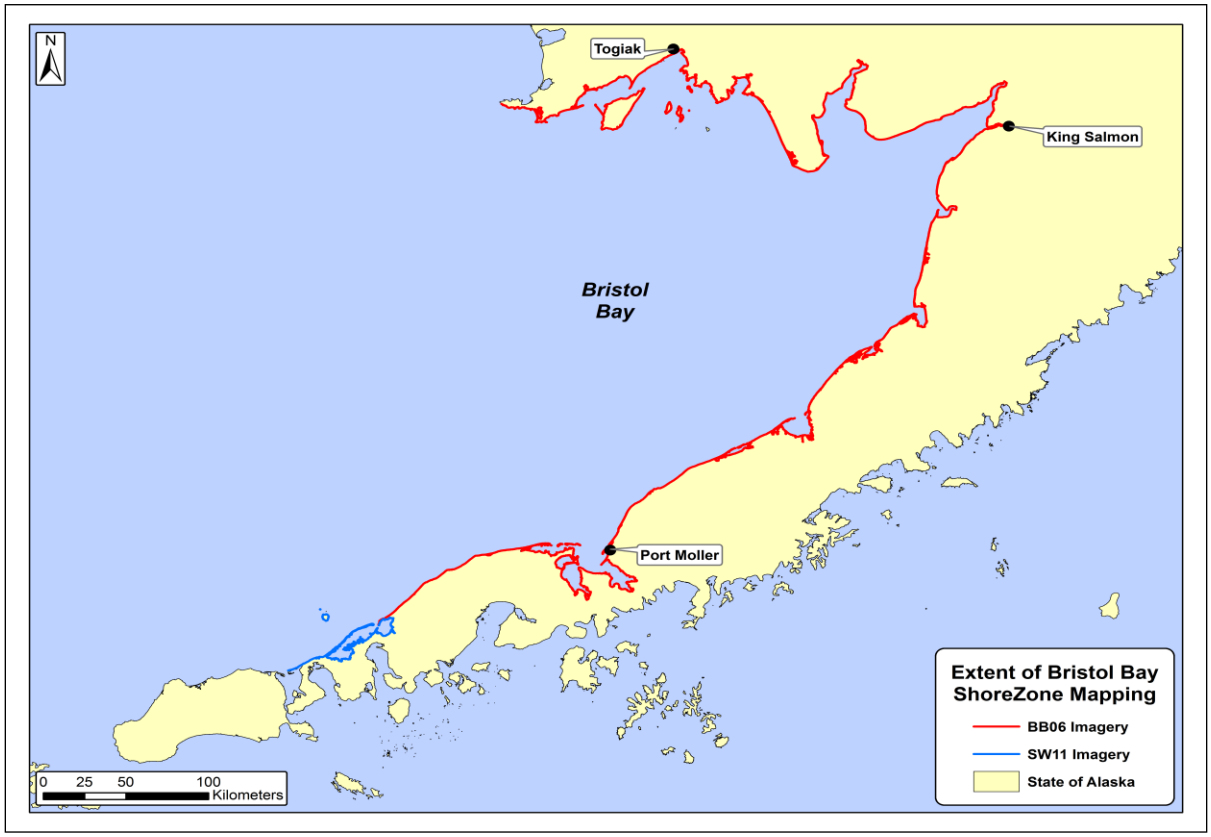
CORI Project: 12-27 **September 2013**

ShoreZone Coastal Vulnerability Report

Bristol Bay Survey Area



Prepared for:
NOAA National Marine Fisheries Service, Alaska Region

Prepared by:
Sean Daley and Kalen Morrow

COASTAL & OCEAN RESOURCES
759A Vanalman Ave., Victoria BC V8Z 3B8 Canada
(250) 658-4050
www.coastalandoceans.com

Coastal and Ocean Resources

The ShoreZone Coastal Vulnerability Module

The Coastal Vulnerability Module (CVM) for ShoreZone is intended to provide users with a spatial picture of where and how shorelines are likely to be sensitive to climate change, specifically sea level rise. For example, shorelines with very low gradients will become increasingly flooded by storm surges.

Coastal Vulnerability Module provides a measure of coastal sensitivity to climate change in terms of three indices that are based on observed coastal geomorphology of the shoreline. The three indices are:

> ***Coastal Stability Index*** (Table 1) that provides a measure of stability (retreating or prograding) for both clastic/sediment shorelines or for wetland shorelines.
>
> ***Flooding Sensitivity Index*** (Table 2) that provides an estimate of the degree of observed flooding of immediate backshore areas.
>
> ***Thaw Sensitivity Index*** (Table 3) that provides an estimate of thaw lake or water coverage in the backshore that is an indirect indicator of thaw settlement potential.

These indices are complemented by an inventory of descriptive coastal features of mass-wasting/wetland morphology (Table 4) that are potentially of interest to coastal planners and managers.

