Alaska CIAP State Tier 1-10:

Geohazard Evaluation & Geologic Mapping for Coastal Communities

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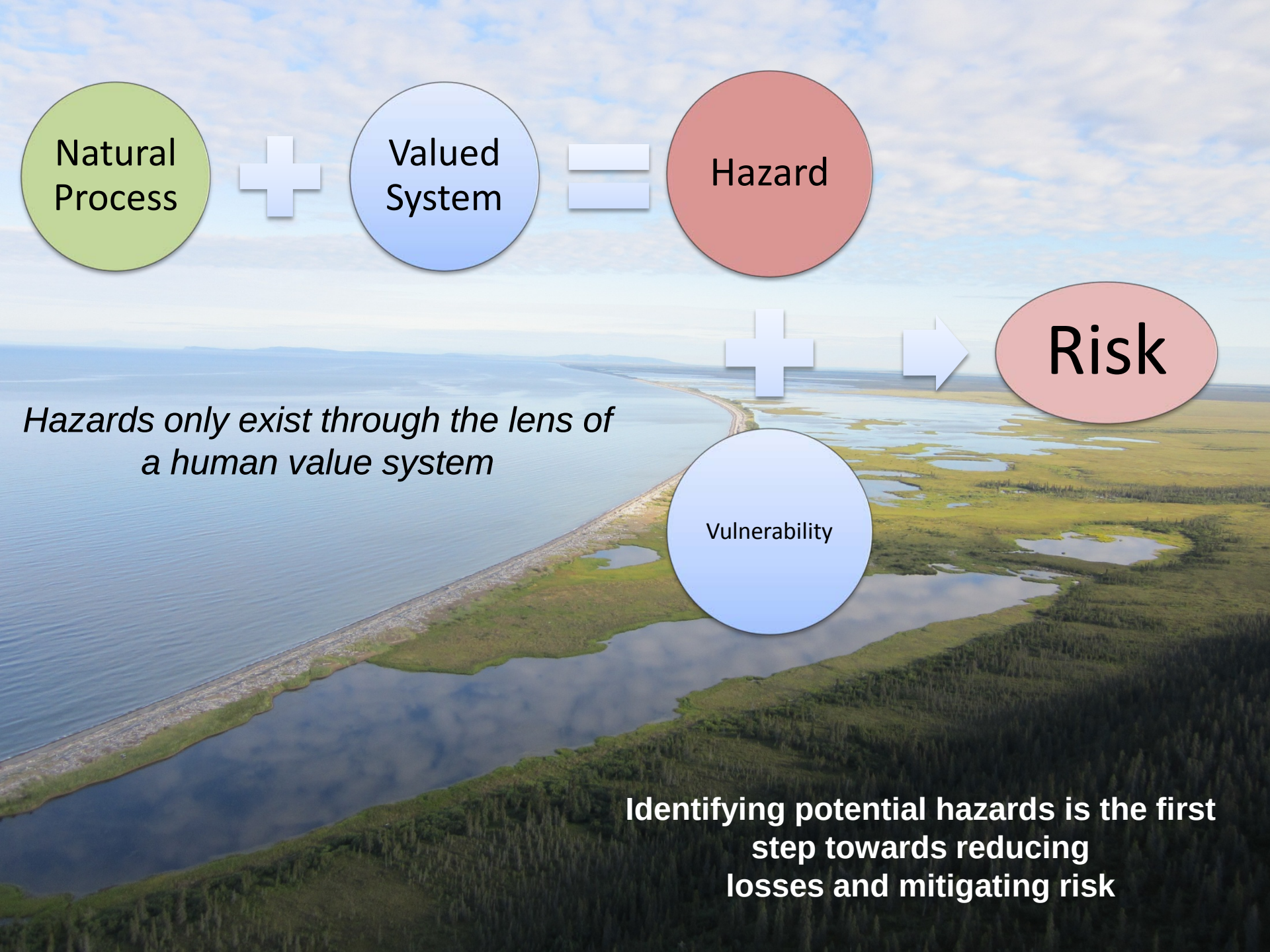
www.dggs.alaska.gov

Alaska Forum on the Environment

February 7, 2013

What are

COASTAL GEOHAZARDS IN ALASKA?


Natural Process
Valued System
Hazard
Risk
Vulnerability
Hazards only exist through the lens of a human value system
Identifying potential hazards is the first step towards reducing losses and mitigating risk

WHAT ARE COASTAL GEOHAZARDS IN ALASKA?

Beach Erosion/Accretion, Slope Failure, Coastal Flooding, Tsunami, Ivu, Sea Level Change, Salt Spray…

Bluff Failure
Kivalina, AK *(Kinsman 2010)*

Storm Surge
Shaktoolik, AK July 2011 *(Kinsman 2011)*

Ivu (Ice Push)
Nome, AK - May 2004 *(Tom Busch 2004)*

Tsunami Damage
Kodiak, AK – March 1964 *(noaa.gov)*

Coastal processes have highly variable:
- Intensities
- Frequencies
- Spatial Extents

Processes may be <u>catastrophic</u> or <u>gradual</u>

- Storm Surge
- Tsunami

- Permafrost melt
- Gravel mining
- ATV use on dunes

WAVE ENERGY

Translated inland by elevated water levels

May pose an enhanced danger when materials are present and mobile

- Ice
- Driftwood
- Man-made objects

Energy may be dissipated by:

- Slush in the nearshore
- Vegetation or wide beaches
- Natural or man-made revetments

The elevation that water can reach on the shore is called the run-up height

Video by Shawn Hulse – November 2011

Nome (AK DHSEM, 2008)

How is DGGS

EVALUATING COASTAL GEOHAZARDS?

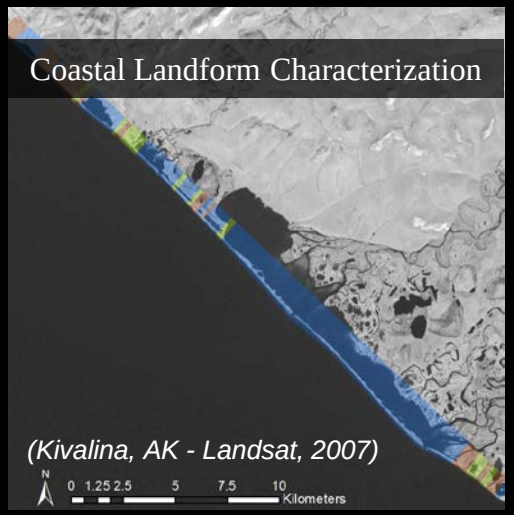
BASELINE DATA COLLECTION

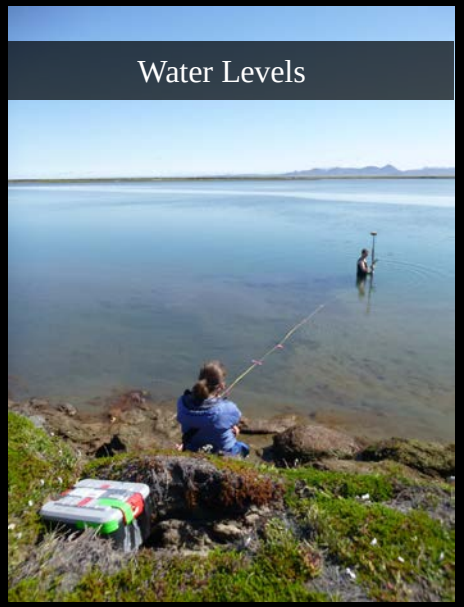
What has shaped the coast?

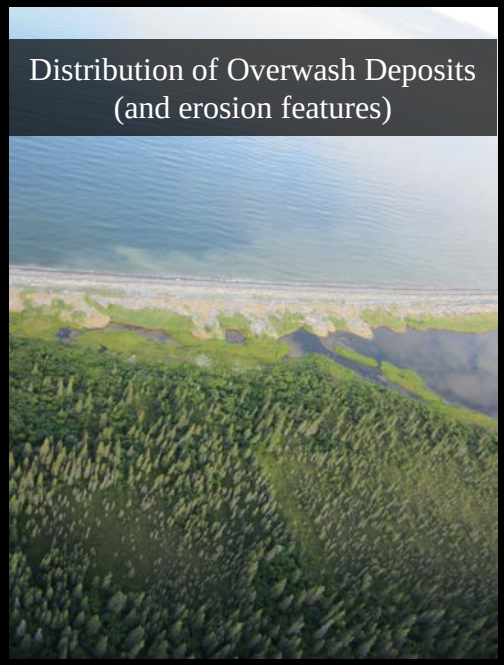
What is shaping the coast now?

