Securing Instream Flow on Stariski Creek

FY 2009

Annual Water Quantity Report

Prepared for:
Alaska Sustainable Salmon Fund

by

COOK INLETKEEPER

HOMER, AK

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Introduction

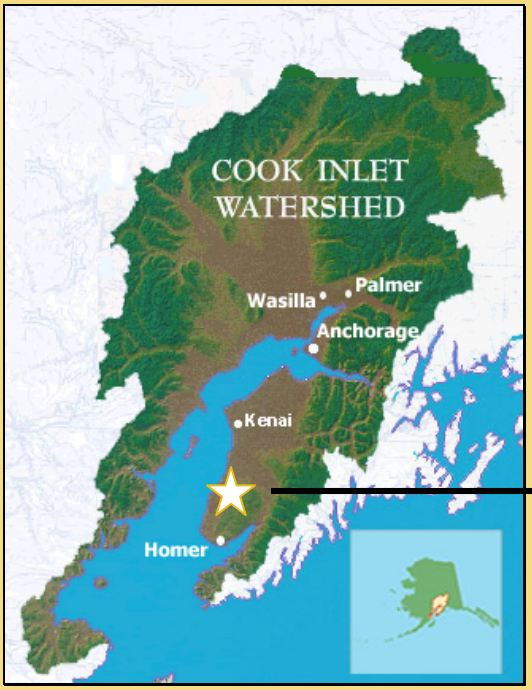
Kenai Peninsula's coastal watersheds in South-central Alaska are under new development pressures with increased road building, housing developments, and gravel mining. These activities may change the natural hydrograph of these systems as well as affect stream water quality. In addition, a Spruce Bark Beetle epidemic has impacted more than 2 million acres of Kenai Peninsula's forests. Increased water yields due to reduced transpiration from tree mortality accompanied by accelerated logging pose additional threats to these watersheds. Climate change also threatens to alter Kenai Peninsula watersheds by affecting flooding frequencies, precipitation levels, surface and ground water volumes, and other hydrologic characteristics. Major flooding in the fall of 2002 and low instream flows in the summer of 2004 have highlighted the need to understand the habitat requirements in relation to seasonal and long-term hydrologic characteristics of these waterbodies in regards to their Chinook, coho, and pink salmon, Dolly Varden char, steelhead and rainbow trout populations.

Sufficient water quantity in freshwater habitats is essential for sustaining healthy salmon production. Decision-makers cannot manage streams effectively without the historical flow and water volume information needed to predict seasonal water availability and characteristics. At the most fundamental level, this information is required to determine water availability and needs for protection of fish and wildlife habitat, migration, and propagation under Alaska law, specifically the Water Use Act (AS 46.15.).

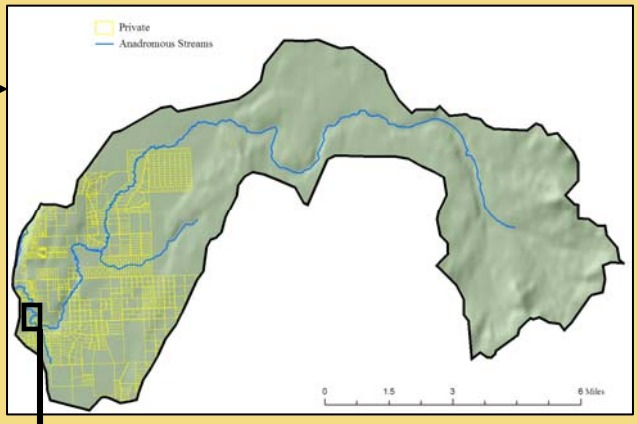
To date, however, limited hydrologic data exist throughout the state, including on the lower Kenai Peninsula. These data gaps hinder the precision and accuracy of flow and stage estimates required for research and management decisions related to fish and water management and planning. Collecting stream water level data from stage gages in conjunction with regular instream discharge measurements allows for a correlation between water level and discharge. As a result, continuous stage data provide the information necessary to construct a hydrograph and calculate mean annual and monthly flows. These calculations are critically important for quantifying flow requirements for the various salmonid life stages, and for securing instream flow reservations for fish.

