

8. Risk Analysis

This section outlines the vulnerability process for determining potential losses for Alaska from various hazard impacts.

8.1. OVERVIEW

This section's risk analysis includes a vulnerability assessment that predicts the exposure extent that may result from a given hazard event and its impact intensity, within regional areas. This qualitative analysis provides data to identify and prioritize potential mitigation measures by allowing state agencies and communities to focus attention on areas with the greatest risk. A risk analysis is divided into the following five focus areas:

1. Asset inventory
2. Infrastructure risk, vulnerability, and losses from identified hazards
3. Development changes and trends
4. Data limitations
5. Future development considerations

DMA 2000 requirements and implementing state governance regulations for developing risk and vulnerability assessment initiatives:

DMA 2000 Multi-Jurisdictional Requirements
STANDARD STATE. Hazard Risk Assessment
S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets? [44 CFR §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)]
S6. Does the risk assessment include an overview and analysis of the vulnerability of jurisdictions to the identified hazards and the potential losses to vulnerable structures? [44 CFR §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)]
S7. Was the risk assessment revised to reflect changes in development? [44 CFR §201.4(d)]
<i>Source: FEMA, March 2015</i>

8.2. CURRENT ASSET EXPOSURE ANALYSIS

8.2.1. CRITICAL ASSET INFRASTRUCTURE

Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings (where data is available), and critical facilities and infrastructure.

Assets are grouped into two structure types:

- Critical infrastructure
- Residential properties

8.2.1.1. ALASKA'S CRITICAL INFRASTRUCTURE

The following critical infrastructure information is used during DHS&EM's infrastructure protection planning and program development, and in applying state risk mitigation analysis in the most effective manner.

Critical infrastructure is defined as a facility that provides essential products and services to the general public, such as preserving quality of life while fulfilling important public safety, emergency response, and disaster recovery functions. Due to many of Alaska's communities' remote rural location (i.e., communities that are a long distance from their nearest neighboring

community) most all facilities are deemed “critical” to a community or agency’s survival. Critical facilities and infrastructure profiled in this plan include the following facilities (see also Table 8-1):

- Government: state, city, and tribal administrative offices, departments, and agencies
- Emergency Response: including police department and firefighting equipment
- Educational: including K-12, universities, colleges, and charter schools
- Health Care: medical clinics, congregate living, health, residential, and continuing care and retirement facilities
- Community Gathering Places: community, tribal, and youth centers, and culturally significant and ceremonial sites
- Utilities: electric and alternative power generation, communications, water and waste water treatment, sewage lagoons, and landfills

(Note: Table 8-1 has no particular order except that the left column starts with 1st responders and progresses right to relatively less critical facilities - the order is very subjective.)

Table 8-1		Alaska’s Critical Infrastructure		
• Hospitals, Clinics, & Assisted Living Facilities	• Satellite Facilities	• Power Generation Facilities	• Oil & Gas Pipeline Structures & Facilities	• Schools
• Fire Stations	• Radio Transmission Facilities	• Potable Water Treatment Facilities	• Service Maintenance Facilities	• Community Washeterias
• Police Stations	• Highways and Roads	• Reservoirs & Water Supply Lines	• Community Halls & Civic Centers	• National Guard Facilities
• Emergency Operations Centers	• Critical Bridges	• Waste Water Treatment Facilities	• Community Stores	• Landfills & Incinerators
• Any Designated Emergency Shelter	• Airports	• Fuel Storage Facilities	• Community Freezer Facilities	• Community Cemeteries
• Telecommunications Structures & Facilities	• Harbors / Docks / Ports			

The 2018 SHMP’s State facilities, Department of Transportation, Alaska Railroad, public schools, and the state’s university system data were incorporated into Section 8.6.2 risk analysis and resultant vulnerability assessment.

Note: State asset managers explained that state assets and associated values were detailed in 2013 with few substantive changes identified for this 2018 SHMP update. Therefore the following sections were brought forward into this plan.

8.2.1.2. ALASKA DEPARTMENT OF TRANSPORTATION

The Departments of Transportation and Public Facilities (DOT/PF) and Administration (DOA), Division of Risk Management provided location and replacement values for State-owned facilities and roads (including those found in State parks and forests). Information regarding State facilities and roads is provided as follows.

Note: DOT/PF estimates road construction cost equals approximately \$5M dollars per paved road mile and \$1.5M per unpaved road miles

AK DOT&PF (Road Miles)	Central Region			Northern Region			Paved	Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total		Unpaved	Unknown	Total	
Interstate - TOTAL	387.657		387.657	692.576		692.576					1080.233
Interstate - Rural	333.525		333.525	667.982		667.982					1001.507
Interstate - Urban	54.132		54.132	24.594		24.594					78.726
Principal Arterial - TOTAL	221.158		221.158	364.636	262.687	627.323	71.925			71.925	920.406
Principal Arterials - Rural	135.713		135.713	342.366	262.687	605.053	58.486			58.486	799.252
Principal Arterials - Urban	85.445		85.445	22.270		22.270	13.439			13.439	121.154
Minor Arterial - TOTAL	103.266		103.266	313.478	87.744	401.222	75.450			75.450	579.938
Minor Arterials - Rural	37.768		37.768	278.111	87.744	365.855	24.243			24.243	427.866
Minor Arterials - Urban	65.498		65.498	35.367		35.367	51.207			51.207	152.072
Major Collector - TOTAL	282.221	0.781	283.002	337.021	532.247	869.268	237.807	5.941	0.185	243.933	1396.203
Major Collectors - Rural	202.898	0.781	203.679	278.013	532.246	810.259	210.329	5.570	0.185	216.084	1230.022
Major Collectors - Urban	79.323		79.323	59.008	0.001	59.009	27.478	0.371		27.849	166.181
Minor Collector - TOTAL	241.241	138.053	379.294	125.369	264.156	389.525	123.616	65.054	0.000	188.670	957.489
Minor Collectors - Rural	205.815	138.053	343.868	87.303	263.441	350.744	99.916	64.370		164.286	858.898
Minor Collectors - Urban	35.426		35.426	38.066	0.715	38.781	23.700	0.684		24.384	98.591
Local - TOTAL	64.970	114.489	179.459	81.039	301.063	382.102	45.463	87.934		133.397	694.958
Local - Rural	48.379	113.307	161.686	63.494	298.975	362.469	24.943	75.635		100.578	624.733
Local - Urban	16.591	1.182	17.773	17.545	2.088	19.633	20.520	12.299		32.819	70.225
Totals	1300.513	253.323	1553.836	1914.119	1447.897	3362.016	554.261	158.929	0.185	713.375	5629.227
Rural	964.098	252.141	1216.239	1717.269	1445.093	3162.362	417.917	145.575	0.185	563.677	4942.278
Urban	336.415	1.182	337.597	196.850	2.804	199.654	136.344	13.354		149.698	686.949



AK DNR (Road Miles)	Central Region Paved Unpaved Total			Northern Region Paved Unpaved Total			Southcoast Region Paved Unpaved Total			State Total
Forestry		21.100	21.100		361.652	361.652		74.910	74.910	457.662
Local - Rural		21.100	21.100		361.652	361.652		74.910	74.910	457.662
Local - Urban										
Parks	23.575	21.125	44.700	2.200	23.075	25.275	0.900	7.296	8.196	78.171
Local - Rural	23.575	21.125	44.700	1.500	23.075	24.575	0.900	7.296	8.196	77.471
Local - Urban				0.700		0.700				0.700
Minor Collector								0.204	0.204	0.204
Minor Collectors - Rural								0.204	0.204	0.204
Minor Collectors - Urban										
Totals	23.575	42.225	65.800	2.200	384.727	386.927	0.900	82.206	83.106	536.037
Rural	23.575	42.225	65.800	1.500	384.727	386.227	0.900	82.410	83.310	535.133
Urban				0.700		0.700				0.700

BOROUGH (Road Miles)	Central Region Paved Unpaved Total			Northern Region Paved Unpaved Total			Southcoast Region Paved Unpaved Total			State Total
Principal Arterial - TOTAL	18.616		18.616							18.616
Principal Arterials - Rural										
Principal Arterials - Urban	18.616		18.616							18.616
Minor Arterial - TOTAL	35.902		35.902		1.922	1.922	2.042	0.000	2.042	39.866
Minor Arterials - Rural	0.871		0.871		1.922	1.922				2.793
Minor Arterials - Urban	35.031		35.031				2.042		2.042	37.073
Major Collector - TOTAL	69.845	1.966	71.811	8.230	5.603	13.833	12.732	0.087	12.819	98.463
Major Collectors - Rural	24.697	0.372	25.069	5.096	5.323	10.419	2.927	0.087	3.014	38.502
Major Collectors - Urban	45.148	1.594	46.742	3.134	0.280	3.414	9.805		9.805	59.961
Minor Collector - TOTAL	145.197	56.184	201.381	15.449	28.790	44.239	22.092	19.791	41.883	287.503
Minor Collectors - Rural	57.221	51.453	108.674	12.848	28.017	40.865	11.443	19.095	30.538	180.077
Minor Collectors - Urban	87.976	4.731	92.707	2.601	0.773	3.374	10.649	0.696	11.345	107.426
Local - TOTAL	1084.000	1543.000	2627.000	33.000	657.000	690.000	123.000	170.000	293.000	3610.000
Local - Rural	191.000	1289.000	1480.000	5.000	460.000	465.000	29.000	126.000	155.000	2100.000
Local - Urban	893.000	254.000	1147.000	28.000	197.000	225.000	94.000	44.000	138.000	1510.000
Totals	1353.560	1601.150	2954.710	56.679	693.315	749.994	159.866	189.878	349.744	4054.448
Rural	273.789	1340.825	1614.614	22.944	495.262	518.206	43.370	145.182	188.552	2321.372
Urban	1079.771	260.325	1340.096	33.735	198.053	231.788	116.496	44.696	161.192	1733.076



MUNICIPAL <i>(Road Miles)</i>	Central Region Paved Unpaved Total			Northern Region Paved Unpaved Total			Southcoast Region Paved Unpaved Total			State Total
Minor Arterial - TOTAL	2.244		2.244	5.927		5.927	2.908		2.908	11.079
Minor Arterials - Rural										
Minor Arterials - Urban	2.244		2.244	5.927		5.927	2.908		2.908	11.079
Major Collector - TOTAL	15.158	0.642	15.800	14.316	23.202	37.518	14.015	18.664	32.679	85.997
Major Collectors - Rural	4.582	0.596	5.178	5.925	23.202	29.127	8.474	18.664	27.138	61.443
Major Collectors - Urban	10.576	0.046	10.622	8.391		8.391	5.541		5.541	24.554
Minor Collector - TOTAL	31.327	90.402	121.729	19.355	111.865	131.220	23.344	73.122	96.466	349.415
Minor Collectors - Rural	18.733	90.264	108.997	10.193	111.588	121.781	18.717	73.122	91.839	322.617
Minor Collectors - Urban	12.594	0.138	12.732	9.162	0.277	9.439	4.627		4.627	26.798
Local - TOTAL	156.000	336.000	492.000	127.000	334.000	461.000	92.000	334.000	426.000	1379.000
Local - Rural	79.000	298.000	377.000	22.000	331.000	353.000	59.000	324.000	383.000	1113.000
Local - Urban	77.000	38.000	115.000	105.000	3.000	108.000	33.000	10.000	43.000	266.000
Totals	204.729	427.044	631.773	166.598	469.067	635.665	132.267	425.786	558.053	1825.491
Rural	102.315	388.860	491.175	38.118	465.790	503.908	86.191	415.786	501.977	1497.060
Urban	102.414	38.184	140.598	128.480	3.277	131.757	46.076	10.000	56.076	328.431

OTHER STATE AGENCIES <i>(Road Miles)</i>	Central Region Paved Total		Northern Region Paved Unpaved Total			Southcoast Region Paved Unpaved Total			State Total
Major Collector - TOTAL						4.424		4.424	4.424
Major Collectors - Rural						4.424		4.424	4.424
Major Collectors - Urban									
Minor Collector - TOTAL	0.474	0.474							0.474
Minor Collectors - Rural	0.381	0.381							0.381
Minor Collectors - Urban	0.093	0.093							0.093
Local - TOTAL			0.189	1.402	1.591	1.382	12.000	13.382	14.973
Local - Rural			0.189	1.374	1.563	1.074	12.000	13.074	14.637
Local - Urban				0.028	0.028	0.308		0.308	0.336
Totals	0.474	0.474	0.189	1.402	1.591	5.806	12.000	17.806	19.871
Rural	0.381	0.381	0.189	1.374	1.563	5.498	12.000	17.498	19.442
Urban	0.093	0.093		0.028	0.028	0.308		0.308	0.429



OTHER LOCAL AGENCIES (Road Miles)	Central Region		Northern Region			Southcoast Region	State Total
	Unpaved	Total	Paved	Unpaved	Total	Unknown - Total	
Major Collector - TOTAL			0.711	0.654	1.365		1.365
Major Collectors - Rural			0.711	0.654	1.365		1.365
Major Collectors - Urban							
Minor Collector - TOTAL	0.341	0.341	0.470	9.771	10.241		10.582
Minor Collectors - Rural	0.341	0.341	0.470	9.771	10.241		10.582
Minor Collectors - Urban							
Local - TOTAL			1.514	51.950	53.464		53.464
Local - Rural			1.514	51.950	53.464		53.464
Local - Urban							
Totals	0.341	0.341	2.695	62.375	65.070		65.411
Rural	0.341	0.341	2.695	62.375	65.070		65.411
Urban							

BIA (Road Miles)	Central Region		Northern Region		Southcoast Region			State Total
	Unpaved	Total	Unpaved	Total	Paved	Unpaved	Total	
Major Collector - TOTAL					15.474		15.474	15.474
Major Collectors - Rural					15.474		15.474	15.474
Major Collectors - Urban								
Minor Collector - TOTAL	1.298	1.298			4.137	1.850	5.987	7.285
Minor Collectors - Rural	1.298	1.298			4.137	1.850	5.987	7.285
Minor Collectors - Urban								
Local - TOTAL	68.802	68.802	4.200	4.200		392.639	392.639	465.641
Local - Rural	68.802	68.802	4.200	4.200		392.639	392.639	465.641
Local - Urban								
Totals	70.100	70.100	4.200	4.200	19.611	394.489	414.100	488.400
Rural	70.100	70.100	4.200	4.200	19.611	394.489	414.100	488.400
Urban								

INDIAN NATIONS (Road Miles)	Central Region			Northern Region			Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Total	
Minor Collector - TOTAL		1.083	1.083		1.116	1.116		3.814	3.814	6.013
Minor Collectors - Rural		1.083	1.083		1.116	1.116		3.814	3.814	6.013
Minor Collectors - Urban										
Local - TOTAL	3.900	733.617	737.517	6.500	721.280	727.780	1.500	169.490	170.990	1636.287
Local - Rural	3.900	733.617	737.517	6.500	721.280	727.780	1.400	168.690	170.090	1635.387
Local - Urban							0.100	0.800	0.900	0.900
Totals	3.900	734.700	738.600	6.500	722.396	728.896	1.500	173.304	174.804	1642.300
Rural	3.900	734.700	738.600	6.500	722.396	728.896	1.400	172.504	173.904	1641.400
Urban							0.100	0.800	0.900	0.900



