

V. TOOLS AND REPORTS FROM OTHER SOURCES

1. USCG REPORT BERING_STRAIT_PARS_FINAL_REPORT_12_27_16 APPENDIX E
2. FEMA'S UNDERSTANDING THE INPUTS AND IMPACTS ON FLOOD HAZARD IDENTIFICATION IN YOUR COMMUNITY:
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Appendix E – Marine Casualty Analysis

The Coast Guard reviewed its marine casualty database for the 2005 to 2016 timeframe and found numerous reportable marine casualties in the Bering Sea and adjacent areas. As the traffic volume in the study area is light, with a corresponding low number of marine casualties, the Coast Guard included data from an area of western Alaskan waters that is larger than the PARS study area in order to obtain a representative sample of the types of incidents that might occur. The vast majority of marine casualties involved commercial fishing vessels and mishaps leading to the injury of a member of the crew. The Coast Guard omitted accidents of this nature, as they are not preventable by ship routing measures. The enclosed list of marine casualties and subsequent analysis are from marine casualties meeting the following criteria: Occurred between 2005 and 2016, involved a commercial vessel other than a fishing vessel engaged in fishing, and did not involve an injury, controlled substance investigation, or other type of administrative investigation. The resulting list of 144 marine casualties revealed an accident history that the Coast Guard believes is representative of nearly any coastal environment with commercial vessel traffic.

The Coast Guard identified 38 incidents of reported commercial vessel groundings over this 10-year period, representing 26% of the marine casualties determined to be relevant for the purpose of this study. Most of these involved tug/barge traffic operating either in shallow, near shore environments or on river systems such as the Yukon, Kuskokwim and Naknek Rivers. This accident trend is normal and mirrors other parts of the country where vessel groundings are most common in shallow near coastal waters with reduced under keel clearances. As noted elsewhere in this study, much of western Alaska's Coastal waters have not been surveyed to modern standards. The Coast Pilot for this region specifically addresses this issue by noting "...charts must not be relied upon to closely, especially near shore."

Closer review of the 38 grounding incidents identified three vessel groundings directly attributed to incorrect charts. This does illustrate that charts based on unreliable hydrographic data are playing a role in vessel groundings, but it is difficult to quantify how much of a role it is playing without a baseline measure of groundings-per-transit. There are however, two notable exceptions to the typical profile of a tug/barge/landing craft grounding in a near-shore or river environment that are particularly informative to this report.

Grounding #1 (Casualty # 132): In July of 2015, a 9,300 gross ton research vessel with a draft of 27 feet struck an incorrectly charted area of shoal water near Dutch Harbor, Alaska, sustaining a hull fracture approximately 39 inches long and two inches wide. No injuries or pollution was associated with this accident. The vessel had just begun a voyage from Dutch Harbor, AK intending to transit the Bering Strait and continue on to the Chukchi Sea to participate in Outer Continental Shelf (OCS) exploratory drilling. The hydrographic survey information in the area of the grounding dated back to 1935. A NOAA Coast Survey ship was able to investigate immediately. While the chart showed shoal water with a least depth of 5 ¼ fathoms, or 31.5 feet, the actual depth was determined to be as little as 3 ¾ fathoms, or 22.5 feet.

The following figure illustrates how modern multi-beam hydrographic survey techniques can identify unknown hazards to navigation.