Coastal Vulnerability in Bristol Bay

The Coastal Vulnerability indices are summarized in Tables 5, 6, 7 and 8. The total shoreline mapped is 2,092 km. The general distribution of stability classes are shown in Figure 1 and the general distribution of mass-wasting and wetland classes are summarized in Figure 2.

Four features stand out in the summaries:

- A significant portion of the coast (32%) is highly sensitive to flooding (Table 6; Fig. 3, 4).
- At present, areas with >25% thaw lakes subject to flooding make up about 13% of the coastline (Table 7; Fig. 5, 6).
- Areas with highly active eroding cliffs (no vegetation on cliff face) make up about 300 km of coastline (10%; Table 5; Fig. 7).
- Wetland areas of the coast (Classes WA1, WE1, WE2, WS in Table 5) account for 39% of the shoreline length (Fig. 8).

Table 1 Coastal Stability Index

		Stability Class	Description
CLASTIC	CE4	Erosional	Actively eroding, bare-faced cliff (<10% vegetation cover)
	CE3		Actively eroding, partially vegetated cliff (10 - 90% vegetation cover) cliff
	CE2		Actively eroding, complete vegetated cliff (>90% cover) but veg "disturbed"
	CE1		Retreating barrier island, spit; possibly with outcropping peat
	CS	Stable	Stable slope with tundra vegetation
	CA1	Accretional	Prograding beach with a single storm berm or dune
	CA2		Prograding beach with multiple storm berms or dunes
	CA3		Prograding beach with wide beach ridge plain in backshore
WETLAND	WE2	Erosional	Peat layers in sub-tidal, often with polygon form still evident
	WE1		Eroding peat scarp
	WS	Stable	Stable – no obvious features indicating erosion or accretion
	WA1	Accretional	Prograding wetland – immature wetland Prograding across flats (most common in deltaic wetland complexes)
Bedrock	R	Not applicable	Assumed stable, Coastal Vulnerability Module not applicable
Anthropogenic	A	Seawall	Assumed stable, Coastal Vulnerability Module not applicable
Other	X	Provisional	use for initial testing phase, if unit cannot be assigned to any of above

Table 2 Flooding Sensitivity Index

	Flooding Class	Description
F4	Major	Flooding >100 m inland from HWL as indicated by the highest logline
F3	↑	Flooding 50-100m inland from HWL as indicated by the highest logline
F2	↑	Flooding 10-50 m inland from HWL as indicated by the highest logline
F1	Minor	Flooding <10 m inland from HWL as indicated by the highest logline
X		Coastal Hazards not applicable (rock, anthropogenic)

Table 3 Thaw Sensitivity Index

	Thaw Sensitivity Class	Description
T4	High	Extensive thaw lakes, standing water, >50% standing water in flooding zone
T3	↑	Moderate thaw lake density, 25-50% standing water in flooding zone
T2	↑	Minor thaw lake density or standing water, 10-25% standing water in flooding zone
T1	Low	Negligible standing water, <10% standing water in flooding zone
X		Coastal Hazards not applicable (rock, anthropogenic)

Table 4 Coastal Mass-Wasting and Wetland Features

Category	Feature
Mass Wasting	Ground ice slumps
	Block slumps
	Debris flows/solifluction
	Ice Wedges
Wetlands	Lagoonal complex
	Deltaic complex
	Marsh clones
	Associated mudflats
	Submerged morphology
	Relict river morphology
	Relict shoreline morphology
Other	Add description of relevant feature
None	Unit assessed, no relevant features (none of the above)
Not Applicable	Unit assessed, Coastal Hazards not applicable (rock, etc.)

Table 5 Coastal Stability Index

		Stability Class	Occurrences (km)	Occurrence (%)	Subtotals (%)
CLASTIC	CE4	Erosional	294.2	10.1	
	CE3		161.2	5.6	
	CE2		62.8	2.2	
	CE1		36.6	1.3	15.7
	CS	Stable	373.1	12.9	12.9
	CA1	Accretional	370.5	12.8	
	CA2		170.3	5.9	
	CA3		13.6	0.5	12.8
WETLAND	WE2	Erosional	26.8	0.9	
	WE1		119.6	4.1	
	WS	Stable	631.3	21.7	
	WA1	Accretional	351.8	12.1	38.9
Bedrock	R	Not applicable	275.4	9.5	
Anthropogenic	A	Seawall	8.4	0.3	
Other	X	Provisional	7.2	0.2	
		Total:	***2,902.9***		

Table 6 Flooding Sensitivity Index

	Flooding Class	Occurrence (km)	Occurrences (%)
F4	Major	931.3	32.1
F3	↑	259.4	8.9
F2	↑	561.8	19.3
F1	Minor	859.6	29.6

