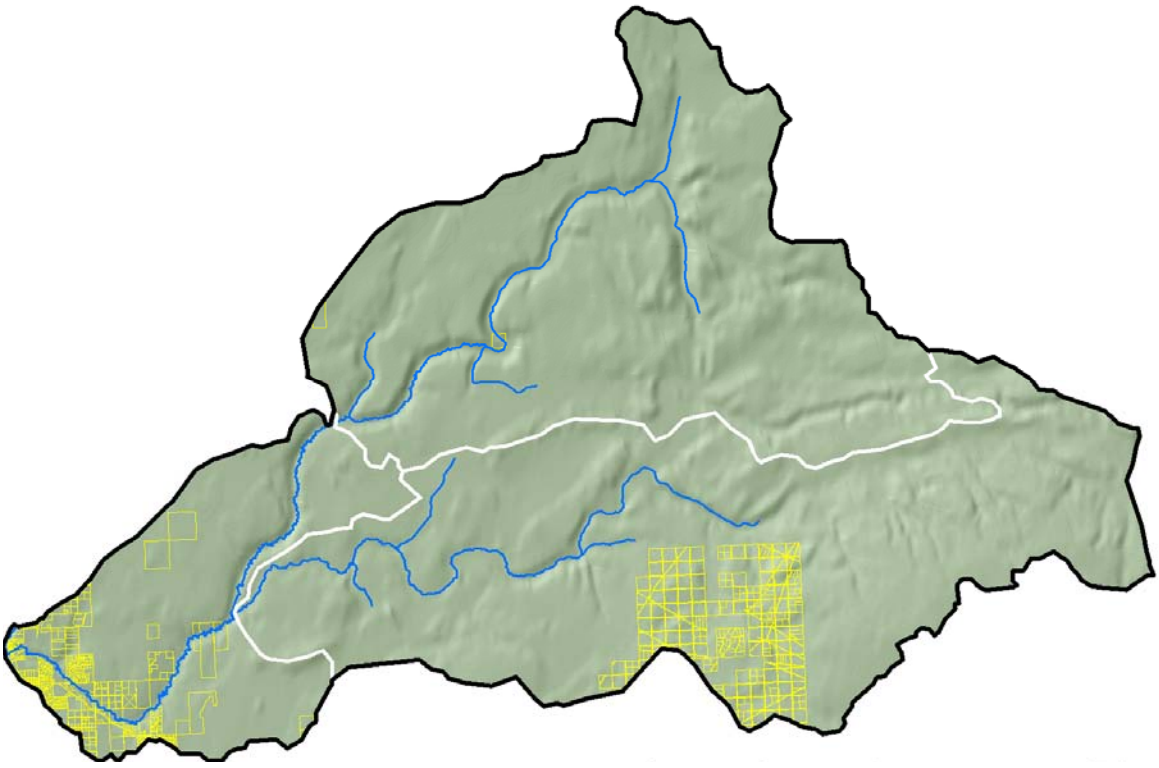
Ninilchik River Watershed Action Plan



Actions to Manage, Protect, Restore and Monitor Watershed Health to Ensure Healthy Salmon Populations for Future Generations

July 2007

Homer Soil & Water Conservation District

COOK INLETKEEPER

Protecting Alaska's Cook Inlet Watershed and the Life it Sustains

NINILCHIK RIVER WATERSHED ACTION PLAN

Summary

The Homer Soil and Water Conservation District, in partnership with Cook Inletkeeper, has used data loggers to collect continuous temperature data in salmon streams on the lower Kenai Peninsula since 2002. Monitoring has revealed that water temperatures in the Ninilchik River are frequently above state-assigned standards set to protect spawning and passing fish. Water temperature is one of the most important factors in the health of stream ecosystems and the fish they support. To address temperature concerns as well as turbidity and habitat-related issues, the Homer District has identified action steps to manage, protect, restore and monitor watershed health to ensure healthy salmon populations for future generations. Actions are aimed at improving protection of stream-side vegetation, wetlands, and instream flows; increasing fish passage to small tributaries; and reducing anthropogenic sources of sediment. These actions will help build watershed resiliency and minimize impacts on salmon populations from climate change and increasing human development.