U.S. FOREST SERVICE (Road Miles)	Central Region			Northern Region			Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Total	
Minor Collector - TOTAL	0.408		0.408				0.280	31.273	31.553	31.961
Minor Collectors - Rural	0.408		0.408				0.280	31.273	31.553	31.961
Minor Collectors - Urban										
Local - TOTAL	8.419	31.473	39.892	2.125	12.513	14.638	5.292	497.748	503.040	557.570
Local - Rural	8.419	31.473	39.892	2.125	12.513	14.638	1.565	488.194	489.759	544.289
Local - Urban							3.727	9.554	13.281	13.281
Totals	8.827	31.473	40.300	2.125	12.513	14.638	5.572	529.021	534.593	589.531
Rural	8.827	31.473	40.300	2.125	12.513	14.638	1.845	519.467	521.312	576.250
Urban							3.727	9.554	13.281	13.281

NATIONAL PARKS SERVICE (Road Miles)	Central Region			Northern Region			Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Total	
Major Collector - TOTAL				14.742		14.742	4.513		4.513	19.255
Major Collectors - Rural				14.742		14.742	4.513		4.513	19.255
Major Collectors - Urban										
Local - TOTAL	1.740	0.090	1.830	3.671	110.740	114.411		36.454	36.454	152.695
Local - Rural	1.740	0.090	1.830	3.671	110.740	114.411		36.454	36.454	152.695
Local - Urban			0.000							
Totals	1.740	0.090	1.830	18.413	110.740	129.153	4.513	36.454	40.967	171.950
Rural	1.740	0.090	1.830	18.413	110.740	129.153	4.513	36.454	40.967	171.950
Urban										

U.S. ARMY CORPS OF ENGINEERS (Road Miles)	Northern Region			State Total
	Paved	Unpaved	Total	
Totals	12.400	7.500	19.900	19.900
Local - Rural	12.400	7.500	19.900	19.900
Local - Urban				

U.S. NAVY (Road Miles)	Northern Region			Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	
Totals		8.020	8.020	5.800	154.990	160.790	168.810
Local - Rural		8.020	8.020	5.800	154.990	160.790	168.810
Local - Urban							

U.S. ARMY (Road Miles)	Northern Region			State Total
	Paved	Unpaved	Total	
Totals	46.110	52.000	98.110	98.110
Local - Rural	31.900		31.900	31.900
Local - Urban	14.210	52.000	66.210	66.210



U.S. AIR FORCE (Road Miles)	Central Region Paved Total		Northern Region Paved Total		State Total
Totals	0.291	0.291	0.444	0.444	0.735
Minor Arterial - Urban	0.291	0.291			0.291
Major Collector - Rural			0.444	0.444	0.444

U.S. COAST GUARD (Road Miles)	Southcoast Region Paved Unpaved Total			State Total
Totals	4.179	0.046	4.225	4.225
Local - Rural				
Local - Urban	4.179	0.046	4.225	4.225

OTHER PUBLIC INSTRUMENTALITY (Road Miles)	Northern Region Paved Unpaved Total			State Total
Major Collector - TOTAL	0.390		0.390	0.390
Major Collector - Rural	0.390		0.390	0.390
Major Collector - Urban				
Minor Collector - TOTAL	2.319		2.319	2.319
Minor Collectors - Rural				
Minor Collectors - Urban	2.319		2.319	2.319
Local - TOTAL	3.528	5.695	9.223	9.223
Local - Rural	3.528		3.528	3.528
Local - Urban		5.695	5.695	5.695
Totals	2.709		2.709	11.932
Rural	0.390		0.390	0.390
Urban	2.319		2.319	2.319

U.S. FISH & WILDLIFE SERVICE (Road Miles)	Central Region Unpaved Total		Northern Region Unpaved Total		Southcoast Region Unpaved Total		State Total
Totals	42.940	42.940	4.600	4.600	42.700	42.700	90.240
Local - Rural	42.940	42.940	4.600	4.600	42.700	42.700	90.240
Local - Urban							

BUREAU OF LAND MANAGEMENT (Road Miles)	Central Region Paved Total		Northern Region Paved Unpaved Total		State Total	
Minor Collector - TOTAL				12.309	12.309	12.309
Minor Collectors - Rural				12.309	12.309	12.309
Minor Collectors - Urban						
Local - TOTAL	1.190	1.190	0.100	10.971	11.071	12.261
Local - Rural	1.190	1.190		10.971	10.971	12.161
Local - Urban			0.100		0.100	0.100
Totals	1.190	1.190	0.100	23.280	23.380	24.570
Rural	1.190	1.190		23.280	23.280	24.470
Urban			0.100		0.100	0.100



PRIVATE AGENCY (Road Miles)	Central Region			Northern Region			Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Total	
Major Collector - TOTAL		0.101	0.101	0.090	0.154	0.244				0.345
Major Collectors - Rural		0.101	0.101	0.090	0.154	0.244				0.345
Major Collectors - Urban										
Minor Collector - TOTAL					0.118	0.118	0.413		0.413	0.531
Minor Collectors - Rural					0.118	0.118	0.413		0.413	0.531
Minor Collectors - Urban										
Local - TOTAL	0.036	1.515	1.551	0.851	58.657	59.508	1.386	13.739	15.125	76.184
Local - Rural	0.036	1.515	1.551	0.065	58.657	58.722		11.565	11.565	71.838
Local - Urban				0.786		0.786	1.386	2.174	3.560	4.346
Totals	0.036	1.616	1.652	0.941	58.929	59.870	1.799	13.739	15.538	77.060
Rural	0.036	1.616	1.652	0.155	58.929	59.084	0.413	11.565	11.978	72.714
Urban				0.786		0.786	1.386	2.174	3.560	4.346

RAILROAD (Road Miles)	Paved	Northern Region		Total	Total	State Total
		Unpaved	Unknown			
Local - Rural						
Local - Urban		0.415		0.415		0.415
Totals		0.415		0.415	0.000	0.415

OTHER (Road Miles)	Central Region			Northern Region			Southcoast Region			State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Total	
Local - Rural		0.050	0.050	0.879		0.879				0.929
Local - Urban					6.447	6.447	0.452	8.509	8.961	15.408
Totals		0.050	0.050	0.879	6.447	7.326	0.452	8.509	8.961	16.337



Table 8-2 Statewide Total Road Miles

	Central Region			Northern Region			Southcoast Region				State Total
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Unknown	Total	
Interstate - TOTAL	387.657		387.657	692.576		692.576					1080.233
Interstate - Rural	333.525		333.525	667.982		667.982					1001.507
Interstate - Urban	54.132		54.132	24.594		24.594					78.726
Principal Arterial - TOTAL	239.774		239.774	364.636	262.687	627.323	71.925			71.925	939.022
Principal Arterials - Rural	135.713		135.713	342.366	262.687	605.053	58.486			58.486	799.252
Principal Arterials - Urban	104.061		104.061	22.270		22.270	13.439			13.439	139.770
Minor Arterial - TOTAL	141.703		141.703	319.405	89.666	409.071	80.400			80.400	631.174
Minor Arterials - Rural	38.639		38.639	278.111	89.666	367.777	24.243			24.243	430.659
Minor Arterials - Urban	103.064		103.064	41.294		41.294	56.157			56.157	200.515
Major Collector - TOTAL	367.224	3.490	370.714	375.944	561.860	937.804	288.965	24.692	0.185	313.842	1622.360
Major Collectors - Rural	232.177	1.850	234.027	305.411	561.579	866.990	246.141	24.321	0.185	270.647	1371.664
Major Collectors - Urban	135.047	1.640	136.687	70.533	0.281	70.814	42.824	0.371		43.195	250.696
Minor Collector - TOTAL	418.647	287.361	706.008	162.962	428.125	591.087	173.882	195.108		368.990	1666.085
Minor Collectors - Rural	282.558	282.492	565.050	110.814	426.360	537.174	134.906	193.728		328.634	1430.858
Minor Collectors - Urban	136.089	4.869	140.958	52.148	1.765	53.913	38.976	1.380		40.356	235.227
Local - TOTAL	1343.830	2914.201	4258.031	321.106	2733.180	3054.286	281.354	2002.455		2283.809	9596.126
Local - Rural	357.239	2621.019	2978.258	154.765	2466.507	2621.272	123.682	1915.073		2038.755	7638.285
Local - Urban	986.591	293.182	1279.773	166.341	266.673	433.014	157.672	87.382		245.054	1957.841
DOT Regional Totals	2898.835	3205.052	6103.887	2236.629	4075.518	6312.147	896.526	2222.255	0.185	3118.966	15535.000
Rural	1379.851	2905.361	4285.212	1859.449	3806.799	5666.248	587.458	2133.122	0.185	2720.765	12672.225
Urban	1518.984	299.691	1818.675	377.180	268.719	645.899	309.068	89.133	0.000	398.201	2862.775

Source: ADOT/PF, Division of Program Development, <http://www.dot.alaska.gov/stwdplng/transdata/pub/2017cprmFinal.pdf>



8.2.1.3. ALASKA SCHOOLS AND UNIVERSITIES

Schools in Alaska fall under several varying jurisdictions. Total insured value and staff numbers organized by borough/Rural Educational Attendance Area (REAA) are displayed in Table 8-3. The State owns Mt. Edgecumbe High School, a boarding school in Sitka, Alaska. The value of that facility is incorporated into appropriate hazard and vulnerability assessments (HVAs). In many Alaska communities, the school facilities serve as the primary emergency shelter and are considered critical infrastructure.

Table 8-3 School Systems Insured Value and Full Time Equivalent Staff

Borough/REAA	Total Valued Insured	FTE
Alaska Gateway REAA	\$48,293,056	32
Aleutians East Borough	unavailable	35
Aleutian Region REAA	\$59,074,028	33
Annette Island REAA	\$28,060,350	32
Bristol Bay Borough	\$33,479,006	14
Bering Strait REAA	\$353,051,455	47
City and Borough of Juneau	\$22,904,112	377
City and Borough of Sitka	\$189,611,658	107
City and Borough of Wrangell	\$44,983,384	25
City and Borough of Yakutat	\$15,783,018	12
Chatham REAA	\$32,654,437	10
Chugach REAA	\$15,716,499	109
Copper River REAA	\$68,344,164	39
Denali Borough REAA	\$29,873,593	23
Delta-Greely REAA	\$46,151,188	62
Fairbanks North Star Borough	\$698,460,000	1,650
Haines Borough	\$39,710,747	23
Iditarod Area	\$48,787,598	25
Kashunamiut REAA	unavailable	25
Ketchikan Gateway Borough	unavailable	173
Kenai Peninsula Borough	\$549,017,951	645
Kuspuk REAA	\$116,960,300	36
Lower Kuskokwim REAA	\$375,670,805	300
Lake & Peninsula Borough	\$86,777,907	52
Lower Yukon REAA	\$302,088,625	12
Matanuska-Susitna Borough	unavailable	1,145
Municipality of Anchorage	1,217,581,907	3,207
Northwest Arctic Borough	\$312,429,495	158
North Slope Borough	unavailable	190
Pribilof Islands REAA	\$63,908,126	11
Southeast Island REAA	\$182,414,559	130
Southwest Region	\$164,187,193	72
Yukon Flats REAA	\$75,153,220	28
Yukon-Koyukuk REAA	\$156,188,082	142
Yupik REAA	\$67,360,000	48
TOTAL	\$3,431,295,521	7,379

Source: Alaska Department of Education & Early Development, Mt. Edgecumbe High School, and the Association of Alaska School Boards (2013). Kodiak Island Borough information is unavailable.



The University of Alaska provided facility values for university properties throughout the state, displayed within Table 8-4.

Table 8-4 University of Alaska Facility and Property Values

Name	Location	Area Sq. Ft.	Adjusted Building Value
University of Alaska Anchorage (UAA) System			
Anchorage	Anchorage	2,255,395	\$592,072,878
Kenai Peninsula	Soldotna	89,432	\$26,288,801
Kachemak Bay	Homer	18,360	\$6,590,566
Kodiak	Kodiak	44,981	\$13,799,752
Matanuska-Susitna College	Palmer	105,316	\$34,885,851
Prince William Sound Community College	Valdez	61,709	\$16,174,362
Sub Total	--	2,575,193	\$689,812,210
University of Alaska Fairbanks (UAF) System			
Fairbanks	Fairbanks	2,903,104	\$89,162,127
Fairbanks Agricultural & Forestry Experiment Station	Fairbanks	48,868	\$3,676,394
State Virology Laboratory	Fairbanks	30,362	\$33,053,288
Matanuska Agricultural & Forestry Experiment Station	Matanuska Borough	89,888	\$11,572,250
Agricultural & Forestry Experiment Station Palmer Research Center	Palmer	--	--
Poker Flat Research Range	Fairbanks	35,760	\$12,064,679
Seward Marine Center	Seward	37,338	\$9,450,054
Bristol Bay	Dillingham	10,523	\$6,594,432
Chukchi	Kotzebue	8,948	\$4,871,069
Interior-Aleutians	various	25,415	\$11,308,307
Kuskokwim	Bethel	51,680	\$20,558,633
Northwest	Nome	20,760	\$4,883,426
Tanana Valley Campus	Fairbanks	193,229	\$9,803,798
Sub Total	--	3,455,875	\$216,998,457
University of Alaska Sitka (UAS) System			
Juneau	Juneau	441,648	\$115,107,322
Ketchikan	Ketchikan	47,850	\$17,589,192
Sitka	Sitka	68,058	\$12,543,719
Sub Total	--	557,556	\$145,240,233
Statewide Programs and Services (SPS)			
Statewide Office of Land Management	State	3,745	\$180,443
Statewide Services	State	108,670	\$43,601,128
Sub Total	--	112,415	\$43,781,571
UAA SYSTEM TOTALS		6,701,039	\$1,095,832,471

Source: University of Alaska 2013 Facilities Inventory, Statewide Planning and Budget, 2013



The State of Alaska Risk Manager uses the Marshall & Swift Valuation Service Classification Class list for determining and maintaining a list of State-owned, insured buildings. Risk management does not use this list for any construction cost determination. Classification categories include:

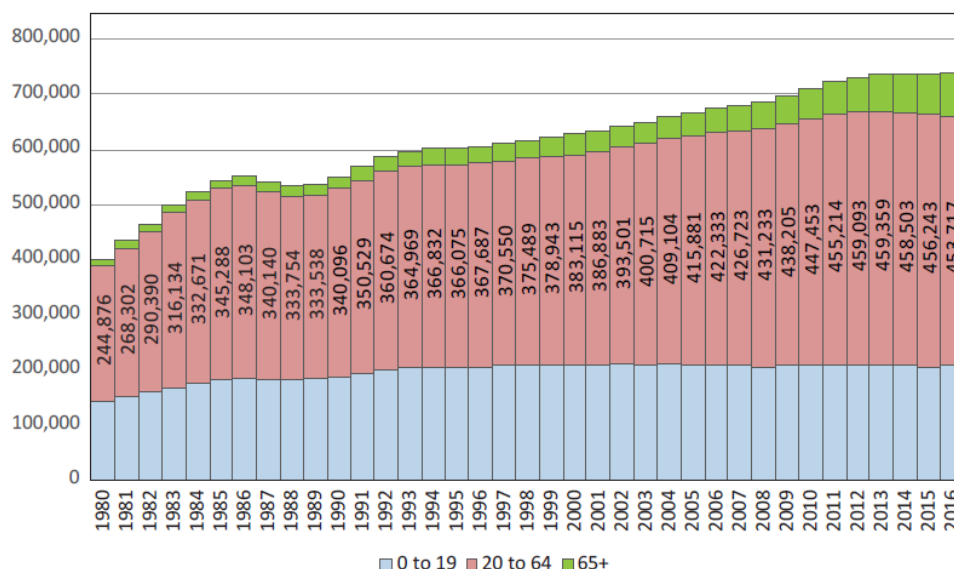
- Class “A,” buildings have fireproofed structural steel frames with reinforced concrete or masonry floors and roofs,
- Class “B,” buildings have reinforced concrete frames with concrete or masonry floors and roofs,
- Class “C,” buildings have masonry or concrete exterior walls with wood or steel roofs and floors, except for concrete slab on grade.
- Class “D,” buildings generally have a wood frame, floor, and roof structure. They may have a concrete floor on grade and other substitute materials, but are considered combustible construction. This class includes engineered pole frame buildings.
- Class “S,” buildings of Alaska and for the purpose of the evaluation of State structures will not be used until future updates of the plan when the State Risk Manager incorporates this class into the classification of structures.
- Class “E,” buildings are statewide leased.
- Class “F,” building refers to uninsured properties

Alaska Risk Management uses the 2002 “Marshall Valuation Service Classification of Construction Statement” to determine the State’s valuation methodology and statement.