Benefits of documenting coastal processes in detail:

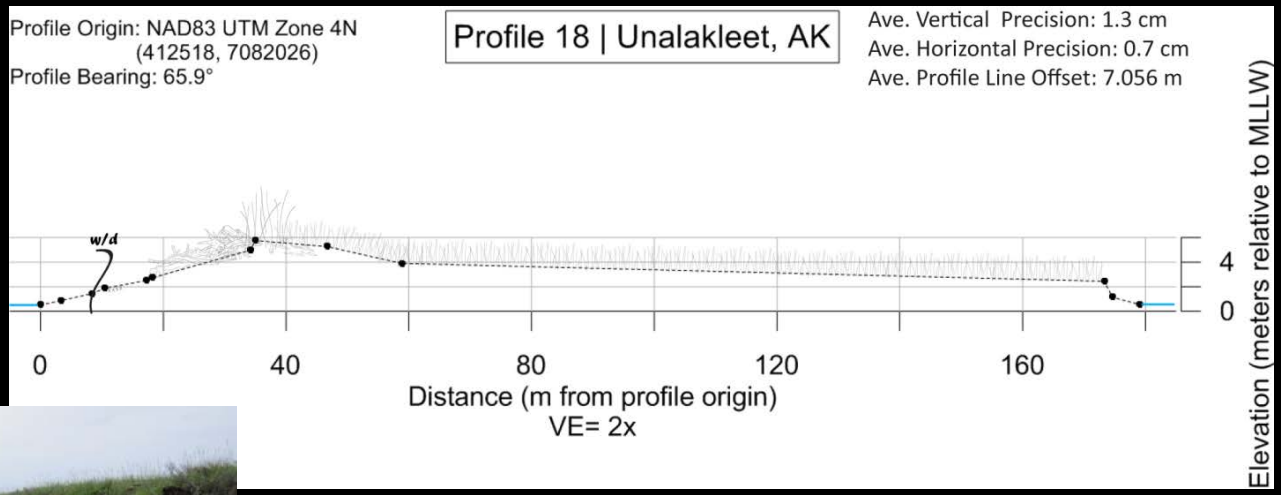
- Map areas of vulnerability
- Establish baselines to monitor changes in event timing, frequency and magnitude
- Design effective mitigation strategies
- Understand how modifications will influence the coastal environment
- Improve mathematical models that predict hazard impacts
- Provide forecasters with known values to test accuracy

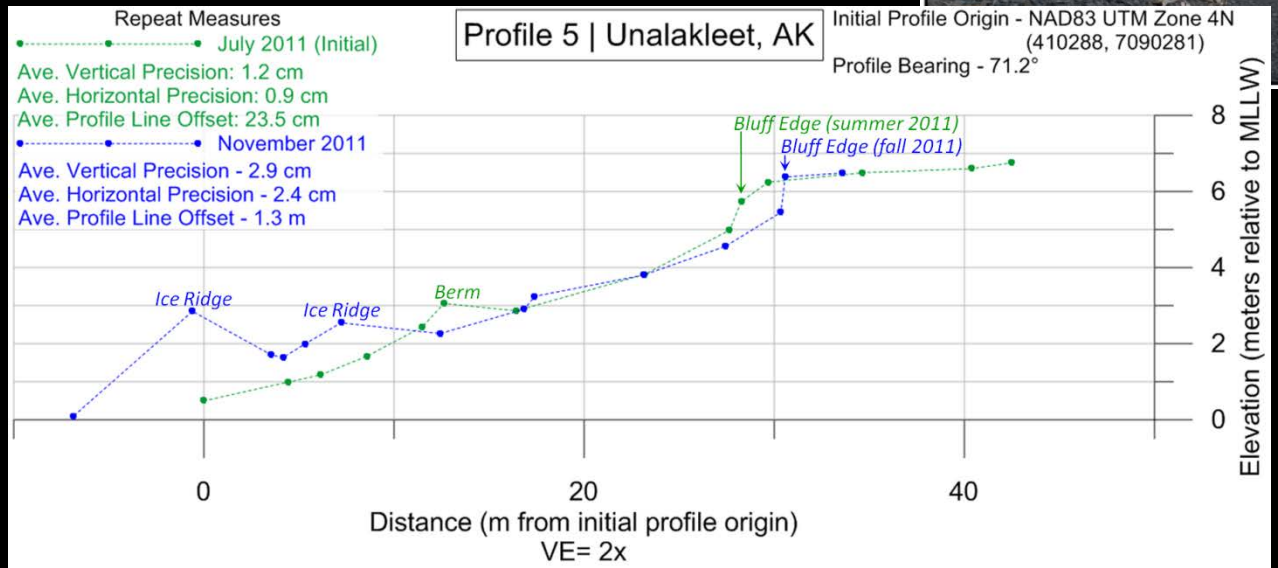






EXAMPLE: Coastal Profiles (Snapshots of Beach Elevation)





← 2.3 m of bluff retreat

EXAMPLE: Characterization of Coastal Sediments

Identification of sediment sources and sediment sinks

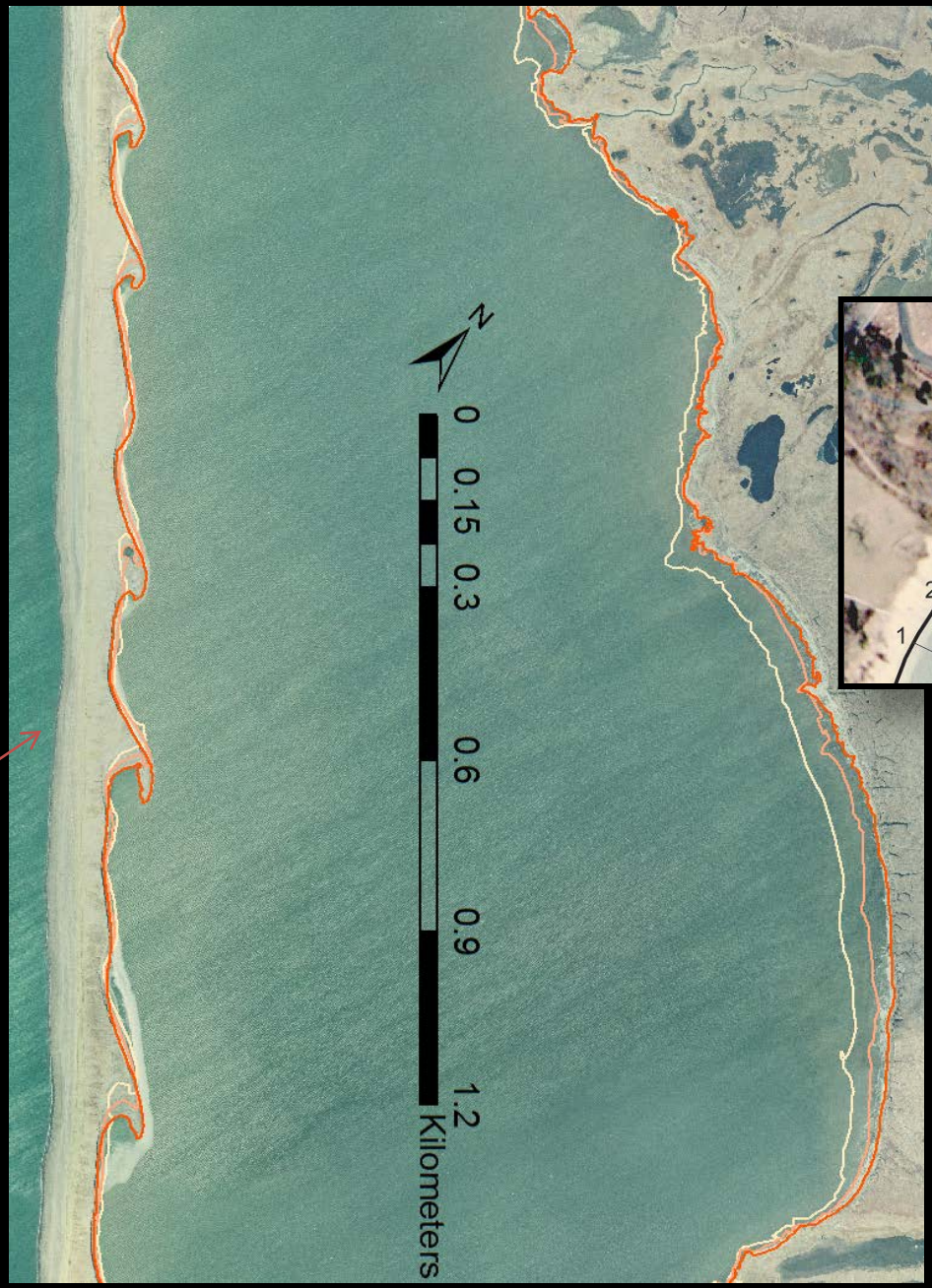
Grain size & mineral composition

EXAMPLE: Shallow-water Coastal Bathymetry

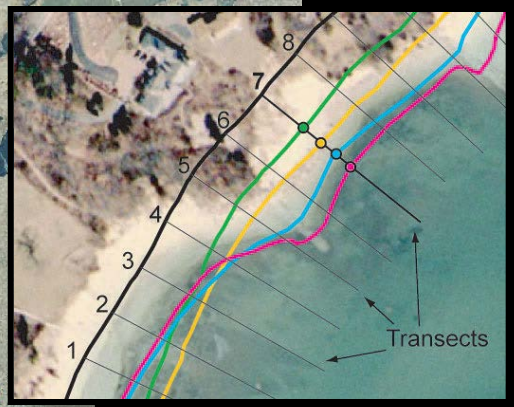
- Highly portable single-beam sonar
- 60+ hours of collection during 2012 field season
- In Partnership with the Western Alaska Landscape Conservation Cooperative
- Testing the feasibility of obtaining shallow water depth measurements from WorldView2 satellite imagery
- Look for processed shiptrack data on AOOS Alaska Ocean Observing System