Action steps include:

1) provide relevant information to Kenai River Center, Kenai Peninsula Borough staff, and elected officials to improve existing ordinances for salmon habitat protection;
2) build public support to strengthen new Kenai Peninsula Borough road and sub-division ordinances that are currently being developed;
3) encourage new road and culvert design to protect riparian habitat and ensure fish passage into small tributaries;
4) prioritize funds for culvert restoration projects;
5) ground truth and update baseline impervious cover analysis and plan for future analyses;
6) catalog anadromous fish presence throughout the Ninilchik River watershed especially in 1st order streams where data is typically lacking;
7) work with local land trust organization to prioritize future partnerships based on temperature refugia information;
8) encourage and promote the use of Low Impact Development (LID) techniques;
9) develop a manual of Best Management Practices for stabilizing stream banks after removal of bridges or culverts on old logging roads;
10) inventory culverts throughout the Ninilchik River watershed and identify highest priority perched and damaged culverts that provide the greatest impediment to upstream habitat;
11) monitor water temperature trends in the Ninilchik River;
12) evaluate stream characteristics that help buffer water temperatures from the effects of warming air temperatures;
13) maintain a stage gage on the Ninilchik River to monitor stream level trends; and
14) monitor macroinvertebrate communities to track recovery from the 2002 floods.

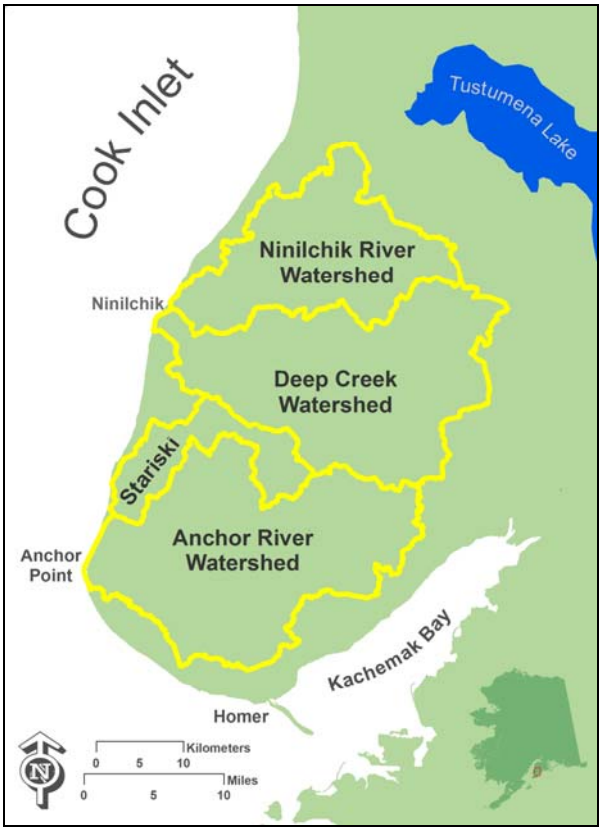
Where is the Ninilchik River Watershed?

The Ninilchik River watershed lies in the southern part of the Kenai Peninsula and encompasses 138 square miles. The region is bounded on the west by Cook Inlet and on the east by the Caribou Hills. The watershed includes 52 miles of anadromous (salmon-bearing) streams and is 37% wetlands.

The climate of the area is considered to be transitional between continental and maritime. Temperatures in Ninilchik, at the mouth of the river, range from 14 to 27°F in the winter and 45 to 60°F in the summer. Average annual precipitation is 24 inches in Ninilchik. Most of the rain falls during August, September, October, and November. High stream flows also occur in April and May when air temperatures increase, resulting in snowmelt and ice breakup.