To reserve water, an application containing supporting data and analyses that substantiate the need for the amount of water being requested must be submitted to the Alaska Department of Natural Resources (DNR) for adjudication (the administrative determination of the validity and amount of a water right, including the settlement of conflicting claims among competing appropriators). Typically a minimum of five years of hydrologic data are necessary to describe the natural variation in hydrologic pattern for a specific stream system. Because Alaska water rights are based on a prior appropriation principle, it is imperative to prioritize completing datasets to accomplish the goal of securing water rights on priority salmon streams.

Stariski Creek



Stariski Creek watershed drains 52 square miles on the lower Kenai Peninsula in Southcentral Alaska.



Stream Gage Site

N 59° 51.010'
W 151° 47.344'

Upstream of Sterling Highway bridge

Stariski Creek

Stariski Creek on the lower Kenai Peninsula was nominated in 2006 by Region 2 Sport Fish Division as a high priority stream warranting a reservation of water. Stariski Creek supports small to moderate runs of Chinook, coho, and steelhead. Cook Inletkeeper, in partnership with the Homer Soil and Water Conservation District, has collected water quality and habitat data in this watershed since 1998; however, hydrologic data have been limited to periodic discharge measurements. In 2006, staff from the Statewide Aquatic Resources Coordination Unit (SARCU) of the Alaska Department of Fish and Game (ADF&G) installed a stage gage on Stariski Creek. In 2006 and 2007, in cooperation with SARCU staff, Cook Inletkeeper conducted surveys to confirm reference elevations and collected regular instream discharge measurements during summer months. SARCU staff provided survey and gage station training to Cook Inletkeeper staff who, in turn, provided field work as an in-kind service. With three years of funding (FY2009-2011) through the Alaska Sustainable Salmon Fund, Cook Inletkeeper and ADF&G can complete the 5-year dataset needed to secure an instream flow reservation on Stariski Creek.

Overall Project Goals

In cooperation with ADF&G, Cook Inletkeeper will maintain a stream gage and measure flow on Stariski Creek to provide the necessary data to protect instream flows for salmon habitat. The objectives for this project are to: 1) establish and maintain a year-round stage gage on the lower reach of Stariski Creek; 2) develop a discharge relationship to stage; 3) describe seasonal and long-term flow characteristics required for life stages of salmon; and 4) secure a reservation of water for the protection of fish on Stariski Creek through the Alaska Department of Natural Resources.

Methodology

Gage installation and data collection techniques follow USGS-WRD standards and protocols. USGS-WRD is the federal agency tasked with our nation's surface water data collection and has established legally defensible standards for quality data collection. General data collection protocols adhered to in this project are also described in the operational plan for ADF&G's Statewide Aquatic Resources Coordination Unit (SARCU). Responsibility for field data collection has been divided among Cook Inletkeeper's Science Director who is qualified to conduct this work according to USGS standards, and ADF&G SARCU personnel.

Stream gauging involves the collection of three main data sets: 1) stream stage usually obtained using survey leveling techniques, and expressed as height or elevation of surface water relative to a nearby benchmark; 2) instantaneous flow or discharge, which is usually measured over a range of flows or stage several times per year; 3) a "continuous" data set that is achieved by using a submersible pressure sensor and data logger to automatically measure and record (usually at 15 minute intervals) water depth which can be calibrated to the stage or surface water elevation data. Stream flow, expressed in terms of volume of water per unit of time is calculated by determining the relationship between

surveyed stage and discharge known as a rating curve or rating. This stage-discharge relationship is a power function, therefore a log-log transformation of the data and linear regression is used to solve for the stage-discharge parameters.

FY 2009 Progress

In cooperation SARCU staff, Cook Inletkeeper installed a stream gage and staff plate on Stariski Creek in the spring of 2008. Although the gage was to be maintained year-round, SARCU staff recommended removing the gage in October due to a crack in the well pipe. Cook Inletkeeper removed the gage and cracked pipe and re-installed the gage in May, 2009. Over the year, Cook Inletkeeper measured discharge six times, including two winter (ice-mode) readings, recorded staff plate readings ten times and conducted five surveys for quality assurance. Discharge, stream gage, staff plate, and survey data were sent to SARCU staff regularly. Using Kister's WISKI software, SARCU staff developed a rating curve to generate a hydrograph for Stariski Creek and calculated mean monthly and daily flows (see Table 1).

