ppt 0/00)			1996-98	
Dissolved Oxygen (MG/L)			1996-98	
Conductivity (microsiemens/cm)			1996-98	
Oxidation-Reduction Potential (mV)			1996-98	
Ortho-Phosphate			1998	
Nitrate-N (NO3-N)			1998	
Total Coliform (colonies/1ml,3ml,5ml)			1998	
Fecal Coliform (colonies/1ml,3ml,5ml)			1998	

Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
57-HS	CIK-AR1000	Anchor River confluence/Cook Inlet	59.7880	151.8577
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1996-98	
Turbidity (JTUs)			1996-98	
Temperature (degrees C)			1996-98	
pH (colormetric)			1996-98	
Salinity (ppt 0/00)			1996-98	
Dissolved Oxygen (MG/L)			1996-98	
Conductivity (microsiemens/cm)			1996-98	
Oxidation-Reduction Potential (mV)			1996-98	
Ortho-Phosphate			1998	
Nitrate-N (NO3-N)			1998	
Total Coliform (colonies/1ml,3ml,5ml)			1998	
Fecal Coliform (colonies/1ml,3ml,5ml)			1998	
Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
58-HS	CIK-AR1034	Anchor River w/confluence of Ruby Creek off North Fork road near Sterling Highway	59.7102	151.7140
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1997-98	
Turbidity (JTUs)			1997-98	
Temperature (degrees C)			1997-98	
pH (colormetric)			1997-98	
Salinity (ppt 0/00)			1997-98	
Dissolved Oxygen (MG/L)			1997-98	
Conductivity (microsiemens/cm)			1997-98	
Oxidation-Reduction Potential (mV)			1997-98	



Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
59-HS	CIK-KB00470	Bridge Creek below Easy Street Culvert	59.6777	151.5043
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1996,97	
Turbidity (JTUs)			1996,97	
Temperature (degrees C)			1996,97	
pH (colormetric)			1996,97	
Sallinity (ppt 0/00)			1996,97	
Dissolved Oxygen (MG/L)			1996,97	
Conductivity (microsiemens/cm)			1996,97	
Oxidation-Reduction Potential (mV)			1996,97	
Site No.	CIK Site No.	Station Name	Latitude Decimal Degrees	Longitude Decimal Degrees
59-HS	CIK-KB00470	Bridge Creek Head waters @ Wynn Nature Center Bridge	59.6777	151.5043
<b>Parameter</b>			<b>Years</b>	
Color (BCS color #)			1996,97	
Turbidity (JTUs)			1996,97	
Temperature (degrees C)			1996,97	
pH (colormetric)			1996,97	
Salinity (ppt 0/00)			1996,97	
Dissolved Oxygen (MG/L)			1996,97	
Conductivity (microsiemens/cm)			1996,97	
Oxidation-Reduction Potential (mV)			1996,97	

# **APPENDIX G**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **Site Selection Matrix**

#### **WORKSHEET**

**Table 1 Site Matrix for the Anchor River**

Proposed Site	Representation	Past Data Collected			Access		Other Comments
		Parameters	Frequency	Bioassay	Logistics	Ownership	
<b>Selected Sites</b>							
07P-HS	1	2	2	Yes	1	Private & State	
16P-HS	1	1	1	Yes	1	State	
62P	1	- <sup>a</sup>	-	No	2	State	Chakok River
65P	1	-	-	No	2	State	
<b>Alternate Sites</b>							
02A-HS	1	2	2	No	3	State	
61A	1	-	-	No	1	Borough	North Fork of Anchor River
<b>Other Sites</b>							
11-HS	2	2	2	No	1	Private	
14-HS	2	1	1	Yes	1	State	

<sup>a</sup> - No data available

**Table 2 Site Matrix for Stariski Creek**

Proposed Site	Representation	Past Data Collected			Access		Other Comments
		Parameters	Frequency	Bioassay	Logistics	Ownership	
<b>Selected Sites</b>							
18P-HS	1	1	1	Yes	1	State/Private	
63P	1	- <sup>a</sup>	-	No	1	State/Native	
<b>Alternate Site</b>							
17A-HS	1	2	2	No	2	State	

<sup>a</sup> - No data available

**Table 3 Site Matrix for Deep Creek**

Proposed Site	Representation	Past Data Collected			Access		Other Comments
		Parameters	Frequency	Bioassay	Logistics	Ownership	
<b>Selected Sites</b>							
20P-HS	1	2	2	No	2	State & Native	
25P-HS	1	2	2	No	2	Native	
29P-HS	1	1	1	Yes	1	State	
<b>Alternate Sites</b>							
27A-HS	2	2	2	No	2	Native	
64A	1	- <sup>a</sup>	-	No	1	Native	Clam Creek

<sup>a</sup> - No data available

**Table 4 Site Matrix for the Ninilchik River**

Proposed Site	Representa-tion	Past Data Collected			Access		Other Comments
		Parameters	Frequency	Bioassay	Logistics	Ownership	
<b>Selected Sites</b>							
35P-HS	1	2	2	No	1	Native	East Fork
36P-HS	1	2	2	No	2	Native	
38P-HS	1	1	1	No	1	Private	
<b>Alternate Site</b>							
31A -HS	1	2	2	No	2	State	
<b>Other Site</b>							
33-HS	2	2	2	No	1	University & Native	

# **APPENDIX H**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

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# **APPENDIX K**

## **LOWER KENAI PENINSULA WATERSHED HEALTH PROJECT**

### **Stream Ecologist Resume**