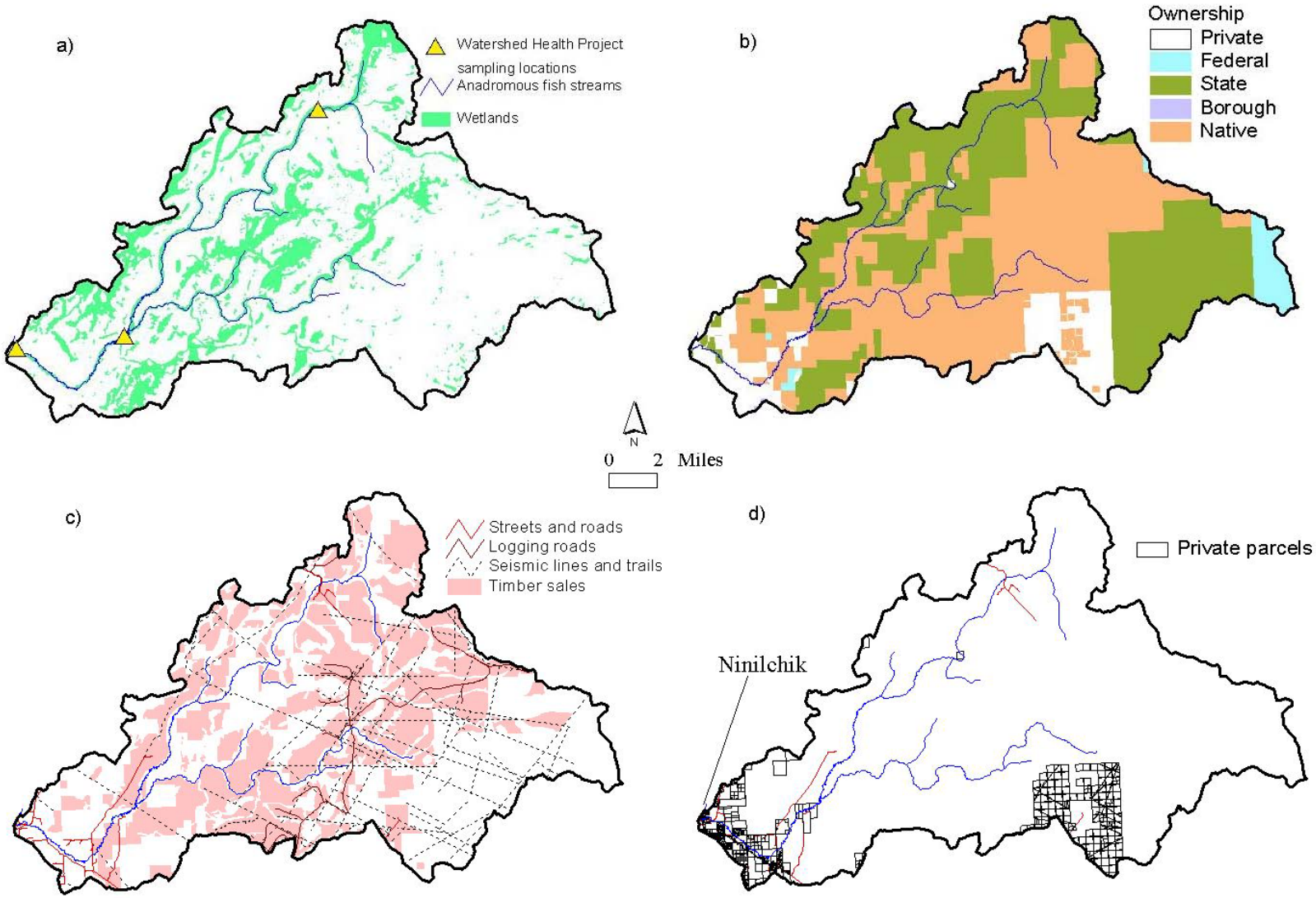
The watershed is home to many species of wildlife. A wide variety of seabirds, shorebirds, raptors, waterfowl, and songbirds live in the watershed. Moose, black and brown bear, fox, lynx, coyote, and many small mammals are found here. Finally, the streams host a variety of fish, including chinook salmon (*Oncorhynchus tshawytscha)*, coho salmon (*O. kisutch)*, pink salmon (*O. gorbuscha)*, Dolly Varden char (*Salvelinus malma)*, and steelhead (anadromous) and rainbow (resident) trout (*O. mykiss)*.

The unincorporated town of Ninilchik sits at the mouth of the watershed and presently has about 700 residents. The economic base of Ninilchik is commercial fishing, sport fishing, and tourism. The vast majority of the watershed is in state and native ownership. Only 8% of the watershed is privately owned.