Boats used during the 2012 field season: Shishmaref, Golovin and Wales

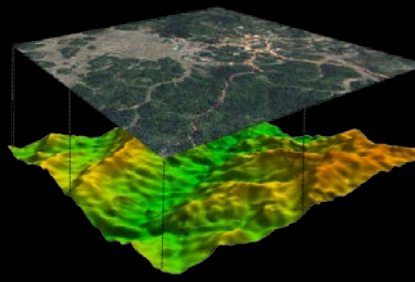
EXAMPLE: Rates of Shoreline Change



1952
1980
2003

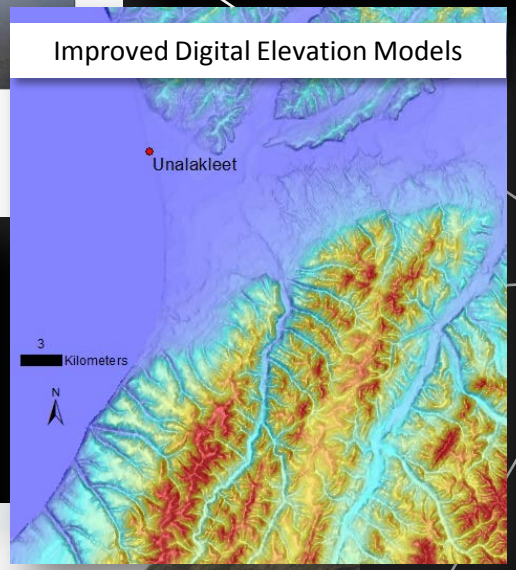


USGS Digital Shoreline Analysis System



MULTI-HAZARD MAPPING APPROACH

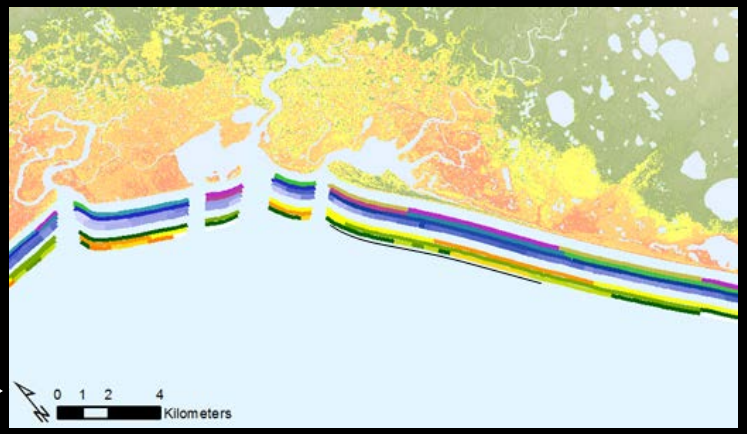
Outside reports, maps, model results, expert and resident knowledge



Field investigations including baseline data collection & ground truthing

Synthesis

Coastal Classification and Vulnerability Bands/Ribbons/Lines/Strips



Composite Coastal Hazard Maps for Alaskan Communities

Included Information:

Geomorphology & Coastal Processes
Historically Recorded Hazards
Existing Defenses
Local Knowledge

COASTAL VULNERABILITY MAPPING – ALASKA CHALLENGES

Shaktoolik, AK *(Kinsman 2011)*

vs.

San Diego, CA
(www.oceanlight.com)

- Existing methodologies designed for densely populated coastlines
- Longest coastline in the United States - very diverse coastal environments
- Extremely limited baseline data
  - Water levels, historic event record, aerial imagery, topography & bathymetry
- Few detailed hazard-specific studies
- Coastal economics are fundamentally different
- Unique hazards & different emphasis

Why is it important to conduct

SURFICIAL GEOLOGIC MAPPING?

Organic-rich Tundra Surface

Angular Colluvium

Surficial Geologic Maps contain basic information about the character and composition of the ground.

May include:
- Composition, rock or soil types
- Drainage conditions
- Permafrost depths/extent
- Radiocarbon ages of soil

Aid in:
- Locating material sources
- Planning detailed engineering studies for new development
- Identifying inland geohazards
- Understanding ancient sea levels and modern coastal processes

What are some

OTHER DGGS COASTAL PRODUCTS?

OBLIQUE AERIAL IMAGE COLLECTION

DGGS Fall/Winter Field Activities

Rapid Response to November 2011 Bering Sea Storm

- On site less than 24 hours after storm surge
  - 2 days in Unalakleet
  - 2 days in Shaktoolik
  - 1 day in Nome
  - 1 day in Golovin
- Used precision GPS equipment to document
  - 20 post-storm coastal profiles
  - >50 storm-induced water level indicators
- Collected photographs, video and eyewitness accounts from community residents for inclusion in scientific reports

DGGS is committed to having a field-ready team available during the fall storm season to make immediate measurements documenting future storm surges.

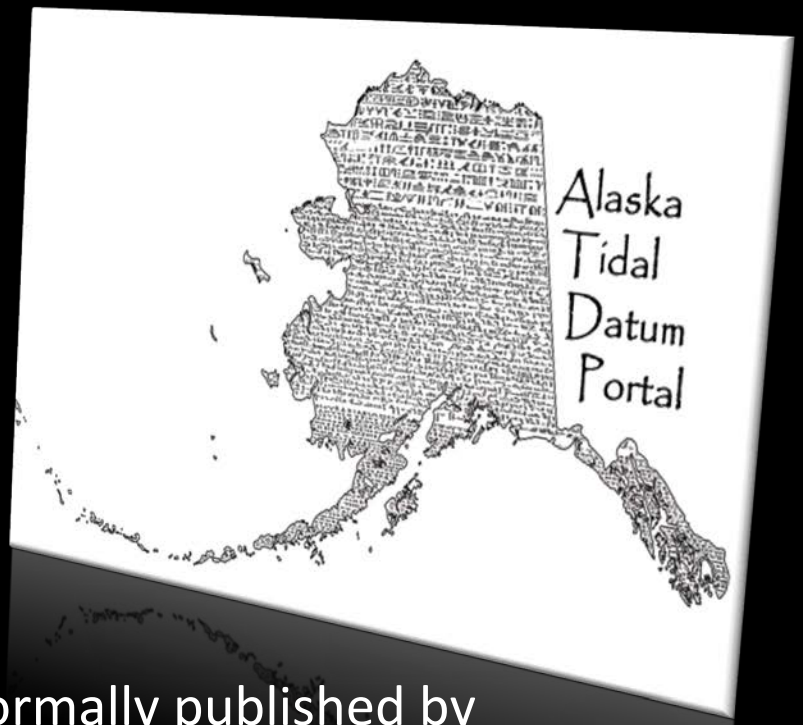
PRIOR DGGS INVOLVEMENT IN AN AREA IS NOT REQUIRED FOR A POST-STORM REPONSE

July 2012 Images of Ivu Site

Toby Anungazuk at the November 2011 Ivu Site

Kachauik River Fish Camp - Golovin, Alaska

RAISING AWARENESS ABOUT ACCURATE LOCAL WATER LEVELS IN COASTAL ALASKA



Some quick facts:

Delaware Coast = 30 miles

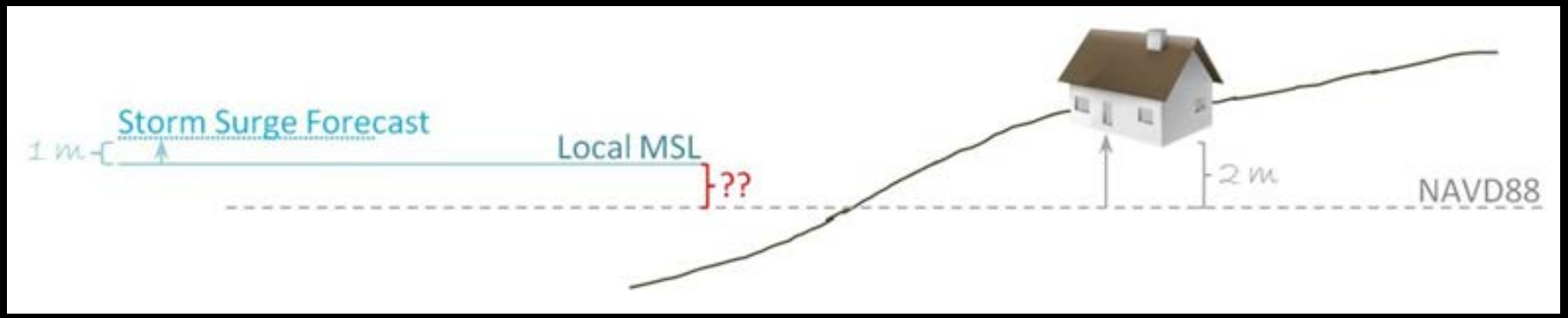
… 4 active tide gauges

Northwest Alaska = 2,000+ miles

… 3 active tide gauges

The position of local mean sea level is not formally published by NOAA for many of Alaska's coastal communities

Conversion factors to change between onshore and offshore elevation measurements are available for fewer than half (89/209) of areas with published local sea levels.



link

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Alaska Tidal Datum Portal

The Alaska Division of Geological & Geophysical Surveys (DGGS) has a coastal community geohazards evaluation and geologic mapping program that is funded through the federal Coastal Impact Assistance Program (CIAP). Since this program was launched in 2010, fieldwork has been conducted in seven coastal communities and includes field efforts to rapidly document the impacts of severe storms on Alaska's coastline. Accurate vertical datums in the coastal environment are critical to the evaluation of natural hazard vulnerability in support of local and regional planning. Appropriate tidal data must be considered in the siting, design, construction, and operations of development projects to ensure protection of human life, property, and the coastal environment.

- About the Alaska Tidal Datum Portal
- Frequently Asked Questions (FAQ)
- The Alaska Tidal Datum Calculator
- Recommended External Resources

The development of this site was partially funded with qualified outer continental shelf oil and gas revenues by the Coastal Impact Assistance Program, Fish & Wildlife Service, and U.S. Department of the Interior. The views and conclusions contained herein are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. government.