Table 7 Thaw Sensitivity Index

	Thaw Sensitivity Class	Occurrence (km)	Occurrences (%)
T4	High	170.1	5.9
T3	↑	237.3	8.1
T2	↑	392.1	13.5
T1	Low	1813.5	62.5
X		2,902.9	

Table 8 Coastal Mass-Wasting and Wetland Features

Category	Feature	Occurrence (km)	Occurrences (%)
Mass Wasting	Ground ice slumps	26.9	0.9
	Block slumps	13.3	0.5
	Debris flows/solifluction	163.5	5.6
	Ice Wedges		
Wetlands	Lagoonal complex	374.1	12.9
	Deltaic complex	11.1	3.8
	Marsh clones		
	Associated mudflats	190.2	6.5
	Submerged morphology	34.7	1.2
	Relict river morphology	40.7	1.4
	Relict shoreline morphology	90.3	3.1
Other		90.1	3.1
None	No relevant features	1,436	49.5
Not Applicable	Coastal Hazards not applicable	283.3	9.7

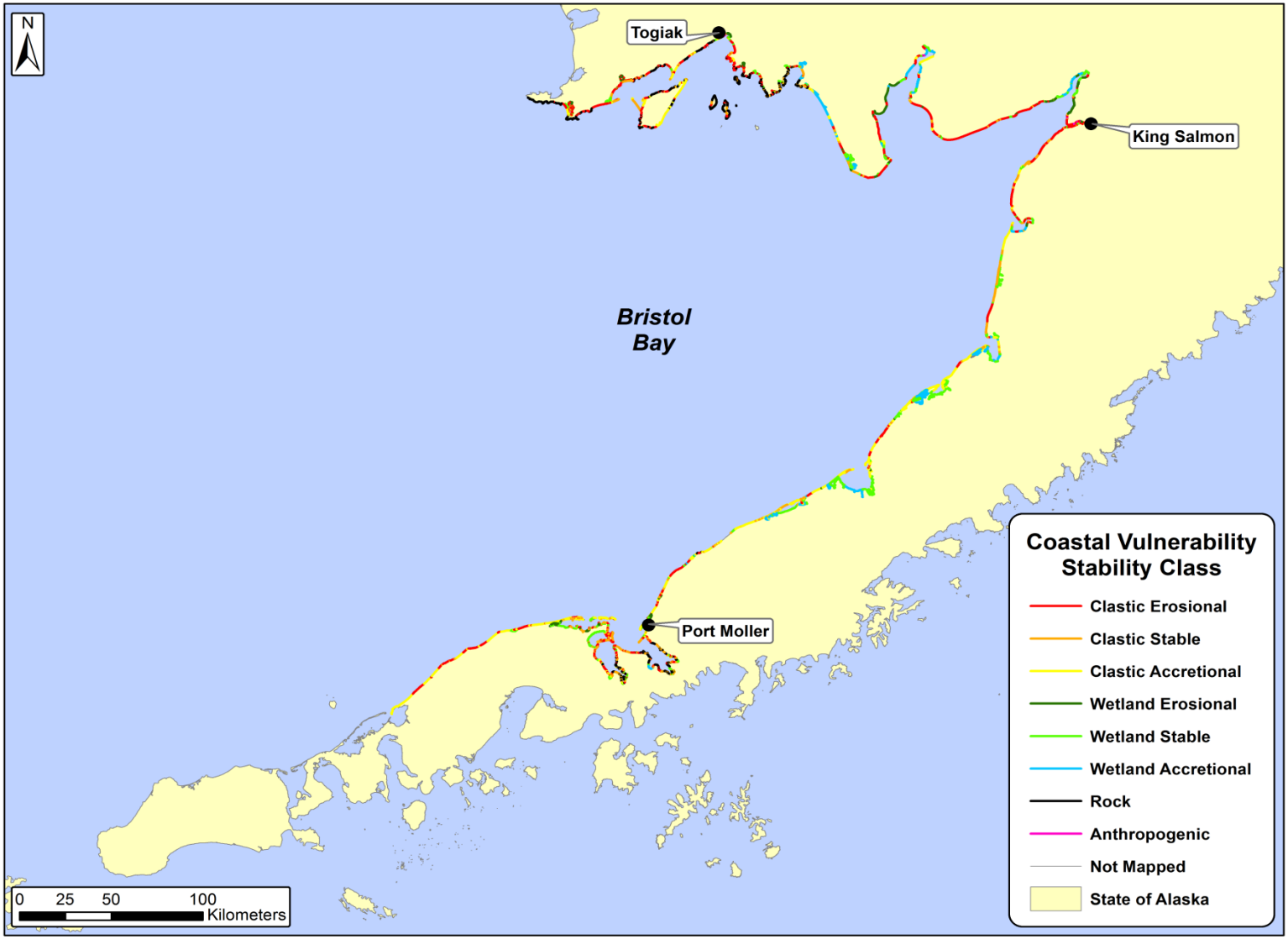


Figure 1. Map of the distribution of stability class regarding coastal vulnerability in the study area.