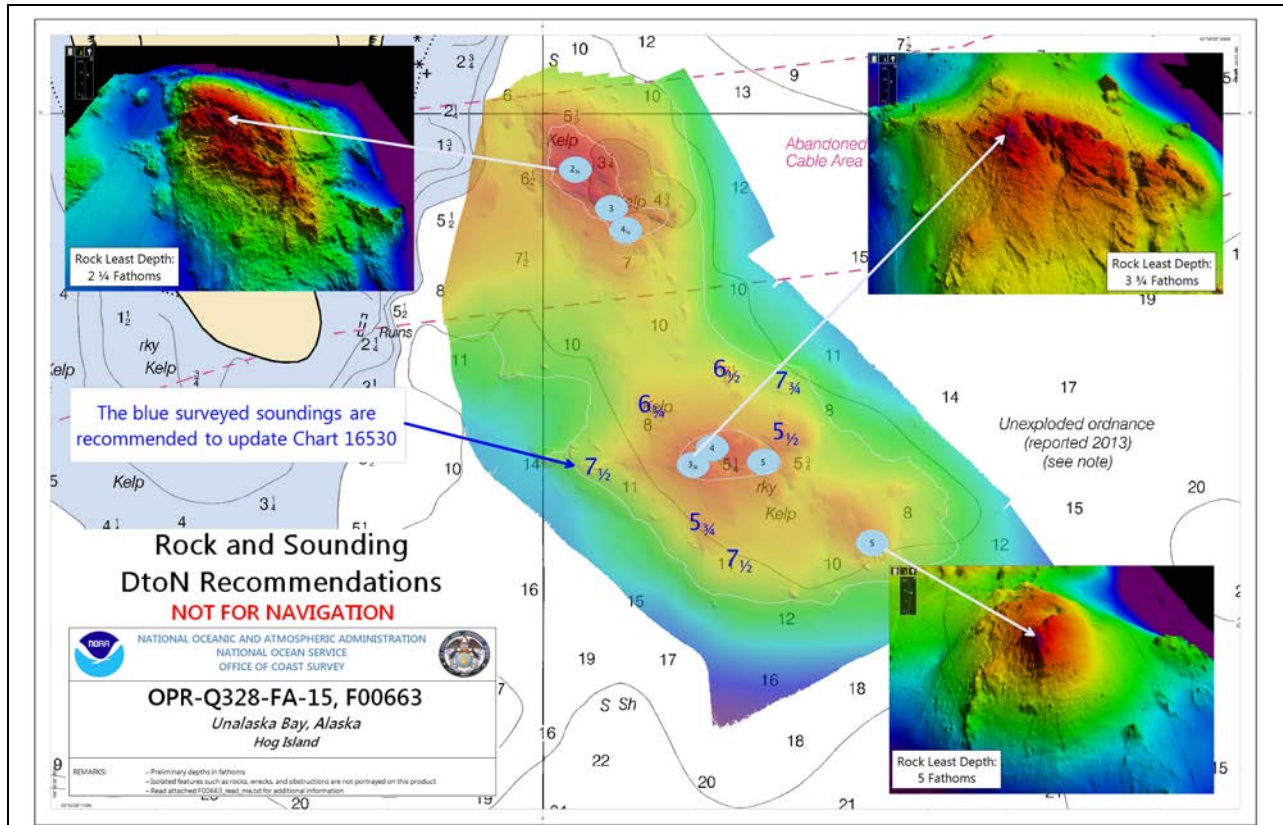


Figure 13: Example of modern multi-beam survey report finding previously uncharted dangers to navigation.

Grounding #2 (Casualty # 142):

In June of 2016, an oil tanker carrying refined petroleum products grounded approximately 10 miles from shore, southeast of Nunivak Island, AK. This 598 foot long, 27,500 gross ton, double hulled tanker was carrying in excess of 11 million gallons of fuel, a combination of bunker fuel, #2 fuel oil, and gasoline. At the time of the grounding, the ship was drawing 10.4 meters, or 34.2 feet forward, and 11.5 meters, or 37.3 feet aft. Charted depths in the area showed 9 fathoms, or 54 feet. The vessel was transiting at a slow speed of about four nautical miles per hour and refloated on a rising tide shortly after the grounding occurred. No pollution or injuries were associated with this accident. The grounding was attributed the vessel striking an uncharted shoal. Hydrographic survey information in the area of the grounding is of unknown origin, possibly dating back to a time prior to the purchase of Alaska from Russia in 1867. Single and double hulled oil tankers have been in use for many years to refuel foreign flagged, distant water fishing fleets operating in the western Bering Sea, but their use in lightering operations to transport fuel to western Alaska coastal communities is a relatively new development,

dating back to about 2012. Prior to that time, the typical method of delivery was almost exclusively through use of US flagged tugs and tank barges.

These two grounding incidents are reflective of the type of risk that the Coast Guard believes ship routing measures can mitigate. Identification of ship routing measures and investment in the form of modern hydrographic survey work will provide mariners with a more thorough understanding of the marine environment in which they operate and encourage vessel operators, where it is possible, to avoid areas that may have uncharted hazards. It is notable that both of these groundings are recent, involved vessels that did not have a long history of operating in the Bering Sea region, and were engaged in types of maritime activity that has only recently emerged. Any future significant increase in the number of vessels transiting the Bering Strait will include vessels with these same characteristics. Thus, installing routing measures now might help prevent future similar mishaps.

The 60 incidents in which a vessel lost all or partial mobility represent over 41% of the identified marine casualties. In 27 of these incidents, representing 19% of the 144 casualties, vessels completely lost either propulsion or steering. The exact causes vary widely but are usually the result of equipment failure to a vessel's propulsion plant or ship control systems. Regardless of the exact nature, in cases of a complete loss of mobility, the result is the same. The vessel is no longer able to travel where intended and is subject to winds and currents. Given enough time, the vessel might eventually drift to shallow water and ground. In some areas of the Bering Sea, the consequences arising from a loss of mobility casualty leading to a vessel grounding can be more severe than in other areas, since in many areas vessel traffic is sparse and response resources may be too far away to offer successful towing or salvage assistance before a situation deteriorates.

Some countries have developed routing measures that include some amount of "standoff distance" from the coast in order to afford additional response time for loss of mobility events. A good example of this in Arctic waters is off the North coast of Norway, where routing measures were installed for large ships (5,000 GT or larger) and tank ships to keep them further off the coast. Norway's routing measures intend to provide additional time before a vessel encounters shoal water in the event a navigational error took the ship off course, and provide additional time to respond to a loss of propulsion incident. The Coast Guard took a similar approach in developing proposed routing measures that will keep ships further offshore in areas of particular environmental or navigational concern for the same reasons, while minimizing the overall increase in the length of the voyage. The preliminary orientation of the proposed two-way route maximizes this "stand-off" distances at the closest approaches to land at both King Island and Fairway Rock. In both of these locations, the centerline of the two-way route is approximately 7.8 nautical miles away from each island, and the outer boundary of the two-way route is approximately 5.8 nautical miles away from the islands.

Four incidents (# 19, 86, 94, 135) involved either a tug colliding with its own barge or a collision between a tug/barge and a fishing vessel. The Coast Guard believes incidents such as these are unlikely to occur within the proposed two-way route since existing traffic patterns for tug/barge traffic are closer to shore. Most tug/barge traffic is "destinational" in nature to deliver supplies to coastal communities, and the Coast Guard believes it is unlikely that tug and barge traffic will choose to follow a

route well offshore even if routing measures are established. One incident (#53) involved vessels colliding while intentionally approaching to offload cargo. This type of activity is also unlikely to occur near the location of the proposed route.

Casualties #13 and 27, while representing less than 2% of the marine casualties reviewed, do provide evidence that collisions between ships carrying cargo and fishing vessels do occur in western Alaska, albeit infrequently. One must look much earlier into the accident history to find other useful examples. On March 3, 2003, the fishing vessel Katrina Em and the 617' containership Arkona Trader, both transiting Unimak Pass, were involved in a collision that significantly damaged the fishing vessel. In September of 1983, two Korean flagged freighters, the 551' bulk carrier Pan Nova and the M/V Swibon were involved in a collision in Unimak Pass. The collision occurred in the early morning hours before sunrise, but environmental conditions were good, with 10 knot winds, 2 foot seas, and 12 mile visibility. Response efforts rescued the crew of 26, but attempts to salvage the Pan Nova were unsuccessful and the ship ultimately sank due to damage resulting from the collision. While collisions occur with far less frequency than loss of maneuverability incidents, their consequences can be far more severe, with most damage occurring immediately, and subsequent damage due to fire, flooding and loss of vessel stability potentially occurring at an accelerated pace.

