Interagency Hydrology Committee of Alaska (IHCA)
USF&W Service Office - Anchorage, Alaska
October 22-23, 2003

Agency reports received by 10/17/03

U.S. Army Cold Regions Research and Engineering Laboratory

Report to the IHCA Fall Meeting, October 22-23, 2003 USF&W Service Offices

- Working with the Corps Hydrologic Engineering Center (HEC) to include snowmelt into the current version of HEC-HMS (Hydrologic Modeling System, the replacement of HEC-1). Version 3.0 is in Beta testing with a hopeful release date of early 2004. This version has a whole new look from the existing HEC-HMS. HEC says that the release will be for calculation by sub-basins and elevation bands as well as gridded cells from 10m to 10 km.
- Statistical analysis of peak accumulated freezing degree days (AFDD) for all 1st order stations in US (coop stations not tested yet). For colder stations, the distribution is nearly normal and adequately described by the mean and standard deviation. Warmer stations (those with AFDD less than zero) didn't fit as well unless the zero years were dropped.
- RADARSAT image analysis to determine ice conditions on rivers showed that large and medium rivers ok, (smaller rivers less than 100m wide not very good) in determining ice presence, smooth ice or rough ice.
- Ship Creek Geomorphic Assessment continues. Baseline bed material characterized from Reservoir to inlet and will do again after current dredging (in reservoir) is completed. New bank restoration/stabilization project completed just upstream of Fish hatchery on Ft. Richardson.
- USARAK interested in baseline water quality monitoring prior to transition to "new" training lands usage (Stryker vehicle). May use Ship Creek as model for all Army lands in AK.
- Eagle River Flats pumping work completed final year of full program. One pump may operate next summer, concentrating on an area where new white phosphorous rounds were found in September.
- Water quality sampling in Knik Arm in May (metals, explosives, phosphorous) off of Eagle River Flats (off Goose Bay for control) showed no detectable levels. This program may continue each spring for 5 years.
- Soil and water characterization, looking for residual contaminants (explosives) from past and current training activities along Gerstle River, Delta River, Jarvis Creek, and Stuart Creek near Fort Greeley.
- Tanana Flats Training Area Access Study has begun to look at methods to access training area all year (ice bridges, ferries, permanent bridges, etc). Being conducted by UAF consortium with CRREL as USARAK reviewer.

Interagency Hydrology Committee of Alaska – Update, Fall, 2003
Nancy Deschu, National Park Service (NPS), Alaska Regional Office

Inventory and Monitoring Program, National Park Service:
The NPS in Alaska is part of the nationwide Inventory and Monitoring (I&M) Program. This intensive program is focused on inventorying and subsequently monitoring natural resources in national parks nationwide – this includes not only flora and fauna but also physical parameters such as hydrology, weather, and air quality.

For the purposes of the I&M program, parks are set up in "networks". In Alaska, these are the networks and the network leads:
Central Alaska Network: Denali, Yukon-Charley, Wrangells-St.Elias (Maggie MacCluskie); Southwest Alaska Network: Katmai. Lake Clark, Kenai Fjords (Alan Bennett); Arctic Alaska Network: Gates of the Arctic, Bering Land Bridge, Noatak, Kobuk, Cape Krusenstern (Diane Sanzone); Southeast Alaska Network: Glacier Bay, Sitka, Klondike (Chitra Dur).

Regarding water resources, each network will be addressing water resources to some degree dependent upon the resources in the parks and the networks' priorities. Planning is still in early stages for water resource monitoring in the Alaska networks. What has been accomplished to date has been water "inventories" (baseline data) collected at sites where freshwater fish inventories were conducted. As the planning for monitoring moves along, water resources (water quality, hydrology, aquatic habitat, climate, air) will be an integral part of each network's program. For an overview of the national program go to: http://science.nature.nps.gov/im/monitor/index.htm

Some of the Water Resource Projects Ongoing in NPS areas in Alaska:
Tanada Lake Limnology Study, Wrangell St. Elias National Park and Preserve
Anaktuvuk Groundwater Study, Gates of the Arctic National Park and Preserve
Crescent River Study, Lake Clark National Park and Preserve
Taiya River Geomorphology, Klondike Gold Rush National Historical Park
Snow Courses, Weather Stations – ongoing, Denali National Park and Preserve
Restoration of Nelson Slough, Klondike Gold Rush National Historical Park
Exit Glacier Floodplain Survey, Kenai Fjords National Park
Water Resource Management Plan, Denali National Park and Preserve
Kijik River Basin, Lake Clark National Park and Preserve
Freshwater Fish Surveys, Aniakchak National Monument
Biology of Landlocked Sockeye (kokanee) Jo-Jo Lake, Katmai, National Park
Long Lake Fish Weir and WQ in Cooperation with Cooper River Watershed Project, Wrangell-St. Elias National Park and Preserve