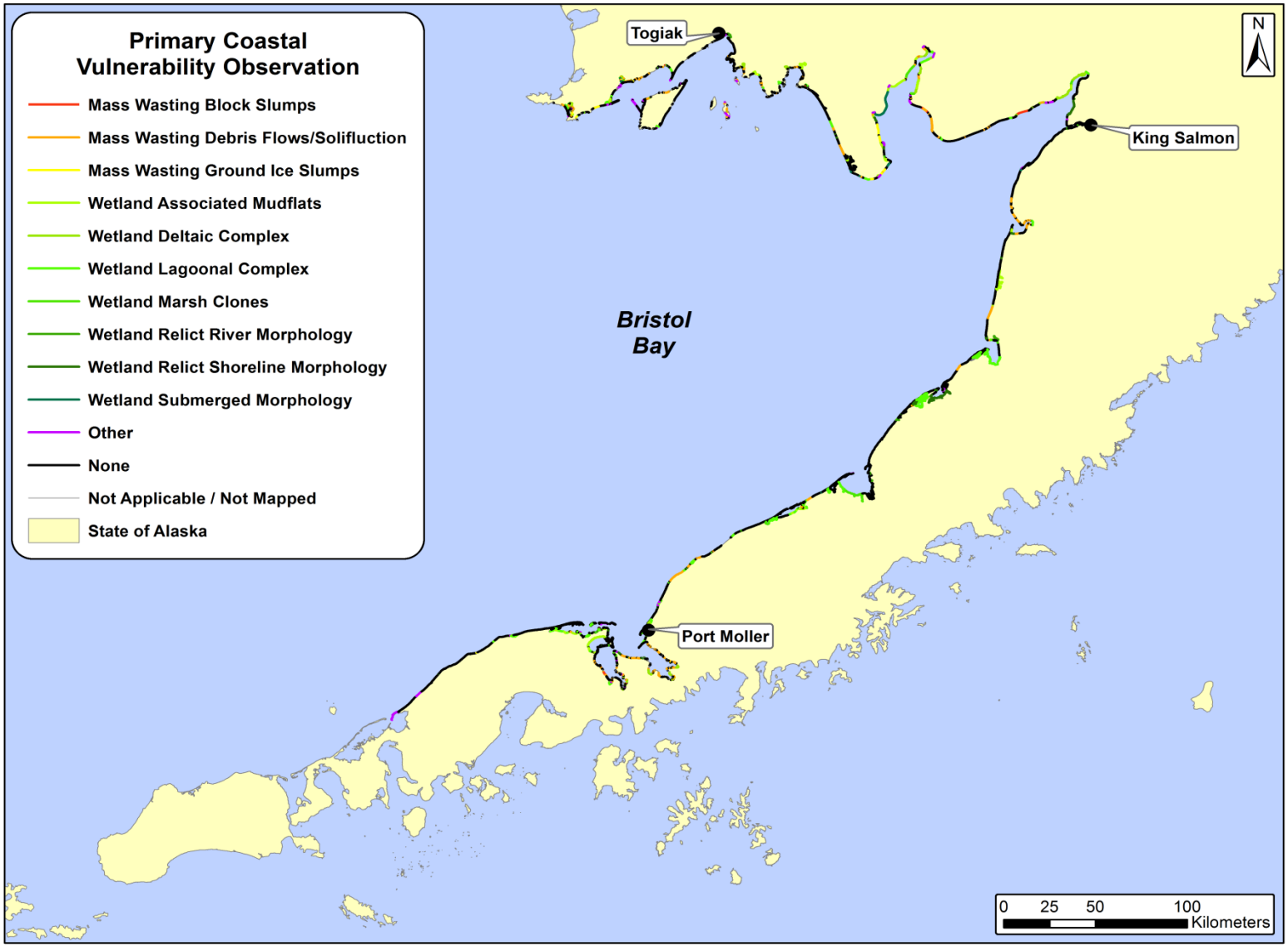


Figure 2. Map of the distribution of primary observations regarding coastal vulnerability in the study area.