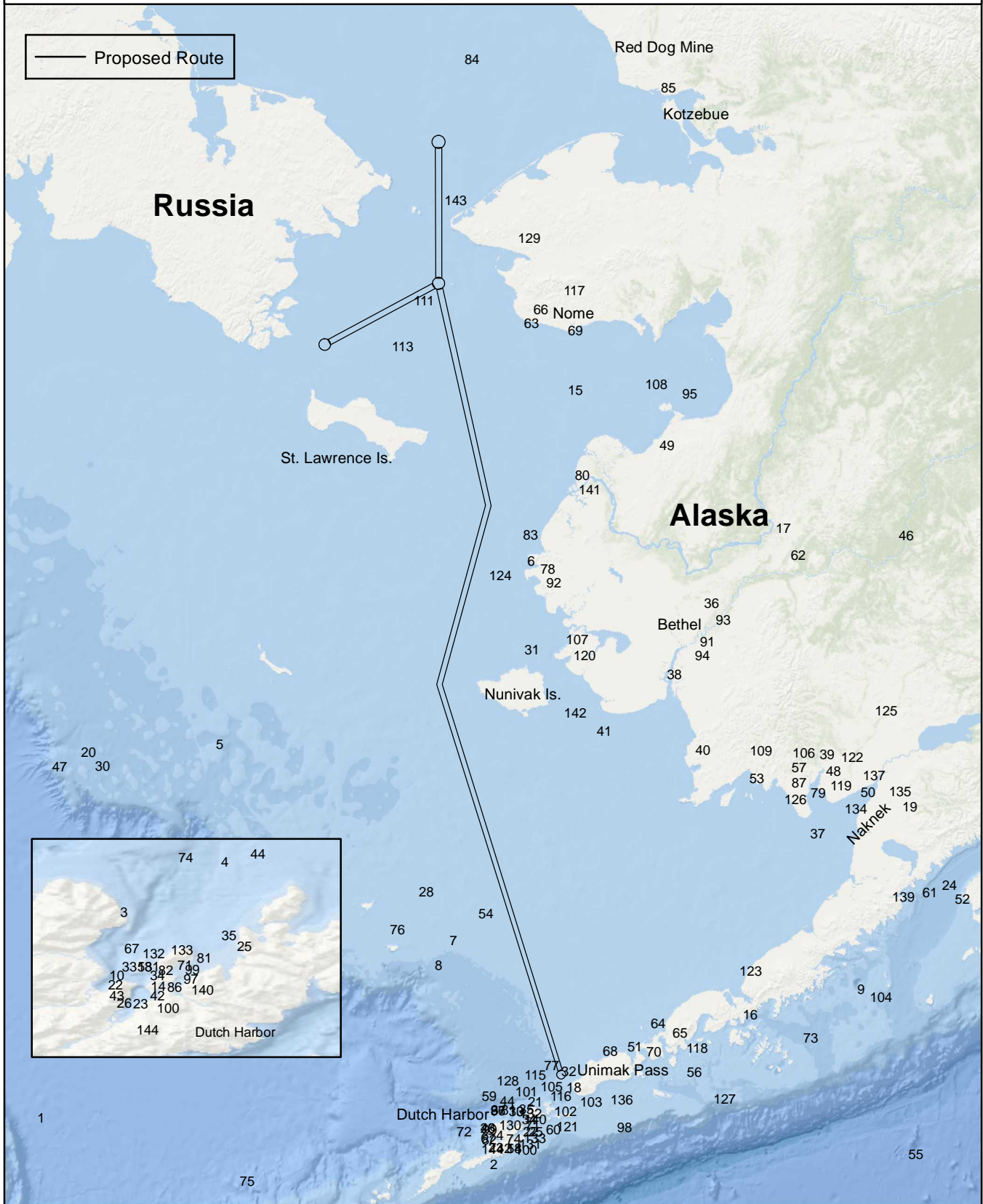
Since the proposed route crosses productive commercial fishing grounds in the southern Bering Sea, any future increase in traffic bound to or from the Bering Strait will result in increased interactions between fishing vessels and other large vessel traffic. The Coast Guard believes the proposed two-way route in this area offers definite advantages to these vessel interactions. Fishing vessels would know where to expect larger vessel traffic, which may be moving at much higher speeds than the other fishing vessels in the area. Display of routing measure boundaries on nautical charts and electronic charting displays will allow vessels to quickly determine whether another vessel is following the two-way route or not. This, in turn, affords more time for vessels to coordinate passing arrangements in situations where risk of collision exists.

With specific consideration toward reducing the risk of vessel collisions, the Coast Guard did consider other possible routing measures, such as a traffic separation scheme that would include a traffic separation zone. This type of measure would result in better separation of vessel traffic travelling in different directions, but it would limit the amount of sea room available for collision and ice avoidance. In the areas where high densities of commercial fishing activity exist, the Coast Guard believes that in the near term, implementation of a Traffic Separation Scheme could actually increase the risk of collisions. The reason for this is that the Traffic Separation Scheme alters the responsibilities between vessels for avoiding collisions. In a scenario with no routing measures, or in the case of a two-way route, a commercial ship is obligated under COLREGS to avoid vessels that are actually fishing. In a scenario with a traffic separation scheme, fishing vessels are obliged to avoid impeding the passage of other vessels that are following the lane of a traffic separation scheme. Currently, and for the near future, there are far more fishing vessels operating in the area where the two-way route crosses the fishing grounds. Most of them do not expect to see vessels other than other fishing vessels, but they do expect that they will have the right of way under COLREGS when they are actively fishing in this area and encounter another vessel that is not also fishing. Implementing a traffic separation scheme can thus

create a scenario could create a situation where two vessels (one actively fishing, one following a traffic separations scheme lane) might both believe they have the right of way. In a future scenario, where use of the routing measure by vessel traffic bound to or from the Bering Strait becomes more frequent, this is less of a concern.