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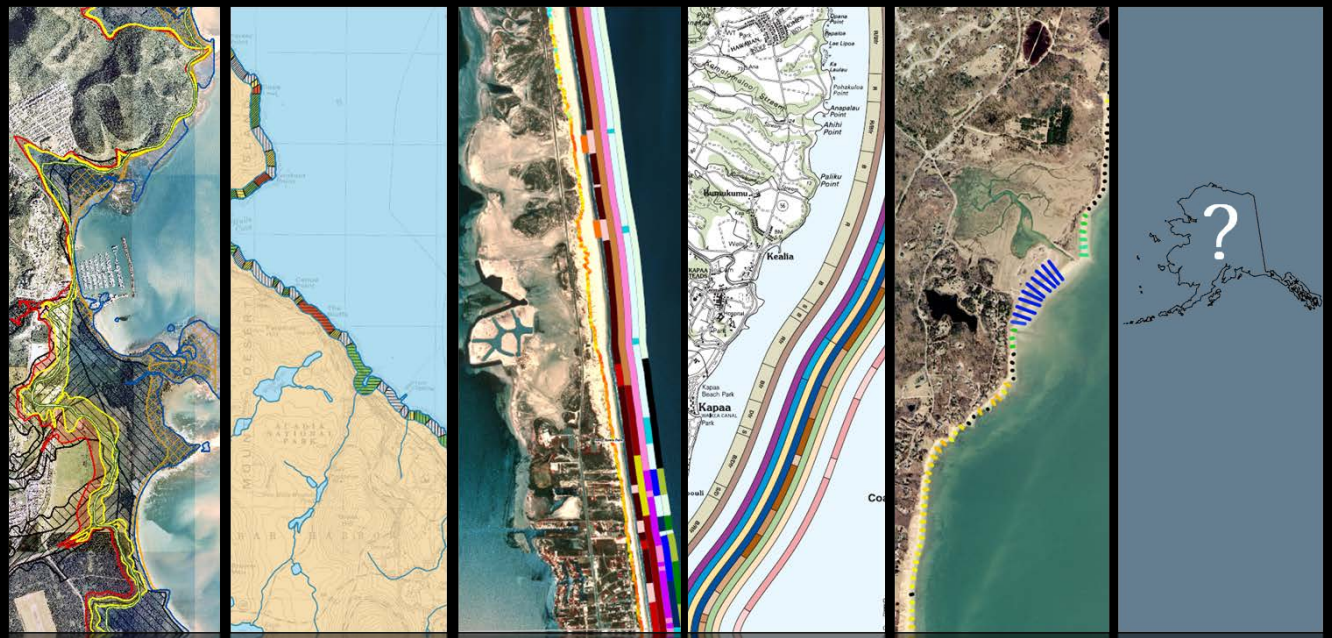
LEO Webinar: March 19th - All about local sea levels (for non-experts)

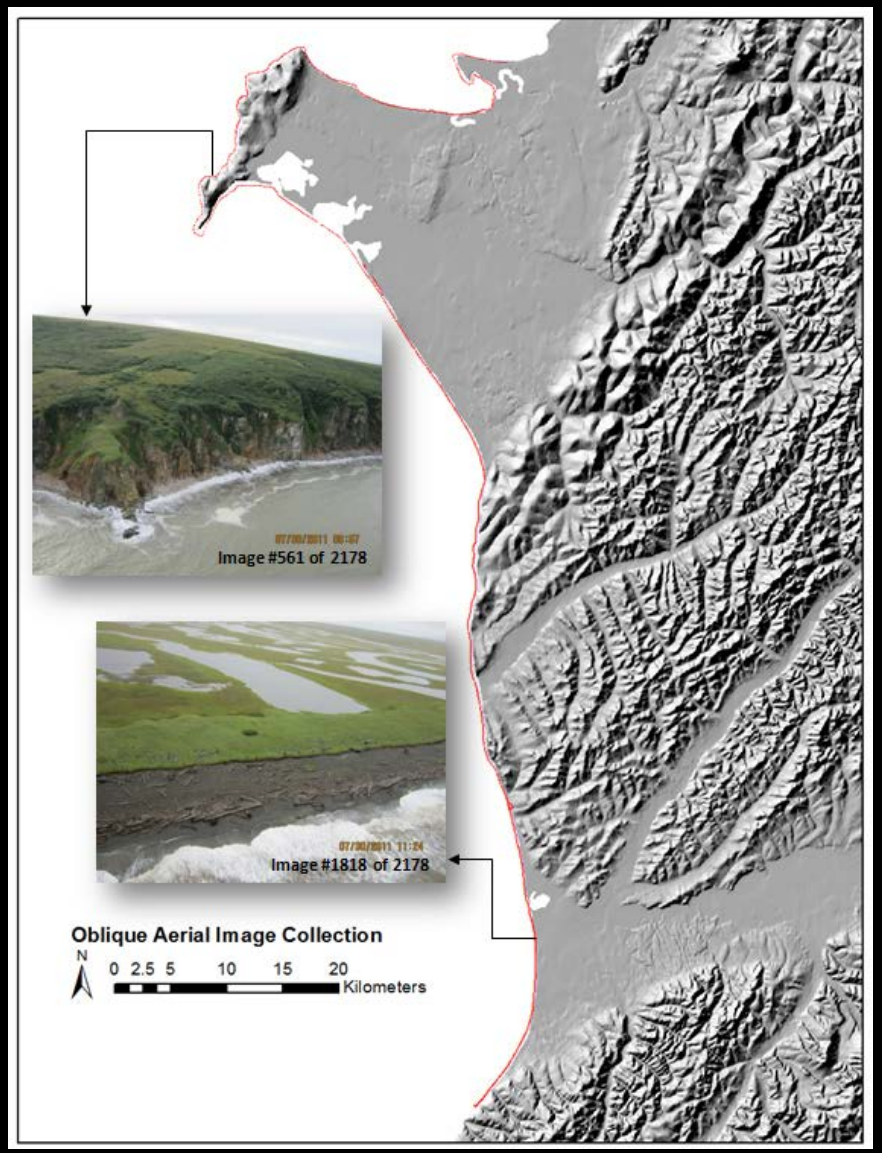


What is

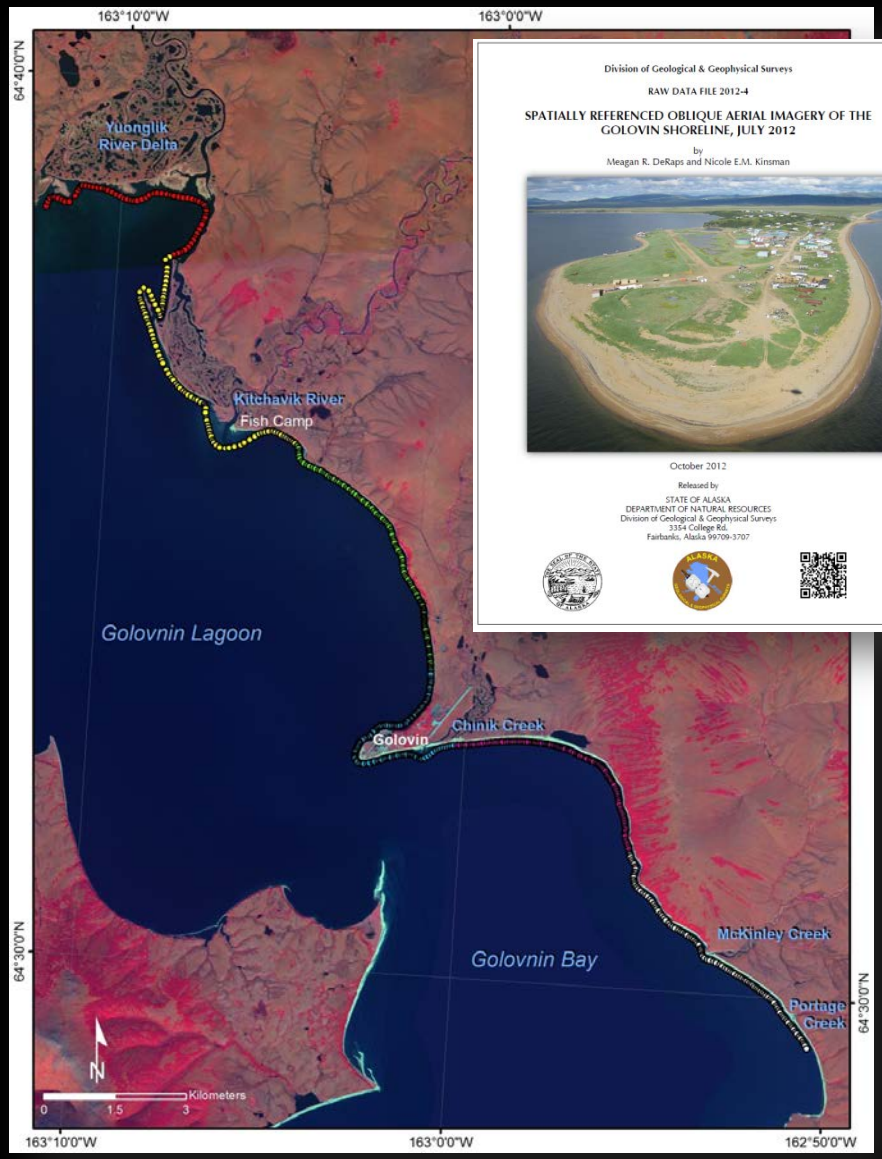
THE STATUS OF MAPS AND PUBLICATIONS?