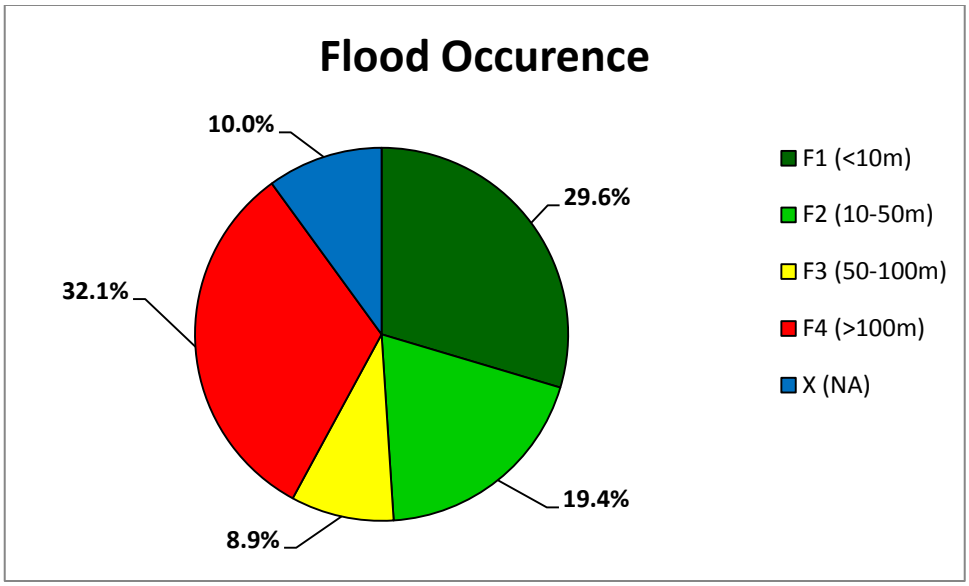


Figure 3. Relevant flood occurrence regarding coastal vulnerability in study area.

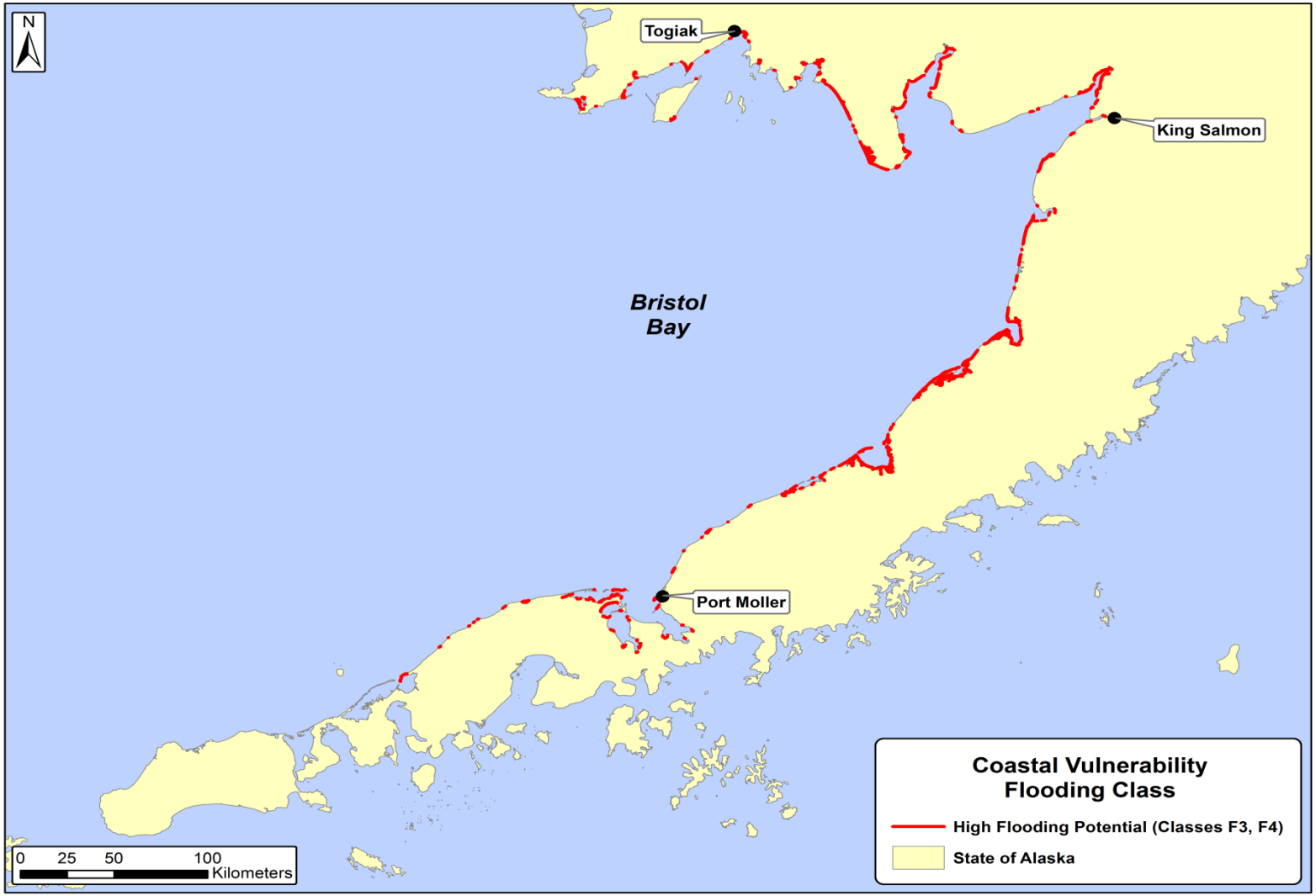


Figure 4. Map of shorelines with >50 m of inundation potential during storm surges.