Detailed information on marine casualties follows:

Marine Casualties 2005 - 2016



Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
1	04/08/2005	Cargo Ship	24,479	Fire	53.7650	-178.8700	While underway, hotwork ignited wood-pulp cargo in hold #1.
2	08/08/2005	Freight Ship	76	Grounding	53.6233	-167.0750	While unloading onshore at Scan Bay, the wind pushed vessel onto a rock, resulting in minor damage to the hull.
3	09/22/2005	Freight Ship	76	Grounding	53.9500	-166.6000	While recovering fishing gear near shore, the vessel grounded on Eider Reef. Grounding re-open previously damage section of hull.
4	06/09/2006	Cargo Ship	4,964	Loss of Propulsion	54.0167	-166.4667	While in Dutch Harbor, vessel engine suffered overheat and shut-down. Vessel towed to berth for repairs.
5	07/10/2006	Cargo Ship	17,845	Equipment Failure	59.1450	-174.2100	On deck hydraulic pump leak resulting in 10 gallons hydraulic oil spilled.
6	07/17/2006	Tank Barge	495	Oil Spill	61.5167	-166.1000	During transfer on Kashunuk River less than 1 gallon of #1 diesel spilled, created sheen.
7	08/27/2006	Barge	1,856	Oil Spill	56.4167	-168.1333	While in Bristol Bay a cargo deck spill from ISO container on deck of freight barge resulted in 250 gallon diesel spill.
8	08/28/2006	Towing Vessel	146	Grounding	56.0569	-168.5214	Vessel hit a rock in St. George harbor, unconfirmed spill of 5 gallons of Number 4 fuel oil.
9	09/05/2006	Passenger Vessel	48,075	Reduction of Maneuverability	55.7099	-157.5150	While underway one propulsion pod suffered mechanical damage.
10	10/12/2006	Cargo Ship	4,392	Weather Damage	53.8778	-166.5778	While anchored near Unalaska, vessel dragged anchor.
11	01/23/2007	Towing Vessel	198	Reduction of Maneuverability	51.8500	-176.6333	Near Adak Harbor, a bearing on the starboard seized, shutting down one engine.
12	02/03/2007	Offshore Supply Vessel	3,534	Weather Damage	52.0000	-175.5000	While underway in Bering Sea, a wave broke loose a life-raft.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
13	02/04/2007	Cargo Ship	3,475	Collision	51.5917	-176.6000	During extreme weather near Adak, F/T SEA FISHER collided with M/V Khana causing damage to both vessels.
14	03/09/2007	Cargo Ship	7,207	Loss of Propulsion	53.8778	-166.5778	While riding out a storm near Dutch Harbor, vessel suffered clogged fuel filters and lost all engines and generators.
15	06/03/2007	Towing Vessel	76	Grounding	63.5651	-165.0548	Muddy bottom grounding while towing alongside. No damage.
16	06/04/2007	Towing Vessel	143	Loss of Propulsion	55.3330	-160.5000	Near Sand Point, vessel suffered engine cooler failure resulting in a partial loss of propulsion.
17	06/12/2007	Tank Barge	495	Grounding	61.9667	-159.8833	Near Aniak, barge struck submerged object holing barge resulting in an 50 gallon oil spill.
18	06/20/2007	Research Vessel	195	Loss of Power	54.3667	-165.4167	While underway in Unimak Pass, vessel suffered loss of power due to an engine casualty on its generator.
19	07/13/2007	Towing Vessel	188	Collision	58.6967	-156.6761	On the Naknek river, the F/V ALCHEMIST and MALOLO collided dealing damage to both vessels, but not the towed barge.
20	08/04/2007	Research Vessel	3,779	Oil Spill	59.0444	-177.7250	Oil leaked from a small boat's hydraulic system where it discharged into the Chukchi Sea forming a sheen on the surface.
21	09/06/2007	Cargo Ship	5,286	Loss of Propulsion	54.0733	-166.3467	While entering Dutch Harbor, vessel switched to Heavy Fuel Oil, causing engines to shut-down.
22	09/07/2007	Cargo Ship	6,670	Loss of Propulsion	53.8778	-166.5778	While in Dutch Harbor, an o-ring blew off the air system causing the main engine to shut-down.
23	09/12/2007	Cargo Ship	5,286	Partial Loss of Propulsion	53.8778	-166.5778	No data.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
24	09/13/2007	Passenger Vessel	2,174	Partial Loss of Propulsion	57.2150	-155.3083	While in Shelikof Strait, shut one engine down for repairs.
25	10/04/2007	Barge	2,898	Grounding	53.9047	-166.4462	Barge broke free from moorings and grounded in Summers Bay.
26	10/07/2007	Mobile Offshore Drilling Unit	10,264	Equipment Failure	53.8778	-166.5778	While in Dutch Harbor, vessel service generators shut down.
27	10/26/2007	Cargo Ship	3,264	Collision	51.8575	-176.6459	While near Adak, the SEAFREEZE ALASKA collided with the JACHA.
28	01/17/2008	Misc. Vessel	187	Loss of Propulsion	57.1167	-168.9333	While in Bering Sea, lost of control of controllable pitch propeller due to frozen control air lines.
29	01/26/2008	Cargo Ship	188	Oil Spill	51.8575	-176.6459	While near Adak, the vessel spilled 100 gallons of diesel.
30	07/05/2008	Research Vessel	370	Loss of Propulsion	59.0444	-177.7250	Enroute to Dutch Harbor vessel experience loss of CPP control due to water in CPP system.
31	09/27/2008	Freight Ship	95	Grounding	60.3867	-166.1750	Meykoyruk Beach, loss of hull integrity resulted in an estimated 50-100 gallon diesel spilled.
32	11/10/2008	Passenger Vessel	2,174	Partial Loss of Propulsion	54.4911	-165.3621	While in the Gulf of Alaska, vessel shut-down one engine due to high cooling water temperature.
33	02/08/2009	Misc. Vessel	111	Grounding	53.8778	-166.5778	While departing Dutch Harbor, vessel grounded.
34	03/18/2009	Cargo Ship	4,988	Loss of Propulsion	53.8778	-166.5778	While enroute to Dutch Harbor, vessel lost propulsion.
35	07/14/2009	Freight Ship	37,150	Loss of Power	53.9200	-166.4667	While underway in the Bering sea, the auxiliary generator tripped offline.
36	08/11/2009	Towing Vessel	171	Grounding	60.9833	-161.5000	While on the Kuskokwim river, tug grounded and subsequently collided with it's towed barge.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
37	08/12/2009	Barge	3,350	Weather Damage	57.9320	-158.7410	While in Bristol bay, the barge dragged anchor due to weather and ended up grounded.
38	08/20/2009	Towing Vessel	171	Grounding	60.0650	-162.4675	While towing on the Kuskokwim river, vessel grounded.
39	08/26/2009	Towing Vessel	177	Loss of Propulsion	59.0099	-158.5000	While anchoring in Bristol Bay, vessel suffered engine casualty.
40	08/27/2009	Tank Barge	629	Grounding	59.0679	-161.7284	During intentional grounding for cargo offload near Goodnews bay, the vessel was unable to get off ground without additional assistance.
41	09/17/2009	Tank Barge	531	Grounding	59.3167	-164.3000	While in Quinhagak channel, barge grounded.
42	09/23/2009	Passenger Vessel	2,174	Loss of Power	53.8778	-166.5778	While departing Dutch Harbor, vessel lost power due to an overheated generator.
43	09/25/2009	Freight Ship	13,779	Loss of Propulsion	53.8778	-166.5778	While in Unalaska bay, vessel lost propulsion due to a bad air control valve.
44	01/22/2010	Freight Ship	25,644	Reduction of Maneuverability	54.0267	-166.4283	While entering Dutch Harbor, vessel lost steering.
