Division of Geological & Geophysical Surveys

MISCELLANEOUS PUBLICATION 147I

ANNOTATED BIBLIOGRAPHY SERIES IN SUPPORT OF COASTAL COMMUNITY HAZARD PLANNING—NORTHWEST ALASKA

KOTLIK, ALASKA

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November 2011

This annotated bibliography is part of a series created to facilitate access to documents useful for coastal geohazard evaluation and community planning in Northwest Alaska. Below is a comprehensive list of community-specific information sources, each with full bibliographic information and an informative-style annotation that highlights content pertaining to the community of Kotlik, Alaska. For a detailed description of the preparation and scope of this resource, please refer to this bibliography series' foreword. Any notable errors and/or omissions may be reported to the Coastal Hazards Program manager at the Alaska Division of Geological & Geophysical Surveys (DGGS).

Alaska Department of Commerce, Community, & Economic Development (DCCED), accessed 2011, Division of Community & Regional Affairs (DCRA) Community Profiles [website]: State of Alaska Department of Commerce, Community, & Economic Development.

http://www.commerce.state.ak.us/dca/profiles/profile-maps.htm

This website provides access to community profile maps for community-based planning. The maps are available in 24" by 36" and 30" by 42" formats. The Kotlik maps were created in 2006, 1994, and 1979 based on land surveys and/or interpretation of aerial imagery. Subsistence hunting grounds, habitat areas, community buildings, and public facilities are delineated. Shoreline position and potential erosion zones are included in the map content. All maps have been sponsored by the Alaska Division of Community & Regional Affairs and contracted to local agencies for production.

Alaska Department of Natural Resources Division of Coastal and Ocean Management (DCOM), accessed February 2011, Alaska Coastal Management Program [website]: Alaska Department of Natural Resources Division of Coastal and Ocean Management.

http://alaskacoast.state.ak.us/Explore/Tour.html

This website outlines the Alaska Coastal Management Plans for each coastal district. It provides stewardship plans "to ensure a healthy and vibrant Alaskan coast that efficiently sustains long-term economic and environmental productivity."

Blier, Warren, Stanley Keefe, Wilson A. Shaffer, and Sung C. Kim, December 1997, Storm surges in the region of western Alaska: Monthly Weather Review, vol. 125 p. 3094–3108.

The authors describe the relationship between storm surges in Alaska and extratropical cyclones. They have identified Norton Sound and the Bering Sea as the two regions most vulnerable to cyclone-linked coastal flooding. A statistical storm-surge model was developed to provide advanced warning to coastal villages, however, the author highlights that a more accurate model would be necessary to utilize this warning system as a hazard mitigation strategy. The installation of storm-surge gauges would also be required for this warning system to be used successfully.

Brabets, Timothy P., Bronwen Wang, and Robert H. Meade, 2000, Environmental and hydrologic overview of the Yukon River Basin, Alaska and Canada: U.S. Geological Survey, Anchorage, Alaska, Water-Resources Investigations Report no. 99-4204, 114 p.

This compilation report of the environmental and hydrological conditions of the Yukon River basin includes summaries of the following characteristics by region: physiography, climate, geology, land cover, soils, permafrost, surface water, sediment, and water quality. The focus of the report is on surface water characteristics only and it was produced to facilitate the design of an improved water quality sampling program. The report contents are limited by the number of available recording stations with consistent historical data.

Cacchione, David A., and David E. Drake, 1979, Sediment transport in Norton Sound, Alaska: U.S. Geological Survey, Open File Report 79-1555, 88 p.

This report is an investigation of sediment dynamics in Norton Sound and the northern Bering Sea. The major topic of the research was sediment movement and hydrodynamic stresses that occur in the Sound and their relationship to Bering Sea ocean dynamics. Other studies have found sediment accumulation from the Yukon River inconsistent with the rate of supply. The modes of transport for this loss of materials are discussed in the report. This study attempts to provide a description of the bottom transport of sediments, pollutants, nutrients, and other particulate matter as well as identify hazardous sea floor conditions in Norton Sound.

Chikita, Kazuhisa A., Richard Kemnitz, and Ryuji Kumai, 2002, Characteristics of sediment discharge in the subarctic Yukon River, Alaska: Catena, vol. 48, p. 235–253.

The authors describe the construction of a physical model of sediment discharge from the Yukon River. The study uses the results of observations made in 1999 to characterize temporal patterns in the volume of sediment discharged by the Yukon River. The results of this study reveal that peak sediment discharge did not coincide with peak water discharge. The peak sediment discharge was linked to glacier-melt from summer to autumn, while peak water discharge was linked to snowmelt in the spring.