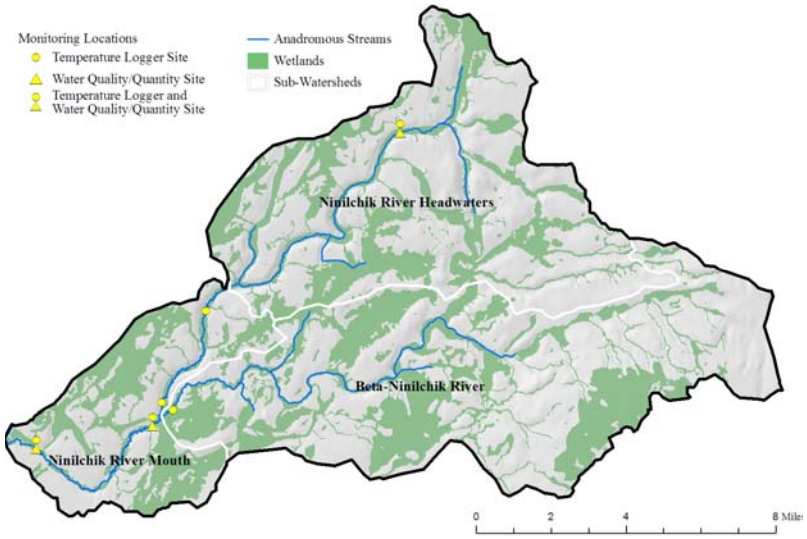


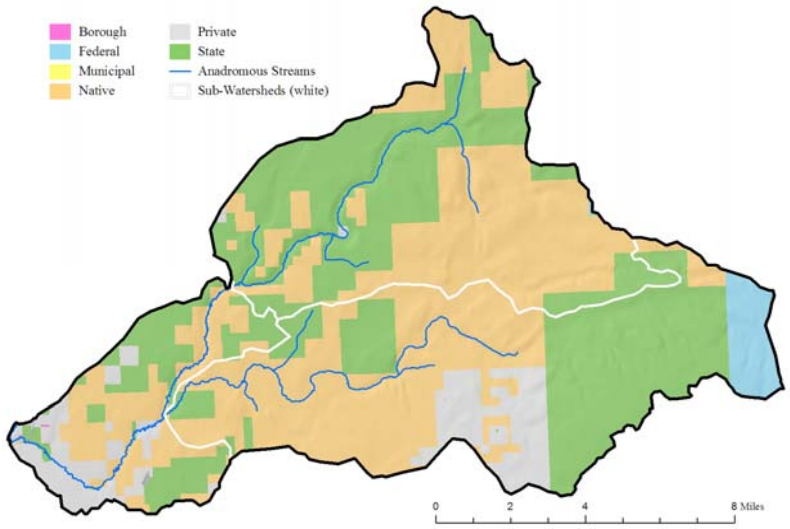
The boundaries of the Ninilchik River watershed are delineated on page 3. The extent of wetlands, anadromous streams, roads, timber sales, and land ownership are illustrated based on data collected in 1998. These maps were updated with more current information in 2005 and sub-watershed boundaries were delineated (page 4). An inventory of watershed and sub-watershed characteristics is on page 5.

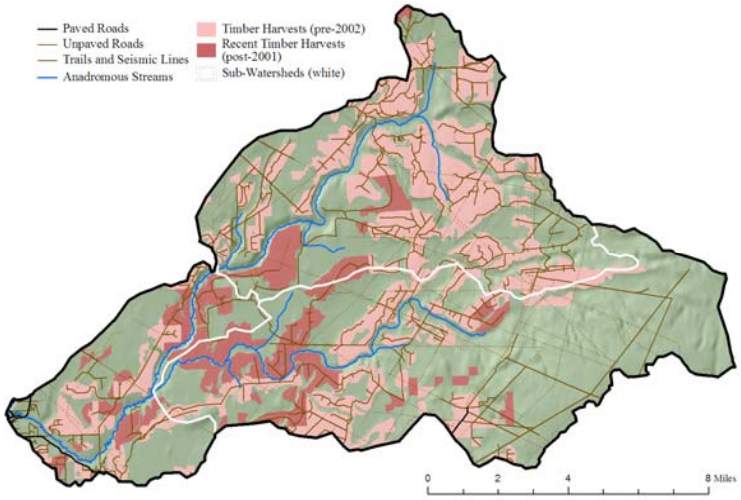
WATERSHED DELINEATION (1998): Ninilchik River watershed: a) wetlands and anadromous fish streams; b) land ownership; c) roads, trails, and timber sales; and d) communities and private parcels. Anadromous streams mapped by Alaska Department of Fish & Game; wetlands mapped by US Fish and Wildlife Service National Wetlands Inventory; and ownership, timber sales, trails and roads from Kenai Peninsula Borough data.