45	06/21/2010	Towing Vessel	193	Loss of Propulsion	51.4517	-166.0367	While towing, vessel suffered a casualty on one of it's two clutches.
46	06/22/2010	Tank Barge	334	Grounding	61.8285	-156.4305	While on the Kuskokwim river, tank barge grounded on soft bottom.
47	07/09/2010	Towing Vessel	62	Oil Spill	59.0444	-177.7250	While conducting transfer in Nome harbor, approximately 1 gallon of diesel spilled.
48	07/11/2010	Freight Ship	4,295	Grounding	58.8355	-158.5747	Vessel drug anchor and struck bottom in the vicinity of Clark's Point.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
49	09/20/2010	Towing Vessel	181	Loss of Propulsion	62.9215	-162.6583	While en route Pilot Station, AK from Russian Mission, AK, at approximately 2045, the TUG TANANA (272122) suffered a failure of their starboard engine.
50	10/14/2010	Towing Vessel	117	Oil Spill	58.6967	-156.6761	While on the Naknek river, vessel spilled 1 quart of gasoline.
51	10/16/2010	Barge	362	Grounding	54.8500	-163.5000	Towing vessel grounded, towline parted and barge grounded in rough weather near Bechevin bay.
52	02/15/2011	Towing Vessel	88	Loss of Maneuverability	57.0300	-155.1017	While in rough weather in Shelikof Strait, steering ram broke and towing wire parted.
53	05/25/2011	Freight Ship	4,457	Collision	58.6850	-160.3300	Vessels collided approaching for offloading.
54	06/26/2011	Towing Vessel	98	Sinking	56.8000	-167.3833	Enroute from Dutch Harbor to Nome, towing vessel rapidly developed list, overturned and sank in 300 ft of water, an unknown amount diesel onboard potentially, 29,000 gallons.
55	07/02/2011	Cargo Ship	8,665	Partial Loss of Propulsion	53.2033	-156.1783	Near Metrofania Bay, vessel suffered a turbocharger failure on one engine.
56	07/06/2011	Towing Vessel	193	Reduction of Maneuverability	55.0342	-161.9493	Near Liiasik pass Vessel experienced an issue with their starboard rudder/steering pump.
57	07/09/2011	Tank Barge	4,076	Grounding	59.0360	-158.4663	Nushagak river, tank barge grounded and tug became entangled in gill-net.
58	07/25/2011	Recreational Vessel		Grounding	53.8778	-166.5778	While attempting to enter the small boat harbor, vessel grounded on the rocks in the vicinity of East Point, Iliuliuk Bay.
59	07/29/2011	Cargo Ship	17,845	Loss of Maneuverability	54.3267	-166.5467	During pre-arrival checks for Dutch Harbor, vessel discovered number one steering gear to be non-operational.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
60	08/04/2011	Cargo Ship	90	Grounding	54.1600	-165.6000	Vessel landed at Surf Beach near Akutan Island and fouled one of its propellers.
61	08/07/2011	Towing Vessel	193	Fire	57.1167	-155.9500	While transiting Shelikof Strait, vessel had a fire on the port generator.
62	08/13/2011	Towing Vessel	91	Fire	61.5833	-159.2500	While near the Kuskokwim river, vessel experience engine room fire which damaged one engine.
63	08/30/2011	Towing Vessel	93	Loss of Maneuverability	64.4997	-165.4323	While near Nome Harbor, fouled starboard screw with towline and grounded with barge on beach.
64	09/02/2011	Passenger Vessel	2,174	Equipment Failure	55.2083	-162.6950	While at the Cold Bay pier, detachable link failed on the anchor.
65	09/03/2011	Towing Vessel	193	Loss of Propulsion	55.0597	-162.3210	While approaching the dock at King Cove, propulsion was lost in the starboard main engine
66	09/10/2011	Towing Vessel	93	Grounding	64.5000	-165.4167	Near Port of Nome outer harbor, screws fouled resulting in grounding and 800 gallon diesel spill.
67	09/24/2011	Cargo Ship	4,429	Loss of Propulsion	53.9017	-166.5950	While in Unalaska bay, vessel lost propulsion due to a bad engine start valve.
68	11/01/2011	Towing Vessel	54	Equipment Failure	54.8500	-163.5000	In vicinity of Unimak Island, tug's winch failed when shortening tow. Rough weather caused the towline to break and the towed barge ALASKA VILLAGER grounded.
69	11/10/2011	Towing Vessel	51	Oil Spill	64.4967	-165.4086	In Nome small boat harbor, vessel partially submerged due to weather, resulted in 5 gallon lubricating oil spill.
70	11/16/2011	Towing Vessel	171	Partial Loss of Propulsion	54.7833	-163.0000	While in Ikatan Bay, one of three engines reported low lube oil pressure and was shut-down.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
71	11/23/2011	Towing Vessel	359	Partial Loss of Propulsion	53.8800	-166.5250	While assisting a vessel in Dutch Harbor, an engine control module failed shutting down one engine.
72	12/05/2011	Cargo Ship	51,334	Loss of Maneuverability	53.6833	-168.2833	In vicinity of Unimak Island, vessels steering gear failed due to bad bearing.
73	12/15/2011	Cargo Ship	19,311	Weather Damage	54.9833	-158.9167	While in the Gulf of Alaska, vessel sustained damage to it's bow bulwark.
74	01/04/2012	Tank Vessel	5,191	Partial Loss of Propulsion	54.0218	-166.5235	While in the vicinity of Dutch Harbor, vessel had an exhaust valve fail, reducing its speed.
75	05/14/2012	Towing Vessel	177	Partial Loss of Propulsion	52.7817	-173.5933	While near Shemya, water pump on one engine failed.
76	05/17/2012	Tank Barge	938	Grounding	56.5771	-169.6792	While under tow by CHUCKCHI SEA, tank barge grounded in harbor with no damage.
77	05/28/2012	Towing Vessel	196	Fire	54.5857	-165.1423	Near Unimak Island, vessel suffered a fire to it's switchboard and a subsequent loss of electrical power.
78	06/08/2012	Freight Ship	95	Oil Spill	61.5166	-166.1000	Near Hooper Bay, 1 gallon hydraulic oil spill.
79	06/25/2012	Towing Vessel	169	Partial Loss of Propulsion	58.4920	-158.6916	While in Bristol Bay, vessel fouled propeller with towing line.
80	07/11/2012	Towing Vessel	815	Grounding	62.5633	-164.8725	Tug and Tank Barge grounded on sand/silt in Kwiklokchun Channel.
81	07/11/2012	Freight Ship	49,985	Loss of Propulsion	53.8950	-166.5117	While in Dutch Harbor, vessel had issues with engine start air distributor.
82	07/14/2012	Mobile Offshore Drilling Unit	10,264	Weather Damage	53.8847	-166.5667	While anchored near Dutch Harbor high winds caused the vessel to drag anchor and nearly pushed the vessel aground.
83	07/19/2012	Towing Vessel	166	Fire	61.8358	-166.2142	In vicinity of Hooper Bay, battery charger caught fire. Vessel seaworthiness not affected.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
84	08/02/2012	Towing Vessel	105	Fire	67.1600	-167.7467	Between Point Barrow and Prudhoe Bay an oily rag caught fire in the engine room. Vessel seaworthiness not affected.
85	08/06/2012	Barge	1,474	Grounding	66.8672	-162.6277	Near Kotzebue, barge grounded on bar due to heavy loading.
86	08/07/2012	Towing Vessel	4,721	Collision	53.9000	-166.5333	In Dutch Harbor tug and tank barge collided while doing a personnel transfer.
87	08/16/2012	Towing Vessel	93	Grounding	59.0099	-158.5000	Vessel grounded after departing from Bethel.
88	08/29/2012	Tank Barge	4,076	Flooding	71.3483	-156.7900	Worn fendering resulted in puncture of the barge side-shell.