Drake, D.E., D.A. Cacchione, R.D. Muench, and C.H. Nelson, 1980, Sediment transport in Norton Sound, Alaska: Marine Geology, vol. 36, p. 97–126.

This study examines the suspended sediment and ocean circulation of the northeastern part of the Bering Sea shelf. The authors describe the fate of sediment delivered by the Yukon River to the southwest corner of Norton Sound and the importance of storm events in Norton Sound associated with erosion and transport of sediment. Landsat images were also used to inspect the distribution of sediments and regional circulation in the Sound.

Hartig, Larry, *of* Alaska Department of Environmental Conservation & Governor's Climate Change Sub-Cabinet, October 2010, State of Alaska and State/Federal Executive Roundtable Activities Regarding the Arctic [presentation]: Anchorage, Alaska, Northern Waters Task Force, 53 p.

http://housemajority.org/coms/anw/pdfs/26/NWTF_Powerpoint_Hartig_01Oct10.pdf

This is a powerpoint presentation about the state and federal executive roundtable activities regarding the Arctic. The discussion includes hazards associated with declining Arctic sea ice extent, melting of permafrost, storm surges, and coastal erosion. Thirty-one villages are identified as imminently threatened: Barrow, Kivalina, Selawik, Allakaket, Hughes, Huslia, Shishmaref, Deering, Teller, Koyukuk, Nulato, Golovin, Shaktoolik, Unalakleet, Saint Michael, Kotlik, McGrath, Emmonak, Alakanuk, Chevak, Newtok, Nunapitchuk, Lime Village, Eyak (Cordova), Napakiak, Akiak, Chefornak, Kwigillingok, Dillingham, Clark's Point, and Port Heiden. Specific photos and engineering initiatives for four communitites are discussed, including: Kivalina, Shishmaref, Unalakleet, and Newtok.

Henricksen, Geri, ed., February 2002, Kotlik erosion: State of Alaska capital project summary, municipal capital matching grants: State of Alaska, reference no. 36101, 1 p.

This an approved request form for renewal and replacement of erosion structures in Kotlik, Alaska, for $25,000.

Immediate Action Workgroup (IAWG), Michael Black and Patricia Opheen, eds., March 2009, Recommendations to the Governor's Subcabinet on Climate Change: Immediate Action Workgroup, 162 p.

The Immediate Action Workgroup was established to address known threats to Alaskan communities caused by coastal erosion, thawing permafrost, flooding, and fires. This report is a follow-up to the recommendations made in April 2008 (in which Kotlik was not mentioned), and provides recommendations for actions and policies to be implemented in 2009 and 2010.

Kotlik was identified as receiving agency actions from the U.S. Army Corps of Engineers (COE) and the Department of Commerce, Community, & Economic Development (DCCED).

Lower Kuskokwim Economic Development Council, June 2006, Lower Kuskokwim Economic Development Council comprehensive economic development strategy and area plan: Lower Kuskokwim Economic Development Council, Bethel, Alaska, 28 p.

This report presents an economic development strategy by the Lower Kuskokwim Economic Development Council (LKEDC). The purpose of this report is to identify a more stable and diversified economy, assist in creating employment opportunities, improve local economic conditions, and act as a catalyst for guiding and coordinating the efforts of individuals and organizations concerned with sustainable economic and natural resource development in the region. The main areas of economic development are the promotion of fisheries resources, tourism and infrastructure development, job development, and the coordination of LKEDC services to local residents. Specific communication efforts, opportunities, and goals are listed for each subject, including watershed management.

Maynard and Partch, 1984, Capital improvements program briefing paper—Yukon–Kuskokwim needs assessment and regional plan: Alaska Department of Community & Regional Affairs (DCRA), 79 p.

This report identifies the multi-year capital improvement needs for 50 communities in the Yukon–Kuskokwim Region. The region was chosen for study because of the rapid change from subsistence to cash-based economy. The capital improvements are summarized in tables for each community and are at a scale that will bring substantial benefits to the region.

Mike, Mary Ann, and Rose Cheemuk, eds., December 2007, Hazard mitigation plan, City of Kotlik, Alaska: URS, Anchorage, AK, 71 p.

This plan was developed to plan for potential natural hazards to the City of Kotlik,, to meet the Federal Emergency Management Agency's requirements of the Disaster Mitigation Act.

Erosion is identified as a hazard to Kotlik in three forms, coastal, riverine, and wind. The riverine erosion impinges the greatest impact on public and private infrastructure in Kotlik. The riverine erosion occurs through bank slumping (slab failure) with the fine bank material being carried away by river flow and wave action. Other natural and anthropogenic factors contribute to this form of erosion and are explained in further detail. Historical information was analyzed to define this hazard as a "Highly Likely" event. This means the event is probable to occur within the calendar year.