	COMMUNITY	OBLIQUE AERIAL IMAGERY	COASTAL BATHYMETRY	SURFICIAL GEOLOGIC MAP	COASTAL VULNERABILITY MAPS/REPORT	OTHER
PILOT	**Kivalina**	ShoreZone 2012		Draft Completed DGGS Report of Investigation (in edits)	In progress	
GROUP I	**Unalakleet**	DGGS Raw Data File 2011-5	Data collected 2011	Data collected 2011	Data collected 2011	DGGS Report of Investigation 2012-2
GROUP I	**Shaktoolik**	DGGS Raw Data File 2011-5	Data collected 2011	Draft Completed DGGS Report of Investigation (in edits)	In progress	DGGS Report of Investigation 2012-2
GROUP II	**Nome-Solomon**				Data collected 2012	DGGS Report of Investigation 2012-2
GROUP II	**Golovin**	DGGS Raw Data File 2012-4	In progress	Data collected 2012	Data collected 2012	DGGS Report of Investigation 2012-2
GROUP II	**Wales**	ShoreZone 2012	In progress	Data collected 2012	Data collected 2012	
GROUP II	**Shishmaref**	ShoreZone 2012	In progress	DGGS Report of Investigation 1996-7	Data collected 2012	Draft Completed DGGS Preliminary Interpretive Report (in review)

ALREADY AVAILIBLE: Raw Data Files (2) of Oblique Aerial Imagery



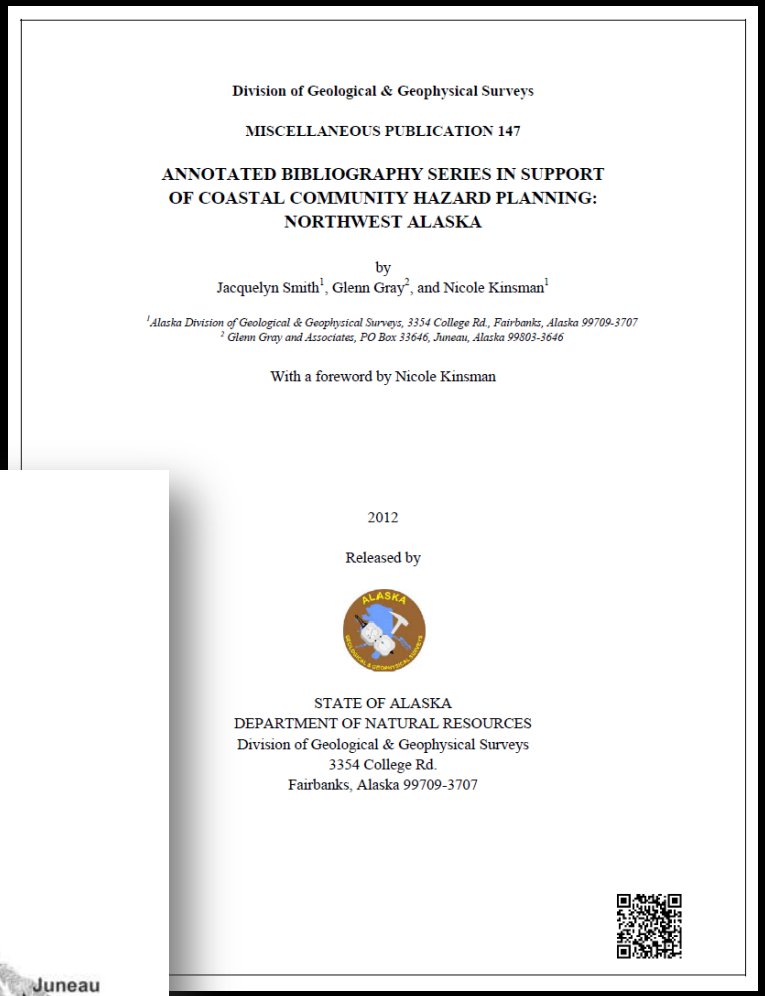
Spatially Referenced Oblique Aerial Photography of the Eastern Norton Sound Shoreline, July 2011 (RDF 2011-5)



Spatially Referenced Oblique Aerial Photography of the Golovin Shoreline, July 2012 (RDF 2012-4)

ALREADY AVAILIBLE: Community-specific Annotated Bibliographies

- 20 stand-alone bibliographies
- A comprehensive foreword to statewide resources
- Digital database that allows for keyword searches, export to citation software and contains links to online documents
- Improves ease of access to widely cited resources for new coastal investigators



Division of Geological & Geophysical Surveys

MISCELLANEOUS PUBLICATION 147

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

by
Jacquelyn Smith[1], Glenn Gray[2], and Nicole Kinsman[1]

[1]Alaska Division of Geological & Geophysical Surveys, 3354 College Rd., Fairbanks, Alaska 99709-3707
[2] Glenn Gray and Associates, PO Box 33646, Juneau, Alaska 99803-3646