89	08/31/2012	Freight Ship	12,892	Weather Damage	68.7400	-167.9467	While towing in the Chukchi Sea, vessel sustained weather damage.
90	09/17/2012	Towing Vessel	93	Barge Breakaway	68.3306	-166.8990	Near Point Hope, towline parted due to heavy weather. Barge was later recovered without damage.
91	09/17/2012	Towing Vessel	88	Grounding	60.6814	-161.9665	Vessel grounded on Kuskokwim river.
92	10/03/2012	Towing Vessel	169	Loss of Maneuverability	61.4783	-165.9667	While transiting from Chivak to Hooper bay the vessel lost one of three rudders due to a failed flange.
93	10/04/2012	Barge	673	Flooding	60.8190	-161.4540	On the Kuskokwim river, barge was pulled off of the riverbank and subsequently sunk due to unknown damage.
94	10/10/2012	Barge	1,469	Collision	60.7912	-161.7477	Tug lost control of barge in Adak Harbor, the barge collided with a skiff and sunk it.
95	10/12/2012	Towing Vessel	69	Grounding	63.5194	-162.0724	Tug ran aground on reef near St. Michael in Norton Sound. Unknown quantity of diesel spilled.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
96	11/10/2012	Offshore Supply Vessel	12,892	Loss of Power	71.1750	-158.8417	While towing in the Arctic Ocean, the tug lost power and shortly thereafter all propulsion.
97	11/16/2012	Mobile Offshore Drilling Unit	10,264	Fire	53.9000	-166.5333	While making Dutch Harbor, vessel engine backfired rupturing exhaust, causing a small fire.
98	11/22/2012	Mobile Offshore Drilling Unit	10,265	Loss of Propulsion	54.1983	-163.7700	South of False pass vessel suffered a reduction of propulsion.
99	11/29/2012	Cargo Ship	64,502	Fire	53.9000	-166.5333	While mooring in Dutch Harbor, bow thruster caught fire.
100	12/03/2012	Offshore Supply Vessel	12,892	Weather Damage	53.8353	-166.5687	While moored in Dutch Harbor, vessel Fast Rescue Craft suffered cold weather damage.
101	01/05/2013	Misc. Vessel	90	Reduction of Maneuverability	54.1667	-166.0000	In Bearing Sea access, hovercraft suffered loss of one of three rudders.
102	01/24/2013	Misc. Vessel	90	Allision	54.1333	-165.7667	While getting underway at Akutan city, hovercraft contacted city dock and moored fishing vessel due to wind.
103	02/21/2013	Cargo Ship	44,234	Loss of Propulsion	54.4582	-165.0756	Near Unimak Pass, vessel was unable to start it's engine after extended period of drifting.
104	03/04/2013	Towing Vessel	1,038	Loss of Propulsion	55.7099	-157.5150	While towing in the Gulf of Alaska vessel clutch malfunctioned.
105	04/09/2013	Cargo Ship	9,438	Loss of Propulsion	54.2700	-165.9100	Vessel suffered engine casualty.
106	06/09/2013	Towing Vessel	96	Loss of Propulsion	59.0360	-158.4663	While transiting the Nushagak river, vessel and barge ran aground due to changing water levels.
107	06/11/2013	Freight Ship	187	Oil Spill	60.5183	-165.1000	Near Tokssook Bay, overfilled day-tank resulting in 30 gallon diesel spill.
108	06/28/2013	Towing Vessel	89	Loss of Maneuverability	63.6345	-163.0362	Near Stebbins, vessel struck a log, bending the port propeller, both other engines unaffected.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
109	07/17/2013	Towing Vessel	629	Grounding	59.0556	-160.3167	While transiting to Togiak, barge struck unmarked boulder. Approximately 10 gallons of #1 diesel spilled.
110	07/22/2013	Barge	1,083	Grounding	70.5922	-160.1392	At Arctic Ocean access, vessel struck unmarked sandbar after guide vessel missed it.
111	07/24/2013	Tank Barge	495	Oil Spill	64.5820	-169.0635	While anchored near Wales, AK, 1 gallon of gasoline spilled.
112	07/26/2013	Barge	40	Grounding	69.6700	-163.1167	Vessel broke loose from it's mooring and grounded.
113	08/13/2013	Towing Vessel	89	Loss of Propulsion	64.0667	-169.6283	In vicinity of St. Lawrence Island, contaminated fuel caused the shut-down of all engines onboard.
114	08/27/2013	Research Vessel	9,088	Oil Spill	68.3266	-167.6608	Greywater discharge in Arctic Ocean, resulting in a sheen.
115	10/02/2013	Cargo Ship	65,531	Loss of Propulsion	54.4911	-165.3621	While in Unimak Pass vessel shut-down main engine to make repairs.
116	10/04/2013	Towing Vessel	590	Flooding	54.2317	-165.8500	Transiting from Dutch Harbor to Akutan, vessel developed a list due to flooding because of a bad gasket on a water-tight closure.
117	10/11/2013	Tank Barge	668	Oil Spill	64.6977	-165.1605	Spill during transfer near Norton Sound, 750 gallons of JP-5 into secondary containment. No oil in the water.
118	10/30/2013	Towing Vessel	198	Partial Loss of Propulsion	55.0563	-162.3192	Near King Cove, vessel voluntarily shut down one engine due to excessive smoke because of bad fuel.
119	10/31/2013	Towing Vessel	117	Partial Loss of Propulsion	59.0342	-158.4747	While getting underway at Dillingham vessel had an engine stall out.
120	11/05/2013	Passenger Vessel	88	Loss of Propulsion	60.5522	-165.2717	While towing in Etolin Strait, worn bearings on the reduction gear caused it to seize.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
121	11/17/2013	Passenger Vessel	90	Partial Loss of Propulsion	54.1505	-165.6073	At Akun Island hovercraft ramp the shaft on starboard lift engine broke.
122	05/14/2014	Towing Vessel	97	Grounding	59.0307	-158.1945	10 miles from the mouth of the Nushagak River, vessel struck a rock and holed the main fuel tank resulting in a 5,500 gallon diesel spill.
123	07/04/2014	Towing Vessel	2,393	Grounding	55.9792	-160.5758	Near Port Moller, towing vessel grounded then was hit by the towed barge.
124	09/13/2014	Freight Ship	166	Grounding	61.5190	-166.1567	During intentional grounding for cargo offload near Bering Sea, hull breached resulting in 75 gallon #2 diesel spill.
125	09/15/2014	Towing Vessel	172	Reduction of Maneuverability	59.5964	-157.0589	While mooring in Dillingham, vessel's port steering arm failed.
126	10/07/2014	Towing Vessel	172	Partial Loss of Propulsion	58.8517	-158.5750	Near Clarke's Point vessel fouled propeller on safety line to towed barge, intentionally grounded vessel to detangle propeller.
127	11/01/2014	Cargo Ship	64,502	Weather Damage	54.0617	-161.2583	East of Unimak pass large wave damaged hatch to line scuttle hatch.
128	11/04/2014	Towing Vessel	106	Reduction of Maneuverability	54.3550	-166.1850	In vicinity of Akutan Island, vessel's clutch malfunctioned resulting in a reduction of maneuverability.
129	12/18/2014	Towing Vessel	171	Reduction of Maneuverability	65.2758	-166.3489	While enroute to Teller, vessel was found to be missing one of three rudders.
130	04/02/2015	Cargo Ship	128,929	Loss of Propulsion	54.1667	-166.0000	Approximately 10 miles from Akutan Island, vessel adrift due to required repairs to engine injector.
131	07/02/2015	Freight Ship	196	Partial Loss of Propulsion	53.8778	-166.5778	In Unalaska bay one of vessel's engines kept shutting down to excessive vibration on engine controls.