Gage Status in National Parks in Alaska:
Alsek River, Glacier Bay National Park and Preserve: active (USGS-Juneau)
Indian River, Sitka National Historical Park: continued pending funding (USGS-Juneau)
Johnson River, Lake Clark National Park and Preserve: active (USGS-Anchorage)
Kandik River, Yukon Charley National Preserve: discontinued
Nation River, Yukon Charley National Preserve: (continuing dependent on funding)

IHCA Agency Report **Presented by:**

October 21-22, 2003 **Emerson Krueger**

Stewart River Training Area

2003-2004 Natural Resource Projects

- Surface Water Quality Survey USGS

- In-stream Macroinvertebrate Survey in conjunction with UAA ENRI

Using the standard operating procedures for the Alaska Stream Condition Index, one round of sampling has been conducted. We are planning on a sampling event in November if we can break through the ice. Sampling will occur as often as we can get to the training area (1-3 times / year)

- Erosion Hazard Survey NRCS

- Soil Survey NRCS

- Revegetation and Restoration of Maneuver Damage

- Wetland delineation

Local Training Areas

Prioritizing training areas by use and will begin conducting environmental baseline surveys for new areas and environmental surveys of training areas with an established baseline.

Report to the Fall IHCA Meeting October22-23, 2003
UAA

- Orson Smith (CE) finishing study of beach erosion at Nikiski extending it to include more wave-induced sediment transport simulations. STWAVE (a WES model) is working now. Simon Evans successfully defended thesis "tidal effects on groundwater at Pillar's park" which showed an implicit exchange of water between the river and the confined aquifer. Heike Merkel "tidal effects on sediment transport in the lower Kenai River" defense will be October 31.
- Flume construction continues with hopeful water flow in November.
- Bill Schnabel (CE) is studying uptake character of wetlands. Also has greenhouse ready and will be constructing an artificial wetlands with flow from Chester Creek.
- Bill Schnabel and Bill Lee (CE) are building lysimeters at Elmendorf to measure the infiltration of moisture through a vegetated landfill cap.
- Craig Woolard (CE) has been involved with several studies on water and wastewater treatment schemes in Arctic native villages.
- LeeAnn Munk (Geology) is studying the geochemistry of trace elements including arsenic in surface water, streambed sediments and groundwater in the Anchorage area. She is also investigating the distribution and environmental effects of metals in the terrestrial and nearshore environments at abandoned copper sulfide mines in Prince William Sound.
- Patricia Hieser (Geology) recently received a 3 year grant on Lake Clark, Iliamna, and Naknek to look at paleohydrology, salmon history, landscape dynamics by investigating lake bed sediment cores. This could be helpful in defining if and when Russell Fiord has spilled in the past.

Caribou Poker Creeks Research Watershed
A summary of recent research accomplishments

Larry Hinzman, University of Alaska Fairbanks

Our research combines hydrology, permafrost science and biogeochemistry to better understand disturbance at the landscape scale. For instance, we have quantitatively determined source area for major solutes, dissolved organic carbon, and dissolved organic nitrogen in stormflow periods during the summer months and after the Frostfire prescribed burn (Petrone et al., 2000). Identification of these source areas has allowed us to determine how processes such as weathering in the groundwater system and decomposition in the surface soils affect stream chemistry. We have also discovered that changes in the active layer thickness throughout the summer play a major role in the hydrologic response and the coupling of upland soil and stream chemistry. Furthermore, we are now compiling a complete annual record of hydrology and chemistry to calculate annual flux rates of major solutes and organics from watersheds that differ in permafrost coverage. It appears that annual flux rates of nitrogen at the CPCRW watershed are higher than atmospheric inputs (measured from the on-site National Atmospheric Deposition Program). This is in sharp contrast to watersheds in the temperate U.S or Boreal forests of Canada that retain much of the nitrogen entering with precipitation. These findings demonstrate that boreal forest watersheds in Alaska may be fundamentally different than their counterparts in Canada and the U.S due to a changing climate driving a release of nitrogen from previously frozen soils.

Results from our experimental forest fire have resulted in numerous publications (specifically, see JGR special issue, Hinzman et al., 2003). This experiment has enabled documentation of the role of fire as an important factor controlling landscape change in permafrost regions (Hinzman et al., 2001a). Additionally, it has further enhanced our understanding of the interconnection among disturbance and climate change particularly with respect to permafrost degradation following fire (Yoshikawa et al., 2003a).

