

American Water Resources Association
2009 SPRING SPECIALTY CONFERENCE
Managing Water Resources Development in a Changing Climate
May 4-6, 2009
Anchorage, AK

Tuesday, May 5

10:30 AM – 12:00 Noon

Session 15: Managing Arctic Watersheds II

1. Application of Reservoirs in the Arctic to Reduce Future Water Use Uncertainty – Horacio Toniolo, University of Alaska Fairbanks, Fairbanks, AK (co-author: Michael Lilly)

Oil and gas development on the North Slope provides a critical part of the US energy supply. The North Slope is facing a period of new growth to meet the increasing energy needs of the nation. While this growth is taking place in areas active in development and production for more than 20 years, it is expected that new areas will be open in the near future. Thus, industry and management agencies will face increasing challenges in developing and operating new oil and gas fields. One of these challenges is the availability of water, especially during winter for ice-road and pad construction. Another challenge is the uncertainty associated with changing climate. As development progresses to areas where water sources are scarce, manmade reservoirs can provide excellent water sources.

We will describe main parameters involved in the design of future manmade reservoirs such as potential recharge, residence time (i.e., particle travel time along the reservoir); inlet and outlet elevations; depths, top shape and volume; shoreline slopes to promote aquatic habitat diversity; safety considerations. In addition, future reservoirs must preserve water quality. Thus, reservoirs located in the coastal region need to be designed to avoid the inflow of saline water. The location of reservoirs on the Arctic landscape will need to be balanced with gravel deposits and use, potential use for over-wintering habitat, and long-term stability in permafrost-rich terrain. Designing reservoirs with these factors taken into account will help ensure the water availability typically needed for decades of field operations.

2. Michael Lilly

3. Current and Future Evaporative Losses from North Slope Lakes - Bill Schnabel, Univ. Alaska Fairbanks Water and Environmental Research Center, Fairbanks, AK (co-authors: Michael Lilly, Amy Tidwell, Horacio Toniolo)

Freshwater lakes on Alaska's North Slope not only fill a crucial ecological role, but also provide source water for drinking, subsistence, and industrial use. Consequently, these varied uses must be balanced against each other such that one use does not negatively impact the others. As industry continues to expand on the North Slope, water resources will potentially become a scarce commodity, thus upsetting the balance between ecological and human uses. In addition, potential changes in the North Slope's climate will likely alter the water balance of Arctic freshwater lakes, although the impacts of these changes are not yet well understood. One crucial, yet infrequently-observed component of North Slope lake water balances is the annual water lost due to evaporation. In this presentation, the evaporative losses from a variety of North Slope lake basin types will be estimated based upon meteorological data collected at existing stations. In addition, a sensitivity analysis will be performed to evaluate the lake water balance response to anticipated changes in the Arctic climate. Results from this assessment will be discussed relative to current and future management of North Slope water resources.

4. Two Distinct Mechanisms of Lake Hydrological and Chemical Change Along the Arctic Coastal Plain, Alaska - Christopher Arp, U.S. Geological Survey, Anchorage, AK (co-authors: Benjamin M. Jones, Frank E. Urban, Joel A. Schmutz)

Abundant thermokarst lakes of the arctic coastal plain are susceptible to changes in summer water balance and storm surge flooding. Both lake change mechanisms may be enhanced by of longer ice-free summers. We present evidence from a lake-rich area along the Beaufort Sea coast, Alaska that lake salinity is increasing both progressively and episodically by two distinct mechanisms. Specific conductance synoptically sampled in the late summer increased consistently by 35% from 2004 to 2008 and 44% since 1977, suggesting widening evaporation to precipitation imbalance. During this same period, at least 7% of

lakes became exposed to periodic seawater flooding because of accelerated erosion coupled to more effective storms creating inland surges. We hypothesize that both mechanisms of lake change are occurring primarily because of a seasonal increase in ice-free conditions both inland and offshore. Local ice-free duration of lakes has increased by 15 days since 1970 and the decline in Arctic sea-ice extent is well recognized. The consequences of these distinct lake change mechanisms are discussed in terms of wildlife habitat, water supply, lake-ice dynamics, and climate feedbacks.