8.2.1.4. POPULATION

The following comes from the Alaska Department of Labor and Workforce Development, Research and Analysis Department’s (RAD) June 2017, “Our Changing Age Structure” article 3.

...Alaska’s Population by Age Group 1980 to 2016



Alaska's population has continued to grow in recent years, although growth has slowed and the state's age structure has shifted. The state grew from 735,859 people in 2013 to 739,828 in 2016, but the only age group to increase was 65-plus.

This doesn't mean more senior citizens are moving to Alaska; rather, it's the result of the large cohort of baby boomers, those born between 1946 and 1964, entering retirement age and the resulting subtraction from the 20-to-64 age group.

The increase in Alaskans over 65 has been steady and rapid for several years. The group grew by more than 4,000 people between 2015 and 2016 alone, reaching 78,980, and Alaska's senior population will likely pass the 80,000 mark in 2017 and top 100,000 in the coming years.

The 20-to-64 population, the typical working-age range, declined to 453,717 by 2016 after peaking at 459,359 in 2013. The under-20 population remained essentially unchanged over that period, as it has for more than two decades, hovering between 205,000 and 210,000 since 1994."

Source: DOL: 2017

The DLW/RAD states that Alaska's statewide population increased by 26,847 people from 2010 to 2017. The growth as a whole is primarily through natural increase (births), listed at just over 20,000.

Many of Alaska's boroughs and census areas slowly grew between 2012 and 2017. Of the 29 boroughs and census areas, 18 experienced population declines during that time. The largest population decreases occurred in the Fairbanks North Star Borough (FNSB) and the Kodiak Island Borough (KIB).

However, population growth in the Matanuska-Susitna Borough (Mat-Su or MSB) accounted for roughly 50 percent of the total growth statewide. The MSB is the fastest growing area in Alaska. These data are listed in Table 8-5 Population Growth and 8.6 Residential Property Values.

There is no comprehensive or published list that correlates population growth and its connected facility and infrastructure growth.

This SHMP has provided new hazard maps (Section xx, page s-s) for each hazard type that depict various risk analysis from Tables 8-14 through 8-21 using colored shading. The darker the hazard color the higher the risk. Alaska's communities with populations over 400 are shown on each map to assist readers with community locational proximity. Readers can therefore assume the relative risk for each community location.

These new hazard maps are based on the most current hazard information available. They therefore become the baseline to facilitate future risk analyses and vulnerability assessments.

Note: more refined hazard risk analysis and vulnerabilities is required to better determine single location risk factors. The larger communities with established land and parcel maps can better define locational hazard risks as these communities generally overlay pertinent GIS data layers to identify known high hazard locations.

Table 8-5 Alaska Population Growth, 2010-2017

	2010 Census	2017 Census Estimates	Natural Increase <i>Births-Deaths</i>	Net Migration	Population Change	Average Annual Growth Rate (%)
	<i>April 2010</i>	<i>July 2017</i>	<i>2010-2017</i>	<i>2010-2017</i>	<i>2012-2017</i>	<i>2016-2017</i>
Alaska	710,231	737,080	20,149	-25,100	6,038	-0.36
Anchorage / Mat-Su Region	380,821	401,649	11,089	-7,368	9,663	0.04
Municipality of Anchorage	291,826	297,483	8,376	-16,307	-851	-0.49
Matanuska-Susitna Borough	88,995	104,166	2,713	8,939	10,514	1.56
Gulf Coast Region	78,628	80,750	3,878	-1,811	122	-0.51
Kenai Peninsula Borough	55,721	58,024	2,245	379	1,391	-0.04
Kodiak Island Borough	13,664	13,287	1,144	-1,449	-706	-2.03
Valdez-Cordova Census Area	9,696	9,387	489	-741	-563	-1.19
Interior Region	112,600	111,911	9,624	-9,734	-3,486	-1.15
Denali Borough	1,831	1,849	82	-59	-7	-1.82
Fairbanks North Star Borough	98,106	97,738	8,868	-8,711	-2,926	-1.24
Southeast Fairbanks Census Area	7,029	6,973	472	-525	-227	0.75
Yukon Koyukuk Census Area	5,612	5,351	202	-439	-326	-1.72
Northern Region	26,586	27,705	3,046	-1,786	431	-0.37
Nome Census Area	9,555	10,006	1,157	-643	154	-0.64
North Slope Borough	9,475	9,849	879	-460	139	0.49
Northwest Arctic Borough	7,556	7,850	1,010	-683	138	-1.10
Southeast Region	72,156	72,915	2,788	-1,537	-1,253	-1.24
Haines Borough	2,532	2,459	7	-56	-148	-0.28
Hoonah-Angoon Census Area	2,153	2,122	53	-80	-78	-3.06
City and Borough of Juneau	31,534	32,269	1,495	-501	-420	-1.40
Ketchikan Gateway Borough	13,538	13,754	554	-277	-124	0.04
Petersburg Census Area	3,226	3,147	134	-190	-104	-0.95
Prince of Wales-Hyder Census Area	6,238	6,390	215	3	-66	-1.57
City and Borough of Sitka	8,926	8,748	228	-361	-317	-1.88



Table 8-5 Alaska Population Growth, 2010-2017

	2010 Census	2017 Census Estimates	Natural Increase <i>Births-Deaths</i>	Net Migration	Population Change	Average Annual Growth Rate (%)
	<i>April 2010</i>	<i>July 2017</i>	<i>2010-2017</i>	<i>2010-2017</i>	<i>2012-2017</i>	<i>2016-2017</i>
Municipality of Skagway	969	1,087	51	68	130	1.67
City and Borough of Wrangell	2,381	2,387	13	5	-57	-2.85
City and Borough of Yakutat	659	552	38	-148	-69	-7.33
Southwest Region	40,875	42,202	4,417	-2,864	561	-0.17
Aleutians East Borough	3,147	2,977	55	-219	-169	-0.74
Aleutians West Census Area	5,572	5,357	136	-340	-265	-2.29
Bethel Census Area	17,122	18,127	2,336	-1,222	567	0.03
Bristol Bay Borough	1,004	887	24	-134	-97	1.25
Dillingham Census Area	4,872	4,925	492	-414	-49	-0.59
Lake and Peninsula Borough	1,643	1,721	132	-42	41	0.10
Wade Hampton Census Area	7,515	8,208	1,242	-493	533	4.70
<i>* 2017. All numbers are based on 2010 Census geography.</i> <i>Sources: Alaska Department of Labor and Workforce Development, Research and Analysis Section; and U.S. Census Bureau</i>						

8.2.1.5. RESIDENTIAL PROPERTIES

The State of Alaska Department of Labor and Workforce provided residential property values from municipalities or jurisdictions levying a property tax (Table 8-6). Jurisdictions not levying property taxes were excluded.

Table 8-6 2018 Residential Property Values by Boroughs

Boroughs & Unified Municipalities	Locally Assessed Real Property	Locally Assessed Personal Property	Approximate Total Assessed Values
Municipality of Anchorage*	\$32,876,827,762	\$2,744,298,672	\$35,621,126,434
Bristol Bay Borough	\$195,240,574	\$185,216,693	\$380,457,267
Fairbanks North Star Borough	\$8,038,878,283	\$0	\$8,038,878,283
Haines Borough	\$347,097,000	\$0	\$347,097,000
Juneau City & Borough	\$4,498,119,846	\$356,741,060	\$4,854,860,906
Kenai Peninsula Borough	\$6,338,989,400	\$362,535,660	\$6,701,525,060
Ketchikan Gateway Borough	\$4,410,790,300	\$90,300,960	\$4,501,091,260
Kodiak Island Borough	\$1,205,698,799	\$137,125,100	\$1,342,823,899
Matanuska-Susitna Borough	\$8,970,380,541	\$55,474,108	\$9,025,854,649
North Slope Borough	\$808,535,066	\$260,488,374	\$1,069,023,440
Petersburg Borough	\$317,225,474	\$0	\$317,225,474
Sitka City & Borough	\$1,016,704,300	\$57,307,441	\$1,074,011,741
Municipality of Skagway	\$338,576,381	\$0	\$338,576,381
Wrangell City & Borough	\$147,125,567	\$0	\$147,125,567
Yakutat City & Borough	\$46,393,389	\$0	\$46,393,389
(Approximate) TOTALs	\$66,556,582,582	\$4,249,488,068	\$73,806,070,750

*Assessed Values from Municipality Property Taxes, 2017.

Source: DCCED



8.3. ALASKA RISK MAP

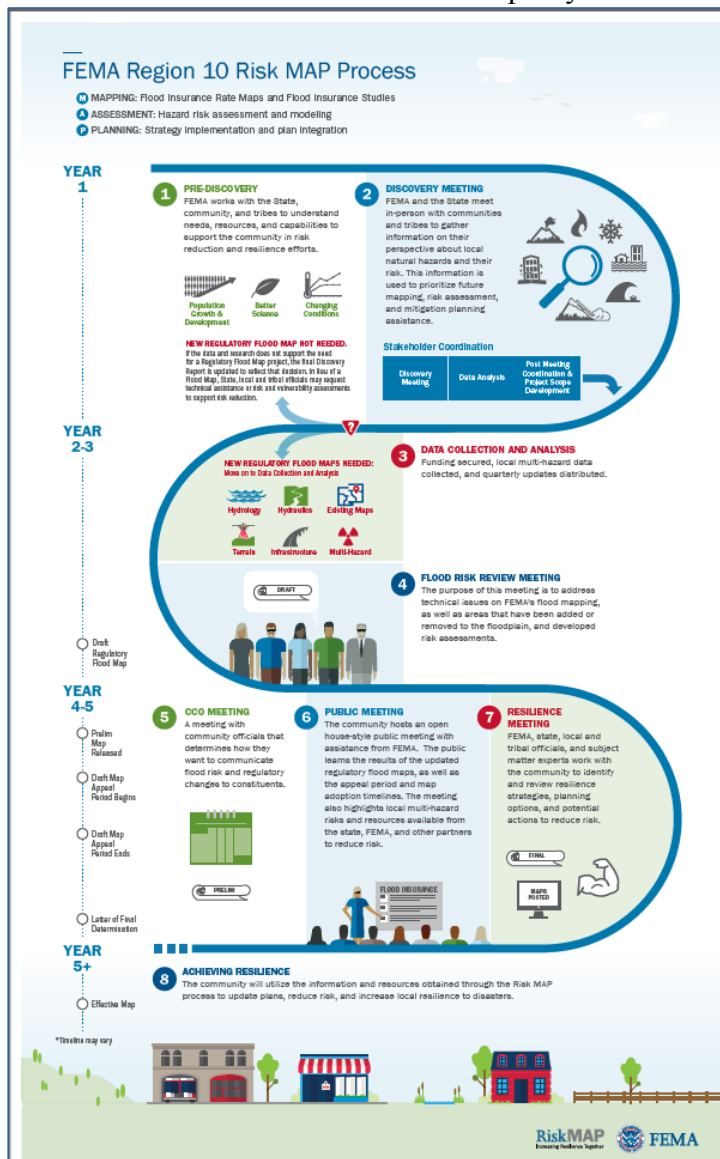
FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Program, integrates mapping, assessment, and planning. Alaska's DCRA staff manages the Risk MAP Program's Mapping Business Plan (MBP) via a Cooperating Technical Partnership (CTP) Agreement with FEMA. The MBP outlines the strategy that FEMA and the State intend to use during future map update efforts. For example, FEMA's additional work in the municipality of Anchorage and the city of Seward's alluvial fan study.

The program provides communities with flood and other hazard information, risk assessment tools, and outreach support to increase local understanding of risk, inform community decisions regarding, and ultimately lead to local actions that will reduce risk. The goal is to increase community resilience to natural hazards.

Risk MAP is a continuing, collaborative partnership to help federal, state, tribal, and local community officials, business owners, private citizens, and stakeholders make sound floodplain management decisions focused on taking action to reduce flood and other hazard's risks.

Risk MAP integrates and aligns with other FEMA mitigation and risk analysis programs, such as the Multi-Hazard Mitigation Planning and National Flood Insurance Program (NFIP) to create an effective, community-based strategy.

The graphic illustrates the Risk MAP Process from discovery through resilience. For more information on each step of the Risk MAP process, please visit the Risk MAP Process story map webpage (https://www.commerce.alaska.gov/web/Portals/4/pub/R10_Risk_MAP_Process_Graphic.pdf).



8.3.1. ALASKA'S RISK MAP STRATEGY

The Alaska Mapping Business Plan: Integrating Mapping, Assessment, and Mitigation Planning comprehensively evaluates the status of Alaska's flood maps, setting priorities for future

mapping and risk assessment, and outlining a collaborative relationship with FEMA to fully execute the Risk MAP strategy for the benefit of Alaska's communities, local governments, tribal entities, and residents. The purpose of the Alaska Mapping Business Plan is to provide FEMA with Alaska's strategy for local government participation in the Risk MAP Program.