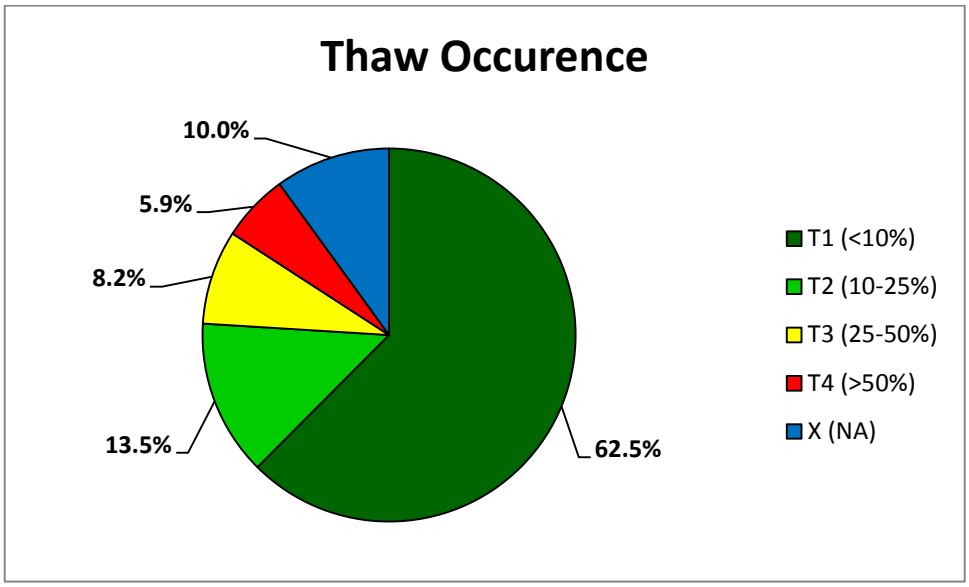


Figure 5. Relevant thaw occurrence regarding coastal vulnerability in study area.

