Abstract

Sediment Budget and Associated Coastal Processes at the Mouth of the Kenai River, Alaska

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The Kenai River drainage system is heavily impacted by human use and development because of its scenic beauty and exceptional salmon fishery. Concerns for adverse changes to the sediment budget and water quality induced by new developments at the mouth of the Kenai River are continually expressed by conservation interests. This paper presents the first stage of analyses that will reveal trends in sediment budget affecting shoreline erosion and formation of bars and shoals important to survival of migrating juvenile salmon and other marine species. Findings will define a baseline condition for assessment of potential impacts from developments along the lower Kenai River.

This phase of the project measured and numerically modeled river and tidal currents and related sediment transport in the lower Kenai River to assess the stability of bluffs, shoals and marshlands in an area strongly impacted by commercial and recreational fishing, tourism, and shoreline development. A numerical model that predicts tidal influence on water levels and currents to the limit of tidal influence about 12 miles upstream from the mouth was developed. The model simulates tidally influenced water levels and current speeds in the Kenai River with reference to Cook Inlet astronomical tides adjusted from long-term historical measurements and predictions at nearby Nikiski. Field measurements at the river mouth and respective transects were made to quantify suspended and bed sediment transport for correlation with long-term stream gauge measurements upstream.

Cross-sections of the river were measured during September and October of 2001 at 22 locations from Soldotna to the mouth of the Kenai River using a portable hydrographic survey system on hand at the University of Alaska Anchorage, School of Engineering. These cross-sections served as input for numerical modeling of tidal influences on river flow, which were estimated over a wide range of tidal conditions using the computer package DYNLET1. This program models one-dimensional dynamic (time-dependent) behavior of tidal flows at inlets based on the shallow-water equations employing an implicit finite difference technique. Upstream river flow is constrained by bed friction and downstream (Cook Inlet) tidal elevations in model computations. Flow in the river is estimated in increments across the channel, allowing corresponding estimates of bed shear stress variation for application to sediment transport computations. Data from the USGS gauge at Soldotna established upstream flow.

Tidal variations at the mouth were based on a NOAA tide gauge at Nikiski, corrected for phase and amplitude at the mouth of the Kenai River. Short-term water level measurement in the river and adjacent ground water (two wells) at Pillars Park provided important calibration and verification data. Water and bed material samples were collected in conjunction with cross-section measurements. Water samples were filtered

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to determine concentration and grain size of suspended sediments. Grain size distribution of bed material was also determined in the laboratory.

The second phase of the project will include measurements of tidal and river currents with an acoustic Doppler current profiler as well as wave-induced sediment transport and ice observations along the lower river and adjacent Cook Inlet waters. The results of this study, documented in reports and GIS, will provide a map of sediment transport increments along the lower Kenai River and adjacent Cook Inlet coast. Seasonal pattern, with a view toward the quantitative effects of river and coastal ice, will be presented.

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