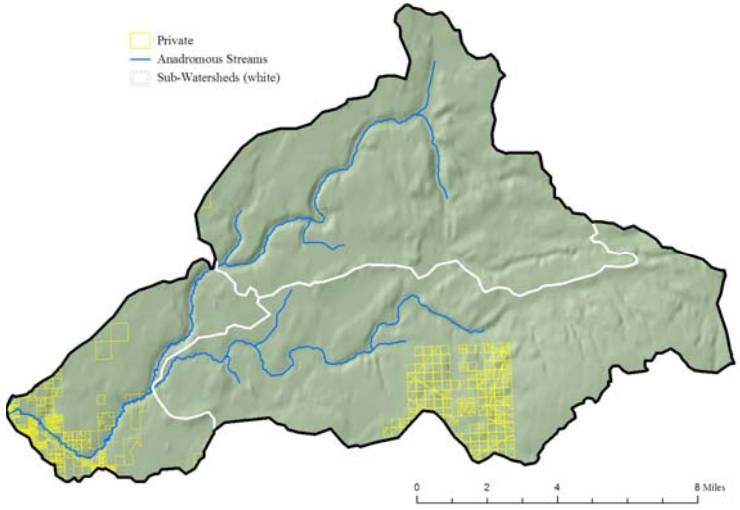


SUB-WATERSHED DELINEATION (2005): Watershed and sub-watershed characteristics have been updated with information from the Alaska Department of Fish and Game (anadromous streams, 2005), Kenai Peninsula Borough (land ownership, road and harvest data, 2005), Alaska Geographic Data Committee (sub-watershed boundaries, 2005 unpublished), and the Kenai Watershed Forum (wetland, trail and seismic data, 2005).









WATERSHED INVENTORY: Ninilchik River watershed and sub-watershed characteristics based on 2005 GIS analysis. Impervious cover determined using Quickbird satellite imagery (2' pixel) from 2002-3.

	Watershed	Sub-watersheds		
	Ninilchik River Watershed	Ninilchik River Headwaters	Beta Ninilchik River	Ninilchik River Mouth
Drainage Area (sq. miles)	**137.5**	53.1	62.0	22.5
Anadromous Streams (miles)	**52.2**	17.6	18.5	16.1
Total Roads (miles)	**325.9**	167.6	102.6	55.7
paved	**5.7**	0.0	0.9	4.8
unpaved	**320.2**	167.6	101.7	50.9
Total Crossings (#)	**18**	6	5	7
paved roads	**2**	0	0	2
unpaved roads	**16**	6	5	5
Land Ownership (%)				
Borough	**0.0**			0.1
Federal	**2.9**	0.1	6.3	
Native	**46.7**	50.3	45.5	41.5
Private	**8.1**	0.3	9.9	21.8
State	**42.3**	49.3	38.3	36.6
Total Wetlands (%) (97.2% of watershed mapped)	**37.4**	32.6	39.0	44.7
Total Timber Harvest (% of area)	**37.0**	45.9	29.3	37.1
Recent Timber Harvest (%, 2001 – 2005)	**10.4**	6.2	11.5	17.0
Impervious Cover (%) (2002-2003)	**1.2**	0.92	0.97	2.53

What do we know about the health of the Ninilchik River?

INITIAL WATERSHED CONCERNS

Land use in the Ninilchik River watershed has rapidly changed over the last twenty years with increased road building and logging. Prior to 1990, much of the watershed was relatively undeveloped with access into the backcountry provided only by trails along seismic lines. Logging activity increased after the forested lands were infested by the spruce bark beetle (*Dendroctonus rufipennis*) and concerns grew about fire danger due to downed or standing beetle-killed trees. Point source concerns identified at the start of the project included road building and logging. Non-point source pollution concerns were related to sedimentation and increasing urbanization.

MONITORING PLAN

The Lower Kenai Peninsula Watershed Health Project was developed in 1998 by the Homer Soil and Water Conservation District, in partnership with Cook Inletkeeper, with an objective to inventory water quality and characterize the health of the Ninilchik River, Deep Creek, Stariski Creek, and Anchor River watersheds. The study was designed under the direction of a Technical Advisory Committee of scientists from federal, state and local agencies as well as Tribal associations, community groups, and the University of Alaska.