Imminently-Threatened Alaska Native Communities

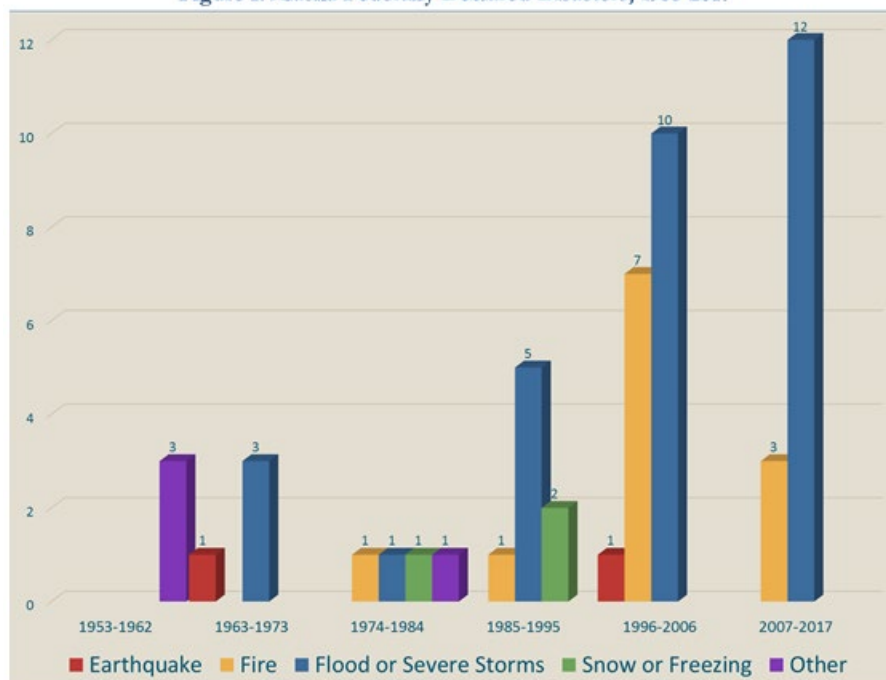
In 2017, a new focus of Alaska's Risk MAP Program was developed to provide assistance to Alaska Native villages threatened by flooding, erosion, and permafrost degradation. This effort will initially focus on the 31 communities identified as imminently threatened in the 2009 U.S. Government Accountability Report, *Alaska Native Villages: Limited Progress Has Been Made on Relocating Villages Threatened by Flooding and Erosion* (GAO-09-551, June 3, 2009).

DCRA will continue to work with other state and federal agencies, private sector organizations, non-profit entities, tribes and local governments to develop a strategy that will bring Risk MAP resources and tools of to the communities who most need this assistance.

The DCRA provides the following information pertaining to this new effort:

Over the last several decades, the number of presidentially-declared disasters in Alaska has increased dramatically, as illustrated in Figure 1, below. The majority of these disasters are caused by flooding associated with severe storms.

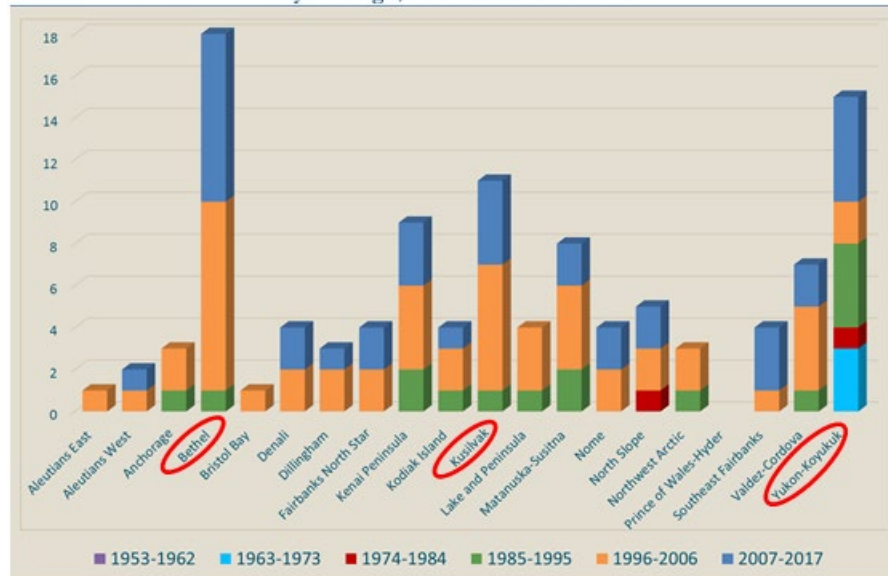
Figure 1: Alaska Federally Declared Disasters, 1953-2017



Most of these events have occurred in the Bethel, Kusilvac and Yukon-Koyukuk census areas (see Figure 2 [below]). These census areas are comprised of small, remote, predominantly Alaska Native communities. The communities are especially vulnerable because all three census areas are part of Alaska's vast unorganized borough where there is no borough form of government to provide services and other resources to address disaster events. Only 9 of the 87 Alaska Native villages within these two census areas participate in the National Flood Insurance Program (NFIP). Nearly half of the villages within these census areas are ineligible to participate in the NFIP because they are not incorporated municipalities. Storm events are increasingly putting these

communities at risk to loss of life and property. Recent studies indicate that the frequency and intensity of these storms is likely to increase, especially in western Alaska.

Figure 2: Alaska Federally-Declared Disasters, Floods or Storms,
By Borough/Census Area 1953-2017



State and Federal agencies have been concerned about the impact of flooding and other natural hazards on the safety and viability of Alaska Native communities for some time. Several key observations and needs have been identified through these efforts:

- *Assistance to imperiled communities should be based on a fair and defensible methodology which prioritizes communities by level of threat and need*
- *The community must be a key player in the decision-making process*
- *Imperiled communities (and the agencies assisting them) need quantifiable data from which to make informed decisions*
- *A coordinated, interdisciplinary approach to address community threats is essential to increasing community resilience*

A briefing paper prepared by the State of Alaska Risk MAP Coordinator, "[Risk Mapping, Assessment and Planning: Assisting Alaska Native Villages](#)," summarizes these efforts and looks at ways in which the tools, resources, and technical assistance offered through FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Program could enhance local understanding of risk in Alaska Native villages and inform local decisions to take action to increase disaster resilience in these communities.

"Understanding risk and having reliable data from which to make informed decisions to take action to reduce or mitigate risk is crucial to community-driven efforts to increase disaster resilience.

Developing a Risk MAP Strategy to Assist Imminently-Threatened Alaska Native Villages

A community does not have to participate in the National Flood Insurance Program (NFIP) to be involved in the Risk MAP Program. Although the regulatory products of the Risk MAP Program, Flood Insurance Studies and Flood Insurance Rate Maps apply to NFIP-participating communities, many of Risk MAP's non-regulatory tools and products can be of great benefit to non-NFIP communities who are dealing with the impacts of natural hazards and environmental change. Below is a summary of what the Risk MAP process might look like for these communities:

Pre-Discovery

FEMA and the State will work with the Alaska Native village to understand the needs, resources, and capabilities to support the community in risk reduction and resilience efforts. Ideally, the Risk MAP process would be tied with the Hazard Mitigation Planning update process. The Data Collection and Analysis Phase will begin prior to the Discovery Meeting and continue afterwards once the needs of the village are identified (see Post-Discovery Data Collection and Analysis, below).

Discovery Interview

A telephone interview will be conducted with various stakeholders (regional, state, federal) to share current information, current and past projects, historical knowledge, and to identify who the best people are to attend the in-person Discovery meeting.

Discovery Meeting

The State Risk MAP Coordinator and a few key stakeholders will conduct an in-person Discovery meeting in the village. The purpose of the Discovery Meeting is to gather information on the community's perspective about local natural hazards and their risk. This information will be used to prioritize risk and vulnerability assessment and mitigation planning assistance.

Considerations for the meeting include:

- Need for interpreter in villages where English is the second language*
- Number of stakeholders attending (We don't want to outnumber attendees)*
- Culturally-appropriate ways to present information*
 - Community gathering/potluck*

*(*see Discovery Report suggestion under Risk MAP Products and Tools, below)*

Post-Discovery Coordination and Project Scope Development

This will be a collaborative effort to identify how we can meet the community's resilience needs and how we can align FEMA's effort with other ongoing efforts.

Post-Discovery Data Collection and Analysis

During this phase of the project, funding will be secured, local multi-hazard data will be collected, and risk and vulnerability assessments will be conducted to evaluate the nature, immediacy, probability, and severity of each hazard.

Data Collection and Analysis will be a collaborative effort between a number of stakeholders in order to meet the community's resilience needs. The discussion should include:

- Ways to incorporate local/traditional knowledge with science*
- How to incorporate local observation as part of the process. Both the Alaska Native Tribal Health Consortium and the Alaska Division of Geological and Geophysical Surveys have local observer efforts and there is real value in training local observers to document change throughout the study process.*

Risk MAP Products and Tools

Discovery Report: a supplement to the report would be more helpful for many communities. DCRA has found that providing a map-sized document which can be hung in a public space, allowing community residents to gather and discuss is often more useful than a multipage report. The traditional Discovery Report could still be prepared to meet the needs of agencies. An example of a translated document can be found here: https://silverjacketsteam.nfrmp.us/LinkClick.aspx?fileticket=6b_0S-nFCso%3d&portalid=0

Resilience Meeting

The Resilience Meeting provides the community with the opportunity to meet with subject matter experts to discuss how the information, tools, and products of the Risk MAP process can be used to inform future planning efforts, reduce risk, and increase local resistance to disaster. A decision on next-steps to implement resilience actions is key to this meeting.

As with the Discovery Meeting, it may be necessary to have an interpreter and to hold the meeting in a community gathering/potluck format. Use of visuals outlining next steps (that can be left in the community) are helpful.

Please visit the Imminently-Threatened Alaska Native Village story map webpage for more information:

(<https://www.commerce.alaska.gov/web/dcra/PlanningLandManagement/RiskMAP/Imminently-ThreatenedAlaskaNativeVillages.aspx>).” Source: DCRA, 2018

Mapping Studies in Alaska

Ten municipalities (cities and boroughs) have ongoing Risk MAP studies. Five municipal Risk MAP studies have resulted in Preliminary Flood Insurance Rate Maps (FIRMs), one study is in the resilience phase, one is in the draft work map phase, five projects are in the discovery phase, and two have been completed. Current Risk MAP Study locations in Alaska include (Table 8-7):

Table 8-7 Alaska Risk Map Program – Jurisdictional Status

Jurisdiction	Status
Municipality of Anchorage	Resilience Phase; In-Progress
Fairbanks North Star Borough	Draft Work Map Phase;
City and Borough of Juneau	Preliminary Map Phase
Kenai Peninsula Borough	Complete
Ketchikan Gateway Borough	Preliminary Map Phase
City of Cordova	Complete
City of Aniak	Discovery Phase
City of Bethel	Discovery Phase
City of Emmonak	Discovery Phase
City of Kotzebue	Discovery Phase
City of Kwethluk	Discovery Phase
Matanuska-Susitna Borough	Preliminary Map Phase
City and Borough of Sitka	Preliminary Map Phase
City of Valdez	Preliminary Map Phase

Source: DCCED/DCR 2018

8.4. NATIONAL FLOOD INSURANCE PROGRAM PARTICIPATION

This section estimates the number and type of structures at risk to repetitive flooding: properties that have experienced repetitive loss (RL), the flood depth extent, and damage potential.

Alaska's NFIP activities include:

- National Flood Insurance Program Participation
 - Repetitive Loss Properties
 - Community Rating System (CRS)

DMA 2000 requirements and implementing state governance regulations for addressing repetitive loss RL and Severe Repetitive Loss (SRL) properties include:

DMA 2000 Requirements	
STANDARD STATE, Repetitive Loss (RL) Strategy	
RL1.	Did Element S6 (risk assessment) address RL and SRL properties? [44 CFR §§201.4(c)(2)(ii), 201.4(c)(2)(iii), and 201.4(c)(3)(v)]
RL2.	Did Element S8 (mitigation goals) address RL and SRL properties? [44 CFR §§201.4(c)(3)(i) and 201.4(c)(3)(v)]
RL3.	Did Element S9 (mitigation actions) address RL and SRL properties? [44 CFR §§201.4(c)(3)(iii) and 201.4(c)(3)(v)]
RL4.	Did Element S10 (funding sources) address RL and SRL properties? [44 CFR §§201.4(c)(3)(iv) and 201.4(c)(3)(v)]
RL5.	Did Element S13 (local and tribal, as applicable, capabilities) address RL and SRL properties? [44 CFR §§201.4(c)(3)(ii) and 201.4(c)(3)(v)]
RL6.	Did Element S15 (prioritizing funding) address RL and SRL properties? [44 CFR §§201.4(c)(4)(iii) and 201.4(c)(3)(v)]
Source: FEMA, March 2015.	

There are nine boroughs with 33 NFIP participating communities as listed in Table 8-8, NF Jurisdictions

Table 8-8 NFIP Participating Jurisdictions

Alaska Boroughs	Participating Communities
Municipality of Anchorage (MOA):	Includes: Municipality of Anchorage, Chugiak, Eagle River, Girdwood, Eklutna, and Vicinity
Fairbanks North Star Borough (FNSB)	Includes: City of Fairbanks and Vicinity & North Pole
City and Borough of Juneau (CBJ)	Includes City of Douglas
Kenai Peninsula Borough (KPB)	Includes: Kachemak, Seldovia, Seward, and SBCFSA
Ketchikan Gateway Borough (KGB)	Includes: City of Ketchikan and Saxman
Lake & Peninsula Borough (LPB)	Includes: Chignik, Egegik, Nondalton, Pilot Point, Port Heiden
Matanuska-Susitna Borough (MSB)	Includes the incorporated areas of the cities of Houston, Palmer and Wasilla and Talkeetna
Northwest Arctic Borough (NWAB)	Includes: Ambler, Buckland, Deering, Kiana, Kobuk, Noorvik, Selawik, and Shungnak) and Cities of Kivalina and Kotzebue
City and Borough of Sitka	Includes: City and Borough of Sitka

FEMA's National Flood Insurance Program's Community Status Book Report lists Alaska's NFIP participating communities and their respective programmatic participation details (Figures 8-1, 8-2, and 8-3)