With a foreword by Nicole Kinsman

2012

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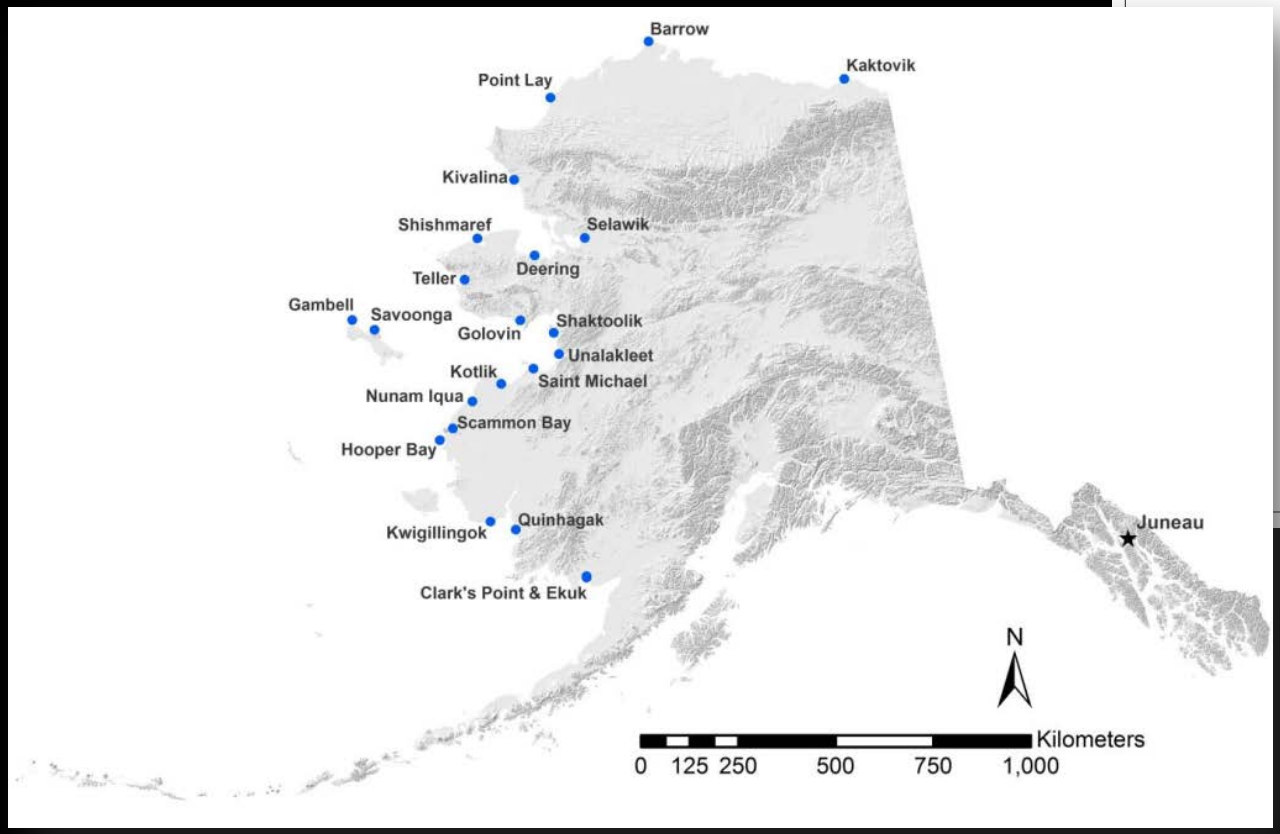
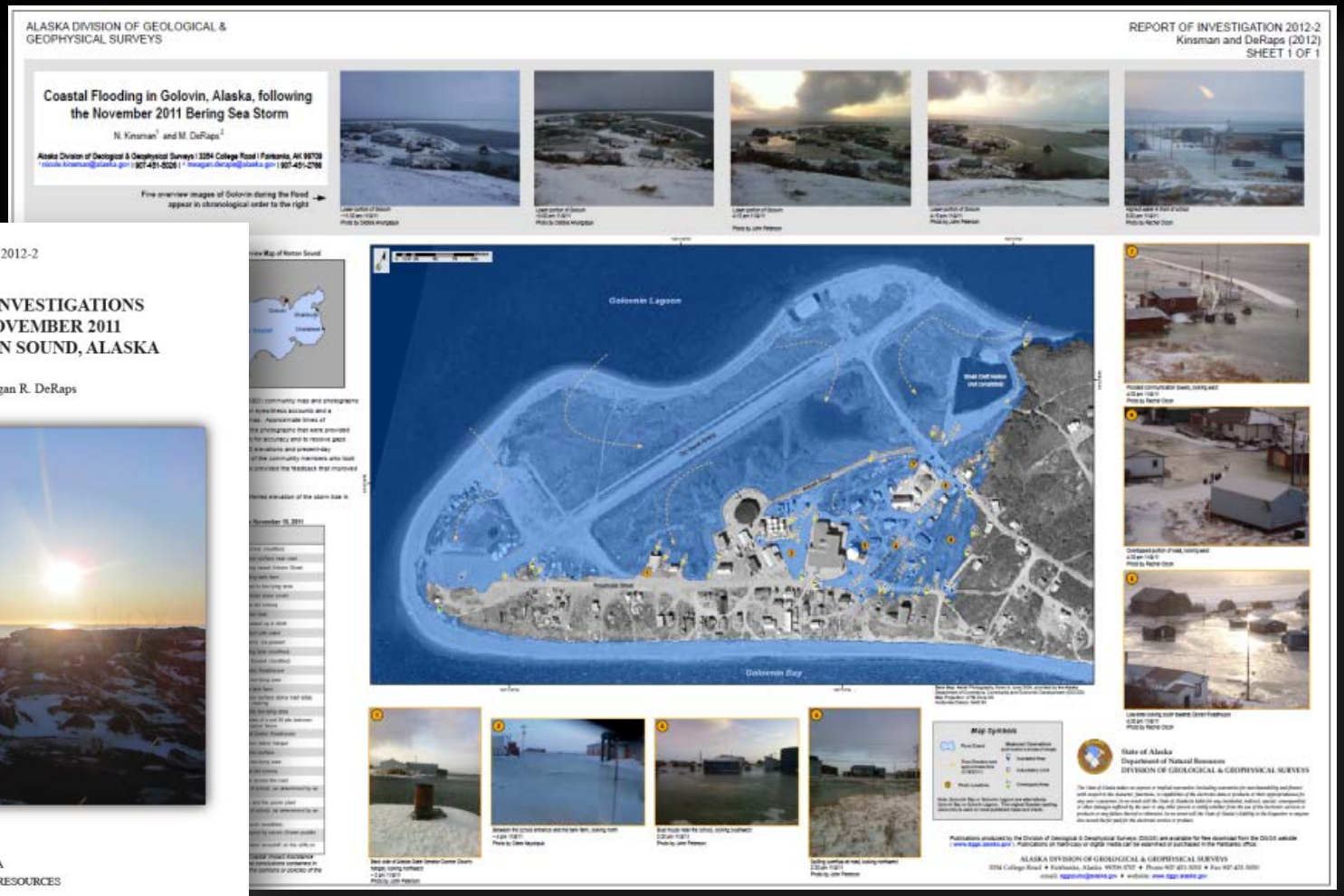
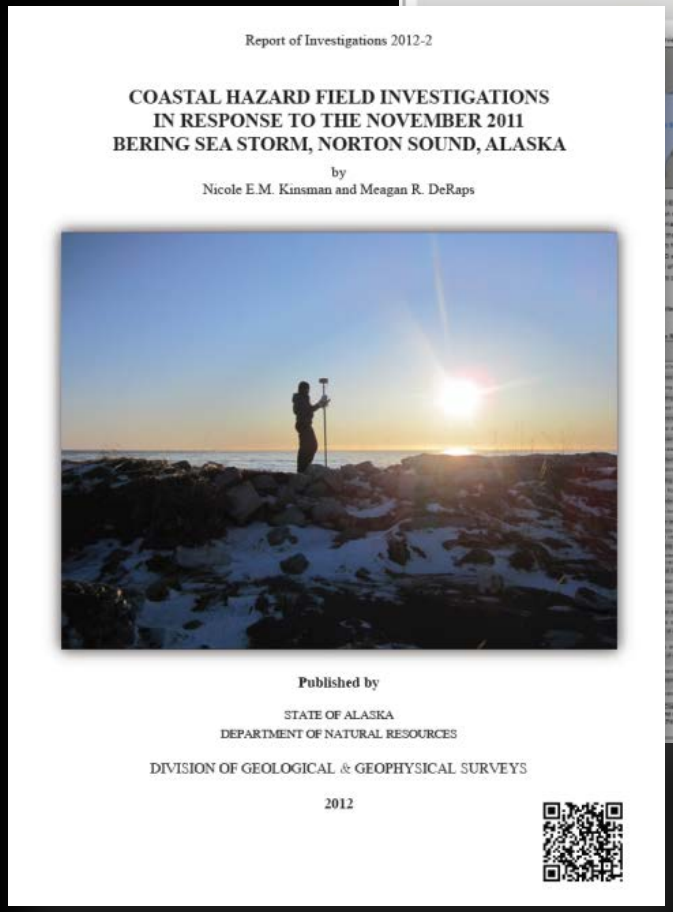


Annotated Bibliography Series in Support of Coastal Community Hazard Planning – Northwest Alaska (MP 147)

ALREADY AVAILIBLE: Report on November 2011 Bering Sea Storm

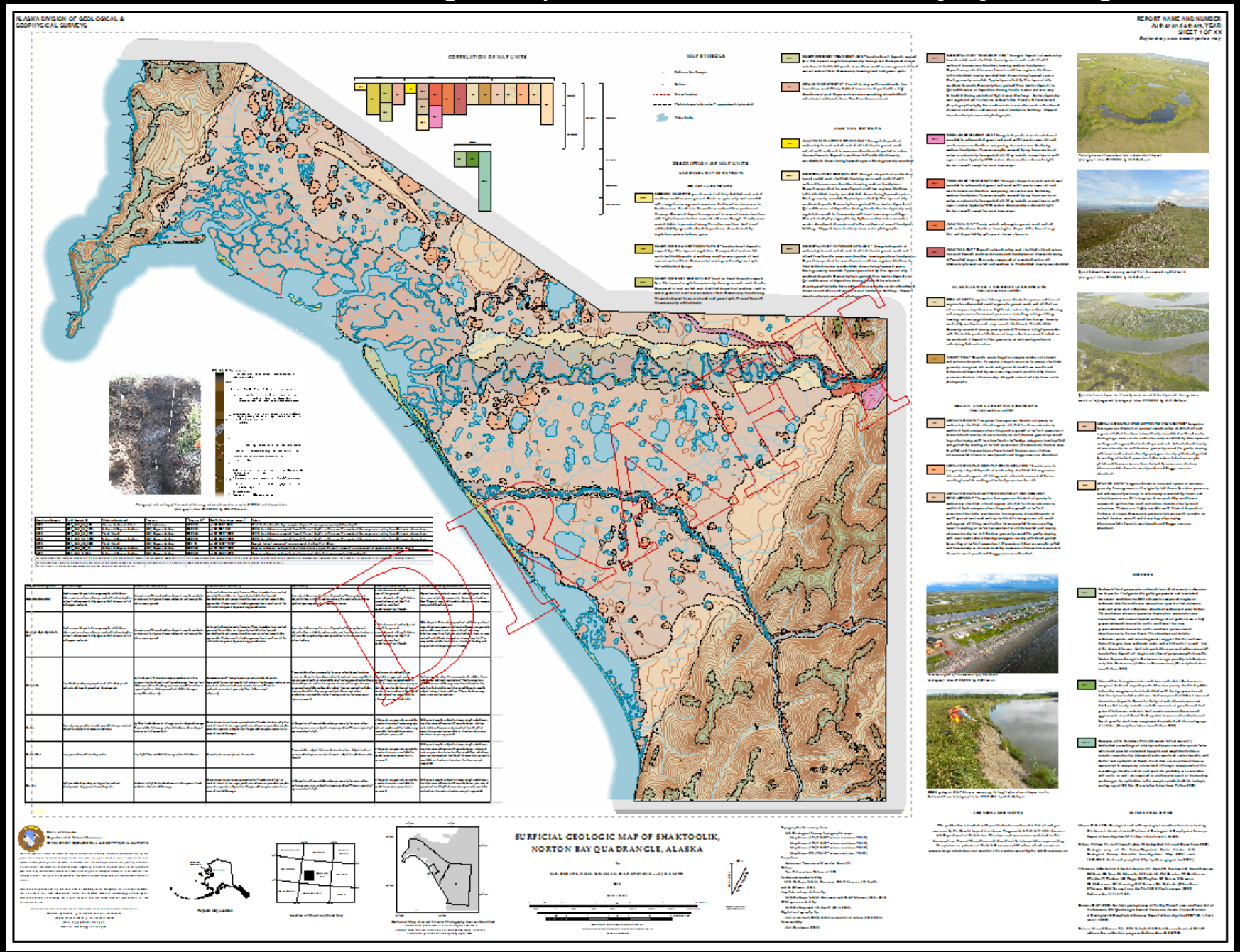




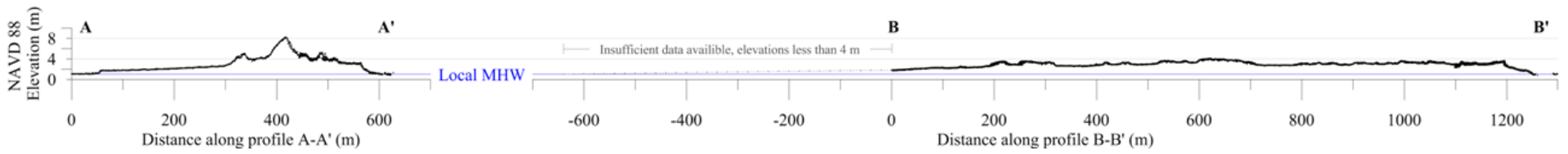
Note: Version 1.1 with amended local MSL water level elevations released January 2013