Using methods outlined in the project's EPA- and DEC-approved Quality Assurance Project Plan, three sites on the Ninilchik River were monitored for discharge, temperature, dissolved oxygen, pH, conductivity, nitrate-nitrogen, ortho-phosphate, ammonia-nitrogen, total phosphorus, color, turbidity, settleable solids, total suspended solids and bacteria.

Monitoring goals were to 1) collect baseline data and determine natural variability over time for each parameter, 2) compare data with state water quality standards and federal recommendations, and 3) educate local citizens about water quality issues. Biological monitoring and habitat assessments were added to the project in 2003 using University of Alaska Anchorage, Environment and Natural Resources Institute's (ENRI) technical-level bioassessment methods.

BASELINE DATA

With significant support from the Alaska Department of Environmental Conservation through Section 319 Clean Water Act grant funds, the Homer District and Cook Inletkeeper collected year-round water quality and quantity data from 1998-2004. Bioassessment data was collected in 2003–2004 with support from an EPA Regional Geographic Initiative grant. The impervious cover analysis was supported by a U.S. FWS Alaska Coastal Program grant.

ANNUAL REPORTS

Annual reports were produced in January 2000, August 2000, September 2001, September 2002, and October 2003. Reports were distributed widely to landowners, land managers, resource users, policy makers and elected officials and made easily accessible on the web. Outreach efforts included presentation to fishing groups, community groups, agency personnel, and local researchers with press releases sent to local and statewide radio and newspapers.

FIVE YEARS OF BASELINE DATA

In November 2004, the Homer Soil and Water Conservation District and Cook Inletkeeper produced a comprehensive report that compiled more than five years of baseline data on the Ninilchik River. Based on these data, water quality is high in this salmon stream. However, temperature exceedances are increasing and may pose a risk to migrating salmon as well as egg and fry survival. In addition, forty-seven percent of the total phosphorus measurements are above the level suggested by EPA for streams and rivers. Determining turbidity exceedances is difficult because Alaska's standard requires an understanding of natural conditions within the watershed. Since this was baseline data, prior natural conditions are not known.

In October and November 2002, the lower Kenai Peninsula experienced flood events not seen in the last 50-100 years. Channel scour, back erosion and major habitat alteration reshaped salmon stream channels and riparian habitat. Based on results from sampling macroinvertebrate communities on the lower Ninilchik River, the diversity and abundance of aquatic insects is low in both pre- and post-flood samples reflecting the sandy, unstable habitat available in this river. By 2005, diversity remains low and total sample abundance is increasing towards pre-flood levels.

PRIORITY ISSUES

In 2004, monitoring was redesigned to address the specific actions detailed on the Alaska Clean Water Action (ACWA) Priorities List, with water quality being a primary concern for temperature and turbidity on the Ninilchik River. Stream bank degradation related to ATV crossings was also a priority concern.

1. Temperature - Temperature monitoring in 2004 - 2005 reveal that summer water temperatures continue to violate water quality standards in the Ninilchik River. From 2002-2005, high temperatures in the lower reaches occurred more often and earlier in the season, which may influence timing of migration to spawning beds. Warm temperatures also extend into the middle and upper reaches of the river.

There is a very tight relationship between water and air temperatures collected at Ninilchik River sites. The relationship between air and water temperature can change due to natural and human influences. Possible natural influences include: shade, flow rate, precipitation, water volume, channel width, channel depth, solar angle, wind speed, cloud cover, and relative humidity. Possible human influences include: loss of shade by removal of stream-side vegetation, lower stream flows due to water withdrawals, loss of floodplain connectivity due to channel straightening, increasing sedimentation by removal of upland vegetation, and less water storage due to wetland loss.

Extensive historical water temperature data are not available so there is no way to be certain if elevated temperatures are typical in the Ninilchik River or if they are new phenomena related to climate change. However, 73 years of daily climate data from the Homer Airport reveals an upward air temperature trend that began worldwide in 1977 and appears to be

accelerating. Since air and water temperatures have a strong relationship in the Ninilchik River, recent high air temperatures suggests that high water temperatures are also a more recent phenomena.