Flooding is identified as another hazard for Kotlik, caused by rainfall–runoff, snowmelt, and ice jams. Previous flood events are recorded for 1974, 1987, 1989, and 1992. Based on historical flooding events, Kotlik is considered likely to experience flooding (within the next 3 years).

Economic loss calculations are provided for each hazard based on economic and structural losses to a predicted percentage of the community.

Sallenger, Asbury H., Jr., 1983, Measurements of debris-line elevations and beach profiles following a major storm: Northern Bering Sea coast of Alaska: U.S. Geological Survey Open-File Report 83-394, 12 p.

From introduction: "During November 1974, a severe storm occurred in the Bering Sea; winds gusted to greater than 100 km/hr and barometric pressure dropped 34 mb. Combined storm surge and wave runup reached as high as 5 m along the northern Bering Sea coast of Alaska. Shortly after the storm, the northern Bering Sea froze. Following breakup in 1975 and during the ice-free season of 1976, we surveyed beach profiles and elevations of debris-lines at stations around the northern Bering Sea coast of Alaska. In this open-

file report, these data are used to show the approximate magnitude of combined storm surge and wave runup in the study area."

Sallenger, Asbury H., Jr., and John R. Dingler, September 1978, Coastal processes and morphology of the Bering Sea coast of Alaska: Menlo Park, California, U.S. Geological Survey, Research Unit No. 431, 66 p.

The purpose of the research outlined in this paper was to characterize the regional physical environment of the Bering Sea coast of Alaska to prepare for potential oil and gas development and subsequent hazards to infrastructure and environment. The net direction of longshore transport, coastal morphology, and reconnaissance-based beach morphology and sediment characteristics were used as indicators. Measurements were taken along the Bering Sea coast of debris-line elevations that were reached during the 1974 Bering Sea storm. Coastal change was measured near Nome using nearshore coastal profiling and aerial photography from 1976 and 1977. Wave characteristics and sea level variations were also measured to check the validity of the wave model used. The specific objective of the research was to develop a coastal set-back line beyond which petroleum development would not occur.

Simpson, J.J., January 1984, Final report, Task Force on Erosion Control: Alaska Department of Transportation & Public Facilities, project no. R-30023, 101 p.

The Erosion Control Task Force was appointed to investigate and inventory potential erosion problems on a statewide basis, to prioritize the erosion problem sites by severity and need, and to provide preliminary design plans where immediate remedial action is required. Sites were rated based on public safety, public property, private property, time of projected loss, ability to move, approximate replacement value, and economic value. Projected costs of erosion protection measures were analyzed and totaled $16,802,300 for all projects. This report outlines specific engineering projects to reduce the effects of coastal and riverine erosion for communities throughout Alaska.

Erosion at Kotlik was shown to have affected about 3,000 feet of riverbank next to the community. Public and private buildings are expected to be impacted by erosion within 10 years based on current rates of erosion. The suggested was made to build two 250 feet concrete mats and 1,150 feet of pile and fascine revetment to reduce threats to erosion in the community.

Tetra Tech *for* Immediate Action Workgroup: Advisory Group of the Governor's Climate Change Sub-Cabinet, June 2010, Imperiled community water resources analysis: Anchorage, AK, Tetra Tech, 47 p.

This report summarizes climate-related threats to water and wastewater infrastructure in Alaskan communities including those at risk of flooding, saltwater intrusion, loss of surface water supply, erosion, and sedimentation of the source region. The primary objectives of the analysis were to:

1. *Identify and select study group communities whose water infrastructure is threatened*
2. *Collect information on the threatened water infrastructure for the study group communities*
3. *Analyze information to determine the climate-related impacts to study group community water infrastructure. (p. 2)*

For this study, Kotlik was examined for melting permafrost. It was reported that Kotlik had 60% of the community at risk from erosion and 100% susceptible to flooding from the Yukon River and coastal surge. The landfill was included as a critical facility at risk to these hazards and may affect water infrastructure if damaged.

Thorsteinson, Lyman K., Paul R. Becker, and David A. Hale, 1989, The Yukon Delta—A synthesis of information: Anchorage, Alaska, National Oceanic and Atmospheric Administration (NOAA), OCS study no. MMS 89-0081, 89 p.

This document contains a synthesis of physical and ecological information about the Yukon–Kuskokwim River Delta. "[Since 1974], the Outer Continental Shelf Environmental Assessment Program (OCSEAP) has administered oceanographic research to characterize the environmental components and processes of the Alaskan Outer Continental Shelf." This research, once primarily based on oil and gas exploration, has stimulated interest about the importance of the physical and biological habitats of the delta.