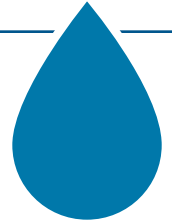
Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
132	07/03/2015	Research Vessel	9,392	Grounding	53.8955	-166.5634	In vicinity of Dutch Harbor, vessel struck an un-marked shoal and sustained a hull fracture.
133	07/10/2015	Towing Vessel	1,038	Reduction of Maneuverability	53.9000	-166.5333	In Unalaska bay worn wiring in the clutch control system resulted in one engine declutching and shutting down.
134	07/11/2015	Towing Vessel	198	Grounding	58.7226	-156.9988	Vessel grounded in Naknek river, damaging both propellers.
135	07/28/2015	Fishing Vessel	1,856	Collision	58.7173	-157.0483	At mouth of Naknek river, fishing vessel lost steering and collided with moored barge.
136	09/11/2015	Cargo Ship	20,965	Loss of Propulsion	54.0500	-163.9333	On North Pacific ocean, enroute to Dutch Harbor, vessel shut-down engine to perform maintenance.
137	09/19/2015	Towing Vessel	41	Grounding	59.1175	-157.7061	While navigation on the Nushagak River, vessel and tow ran aground on sand bar.
138	10/03/2015	Offshore Supply Vessel	1,596	Partial Loss of Propulsion	71.1618	-163.3694	Near Wainright vessel suffered an engine casualty.
139	10/31/2015	Freight Ship	196	Grounding	57.0493	-156.6110	Near Point Wrangle, vessel was affected by wind and grounded while trying to anchor.
140	01/17/2016	Oil Response Barge	1,325	Grounding	53.8764	-166.5249	In Illiluk Bay vessel broke free from its moorings and drifted onto ground.
141	06/02/2016	Towing Vessel	85	Grounding	62.5564	-165.1356	While transiting the mouth of the Yukon river, vessel grounded on sandbar.
142	06/24/2016	Tank Vessel	27,547	Grounding	59.7500	-165.5033	While conducting lightering operations near Nunivak Island vessel grounded due to inaccurate soundings on chart.
143	06/29/2016	Towing Vessel	199	Reduction of Maneuverability	65.6883	-168.2700	While underway in Bering Strait a bolt failed in the steering system, requiring the vessel to be steered in an alternate control mode.