In 2006 - 2007, more intensive monitoring occurred to evaluate stream characteristics that help buffer temperatures to provide insight into the extent of thermal refugia for salmon and help determine the spatial variability of temperatures in rearing and spawning areas. Preliminary results from the Anchor River suggest that overhanging vegetation is an important habitat characteristic for cool water refugia.

2. Turbidity - To describe background levels of turbidity across the hydrologic gradient, a stage gage was established on the Ninilchik River in September 2005. A preliminary discharge - stage relationship has been created by collecting discharge data when the stream is wadeable to create a continuous discharge dataset for the Ninilchik River. Weekly turbidity samples are being collected and compared with the discharge dataset to develop a relationship between turbidity and stream discharge; only with this complete discharge dataset can turbidity exceedances be determined.

3. ATV Impacts – Habitat assessments and community input identified ATV stream crossings a concern in the Ninilchik River watershed. Off-road vehicle trail stream crossings can contribute to riparian zone degradation and bank alteration, which may increase sedimentation rates.

Extensive logging occurred in the Ninilchik River watershed after the peak of the spruce bark beetle infestation. Many of these roads are no longer needed for logging access and have become important for recreation access to hunting and fishing areas. Un-maintained culverts can create an impediment to fish passage. Where bridges and culverts have been pulled out, stream crossings have not been stabilized or rehabilitated.

Actions to Manage, Protect, Restore and Monitor Watershed Health to Ensure Healthy Salmon Populations for Future Generations

The Homer District and Cook Inletkeeper have identified actions aimed at improving protection of stream-side vegetation, wetlands, and instream flows; increasing fish passage to small tributaries; and reducing anthropogenic sources of sediment. These actions will help build watershed resiliency and minimize impacts on salmon populations from climate change and increasing human development.

MANAGEMENT ACTIONS

1. Provide relevant information to Kenai River Center, Kenai Peninsula Borough staff, and elected officials to improve existing ordinances for salmon habitat protection.

The Kenai Peninsula Borough (KPB) has two relevant ordinances on the books to protect salmon habitat: Kenai Peninsula Anadromous Streams Habitat Protection Ordinance and the KPB Floodplain Ordinance. Both of these ordinances could benefit from new information garnered through this watershed assessment process. The Habitat Ordinance establishes a 50 horizontal feet set back on anadromous streams. This set back requirement should be reviewed to consider critical areas that provide important refuge from warm stream temperatures. The Floodplain Ordinance needs more updated maps using current imagery and could be revised to include a greater upstream extent. The ordinance currently only includes areas below the Sterling Highway bridge.

2. Build public support to strengthen new KPB road and sub-division ordinances that are currently being developed.

The Kenai Peninsula Borough has two ordinances pending that could benefit from greater consideration of riparian habitat and potential fish passage concerns. Ordinance 2007-10 would amend KPB Chapter 14.06, Road Standards; Ordinance 2007-11 would amend KPB Title 14, "Streets, Sidewalks, Roads and Trails" and KPB Title 20 "Subdivisions," Providing for the Construction of Roads to Borough Maintenance Standards Prior to Final Plat Approval.

3. Encourage new road and culvert design to protect riparian habitat and ensure fish passage into small tributaries.

There is a need to elevate the discussion with the Alaska Department of Transportation and Public Facilities about new road and culvert designs as an effective tool to maintain watershed resilience to climate change in areas of expanding population growth. Consideration of environmental factors before the project's design phase at ADOTPF will prevent environmental issue from being considered an impediment to the lowest cost design.

4. Prioritize funds for culvert restoration projects.

Fish passage must become a higher priority for availability of state-wide transportation funds. Culvert restoration projects need to be coordinated with new or rehabilitating road work. Legislators should be educated about culvert and fish passage concerns and the need to increase ADOTPF's fish passage improvement fund grant.

PROTECTION ACTIONS

5. Catalog anadromous fish presence throughout the Ninilchik River watershed especially in 1st order streams where data is typically lacking.

The Anadromous Fish Act (Alaska Statute 41.14.870) requires that an individual or government agency provide prior notification and obtain permit approval for all activities within or across a specified anadromous waterbody and all instream activities affecting a specified anadromous waterbody The location of specified anadromous waterbodies is contained in the "Catalog of Waters Important for the Spawning Rearing or Migration of Anadromous Fishes." The Catalog is updated annually after public review. The catalog is lacking fish presence data on most first order streams in Alaska including those in the Ninilchik River watershed. Cataloging fish presence in the watershed will provide greater protections under the Anadromous Fish Act.