Federal Emergency Management Agency Community Status Book Report ALASKA Communities Participating in the National Flood Program							
CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date	Tribal
020005#	ANCHORAGE, MUNICIPALITY OF INCLUDES CHUGIAK, EAGLE RIVER, GIRDWOOD, EKLUTNA, AND THE HISTORIC CITY & BOROUGH OF ANCHORAGE.	ANCHORAGE MUNICIPALITY	06/09/70	09/05/79	09/25/09	09/05/79	No
020033#	ANIAK, CITY OF	BETHEL CENSUS AREA	09/05/78	04/02/90	09/29/08	04/02/90	No
020104#	BETHEL, CITY OF	BETHEL CENSUS AREA	06/28/74	03/18/76	09/25/09	03/18/76	No
020037A	CORDOVA, CITY OF	VALDEZ-CORDOVA CENSUS AREA	05/24/77	04/02/79	12/18/15	04/02/79	No
020041#	DILLINGHAM, CITY OF	DILLINGHAM CENSUS AREA	05/31/74	09/30/82	09/30/82	09/30/82	No
020125#	EMMONAK, CITY OF	WADE HAMPTON CENSUS AREA		09/21/98	09/25/09	09/21/98	No
025009#	FAIRBANKS NORTH STAR BOROUGH INCLUDES CITY OF FAIRBANKS & VICINITY & NORTH POLE	FAIRBANKS NORTH STAR BOROUGH		08/25/99	03/17/14	05/15/70	No
020045#	FORT YUKON, CITY OF	YUKON-KOYUKUK CENSUS AREA		02/03/10	02/03/10	02/03/10	No
020124#	GALENA, CITY OF	YUKON-KOYUKUK CENSUS AREA	10/12/82	03/01/84	03/01/84	03/01/84	No
020007	HAINES BOROUGH NOW INCLUDES THE DEFUNCT COMMUNITY OF HAINES CITY OF AS OF 10/17/2002. ON 9/1/2004 THE BOROUGH ADOPTED FHBM OF AUGUST 22, 1975 INITIALLY DEVELOPED FOR THE CITY OF HAINES WHICH WAS SUBSEQUENTLY CONVERTED TO A FIRM BY LETTER.	HAINES BOROUGH	05/31/74	05/01/87	05/01/87(L)	02/02/05	No
020107B	HOMER, CITY OF	KENAI PENINSULA BOROUGH	05/19/81	08/18/99	10/20/16	08/02/03	No
020049#	HOONAH, CITY OF	SKAGWAY-HOONAH- ANGOON CENSUS A	08/07/74	04/02/79	08/04/10	04/02/79	No
020009#	JUNEAU, CITY AND BOROUGH OF INCLUDES THE CITY OF DOUGLAS.	JUNEAU CITY AND BOROUGH	05/20/77	02/04/81	08/19/13	02/04/81	No
020012B	KENAI PENINSULA BOROUGH INCLUDES THE CITIES OF SELDOVIA AND KACHEMAK.	KENAI PENINSULA BOROUGH		05/19/81	10/20/16	11/20/88	No
020003#	KETCHIKAN GATEWAY BOROUGH INCLUDES THE CITIES OF KETCHIKAN AND SAXMAN	KETCHIKAN GATEWAY BOROUGH	05/09/78	04/18/90	04/18/90	04/18/90	No
020059#	KOTZEBUE, CITY OF	NORTHWEST ARCTIC BOROUGH	08/21/74	07/18/83	07/18/83	07/18/83	No
020127	KOYUKUK, CITY OF	YUKON-KOYUKUK CENSUS AREA				01/15/02(E)	No
020130	KWETHLUK, CITY OF	BETHEL CENSUS AREA				10/28/99(E)	No
025063#	LAKE AND PENINSULA BOROUGH	LAKE AND PENINSULA BOROUGH		02/03/10	02/03/10	02/03/10	No
020021#	MATANUSKA-SUSITNA, BOROUGH OF INCLUDES THE INCORPORATED AREAS OF THE CITIES OF HOUSTON, PALMER AND WASILA.	MATANUSKA-SUSITNA BOROUGH	02/28/78	05/01/85	03/17/11	05/01/85	No
020128#	MCGRATH, CITY OF	YUKON-KOYUKUK CENSUS AREA		10/04/11	10/04/11	10/04/11	No
025010#	NENANA, CITY OF	YUKON-KOYUKUK CENSUS AREA		08/09/72	04/07/99	08/09/72	No
020089#	NOME, CITY OF	NOME CENSUS AREA	06/28/74	09/01/83	05/03/10	09/01/83	No
020121	NORTHWEST ARCTIC BOROUGH	NORTHWEST ARCTIC BOROUGH				05/17/05(E)	No
020074#	PETERSBURG, CITY OF	WRANGELL-PETERSBURG CENSUS ARE	08/14/74	08/01/82	08/01/82	08/01/82	No

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Figure 8-1 Alaska NFIP Participation Status as of April 2018 Source: NFIP 2018



Federal Emergency Management Agency Community Status Book Report ALASKA Communities Participating in the National Flood Program							
CID	Community Name	County	Init FHB Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date	Tribal
020113B	SEWARD, CITY OF THE CITY OF SEWARD HAS ADOPTED THE KENAI PENINSULA BOROUGH (020012) FIRM.	KENAI PENINSULA BOROUGH		05/19/81	10/20/16	11/20/86	No
020084#	SHISHMAREF, CITY OF	NOME CENSUS AREA		05/03/10	05/03/10	08/23/01	No
020006#	SITKA, CITY AND BOROUGH OF	SITKA CITY AND BOROUGH	08/28/74	08/01/82	09/29/10	06/01/82	No
025011	SKAGWAY, CITY OF	SKAGWAY-HOONAH- ANGOON CENSUS A	09/09/70	03/01/77	03/01/77	03/01/77	No
020090#	TOGIAK, CITY OF	DILLINGHAM CENSUS AREA	05/10/77	02/03/10	02/03/10	05/21/09	No
020094#	VALDEZ, CITY OF	VALDEZ-CORDOVA CENSUS AREA	11/01/74	09/03/80	12/01/83	09/03/80	No
Summary:							
Total In Flood Program			31				
Total In Emergency Program			3				
Total In the Regular Program			28				
Total In Regular Program with No Special Flood Hazard			0				
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Figure 8-2 Alaska NFIP Participation Status as of April 2018 Source: NFIP 2018

Federal Emergency Management Agency Community Status Book Report ALASKA Communities Not in the National Flood Program							
CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Sanction Date	Tribal
020040#	DELTA JUNCTION, CITY OF	SOUTHEAST FAIRBANKS CENSUS ARE	10/25/77	09/18/82	09/18/82	02/01/16(W)	No
020114B	KENAI, CITY OF FORMERLY PARTICIPATED UNDER THE BOROUGH OF KENAI PENINSULA'S APPLICATION. CURRENTLY NOT PARTICIPATING IN THE NFIP. FAILED TO ADOPT REQUIRED MEASURES.	KENAI PENINSULA BOROUGH	08/14/74	05/19/81	10/20/16	06/14/75	No
020014#	SOLDOTNA, CITY OF	KENAI PENINSULA BOROUGH	08/14/74	12/08/99	12/08/99	06/14/75	No
020098#	WRANGELL, CITY AND BOROUGH OF	WRANGELL-PETERSBURG CENSUS ARE	08/28/74	08/15/82	08/15/82	06/15/82(S)	No
Summary:							
Total Not in Flood Program			4				
Total Suspended from Emergency Program			0				
Total Suspended from Regular Program			1				
Total Withdrawn Communities Not In Program			1				
Total Not In Program With Hazard Area Identified			4				
Total Not In Program With Hazard Area Identified < 1 Year			0				
Legend:							
(E) Indicates Entry In Emergency Program							
NSFHA No Special Flood Hazard Area - All Zone C							
(>) Date of Current Effective Map is after the Date of This Report							
N/A Not Applicable At This Time							
(S) Suspended Community							
(W) Withdrawn Community							
(M) No Elevation Determined - All Zone A, C and X							
(L) Original FIRM by Letter - All Zone A, C and X							

Figure 8-3 Alaska NFIP Participation Status as of April 2018 Source: NFIP 2018



Community Rating System

The NFIP provides opportunities for jurisdictions to voluntarily participate in the Community Rating System (CRS). The 2018 Flood Insurance Manual describes the CRS and summarizes a few of its benefits as follows:

The Community Rating System (CRS) is a voluntary program for National Flood Insurance Program (NFIP) participating communities. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management.

The CRS has been developed to provide incentives in the form of premium discounts for communities to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding.

TABLE 2. CRS PREMIUM DISCOUNTS

Rating	Percentage (%)	Rating	Percentage (%)
1	45%	6	20%
2	40%	7	15%
3	35%	8	10%
4	30%	9	5%
5	25%	10	0%
SFHA (Zones A, AE, A1–A30, V, V1–V30, AO, and AH): Discount varies depending on class. SFHA (Zones A99, AR, AR/A, AR/AE, AR/A1–A30, AR/AH, and AR/AO): 10% discount for Classes 1–6; 5% discount for Classes 7–9.* Non-SFHA (Zones B, C, X, D): 10% discount for Classes 1–6; 5% discount for Classes 7–9.			

* In determining CRS Premium Discounts, all AR and A99 Zones are treated as non-SFHAs.

Source: FEMA FIM 2018, <https://www.fema.gov/media-library/assets/documents/162601>

The following jurisdictions participate in the Community Rating System and receive applicable flood insurance discounts (Table 8-9).

Table 8-9 Community Rating System Eligible Communities

Effective May 1, 2018

State	CID	Community Name	CRS Entry Date	Current Effective Date	Current Class	Discount (%)	Discount For Non-SFHA ¹ (%)	Status ²
AK	020005	Anchorage, Municipality of	10/1/95	10/1/09	6	20	10	C
AK	020107	Homer, City of	05/1/16	05/1/16	8	10	5	C
AK	020012	Kenai Peninsula, Borough of	05/1/00	05/1/00	8	10	5	C
AK	020003	Ketchikan Gateway Borough	10/1/05	05/1/16	10	0	0	R
AK	020069	Nome, City of	10/1/05	10/1/16	9	5	5	C
AK	020113	Seward, City of	10/1/05	10/1/16	9	5	5	C
AK	020094	Valdez, City of	10/1/92	10/1/14	9	5	5	C
1. For the purpose of determining CRS discounts, all AR and A99 Zones are treated as non-SFHAs. 2. Status: C = Current, R = Rescinded.								



8.4.1. REPETITIVE LOSS PROPERTIES

Repetitive loss properties are properties that have had at least two \$1,000 claims within any 10-year period since 1978. Severe repetitive loss properties have experienced four or more separate building and content claims since 1978 each exceeding \$5,000 with cumulative claims exceeding \$20,000; or at least two separate building claims with cumulative losses exceeding the value of the main living structure.

Due to limited FEMA funding, there are very few of Alaska communities with Flood Insurance Rate Maps (FIRMs) (Figures 8-1, 8-2, & 8-3). Therefore, the majority of Alaska's flood-prone communities do not participate in the NFIP, many do not have a repetitive flood property inventory that meets NFIP criteria as the loss thresholds are substantially below FEMA values, nor do they have any historical flood hazard maps or funding to create them.

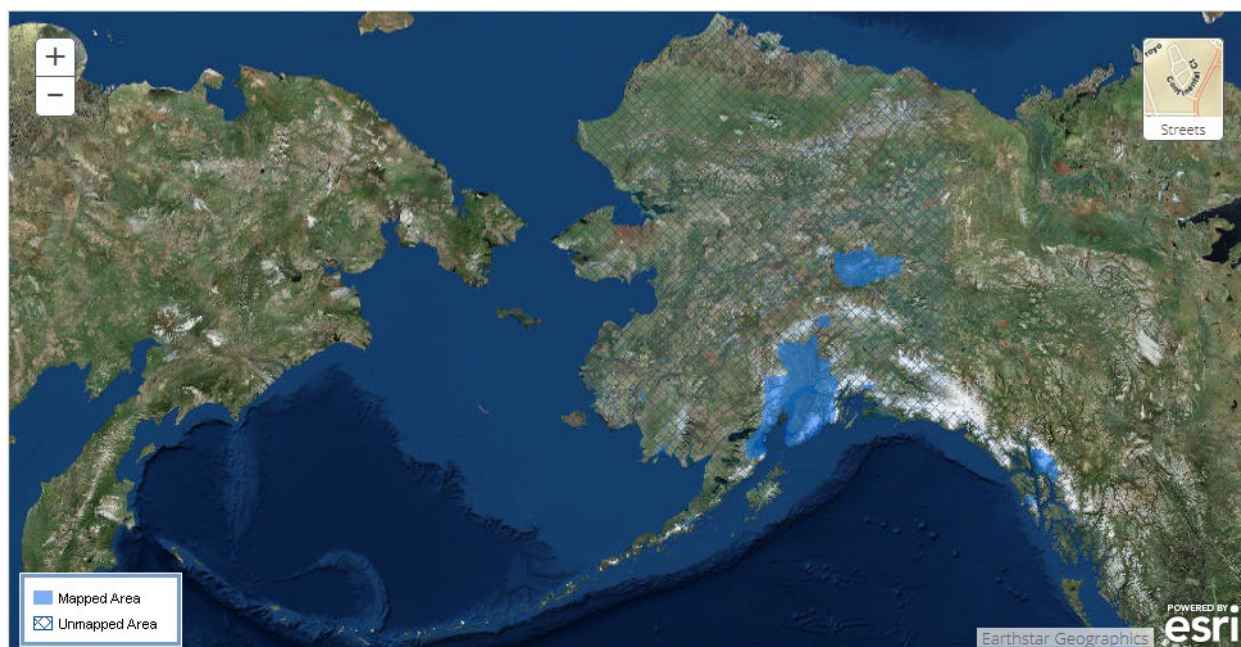


Figure 8-4 Alaska's Mapped NFIP locations (Blue Shaded Areas) Source: FEMA 2018

8.4.2. REPETITIVE LOSS AND SEVERE REPETITIVE LOSS FUNDING OPPORTUNITIES

There are numerous repetitive flood properties and damage claims within Alaska NFIP participating communities as noted in Table 8-10. These data reflect 2017 federally declared flood disasters, as well as additional best available data. Applicants can file for NFIP damage claims based on their community's status and whether the individual home or facility owner is eligible to participate.

Table 8-10 Repetitive Flood Claim (RFC) Communities

Area	Community	Total Payments (\$)	Losses	Properties	As of Date
Municipality of Anchorage	Municipality of Anchorage	19,801.06	4	2	05/31/2018
Bethel Census Area	City of Aniak	161,072.58	14	5	05/31/2018
Bethel Census Area	City of Bethel	21,040.18	3	1	05/31/2018

Table 8-10 Repetitive Flood Claim (RFC) Communities

Area	Community	Total Payments (\$)	Losses	Properties	As of Date
Bethel Census Area	City of Kwethluk	14,600.57	2	1	05/31/2018
Fairbanks North Star Borough	Fairbanks North Star Borough	900,177.78	52	19	05/31/2018
Juneau Borough	City and Borough of Juneau	270,393.58	9	2	07/30/2018
Kenai-Cook Borough	Kenai Peninsula Borough	127,304.44	12	6	07/30/2018
Nome Census Area	City of Nome	80,930.85	6	3	07/30/2018
Valdez Cordova Census Area	City of Valdez	34,859.96	3	1	07/30/2018

Future SHMP updates will strive to obtain more comprehensive property loss information to facilitate updating Table 8-11 and the Mitigation Strategy to garner additional NFIP and Community Rating System (CRS) benefits.

NFIP RL/SRL Program Challenges

There are only 33 jurisdictions that participate in the NFIP. All of which qualify for FMA's RL/SRL repetitive loss funding. However that is only 33 of Alaska's 184 flood threatened communities.

The remaining 151 communities do not have repetitive loss property inventories that meet FEMA NFIP standards, flood insurance study (FIS) based flood hazard maps, or FEMA, USACE, NRCS or other agency sponsored flood impact studies and are therefore ineligible for most agency funding. Severely flood threatened communities cannot even apply for nationally competitive PDM grants because they do not participate in the NFIP.