Hydrological studies have demonstrated the critical controls that permafrost exerts upon hydrological processes (Bolton et al., 2000; Ishikawa et al., 2001; Knudson et al., 2000). As permafrost becomes thinner, small springs can penetrate the frozen ground and lead to formation of aufeis in the winter and more stable baseflow in the summer (Hinzman et al., 2001b). As permafrost degrades to the point of becoming discontinuous, surface water can infiltrate to groundwater and eventually enter the stream drainage network providing stable baseflow during dry periods and in winter. Soils over permafrost with a thin active layer have higher soil moistures as compared to permafrost-free soils, all other factors being equal. As permafrost disappears in the upland areas (where soil moisture can infiltrate to deeper groundwater) the ecosystem will become drier. In lowland areas (where groundwater has upward gradients) the ecosystems may become wetter as permafrost degrades. This understanding of hydrological interactions with permafrost has permitted improved modeling of groundwater flow pathways and, consequently, stream chemistry dynamics (Hinzman et al., 2002). Hydrological studies have been conducted in CPCRW since 1969; however, not all of these data are continuous or of high quality. The available data have been compiled and rigorously quality controlled. Analyses

on long-term water balance are being completed. Preliminary conclusions are • In most years, precipitation meets or exceeds the evapotranspiration demand.
• The type and distribution of precipitation exerts a strong control over runoff regime and evaporation rates (and therefore influence the R/P ratios).
• Watersheds with higher permafrost coverage tend to be more sensitive to daily and seasonal variations. Year-to-year differences in each watershed are likely due to snowpack conditions, soil moisture content prior to the fall freeze-up and summer precipitation events, and the amount and timing of rainfall events. Historical data indicate that during large precipitation events, the contribution of the base flow component from the low permafrost watershed is about 80% throughout the summer. The base flow component of the medium and high permafrost sub-watersheds increases throughout the summer from between 50-60% at the beginning of the summer to approaching 85% by the summer's end.

The central hypothesis of the groundwater research in CPCRW was that water emerging from a spring at the base of the north-facing slopes was derived from infiltration on south-facing slopes and displayed a different groundwater source pathway from other shallow springs (Yoshikawa et al., 2003b). This was expected since less water can infiltrate the subsurface on the north-facing slopes where ice rich permafrost forms a hydraulic boundary. Artesian spring water emerging from beneath the permafrost on the north-facing slopes may therefore be derived from sources outside the topographic boundary of the watershed. The groundwater from pingo spring and lower south-facing slopes has unique characteristics from the other springs (White et al., 2002). The source of water of the other springs is more likely to be mixing of younger water. The deeper groundwater (pingo) system survived during the entire Holocene period and intense weathering processes. The south-facing slopes had aspen and birch dominant forest colonies (black spruce in north-facing, and valley bottom) today. The lower- middle south-facing slope is only place to remain permafrost-free over a long time. Over the last 20 years, most of the permafrost has disappeared from the hilltop's black spruce areas. The area's higher elevation is a reasonable place to expect permafrost retreat, as well as increasing groundwater infiltration. As a result, base flow and spring discharge increased. The increasing base flow was compared to 1907 and 1978 reports and 2001 measurements. The TR-6 spring stared after 1969, and also C3 springs may start within 50 years as well as pingo spring discharge increase since 1989.

We have developed a model for determination presence or absence of permafrost based upon climatic and terrain data (Yoshikawa et al., 2002). This model is useful for predicting spatial variations in hydrological and ecological processes as impacted by permafrost. Additional research has revealed that the spatial extent of permafrost in CPCRW has decreased by approximately 2% over the last century.

We have made significant advances in the CPCRW and Bonanza Creek with our data collection. The first was the installation of a radio network that transmits data hourly to our data server in Fairbanks. This allows us to share information in real time with the general public and also government agencies. Important data retrieved hourly include measured air temperatures at four different elevations in close proximity to each other. This is a valuable tool for identifying and quantifying our winter temperature inversions. In addition to the four weather stations connected in real time, two cameras have been installed in the watershed. The first camera, attached to our main climate station, gives users a general idea of weather conditions in the watershed. This

camera has been operating unattended since May of 2002, with images archived locally at the WERC. This camera could also be used to aid in studying the radiation balance at this site. The long wave and short wave radiometers are in the field of view, allowing a visual inspection of the sensors in order to validate radiation data. The second camera installed at the watershed was in support of an aufeis monitoring station. This camera allowed researchers to inspect their site and correlate the data measured by their station with the physical growth of aufeis. It was operational for approximately nine months. Using current technology we now have the ability to install a camera at virtually any site in the watershed in support of a research project and acquire images hourly. There are many potential uses for such a system.

The established radio network in the watershed is only in its second year. Currently we are using approximately ten percent of the radio networks data transmission capacity. Future projects should consider adding telemetry capabilities to instrumentation that is installed in the watershed. Data intensive sites such as eddy covariance towers would be able to take advantage of this available bandwidth. Future research into surface energy balance could rely on remote cameras capturing real time images to validate data during winter months. Visual observations from radiation sensors could be used to confirm that sensors were snow and ice-free during the measurements.

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