Coastal Hazard Field Investigations in Response to the November 2011 Bering Sea Storm, Norton Sound, Alaska (RI 2012-2)

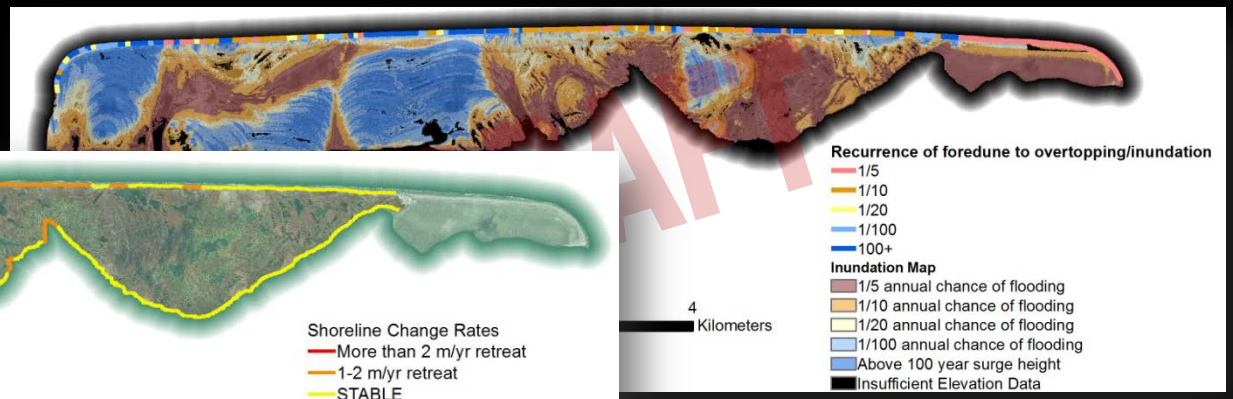
COMING SOON: Surficial Geologic Map of Shaktoolik, Norton Bay Quadrangle, Alaska



COMING SOON: Preliminary Evaluation of Coastal Geomorphology and Geohazards on the Island to the Northeast of Shishmaref, Alaska

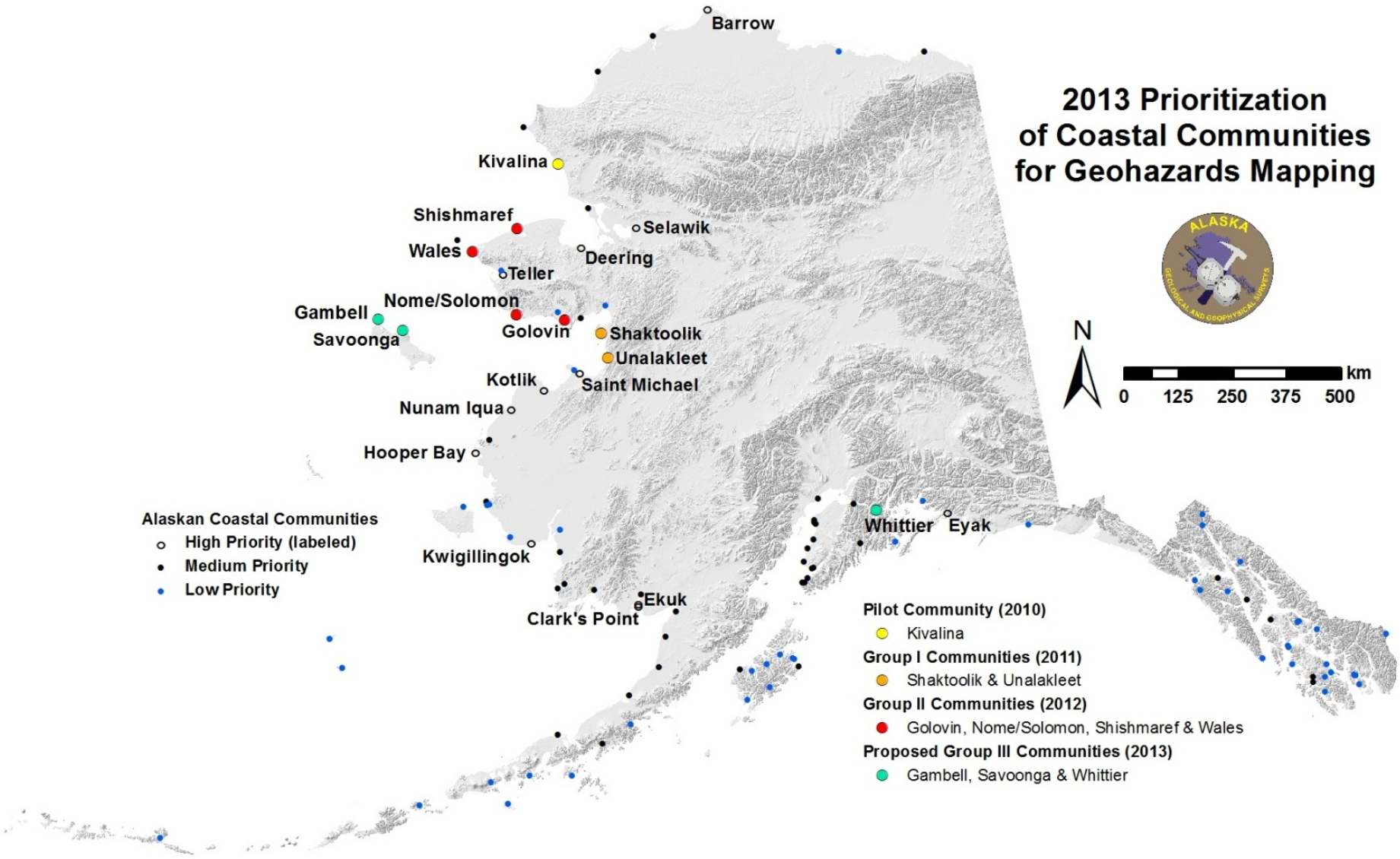


Includes flooding and erosion vulnerability maps



How are

COMMUNITIES SELECTED FOR THIS MAPPING?

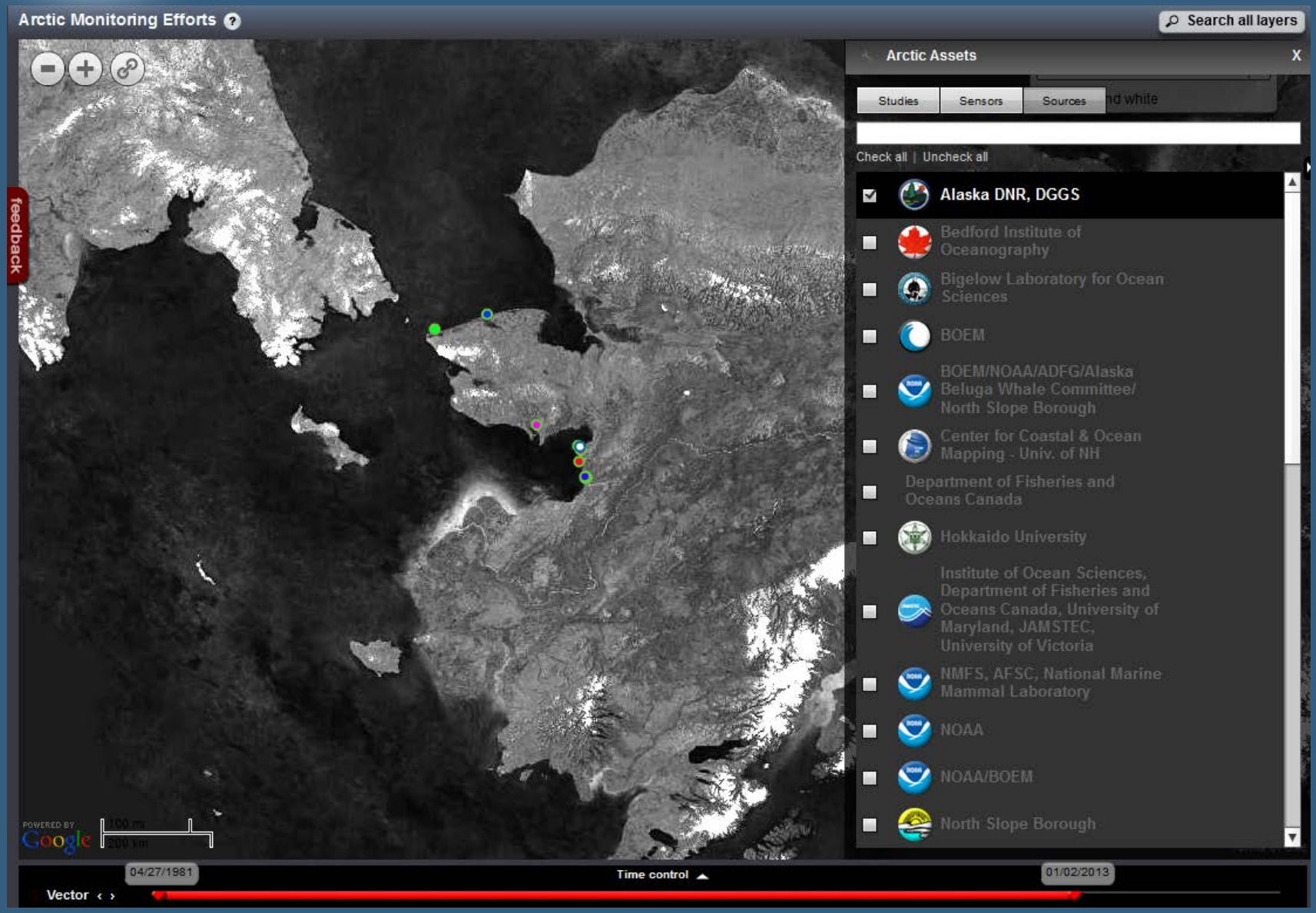

2013 Prioritization of Coastal Communities for Geohazards Mapping
ALASKA
GEOLOGICAL AND GEOPHYSICAL SURVEYS
N
km
0 125 250 375 500
Barrow
Kivalina
Shishmaref
Selawik
Wales
Deering
Teller
Nome/Solomon
Gambell
Savoonga
Golovin
Shaktoolik
Unalakleet
Kotlik
Saint Michael
Nunam Iqua
Hooper Bay
Whittier
Eyak
Kwigillingok
Ekuk
Clark's Point
Alaskan Coastal Communities
High Priority (labeled)
Medium Priority
Low Priority
Pilot Community (2010)
Kivalina
Group I Communities (2011)
Shaktoolik & Unalakleet
Group II Communities (2012)
Golovin, Nome/Solomon, Shishmaref & Wales
Proposed Group III Communities (2013)
Gambell, Savoonga & Whittier

Thank You

How is the

DGGS COASTAL MAPPING PROGRAM COLLABORATING WITH OTHER PROGRAMS?