The only potential funding sources for repetitive flood impact locations comes from the state's federal declared disaster sponsored HMGP opportunities.

State NFIP Goals Going Forward

- The State NFIP Coordinator has an essential role in this collaborative effort by:
- Guiding and coordinating effort to address the RL and SRL properties challenges by working with the communities that have these properties and helping them to prioritize desired remediation practices. This would assist those properties that are most in need. Those property owners have the least ability to address needed property remediation.
- Helping each community to identify their RL/SRL properties within their hazard mitigation plan.
- Encouraging each NFIP participating community to identify their RL/SRL properties as they are the ones who are able to obtain specific property information.
 - Assisting communities with reducing repetitive property losses through structure acquisition, elevation, or relocation.
 - Developing strategies to assist these communities with applying for grants.

Regional Cooperative Assistance Opportunities

NORFMA is a nonprofit organization for regional networking and support on issues of environmental quality, economic sustainability, and scientific discovery on a watershed basis.

NORFMA provides a channel for regional communication and cooperation for all Alaska, Idaho, Oregon, Washington, and British Columbia, Canada's floodplain managers.

NORFMA's mission is to:

- Provide for free exchange of ideas and information among members.
- Support the integration of multi-disciplinary programs and interests in floodplain management.
- Promote educational programs on floodplain and water shed management topics.
- Increase public awareness of the value and function of floodplains.
- Encourage government involvement in programs to reduce flood damages and to protect, manage, and restore floodplains.

8.5. VULNERABILITY ASSESSMENT METHODOLOGY

A worst case exposure analysis was conducted using GIS. The project team gathered data from SHMP participating agencies such as the AVO, DGGs, DOT, AICC, and others. Infrastructure values were totaled for each affected borough or REAA. This analysis is a simplified potential hazard risk assessment without considering recurrence probability or damage level.

The methodology used a two-pronged effort. First, the project team, State, and participating agencies compiled critical facility inventory for potential hazard threat exposure and vulnerability analysis. Second, these data were used to develop a relevant location vulnerability assessment for those facilities.

For example, the following process was used to define potential volcanic ash impacts throughout the state:

To analyze the volcanic ashfall hazard, the state was divided into 10km grids. Each grid was given a score for historic ashfall event frequency and a score for their proximity to volcanos. These two scores were totaled for each grid square resulting in a hazard score.

Therefore: $X+Y=Z$

"X" represents the value given for the total number of historic ashfall events within each 10km square.

If 0-4 events, $X = 0$

If 5-9 events, $X = 1$

If 10-13 events, $X = 2$

"Y" represents the value given based on each 10km square's proximity to historically active Volcanos (ash producing or not).

If no volcano is within 100km, $Y = 0$

If a volcano is within 100km, but has no confirmed or questionable historical ash producing eruption, $Y = 0$

If a volcano is within 100km, and has a questionable historical ash producing eruption account, $Y = 1$

If a volcano is within 100km, and has a confirmed historical ash producing eruptions, $Y = 2$

Note: *If a grid square is within 100km of an ash producing volcano and a non-ash producing volcano, the higher score was given.*

"Z" represents the calculated hazard score of $X+Y$ for each 10km grid square.

If $Z = 0$, Hazard is Low

If $Z = 1$, Hazard is Low-Moderate

If $Z = 2$, Hazard is Moderate

If $Z = 3$ or 4 , Hazard is High



In summary the Ash hazard level is based on the proximity to ash producing, historically active volcanos and the frequency of historic ashfall events across the state. Source DGGS and AECOM 2018

Volcano Ash Frequency Data Recode	Recode ash frequency (historic ashfall events) key to: 0-4 = 0 5-9 = 1 10-13 = 2
Volcano Ash Data Recode	Ash Recode + Volcano Recode = Hazard Score: 0 = Low 1 = Low-Moderate 2 = Moderate 3 and 4 = High
Volcano Presence Recoding	0 = No volcano within 100km = 0 0 = No confirmed or questionable historical eruption with ash cloud within 100km 1 = Questionable historical eruption account that mentions ash cloud within 100km 2 = Confirmed historical eruptions with ash cloud production within 100km

8.5.1. DATA LIMITATIONS

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in risk approximations. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment as well as the use of approximations and simplifications that are necessary for comprehensive spatial analyses.

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, critical facilities, and infrastructure to the identified hazards. It was beyond the scope of this SHMP to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future SHMP updates.

8.5.2. VULNERABILITY EXPOSURE ANALYSIS

The SHMP's GIS vulnerability assessment is based on the following parameters (Table 8-11):

Table 8-11 GIS-based Exposure Analysis Assumptions

Hazard	Severity / Description Determination
Cryosphere: Glacier	DGGS identified potential glacier hazard risk zones as any flowline, area, or waterbody (as defined by the National Hydrography Dataset, www.usgs.gov/core-science-systems/ngp/national-hydrography/access-national-hydrography-products) within 1 km (0.62 mi) of a glacier (as defined by the Randolph Glacier Inventory 5.0, www.glims.org/RGI/randolph50.html).
Cryosphere: Avalanche	DGGS identified Potential Release Areas (PRAs) using a digital surface model as input and modeled based on geostatistical parameters (elevation, slope, and curvature) and land cover overlay (excluding conifer forest). Therefore, avalanche high risk will occur from slope grades spanning from 28 to 60 degrees on non-evergreen vegetated slopes.
Cryosphere/ Ground Failure: Permafrost	No risk along with low, moderate, and high risk categories are based on the likelihood of permafrost degradation as a function of permafrost distribution (extent), soil texture, ground ice volume, current modeled mean annual ground surface temperature, and year 2040 modeled change in active layer thickness (seasonally thawed surface layer above permafrost) (based on data from

Table 8-11 GIS-based Exposure Analysis Assumptions

Hazard	Severity / Description Determination
	Jorgenson and others, 2008; and Denali Commission Threat Assessment & UAF, 2018). See Table 8-12 and Table 8-13.
Earthquake	Ground Motion expressed as a percentage of gravitational (%g) forces Moderate Shaking : 3.9-9.2 (%g) Strong Shaking: 9.2-18 (%g) Very Strong + Shaking: >18 (%g)
Coastal Flooding	AECOM used 0.5 mile buffer along DGGS identified coastal flood threatened communities (based on data from USACE, GAO, IAWG)
Coastal Erosion	USACE identified coastal erosion threatened communities
Riverine Flooding	USACE and DGGS identified riverine flood threatened communities (based on data from USACE, GAO, NOAA-NWS)
Ground Failure Landslide	DGGS identified one category: slopes over 28° AECOM added a 0.5 mile buffer to simulate release downslope runout/washout areas
Volcanic Ash	Classification number 1, 2, 3 represents (Event Frequency) + (Proximity to historically active ash volcanoes)
Tsunami	AECOM assessed USACE and DGGS identified tsunami threatened community areas spanning from sea level to approximately 100ft elevation
Weather	All Alaska population and infrastructure is vulnerable to weather impacts

Permafrost analysis assumptions and detailed parameters are listed in Table 8-12. Scores of 0–3 were tallied from all five input parameters to arrive at a total Permafrost Risk Level; risk level scoring schema is shown in Table 8-13.

Table 8-12 Permafrost Data and Risk Analysis Parameters

Score	Jorgenson PF_EXTENT	Jorgenson TEXTURE	Jorgenson ICECLOWASS	MAGST	Active Layer Thickness Change (ALTC)
0	G, U, W	Ice, Water	Glacier, Unfrozen	no permafrost, based on Jorgenson dataset	no permafrost, shown as no data in ALTC dataset
1	I	Rocky	Low	< -5 degrees C	0.0 to 0.05 m
2	D, S	Sandy	Moderate, Variable	-5 to -2 degrees C	> 0.05 m
3	C	Silty	High	> -2 degrees C	Permafrost disappears, shown as -9999 in ALTC dataset
Source Data: <ul style="list-style-type: none"> Jorgenson and others, 2008 •Mean Annual Ground Surface Temperature (MAGST) (Data source: Denali Commission Threat Assessment, & UAF, 2018) 2040 Projected Active Layer Thickness Change (ALTC) (Data source: Denali Commission Threat Assessment, & UAF, 2018) 			Acronyms: PF-EXTENT: Permafrost extent C: Continuous permafrost (>90%) D: Discontinuous permafrost (50-90%) S: Sporadic permafrost (10-50%) I: Isolated permafrost (>0-10%) U: Unfrozen G: Glacier W: Water TEXTURE: General textural composition of surface deposits ICECLOWASS: Excess ice volume in top 5 m of ground <ul style="list-style-type: none"> High (>40% volume) Moderate (10-40% volume) Low (<10% volume) Variable (buried glacial ice) Unfrozen Glacier 		



Table 8-13 Permafrost Risk

Risk Level (total score)
No risk: 0
Low risk: 1-5
Moderate risk: 6-11
High risk: 12-15

Section 8.6.2 Tables 8-14 through 8-21 summarize GIS-based exposure analyses for Alaska's loss estimation. Section 8-7 provides a narrative explanation of these data results.

Table 8-14 Potential Cryosphere Hazard Exposure Analysis Population and Buildings

Hazard Type	Severity	Description	Population	Housing Units
Glacier	High	Descriptive	23,865	11,542
Avalanche	High	Slopes 28° to 60°	85,380	38,567
Ground Failure – Permafrost	Low risk: 1-5	<10% volume	119,544	53,568
	Moderate risk: 6-11	10-40% volume	249,145	102,930
	High risk: 12-15	>40% volume	115,618	49,021

Table 8-15 Potential Cryosphere Hazard Exposure Analysis – Critical Facilities (Public Statewide)

Hazard Type	Severity	Description	Government	Emergency Response	Education	Medical	Utilities
Glacier	High	Descriptive	9	5	6	4	84
Avalanche	High	Slopes 28° to 60°	20	22	23	13	200
Ground Failure – Permafrost	Low risk: 1-5	<10% volume	105	56	59	36	546
	Moderate risk: 6-11	10-40% volume	206	112	126	78	983
	High risk: 12-15	>40% volume	32	18	17	15	297

Table 8-16 Potential Cryosphere Hazard Exposure Analysis – Critical Facilities (Railroad)

Hazard Type	Severity	Description	Track Miles	Facilities
Glacier	High	Descriptive	87	3
Avalanche	High	Slopes 28° to 60°	248	5
Ground Failure – Permafrost	Low risk: 1-5	<10% volume	116	3
	Moderate risk: 6-11	10-40% volume	192	3
	High risk: 12-15	>40% volume	145	8

Table 8-17 Potential Cryosphere Hazard Exposure Analysis – Critical Facilities (DOT&PF)

Hazard Type	Severity	Description	Road Miles	Bridges	Maintenance Facilities	Airports	Ports	Harbors	Ferry Terminals
Glacier	High	Descriptive	673	164	6	10	4	7	2
Avalanche	High	Slopes 28° to 60°	4,407	285	15	12	1	5	2
Ground Failure – Permafrost	Low risk: 1-5	<10% volume	2,944	183	8	50	0	7	0
	Moderate risk: 6-11	10-40% volume	4,960	436	35	100	0	4	0
	High risk: 12-15	>40% volume	1,758	139	4	17	0	1	0



Table 8-18 Potential Hazard Exposure Analysis – Population and Buildings

Hazard Type	Severity	Description	Population	Housing Units
Earthquake	Moderate Shaking	3.9-9.2 (%g)	47,701	19,187
	Strong Shaking	9.2-18 (%g)	61,477	27,233
	Very Strong + Shaking	>18 (%g)	592,399	257,733
Flood (Coastal Storm Surge, Waves, etc.)	Descriptive	0.5 mile Buffer Along Threatened Community Coastlines	87,188	39,119
Flood (Coastal Erosion)	Descriptive	USACE Identified Threatened Community Coastlines	50,194	21,295
Flood (Riverine)	Descriptive	0.25 mile Buffer Along Threatened Community Embankments	66,315	28,241
Ground Failure: (Landslide)	Descriptive	Slopes > 28 degrees (°)	85,380	38,567
Tsunami (Seiche)	Descriptive	Sea Level to 100' Elevation	115,113	53,921
Volcano (Ash) * Table 8-12 Event frequency and proximity classification	Low-Moderate	1	132,209	65,267
	Moderate	2	396,846	159,999
	High	3	40,764	22,566
Weather: (Cold, Drought, Rain, Snow, Wind, etc.)	Descriptive	Entire State	710,047	306,973
Wildland Fire (Tundra, Interface, etc.)	Moderate	Moderate Fuel Rank	324,356	132,928
	High	High Fuel Rank	123,109	49,548
	Very High	Very High Fuel Rank	50,389	24,723
	Extreme	Extreme Fuel Rank	202,269	94,630

Table 8-19 Potential Hazard Exposure Analysis – Critical Facilities (Public Statewide)

Hazard Type	Severity	Description	Government	Emergency Response	Education	Medical	Utilities
Earthquake	Moderate Shaking	3.9-9.2 (%g)	134	74	81	40	522
	Strong Shaking	9.2-18 (%g)	229	104	121	70	892
	Very Strong + Shaking	>18 (%g)	173	142	109	87	1,268
Flood (Coastal Storm Surge, Waves, etc.)	Descriptive	0.5 mile Buffer Along Threatened Community Coastlines	187	118	88	62	700
Flood (Coastal Erosion)	Descriptive	USACE Identified Threatened Community Coastlines	256	166	129	88	1,121
Flood (Riverine)	Descriptive	0.25 mile Buffer Along Threatened Community Embankments	204	88	106	64	882
Ground Failure (Landslide)	Descriptive	Slopes >28°	20	22	23	13	200
Tsunami (Seiche)	Descriptive	Sea Level to 100' Elevation	44	31	17	14	163
Volcano (Ash) * Table 8-12 Event frequency and proximity classification	Low-Moderate	1	79	50	58	37	598
	Moderate	2	38	24	15	21	315
	High	3	54	49	27	28	350
Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Descriptive	Entire State	565	339	323	209	2,819
Wildland Fire (Tundra, Interface, etc.)	Moderate	Moderate Fuel Rank	285	165	158	108	1139
	High	High Fuel Rank	30	18	20	13	285
	Very High	Very High Fuel Rank	64	54	45	30	437
	Extreme	Extreme Fuel Rank	68	48	55	29	534