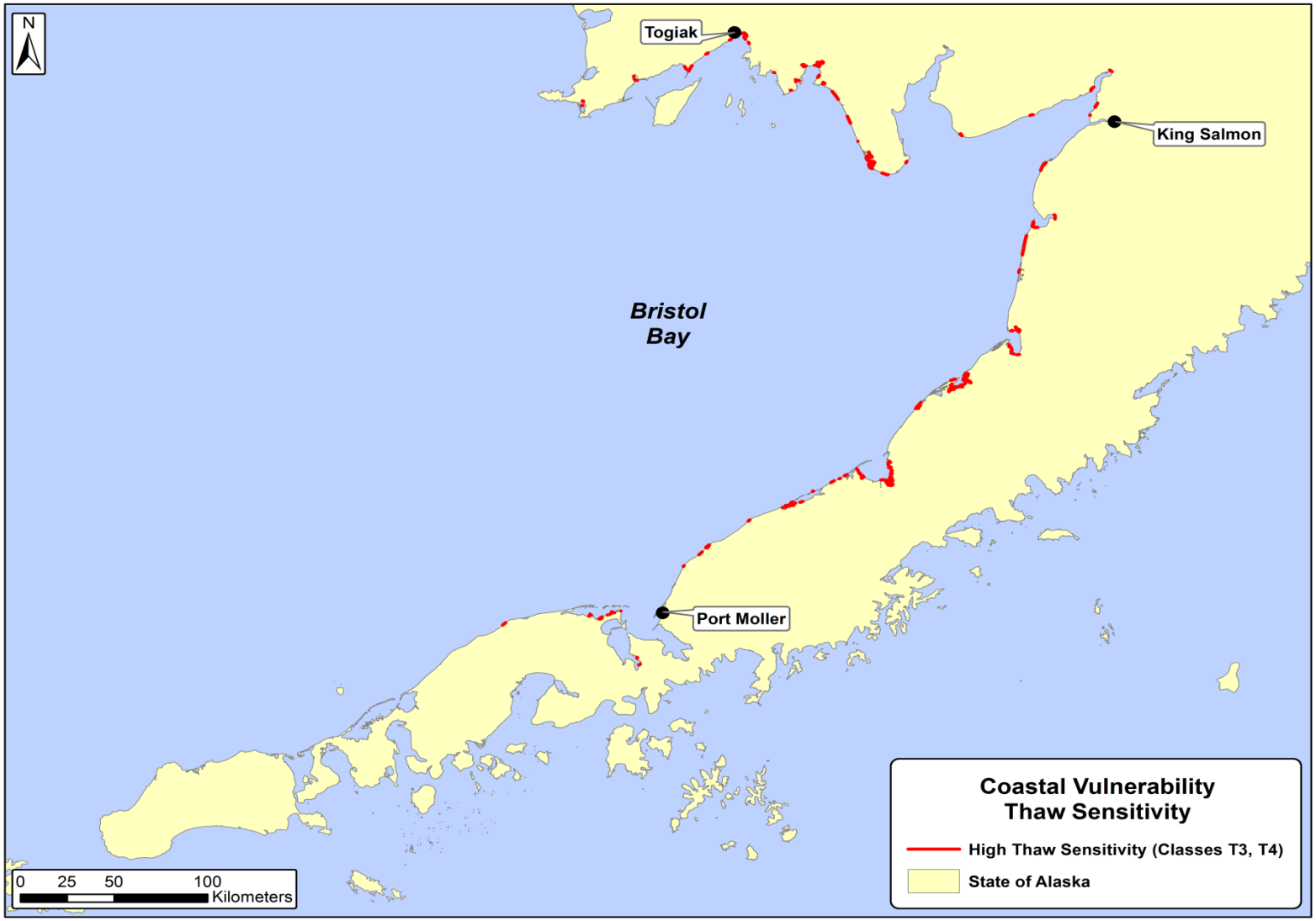


Figure 6. Shoreline with >25% thaw lake occurrence in backshore.