The physical environment is described in terms of geomorphology, hydrology, bathymetry, sedimentology, coastal circulation, hydrography, and environmental sensitivity mapping. The biological environment is described in terms of primary productivity, invertebrates, fisheries, avifauna, and mammals.

Areas of research highlighted as in need of further exploration are ice-edge effects, prevailing sea ice movements to the southwest, and subsurface northwesterly transport of Norton Sound water masses. If oil and gas exploration develops, more work must be conducted to determine the effects that this activity would have on the estuarine habitat.

U.S. Army Corps of Engineers, accessed 2011, Civil works floodplain management services [website]: U.S. Army Corps of Engineers, Alaska District.

http://www.poa.usace.army.mil/en/cw/fld_haz/floodplain_index.htm

This website provides flood-hazard data for communities throughout Alaska. A link is provided to a flood-hazard-specific bibliography, maintained by the U.S. Army Corps of Engineers. The last flood event for Kotlik was in 1987 from stream overflow, and the largest flood on record was in 1974 from a rainfall event. Survey information is available from the 1974 flood event given in elevations based on an arbitrary baseline.

U.S. Army Corps of Engineers, March 2009, Study findings and technical report—Alaska baseline erosion assessment: Elmendorf Air Force Base, Alaska, U.S. Army Corps of Engineers, Alaska District, 68 p.

http://www.poa.usace.army.mil/AKE/Home.html

This statewide assessment was conducted by the U.S. Army Corps of Engineers to coordinate, plan, and prioritize responses to erosion throughout Alaska. The report designated 26 communities, including Kotlik, as priority action communities.

The erosion at Kotlik, about 3 feet per year, is reported as riverine erosion. Several community structures as well as roads are at risk from erosion. Three erosion control projects have been completed in Kotlik, costing a total of about $83,000. All projects were capital matching grants funded by DCCED. It is recommended that Kotlik begin a detailed assessment identifying possible solutions to the erosion issues. The assessment would cost about $100,000.

U.S. Government Accountability Office (GAO), June 2009, Report to congressional requestors—Alaska Native villages, limited progress has been made on relocating villages threatened by flooding and erosion: U.S. General Accountability Office Report GAO-040895T, 53 p.

http://www.gao.gov/products/GAO-09-551

This report is a follow up to the 2003 GAO report on flooding and erosion in Alaska Native villages, and was completed to identify climate change concerns that have increased the urgency of federal and state efforts. The GAO developed recommendations for Congress that include:

1. *A flooding assessment to augment the erosion assessment completed by the Army Corps of Engineers.*
2. *An amendment to federal legislation that would allow 64 more villages to be eligible for grants.*
3. *The designation of a federal entity to oversee and coordinate village relocation efforts.*

This report recognizes Kotlik as one of 31 villages facing an imminent threat from flooding and erosion, and as one of 33 villages with a FEMA-approved disaster mitigation plan.

U.S. Government Accounting Office (GAO), 2003 [2004], Alaska Native villages—Most are affected by flooding and erosion, but few qualify for federal assistance: U.S. General Accounting Office Report GAO-04-142, 82 p.

http://www.gao.gov/products/GAO-04-142

This study was conducted to provide recommendations to Congress to improve how state and federal agencies respond to flooding and erosion in Alaska. This was done by:

1. *Determining the extent to which these villages were affected.*
2. *Identifying federal and state flooding and erosion programs.*
3. *Determining the current status of efforts to respond to flooding and erosion in nine villages.*
4. *Identifying alternatives that Congress may wish to consider when providing assistance for flooding and erosion (see "Highlights" section).*

The recommendations provide alternatives to current actions taken during flooding and erosion responses by including federal agencies and the Denali Commission. The adoption of policies by the Denali Commission would guide investments in infrastructure for Alaska Native villages affected by flooding and erosion. Kotlik was recognized as one of the 184 Alaska Native Villages facing threats from flooding and erosion.

Walters, L., and M. Cushing, 1995, Community profile—Kotlik: Alaska Department of Community & Regional Affairs (DCRA), 15 p.

This profile includes information on the community's status in the following areas: Facilities, U.S. Census, economy and employment, schools, rural businesses, contacts, municipal officials, municipal finances, rural grants, and ANCSA land status.

Wise, James L., Albert L. Comiskey, and Richard Becker, 1981, Storm surge climatology and forecasting in Alaska: Anchorage, Alaska, Arctic Environmental Information and Data Center, University of Alaska, 26 p.

The objective of this study was to improve the quality of life and the security of property in coastal areas susceptible to flooding by enhancing the decision-making process for human activities and development. This study compiles historical climatological data to develop a surge forecast regression equation. Storm profiles specific to Kotlik are recorded for 1978 and 1980.