Table 8-20 Potential Hazard Exposure Analysis – Critical Facilities - Railroads

Hazard Type	Severity	Description	Track Miles	Facilities
Earthquake	Moderate Shaking	3.9-9.2 (%g)	0	0
	Strong Shaking	9.2-18 (%g)	3	0
	Very Strong + Shaking	>18 (%g)	623	13
Flood (Coastal Storm Surge, Waves, etc.)	Descriptive	0.5 mile Buffer Along Threatened Community Coastlines	38	4
Flood (Coastal Erosion)	Descriptive	USACE Identified Threatened Community Coastlines	0	0
Flood (Riverine)	Descriptive	0.25 mile Buffer Along Threatened Community Embankments	180	8
Ground Failure (Landslide)	Descriptive	Slopes >28°	248	5
Tsunami (Seiche)	Descriptive	Sea Level to 100' Elevation	4	0
Volcano (Ash) * Table 8-12 Event frequency and proximity classification	Low-Moderate	1	387	7
	Moderate	2	214	7
	High	3	0	0
Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Descriptive	Entire State	626	13
Wildland Fire (Tundra, Interface, etc.)	Moderate	Moderate Fuel Rank	141	8
	High	High Fuel Rank	139	0
	Very High	Very High Fuel Rank	119	2
	Extreme	Extreme Fuel Rank	204	2

Table 8-21 Potential Hazard Exposure Analysis – Critical Facilities – DOT&PF

Hazard Type	Severity	Description	Road Miles	Bridges	Maintenance Facilities	Airports	Ports	Harbors	Ferry Terminals
Earthquake	Moderate Shaking	3.9-9.2 (%g)	909	97	8	55	0	37	6
	Strong Shaking	9.2-18 (%g)	2,357	231	19	91	0	34	4
	Very Strong + Shaking	>18 (%g)	10,736	915	50	136	13	78	29
Flood (Coastal Storm Surge, etc.)	Descriptive	0.5 mile Buffer Along Threatened Community Coastlines	1,500	226	14	84	13	117	32
Coastal Erosion	Descriptive	USACE Identified Threatened Community Coastlines	1,760	185	20	100	7	58	19
Flood (Riverine)	Descriptive	0.25 mile Buffer Along Threatened Community Embankments	1,666	309	7	48	0	0	0
Ground Failure (Landslide)	Descriptive	Slopes >28°	4,407	285	15	12	1	5	2
Tsunami (Seiche)	Descriptive	Sea Level to 100' Elevation	351	105	3	29	9	131	39
Volcano (Ash) * Table 8-12 Event frequency and proximity classification	Low-Moderate	1	4,838	433	25	54	6	19	5
	Moderate	2	4,325	358	14	31	4	17	7
	High	3	1,552	55	7	30	2	6	2
Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Descriptive	Entire State	14,108	1,245	78	294	13	149	39
Wildland Fire (Tundra, Interface, etc.)	Moderate	Moderate Fuel Rank	7,193	820	70	173	2	68	17
	High	High Fuel Rank	1,710	88	2	24	0	8	1
	Very High	Very High Fuel Rank	1,705	86	3	45	0	1	1
	Extreme	Extreme Fuel Rank	3,417	161	3	22	2	0	1

8.6. EXPOSURE ANALYSIS – NARRATIVE SUMMARIES

Cryosphere Vulnerabilities

Alaska can expect to experience ever-changing effects from melting polar ice sheets, mountain glaciers, and other cryosphere hazard impacts. Global sea level rise will most likely increase as the ice continues to melt.

Based on human location and habitation, a person could experience exposure risks ranging from moderate to significant ground failure as the ground ice melts and residential and public infrastructure is negatively impacted. It is probable that Alaska residents could experience infrastructure damage and personal injury throughout the northern portions of the state where permafrost and subsurface conditions are changing. Northern hemisphere coastal residents will likely experience less sea ice and more open water, which in turn will impact their hunting and fishing subsistence capacity. The existing, transient, and future population, residential structures, critical facilities, and infrastructure are exposed to changing cryospheric impacts (Section 6.1) that potentially threaten:

“Glacier” related events

- 23,865 people in 15,542 housing units
- 9 government facilities
- 5 emergency response facilities
- 6 education facilities
- 4 medical facilities
- 673 highway/road system miles
- 164 highway/road bridges
- 6 maintenance facilities
- 10 airports
- 4 ports
- 7 harbors
- 2 ferry terminals
- 87 railroad track miles
- 3 railroad facilities
- unknown railroad bridges
- 13 railroad facilities
- 84 utilities

“High risk” avalanche risk for slope grade spanning from 28 to 60 degrees on non-evergreen vegetated slopes

- 85,380 people in 38,567 housing units
- 20 government facilities
- 22 emergency response facilities
- 23 education facilities
- 13 medical facilities
- 200 utilities
- 4,407 highway/road system miles
- 285 highway/road bridges
- 15 maintenance facilities
- 12 airports

- 1 port
- 5 harbors
- 2 ferry terminals
- 248 railroad track miles
- 5 railroad facilities
- unknown railroad bridges

Ground Failure hazards periodically cause structure and infrastructure displacement resulting from weather and changing climate influences. Alaska communities have various permafrost conditions classified as limited, discontinuous, or continuous. Permafrost degradation is sometimes coupled with high ground water and expansive soils which accelerates failure.

“Low risk” permafrost having <10 percent by volume

- 119,544 people in 53,568 housing units
- 105 government facilities
- 56 emergency response facilities
- 59 education facilities
- 48 medical facilities
- 546 utilities
- 2,944 highway/road system miles
- 183 highway/road bridges
- 8 maintenance facilities
- 50 airports
- 0 ports
- 7 harbors
- 0 ferry terminals
- 116 railroad track miles
- 3 railroad facilities
- unknown railroad bridges

“Moderate risk” permafrost having 10-40 percent by volume

- 249,145 people in 102,930 housing units
- 206 government facilities
- 112 emergency response facilities
- 126 education facilities
- 78 medical facilities
- 983 utilities
- 4,960 highway/road system miles
- 436 highway/road bridges
- 35 maintenance facilities
- 100 airports
- 0 ports
- 4 harbors
- 0 ferry terminal
- 192 railroad track miles
- 3 railroad facility
- unknown railroad bridges

“High risk” permafrost having >40 percent by volume

- 115,618 people in 6,609 housing units
- 32 government facilities
- 18 emergency response facilities
- 17 education facilities
- 15 medical facilities
- 219 utilities
- 1,758 highway/road system miles
- 139 highway/road bridges
- 4 maintenance facilities
- 17 airports
- 0 ports
- 1 harbor
- 0 ferry terminals
- 145 railroad track miles
- 8 railroad facility
- unknown railroad bridges

Similar to weather vulnerabilities, changing cryospheric conditions also vary across Alaska. For example, northern coasts experience late ice formations; some areas that formerly experienced land fast or ice locked coastlines now have open water throughout the winter. Southern Alaska (southeast, southcentral, and southwest) areas experience wetter winter weather with less snow and more rain. These conditions will negatively impact future populations, residential structures, critical facilities, and infrastructures. Therefore the entire population and infrastructure is vulnerable to recurrent cryosphere hazard impacts.

Earthquake Vulnerabilities

Alaska should expect the full spectrum of potential earthquake ground motion scenarios. Severe shaking may result in infrastructure damage that is equally as extreme. Although all structures are at some risk due to earthquakes, short wooden buildings are less vulnerable than multi-story and complex masonry/steel structures. The majority of Alaska’s school, state, and federal buildings are built and sited based on stringent seismic construction standards and are expected to survive major earthquake vents.

Based on Probabilistic Seismic Hazard Analyses (PSHA) conducted by the USGS in 2007, the entire State may be at risk of experiencing moderate to significant earthquake impacts. The PSHA maps (Figure 6-25) depict peak ground accelerations (PGAs) that can be expected for a range of earthquake exceedance probabilities. The whole state is capable of experiencing earthquake effects and the active geology of Alaska guarantees that there will continue to be earthquakes. Therefore the probability of earthquakes in Alaska is categorized as “highly likely”, even though earthquake prediction is impossible (Section 6.2). In “severe” cases, ground motion may result in infrastructure damage and personal injury throughout the middle and southern portions of the State.

“Moderate risk” shaking causing “very light” potential damage: 3.9-9.2(%g)

- 47,701 people in 19,187 housing units
- 134 government facilities
- 74 emergency response facilities
- 81 education facilities

- 40 medical facilities
- 909 highway/road system miles
- 97 highway/road bridges
- 8 maintenance facilities
- 55 airports
- 0 ports
- 37 harbors
- 6 ferry terminals
- 0 railroad track miles
- unknown railroad bridges
- 0 railroad facilities
- 522 utilities

“Strong risk” shaking causing “light” potential damage: 9.2-18 (%g)

- 61,477 people in 27,233 housing units
- 229 government facilities
- 104 emergency response facilities
- 121 education facilities
- 70 medical facilities
- 2,357 highway/road system miles
- 231 highway/road bridges
- 19 maintenance facilities
- 91 airports
- 0 ports
- 34 harbors
- 4 ferry terminals
- 3 railroad track miles
- unknown railroad bridges
- 0 railroad facilities
- 892 utilities

“Very Strong risk” shaking causing “**moderate**” damage: >18 (%g)

- 592,399 people in 257,733 housing units
- 173 government facilities
- 142 emergency response facilities
- 109 education facilities
- 87 medical facilities
- 10,736 highway/road system miles
- 915 highway/road bridges
- 50 maintenance facilities
- 136 airports
- 13 ports
- 78 harbors
- 29 ferry terminals
- 623 railroad track miles
- unknown railroad bridges
- 13 railroad facilities
- 1,268 utilities

Due to Alaska's highly active geologic setting at a tectonic plate boundary, future populations, residential structures, critical facilities, and infrastructure will be exposed to continued earthquakes of various magnitudes—from those that are barely felt to those that detrimentally affect large regions of the state.

Flood and Erosion Vulnerabilities

Typical flood and erosion impacts include:

- High water flow storm surge floods scour (erode) coastal embankments, coastal protection barriers, and result in infrastructure and residential property losses. Additional impacts can include roadway embankment collapse, foundations exposure, and damaging impacts.
- Damage to structures, roads, bridges, culverts, and other features from high-velocity flow and debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, decreasing water conveyance and increasing loads which may cause feature overtopping or backwater damages.
- Sewage, hazardous or toxic materials release, materials transport from wastewater treatment plant or sewage lagoon inundation, storage tank damages, and/or severed pipeline damages can be catastrophic to rural remote communities.
- Economic losses through business and government facility closure; utilities such as energy generation, communications, potable water and wastewater, and transportation service disruptions.
- Flood soil and debris deposition as well as embankment or shoreline erosion from coastal and riverine high water flow, and wind.

(See Section 6.3.4)

No detailed 100 year flood analysis has been prepared for all Alaska flood prone communities due to FEMA and State budgetary constraints. Neither has the USACE Floodplain Manager been able to provide flood information or 100-year floodplain maps that comply with NFIP regulations. Alaska flood and erosion threatened population and infrastructure potentially include:

“Coastal storm surge flood risk” potentially impacting community within 0.5 miles of shoreline

- 87,188 people in 39,119 housing units
- 187 government facilities
- 118 emergency response facilities
- 88 education facilities
- 62 medical facilities
- 1,500 highway/road system miles
- 226 highway/road bridges
- 14 maintenance facilities
- 84 airports
- 13 ports
- 117 harbors
- 32 ferry terminals
- 38 railroad track miles
- unknown railroad bridges

- 4 railroad facilities
- 700 utilities

“Coastal erosion risk” USACE identified threatened community coastlines

- 50,194 people in 21,295 housing units
- 256 government facilities
- 166 emergency response facilities
- 129 education facilities
- 88 medical facilities
- 1,760 highway/road system miles
- 185 highway/road bridges
- 20 maintenance facilities
- 100 airports
- 7 ports
- 58 harbors
- 19 ferry terminals
- 0 railroad track miles
- unknown railroad bridges
- 0 railroad facilities
- 1,121 utilities

“Riverine flood risk” potentially impacting community within 0.25 miles of major river embankments

(Note: Alaska has very few communities with identified 100- and 500-year floodplains)

- 66,315 people in 28,241 housing units
- 204 government facilities
- 88 emergency response facilities
- 106 education facilities
- 64 medical facilities
- 1,666 highway/road system miles
- 309 highway/road bridges
- 7 maintenance facilities
- 48 airports
- 0 ports
- 0 harbors
- 0 ferry terminals
- 180 railroad track miles
- unknown railroad bridges
- 8 railroad facilities
- 882 utilities

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated to increase over historical impact rates due to changing climate, inconsistent weather patterns, glacial melt, and rain/snowmelt run-off.

Ground Failure Vulnerabilities

Potential ground failure impacts from landslides and subsidence are widespread. Potential debris flows and landslides can damage and disrupt transportation, utility systems, and water and waste treatment infrastructure along with damaging public, private, and business structures located

adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages.

Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require re-establishing electrical, communication, and fuel pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and wastewater utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and re-establishing waste disposal capability. Ground failure events are typically caused by ground water, degrading permafrost, and local or region subsidence or upheaval.

Landslide, mud, and debris flow impacts are based on their slope. USGS elevation datasets were used to determine where these risks are located throughout Alaska. Slopes greater than 28 degrees was assigned a “high” risk where various cohesion failures occur. (see Section 6.4). Threatened population and infrastructure potentially include:

“High risk” landslide due to having greater than (>) 28 degree slopes

- 85,380 people in 38,567 housing units
- 20 government facilities
- 22 emergency response facilities
- 23 education facilities
- 13 medical facilities
- 4,407 highway/road system miles
- 285 highway/road bridges
- 15 maintenance facilities
- 12 airports
- 1 port
- 5 harbors
- 2 ferry terminals
- 248 railroad track miles
- unknown railroad bridges
- 5 railroad facilities
- 200 utilities

Ground Failure hazards periodically cause structure and infrastructure displacement resulting from weather and changing climate influences. Alaska communities have various permafrost conditions classified as limited, discontinuous, or continuous. Permafrost degradation is sometimes coupled with high ground water and expansive soils which accelerates failure.

“Low risk” permafrost having less than <10 volume

- 296,850 people in 125,388 housing units
- 111 government facilities
- 59 emergency response facilities
- 58 education facilities
- 48 medical facilities
- 3,699 highway/road system miles
- 298 highway/road bridges
- 15 maintenance facilities
- 44 airports

- 0 ports
- 4 harbors
- 0 ferry terminals
- 209 railroad track miles
- unknown railroad bridges
- 7 railroad facilities
- 580 utilities

“Moderate risk” permafrost having 10-40 percent volume

- 121,031 people in 55,565 housing units
- 67 government facilities
- 53 emergency response facilities
- 55 education facilities
- 29 medical facilities
- 4,133 highway/road system miles
- 300 highway/road bridges
- 22 maintenance facilities
- 54 airports
- 0 ports
- 3 harbors
- 0 ferry terminals
- 236 railroad track miles
- unknown railroad bridges
- 5 railroad facilities
- 501 utilities

“High risk” permafrost having >40 percent volume

- 18,153 people in 6,609 housing units
- 77 government facilities
- 34 emergency response facilities
- 39 education facilities
- 23 medical facilities
- 918 highway/road system miles
- 93 highway/road bridges
- 8 maintenance facilities
- 37 airports
- 0 ports
- 2 harbors
- 0 ferry terminals
- 9 railroad track miles
- unknown railroad bridges
- 1 railroad facility
- 341 utilities

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated to increase over historical impact rates due to changing climate, inconsistent weather patterns, glacial melt, and rain/snowmelt runoff.