6. Ground truth and update baseline impervious cover analysis (2002-2003) and plan for future analyses.

Cook Inletkeeper performed an impervious cover analysis with Quickbird imagery from 2002-2003 to develop a baseline layer of impervious cover in the Ninilchik River watershed. More ground truthing is necessary to assess the degree of error. In addition an overlay of Borough platted roads (not constructed) should be added to provide a perspective on likely future development. It is recommended that this analysis be completed every 5-10 years. Planning for the next set of imagery should begin now.

7. Work with local land trust organization to prioritize future partnerships based on temperature refugia information.

Kachemak Heritage Land Trust has gathered data on the Kenai Peninsula to identify private parcels with the greatest conservation values. The Homer District should provide temperature refugia information to overlay important reaches that provide thermal refugia to KHLT maps. This important layer of information will strengthen these maps as valuable tools to identify conservation priorities for future land trust partnerships in the Ninilchik River watershed.

8. Encourage and promote the use of Low Impact Development techniques.

Low Impact Development (LID) is an approach to site planning, design and development that reduces stormwater impacts. LID aims to mimic pre-development hydrology, treat storm-water as close to its source as possible, and preserve natural drainage systems and open space. This contrasts with conventional stormwater management approaches geared to concentrating and collecting runoff and exporting it off-site as a waste product. Outreach efforts should be targeted at the Borough level, as well as at area businesses and local developers. Actions should include dissemination of information, organizing workshops and creating tax incentives for implementation of LID techniques.

RESTORATION ACTIONS

9. Develop a manual of Best Management Practices for stabilizing stream banks after removal of bridges or culverts on old logging roads.

Where bridges and culverts have been pulled out of old logging roads, bank stabilization or rehabilitation needs to be implemented by the landowner. Creating a manual will facilitate this necessary stream bank restoration.

10. Inventory culverts throughout the Ninilchik River watershed and identify highest priority perched and damaged culverts that provide the greatest impediment to upstream habitat.

Un-maintained, under-sized, perched and damaged culverts can create an impediment to fish passage. A great deal of quality rearing habitat is likely inaccessible due to poorly maintained and perched culverts. A complete watershed-wide culvert inventory and assessment will be valuable for identifying priority culverts for restoration. Upstream habitat suitable for rearing fish should be assessed to prioritize culverts for restoration.

MONITORING ACTIONS

11. Monitor water temperature trends in the Ninilchik River.

Continued temperature monitoring will provide an understanding of the rate of rising temperatures and which tributaries are contributing the warmest water. With 5 years of temperature logger data already, the goal should be for a long-term (>20 years) data set.

12. Evaluate stream characteristics that help buffer water temperatures from the effects of warming air temperatures.

Habitat complexity, such as deep pools, overhanging vegetation, undercut banks, and large woody debris should provide some refuge from the warmest temperatures. Evaluation of stream characteristics that help buffer stream temperatures will provide insight into the extent of thermal refugia for salmon and help determine the spatial variability of temperatures in rearing and spawning areas. Preliminary work in the Anchor River suggests that overhanging vegetation is an important feature. This should be tested in the Ninilchik River watershed to gain an understanding of which areas have cooler water that should be protected.

13. Maintain a stage gage on the Ninilchik River to monitor stream level trends.

Water volume is likely to change in the coming years as climate change alters watersheds by affecting flooding frequencies, precipitation levels, surface and ground water volumes and other hydrologic characteristics. Summer baseflows may decrease with less snowpack, increased development and loss of wetlands. Stage gage data will also provide the necessary hydrologic data needed to access the two instream flow reservations in the lower watershed.

14. Monitor Ninilchik River macro-invertebrate communities to track recovery from the 2002 floods.

Bioassessment or macroinvertebrate monitoring should continue in order to track flood recovery. In cooperation with UAA, Environment and Natural Resources Institute (ENRI), future macroinvertebrate samples will be used to obtain ASCI scores and will be compared with previous samples and other regional streams. The recovery time of biological communities from floods events will provide another measure of watershed health.