Number	Date	Vessel Type	GT	Accident Type	Lat DD	Long DD	Description
144	07/06/2016	Recreational Vessel	-	Equipment Failure	53.8440	-166.5787	While anchored in Captain's Bay, vessel's anchor failed causing the vessel to ground on rocks, resulting in the discharge of oily bilge wastes.

Understanding the
**INPUTS AND
IMPACTS ON
FLOOD HAZARD
IDENTIFICATION**
in your community

Throughout the process of identifying the extent of flood hazards in a community, local engagement is critical. FEMA encourages citizens and local officials to get involved with the process by providing local flooding history; information on Federal, state, and local investment in mitigation infrastructure; and activities in the community that may have changed the patterns of flooding (development, new roads, etc.). This guide was developed to help communities identify the inputs that will have the most impact and allow for the best use of local resources.

UNDERSTANDING THE INPUTS AND IMPACTS ON FLOOD HAZARD IDENTIFICATION IN YOUR COMMUNITY



DECISION MAKING GUIDE	MODEL INPUTS AND THEIR IMPACTS WHEN ESTIMATING FLOOD HAZARDS ¹								
	MANNING'S "N"			TERRAIN		STRUCTURES			
	Representation of surface roughness/resistance to flow			Topographic surface used by the model		Representation of bridges and culverts in the model			
LAND TYPE Different terrain situations can influence the decision on where to focus community resources	Good	Better	Best	Good	Better	Good	Better	Best	Superior
	One Value	Bank-Channel-Bank	Horizontal Variation	LiDAR	Channel Survey	None	As Weir	Assumed	Surveyed
FLAT 	Minimum Standard	1	4	Minimum Standard	6	Minimum Standard	2	3	5
ROLLING 		1	2		6		3	4	5
HILLY 		1	3		5		No Benefit	2	4

¹ Based on the FEMA Report, "Impact of Flood Hazard Modeling Parameters on Base Flood Elevation (BFE) and Floodplain Top Width", published February 29, 2016.

² # Above numbers represent the recommended order in which to focus resources that provide the most impact to the floodplain width and flood depth using the least amount of resources, thus providing a greater return on investment. For example, in hilly areas, a focus to obtain information on Bank-Channel-Bank Manning's n data would be the best return on investment. If a community had additional resources to spend after that, gathering data related to Assumed Manning's n data would be the second best use of resources, and so on.