Tsunami and Seiche Vulnerabilities

Alaska communities in the Aleutian Islands, the Alaska Peninsula (including the southern Bering Sea communities), the Gulf of Alaska, and Southeast Alaska all have and will continue to be exposed to local and distant tsunami and seiche impacts (See Section 6.5).

Threatened residential structures and infrastructure in these communities include.

“Tsunami risk”

- 115,113 people in 53,921 housing units
- 44 government facilities
- 31 emergency response facilities
- 39 education facilities
- 23 medical facilities
- 351 highway/road system miles
- 105 highway/road bridges
- 3 maintenance facilities
- 29 airports
- 9 ports
- 131 harbors
- 39 ferry terminals
- 4 railroad track miles
- unknown railroad bridges
- 0 railroad facilities
- 341 utilities

Tsunamis and seiches are generated by a range of natural phenomena and are therefore impossible to predict. All communities along Alaska’s Pacific Ocean coastline (from Southeast Alaska to the far western Aleutians) should be aware of potential local and distant tsunami hazards. Bering Sea communities may also experience tsunamis, though they are slightly more removed from the Alaska-Aleutian Subduction Zone. Underwater slope failures can generate a tsunami anywhere along Alaska’s vast coastline.

Volcano Vulnerabilities

A significant volcanic eruption in southeast and southcentral Alaska will certainly necessitate air route deviations and will cause strain on response, financial, and service availability throughout the entire state. Other impacts include respiratory problems from airborne ash, displaced persons, lack of shelter, and personal injury general property damage (e.g., electronics and unprotected machinery), structural damage from ash loading, state/regional transportation interruption, loss of commerce, and water supply contamination (See Section 6.6).

Alaska’s entire existing and future population, residences, and critical facilities have a potential volcanic ash impact risk. Population and infrastructure potentially threatened by volcanic hazards include:

“Low Moderate risk” from volcanic ashfall

- 132,209 people in 65,267 housing units
- 79 government facilities
- 50 emergency response facilities
- 58 education facilities
- 37 medical facilities

- 4,838 highway/road system miles
- 433 highway/road bridges
- 25 maintenance facilities
- 54 airports
- 6 ports
- 19 harbors
- 5 ferry terminals
- 387 railroad track miles
- unknown railroad bridges
- 7 railroad facilities
- 598 utilities

“Moderate risk” from volcanic ashfall

- 396,846 people in 159,999 housing units
- 38 government facilities
- 24 emergency response facilities
- 15 education facilities
- 21 medical facilities
- 4,325 highway/road system miles
- 358 highway/road bridges
- 14 maintenance facilities
- 31 airports
- 4 ports
- 17 harbors
- 7 ferry terminals
- 214 railroad track miles
- unknown railroad bridges
- 7 railroad facilities
- 315 utilities

“High risk” from volcanic ashfall

- 40,764 people in 22,566 housing units
- 54 government facilities
- 49 emergency response facilities
- 27 education facilities
- 28 medical facilities
- 1,552 highway/road system miles
- 55 highway/road bridges
- 7 maintenance facilities
- 30 airports
- 2 ports
- 6 harbors
- 2 ferry Terminals
- 0 railroad track miles
- unknown railroad bridges
- 0 railroad facilities
- 350 utilities

Weather Vulnerabilities

Impacts associated with severe weather events includes roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, injury and death resulting from snow machine or vehicle accidents, and overexertion while shoveling due to heavy snow. A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, utility disruptions, and carbon monoxide poisoning. Additional impacts may occur from secondary weather hazards or complex storms such as extreme high winds combined with freezing rain, high seas, and storm surge. Section 6.7 provides additional detail regarding severe weather impacts. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams and appropriate roofing materials) are more vulnerable to severe weather damage. The entire state is threatened by severe weather events. Current and future population and infrastructure potentially include:

“Severe Weather risk”

- 710,047 people in 306,973 housing units
- 565 government facilities
- 339 emergency response facilities
- 323 education facilities
- 209 medical facilities
- 14,108 highway/road system miles
- 1,245 highway/road bridges
- 78 maintenance facilities
- 294 airports
- 13 ports
- 149 harbors
- 39 ferry terminals
- 626 railroad track miles
- unknown railroad bridges
- 13 railroad facilities
- 2,819 utilities

Climate change impacts vary across Alaska. For example, northern coasts experience late ice formations; some areas that formerly experienced landfast or ice locked coastlines now have open water throughout the winter. Southern Alaska (southeast, south central and southwest) areas experience wetter winter weather with less snow and more rain. These conditions will negatively impact future populations, residential structures, critical facilities, and infrastructure over historical impacts.

Wildland Fire Vulnerabilities

Impacts associated with a wildland fire event include the potential for loss of life and property. A wildland fire event can also impact livestock and pets, destroy forest resources, and contaminate water supplies. Buildings closer to the outer edge of town, those with heavy vegetation surrounding structures, and those constructed with wood are more vulnerable to wildland fire damages. Section 6.8 provides additional detail regarding wildland/tundra fire impacts

According to the Alaska Fire Service, 3,077 wildland fires have occurred within Alaska (Section 6.8.3) costing nearly \$294 million since the legacy 2013 SHMP was implemented. The state’s population centers’ wildfire threats and recurrence probabilities are provided for locations

dependent upon fuel loading and weather. The following threat classifications: moderate, high, very high, and extreme, describe potential impacts within the following ranked fuels locations potentially include:

“Moderate risk” areas having moderate fuel ranking

- 324,356 people in 132,928 housing units
- 285 government facilities
- 165 emergency response facilities
- 158 education facilities
- 108 medical facilities
- 7,193 highway/road system miles
- 820 highway/road bridges
- 70 maintenance facilities
- 173 airports
- 2 ports
- 68 harbors
- 17 ferry terminals
- 141 railroad track miles
- unknown railroad bridges
- 8 railroad facilities
- 1,139 utilities

“High risk” areas having high fuel ranking

- 123,109 people in 49,548 housing units
- 30 government facilities
- 18 emergency response facilities
- 20 education facilities
- 13 medical facilities
- 1,710 highway/road system miles
- 88 highway road bridges
- 2 maintenance facilities
- 24 airports
- 0 ports
- 8 harbors
- 1 ferry terminal
- 139 railroad track miles
- unknown railroad bridges
- 0 railroad facilities
- 285 utilities

“Very High risk” areas having very high fuel ranking

- 50,389 people in 24,723 housing units
- 64 government facilities
- 54 emergency response facilities
- 45 education facilities
- 30 medical facilities
- 1,705 highway/road system miles
- 86 highway road bridges

- 3 maintenance facilities
- 45 airports
- 0 ports
- 1 harbor
- 1 ferry terminal
- 119 railroad track miles
- unavailable railroad bridges
- 2 railroad facilities
- 437 utilities

“Extreme risk” areas having extreme fuel ranking

- 202,269 people in 94,630 housing units
- 68 government facilities
- 48 emergency response facilities
- 55 education facilities
- 29 medical facilities
- 3,417 highway/road system miles
- 161 highway road bridges
- 3 maintenance facilities
- 22 airports
- 2 ports
- 0 harbors
- 1 ferry terminal
- 204 railroad track miles
- unavailable railroad bridges
- 2 railroad facilities
- 534 utilities

Dry forest and tundra conditions increase fire fuels and insect infestations. These conditions create optimum conditions for wildfire propagation, especially around housing and other areas where fire fuels are not controlled near public or private structures. Future populations, residential structures, critical facilities, and infrastructure located in dryer regions of Alaska are anticipated to experience increased wildfire events compared to historical impacts.

Hazard Probably Tables

Tables 8-22 and 8-23 quantify the hazards for each borough or REAA and determine recurrence probability. The ratings are low, moderate, and high, and indicate the number of previous occurrences. This information references DHS&EM internal records, individual community and borough Emergency Operations Plans (EOPs), and available HVAs.

A summary of community EOPs and HVAs were used and applied to census areas. Table 8-22 references the DHS&EM Disaster Cost Index from 1978 to 2018. This matrix also includes large documented events prior to 1978, such as the 1964 earthquake, 1958 Lituya Bay landslide and tsunami, and the 1946 Unimak Island tsunami.

Note: Hazard Frequency and Extent Table Keys:

Table 8-22 Borough or Rural Education Attendance Area (REAA) Event Probability

Borough / REAA (as appropriate)	Cryosphere	Earthquake	Flood	Ground Failure	Tsunami & Seiche	Volcano	Weather	Wildland Fire
Alaska Gateway (REAA)	Y	Y-M	Y-M	Y-L	N	N	Y-L	Y-H
Aleutians East Borough	Y	Y-M	N	Y-M	Y-H	Y-M	Y-M	N
Aleutian Region (REAA)	Y	Y-M	N	N	Y-M	Y-M	Y-H	N
Annette Island (REAA)	Y	Y-L	N	N	Y-L	N	Y-L	Y-L
Bristol Bay Borough	Y	Y-L	Y-L	N	N	Y-L	Y-M	N
Bering Strait (REAA)	Y	Y-M	Y-M	Y-M	N	N	Y-H	Y-M
Juneau	Y	Y-M	Y-M	Y-M	Y-L	N	Y-H	Y-M
Sitka	Y	Y-H	Y-M	Y-H	Y-H	N	Y-H	Y-L
Yakutat	Y	Y-L	Y-M	Y-H	Y-H	Y-L	Y-H	Y-L
Chatham (REAA)	Y	Y-M	Y-L	Y-H	Y-M	N	Y-H	Y-M
Chugach (REAA)	Y	Y-H	Y-H	Y-L	Y-H	Y-L	Y-M	Y-M
Copper River (REAA)	Y	Y-M	Y-M	Y-L	N	Y-L	Y-M	Y-M
Denali Borough	Y	Y-M	Y-L	Y-M	N	N	Y-H	Y-H
Delta/Greely (REAA)	Y	Y-M	Y-L	Y-M	N	N	Y-H	Y-H
Fairbanks North Star Borough	Y	Y-M	Y-M	Y-M	N	N	Y-M	Y-H
Haines Borough	Y	Y-H	Y-M	Y-M	Y-L	N	Y-H	Y-M
Iditarod Area REAA	Y	Y-L	Y-H	Y-M	N	N	Y-H	Y-M
Kashunamiut REAA	Y	Y-M	Y-H	Y-H	N	N	Y-H	Y-L
Ketchikan Gateway Borough*	Y	Y-M	Y-M	Y-L	Y-L	N	Y-L	Y-L
Kodiak Island Borough	Y	Y-H	Y-H	Y-H	Y-M	Y-H	Y-H	Y-M
Kenai Peninsula Borough	Y	Y-H	Y-H	Y-L	Y-H	Y-H	Y-H	Y-H
Kuspuk REAA	Y	Y-M	Y-H	N	N	N	Y-H	Y-M
Lower Kuskokwim REAA	Y	Y-M	Y-H	Y-H	N	N	Y-H	Y-M
Lake & Peninsula Borough	Y	Y-H	Y-M	Y-L	Y-M	Y-H	Y-H	Y-M
Lower Yukon REAA	Y	Y-M	Y-H	N	N	N	Y-H	Y-H
Municipality of Anchorage	Y	Y-H	Y-M	Y-L	N	Y-M	Y-M	Y-M
Matanuska-Susitna Borough	Y	Y-H	Y-H	Y-L	N	Y-M	Y-M	Y-H
Northwest Arctic Borough	Y	Y-M	Y-M	N	N	N	Y-H	Y-M
North Slope Borough	Y	Y-L	Y-M	Y-M	N	N	Y-H	Y-L
Petersburg	Y	Y-L	Y-L	Y-M	Y-L	N	Y-M	Y-M
Pribilof Island REAA	Y	Y-M	Y-L	N	Y-L	N	Y-H	N
Southeast Island REAA	Y	Y-M	Y-L	Y-L	Y-M	N	Y-M	Y-M
Southwest Region REAA	Y	Y-M	Y-M	N	Y-L	Y-L	Y-H	Y-M
Wrangell	Y	Y-L	Y-L	Y-M	Y-L	N	Y-M	Y-M
Yukon Flats REAA	Y	Y-M	Y-H	N	N	N	Y-M	Y-M
Yukon-Koyukuk REAA	Y	Y-L	Y-H	Y-L	N	N	Y-M	Y-M
Yupit REAA	Y	Y-M	Y-H	Y-L	N	N	Y-M	N

Key: Y: Yes, event is likely to occur; N: No hazard for this area

Event Probability: H: High, M: Medium; L: Low



Table 8-23 Borough or REAA Frequency and Extent

Borough / REAA (as appropriate)	Cryosphere	Earthquake	Flood	Ground Failure	Tsunami & Seiche	Volcano	Weather	Wildland Fire
Alaska Gateway REAA	L	1 L	7 L				1 L	2 L
Aleutians East Borough	L			1 L			2 L	
Aleutian Region REAA	L			1 L			2 L	
Annette Island REAA	L						2 L	
Bristol Bay Borough	L		2 L	1 L			5 L	
Bering Strait REAA	L		3 L				21 L	3 L
Juneau	L		2 L				1 L	
Sitka	L		2 L	1 L			3 L	
Yakutat	L	1 L					1 L	
Chatham REAA	L		4 L	1 L	1 L		3 L	3 L
Chugach REAA	L	1 L	3 L	4 L			4 L	
Copper River REAA	L	1 L	8 L				3 L	
Denali Borough	L	1 L	2 L	1 L			1 L	1 L
Delta/Greely REAA		1 L	2 L					4 L
Fairbanks North Star Borough	L	1 L	5 L	1 L			3 L	1 L
Haines Borough	L		6 L				1 L	
Iditarod Area REAA			7 L					3 L
Kashunamiut REAA	L						1 L	
Ketchikan Gateway Borough*								
Kodiak Island Borough	L		2 L	1 L			7 L	
Kenai Peninsula Borough	L	1 L	11 L			3 L	9 L	
Kuspuk REAA			10 L					1 L
Lower Kuskokwim REAA	L		13 L				10 L	1 L
Lake & Peninsula Borough	L		2 L				4 L	2 L
Lower Yukon REAA	L		12 L				7 L	4 L
Municipality of Anchorage	L	2 L	5 L			2 L	5 L	
Matanuska-Susitna Borough	L	2 L	9 L			2 L	7-L	2 L
Northwest Arctic Borough	L		8 L				10 L	
North Slope Borough	L		3 L				4 L	2 L
Pribilof Island REAA	L						3 L	
Southeast Island REAA	L		2 L	2 L			3 L	1 L
Southwest Region REAA	L		2 L				7 L	1 L
Wrangell								
Yukon Flats REAA			10 L					5 L
Yukon-Koyukuk REAA	L	1 L	12 L				1 L	1 L
Yupit REAA	L		2 L				2 L	
Statewide	L		1 L				3 L	10 L

Key:

Extent with Number of total event occurrences, **Zero (Z):** Used for historical information. An event occurred but caused no damage or loss; **Limited (L):** Minimal through maximum damage to part of community. Short of the definition for total extent; **Total (T):** Impact encompasses the entire community;

Frequency: H: High, M: Medium; L: Low