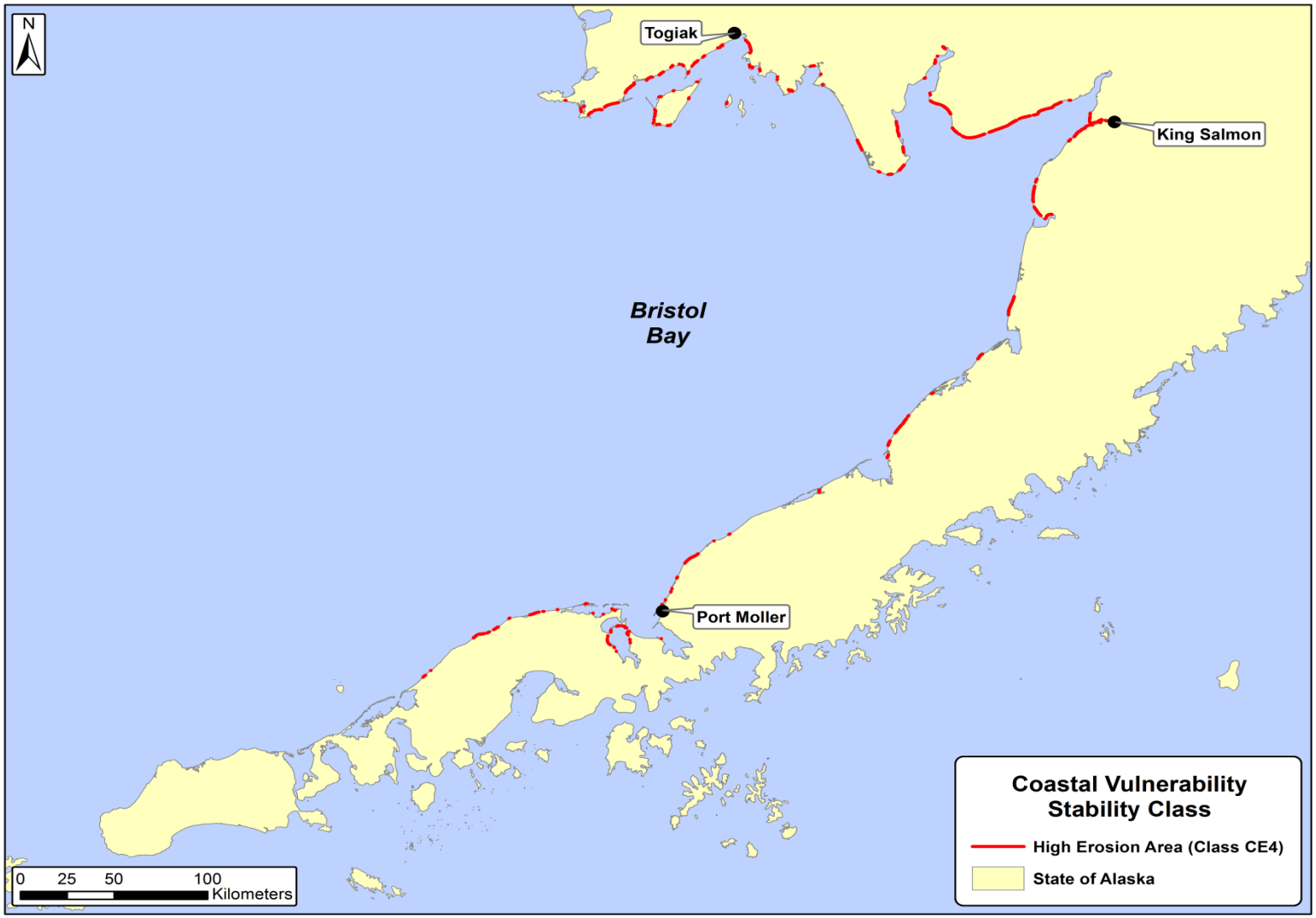


Figure 7. Shoreline with highly active erosional cliffs (no vegetation on cliff face)

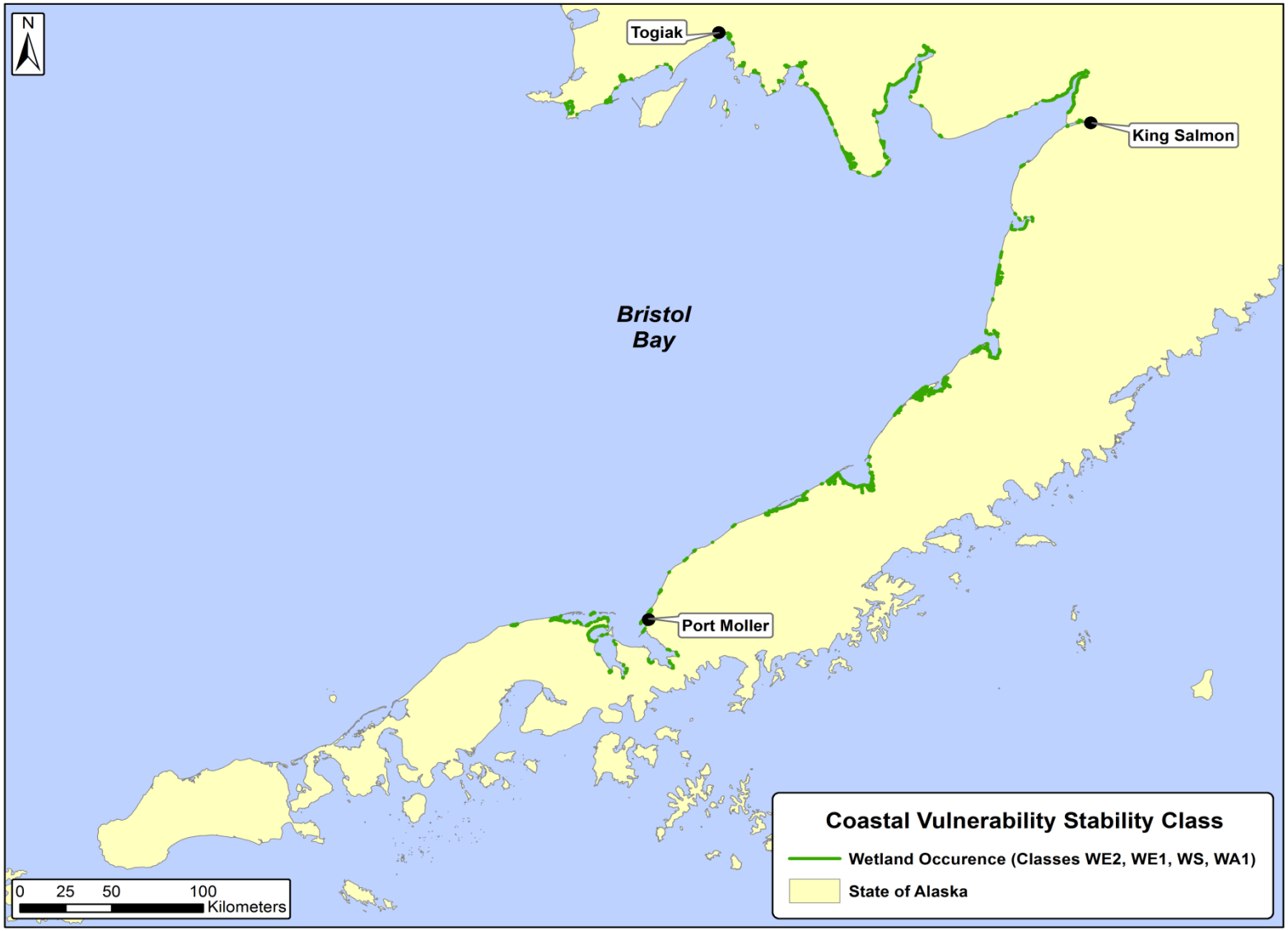


Figure 8. Shoreline with wetland stability classes – about 40% of the coastline.