Future Plans

Cook Inletkeeper will continue to maintain the stream gage through 2011. SARCU staff will continue to provide technical services to generate annual, monthly and daily statistics and provide seasonal and long-term flow characteristics required for life stages of salmon to be included in the reservation of water.

Benefits to Salmon/Salmon Fisheries/Salmon Fishers/Communities

Fish habitat and fish have needs for particular flows for their various life history stages and habitat types. Seasonal out-of-stream uses of water might alter the duration and magnitude of seasonal flows the fish depend on if the use is significant enough. Impoundments (dams), on the other hand, typically alter all parameters, but most importantly the timing of flows caused by economically-driven release schedules. Likewise, the formation and maintenance of specific habitat features, substrate, woody debris, pools, riffles, etc. depend on various features of natural flow regime that can be described and evaluated using the aforementioned flow metrics.

Continuous stage and flow data are essential for scientists and managers to make biologically sound water quantity and quality decisions relating to development practices that have the potential to impact water resources, fish populations, fish habitat and natural resource stewardship. As a result, this project will provide two discrete benefits. First, it will provide concrete data to assist fisheries and other resource managers with permitting, allocation and related decisions in the Stariski Creek watershed. Second, this project will allow scientists, natural resource specialists, engineers, and others to improve models to predict flow availability and characteristics in un-gauged systems or portions of waterways with limited hydrologic information in Southcentral Alaska.

Table 1. Mean daily discharge values (cfs) for Stariski Creek, water year 2008.

----------PROVISIONAL---------

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	45	---	---	---	---	---	---	---	57	34	40	33
2	46	---	---	---	---	---	---	---	56	31	37	33
3	40	---	---	---	---	---	---	---	54	30	36	35
4	38	---	---	---	---	---	---	---	56	31	35	36
5	49	---	---	---	---	---	---	177	64	31	39	33
6	70	---	---	---	---	---	---	236	60	30	40	38
7	62	---	---	---	---	---	---	212	53	35	35	51
8	51	---	---	---	---	---	---	204	49	51	31	58
9	44	---	---	---	---	---	---	153	46	40	29	82
10	---	---	---	---	---	---	---	187	43	34	29	77
11	---	---	---	---	---	---	---	196	43	32	28	65
12	---	---	---	---	---	---	---	215	46	30	29	54
13	---	---	---	---	---	---	---	197	45	30	35	63
14	---	---	---	---	---	---	---	145	46	30	38	66
15	---	---	---	---	---	---	---	123	44	28	47	72
16	---	---	---	---	---	---	---	173	40	30	73	83
17	---	---	---	---	---	---	---	134	38	71	73	236
18	---	---	---	---	---	---	---	117	36	92	57	152
19	---	---	---	---	---	---	---	109	35	58	49	100
20	---	---	---	---	---	---	---	97	35	44	43	83
21	---	---	---	---	---	---	---	100	34	38	40	68
22	---	---	---	---	---	---	---	91	35	40	96	57
23	---	---	---	---	---	---	---	88	39	60	64	54
24	---	---	---	---	---	---	---	91	37	138	53	87
25	---	---	---	---	---	---	---	82	35	190	44	135
26	---	---	---	---	---	---	---	72	33	102	40	106
27	---	---	---	---	---	---	---	66	34	94	41	81
28	---	---	---	---	---	---	---	62	50	135	39	67
29	---	---	---	---	---	---	---	60	43	80	36	59
30	---	---	---	---	---	---	---	58	37	58	34	54
31	---	---	---	---	---	---	---	56	---	47	33	---
MEAN	49.5	---	---	---	---	---	---	129.7	44.1	57.2	43.4	73.9
MAX	70	---	---	---	---	---	---	236	64	190	96	236
MIN	38	---	---	---	---	---	---	56	33	28	28	33