Alaska Ocean Observing System



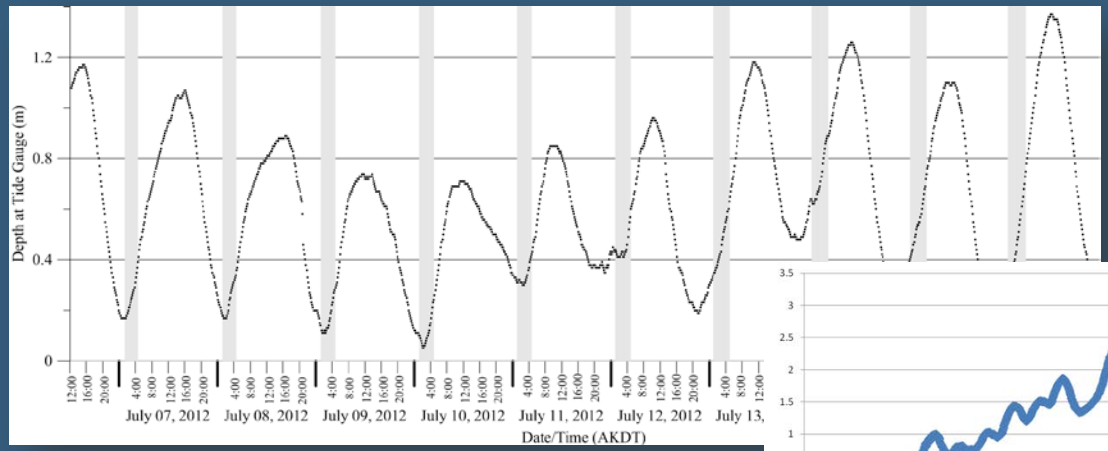
University of Alaska

Graduate Research

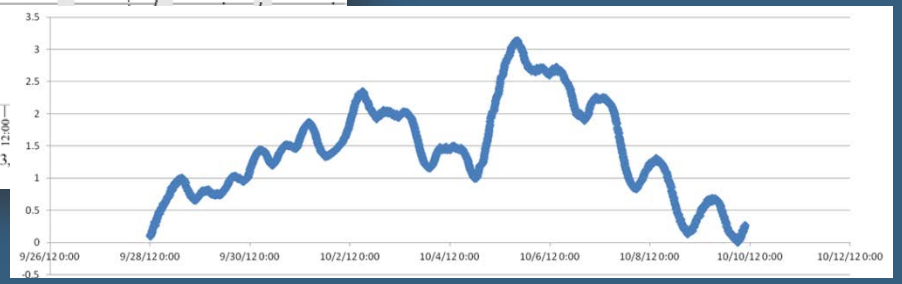
Jacquelyn Smith (co-advised w/ Dr. Debu Misra)
MS Geological Engineering
Modeling Storm Surge Vulnerability in Golovin, Alaska

Kimber DeGrandpre(co-advised w/ Dr. Jeff Freymueller)
MS Geology & Geophysics
Quantifying Relative Sea Level Change in Western Alaska

Water Level Monitoring Network

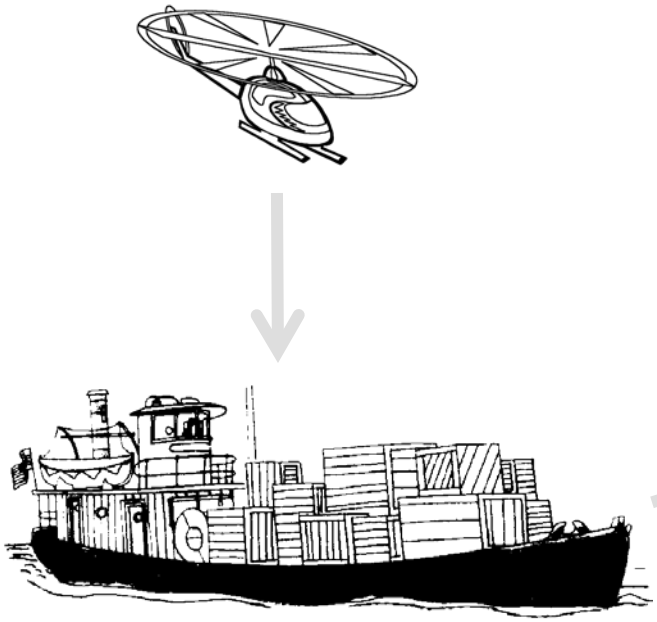


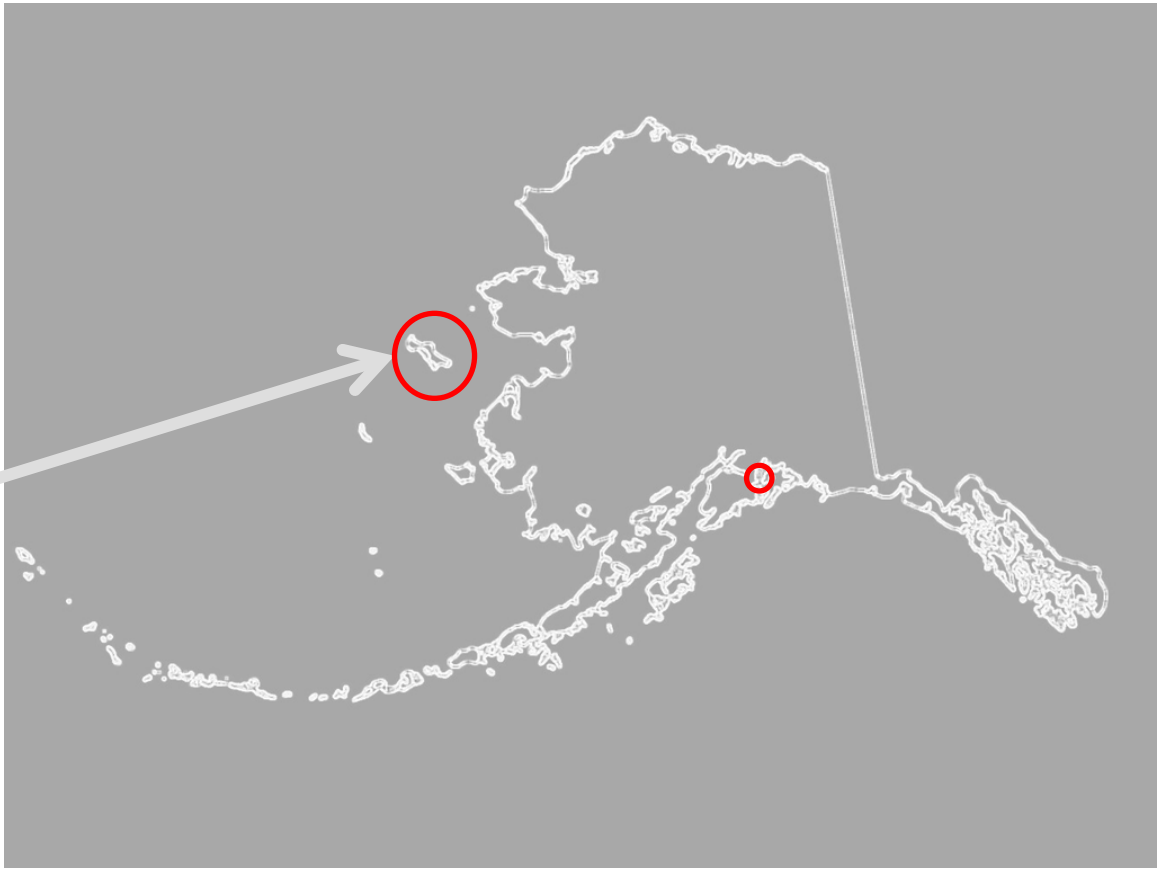
July, 2012 Water Depths in Golovin, AK



October, 2012 Surge in Golovin, AK

2013 – Savoonga and Gambell





Project Contact:
Nicole Kinsman, Coastal Geologist
nicole.kinsman@alaska.gov
Phone: 907.451.5000
www.dggs.alaska.gov

2013 St. Lawrence Island Helicopter

window of availability will be sometime from July 1- August 15

R44 – Bering Air

Rates are $300/hr standby (max charge of $1,200 per day) and $970/hr wet