

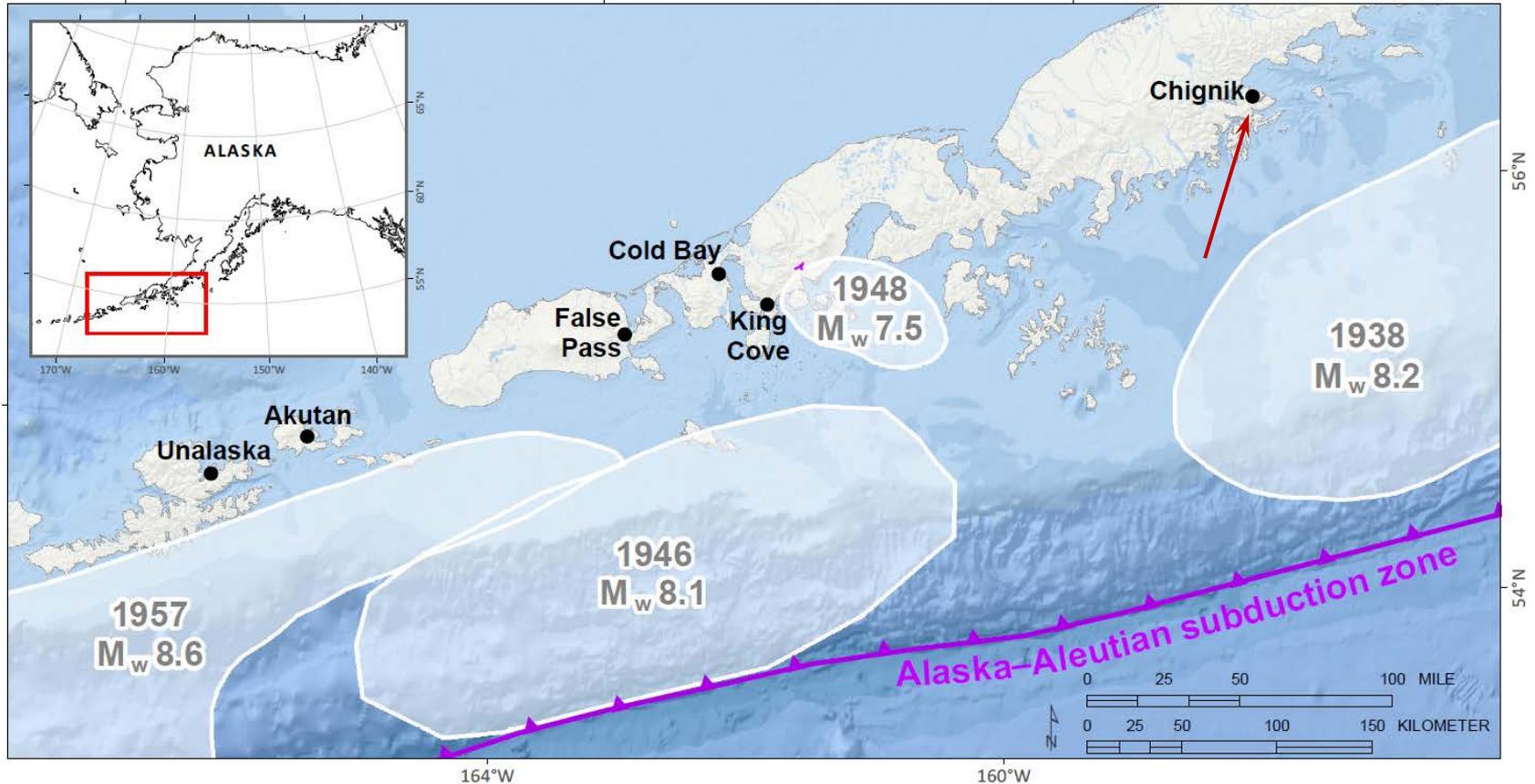
Anisotropic Pedestrian Evacuation Modeling for Alaska Coastal Communities

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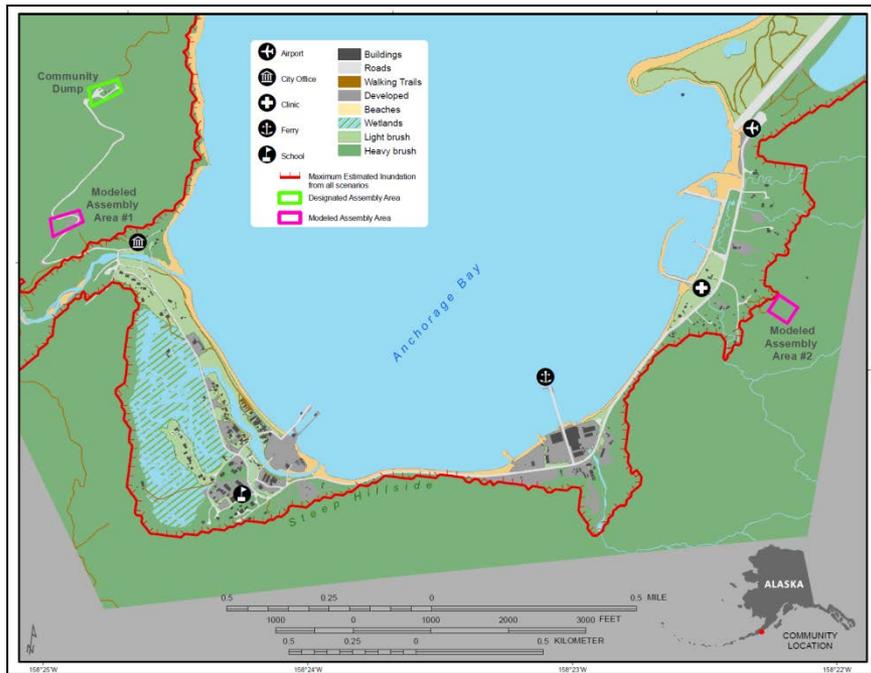
Tsunami Hazard



We apply the pedestrian evacuation modeling tools developed by USGS (Wood and Schmidlein, 2012, 2013; Jones and others, 2014) to provide guidance in assessment of the amount of time required for people to evacuate out of the tsunami-hazard zone.

Community Profile

Map of Chignik, depicting key facilities and the tsunami hazard zone.



A view over Anchorage Bay, Alaska, looking to the southeast down toward the city of Chignik.



- Most of the city is located in the tsunami hazard zone (THZ)
- Tsunami evacuation shelter is in the school outside the THZ
- Steep mountain slopes next to the boundary of the THZ

Considered Scenarios

1. Evacuation to *the hazard zone boundary* across all terrain
2. Evacuation to *the hazard zone boundary* by roads only

Across all terrain:

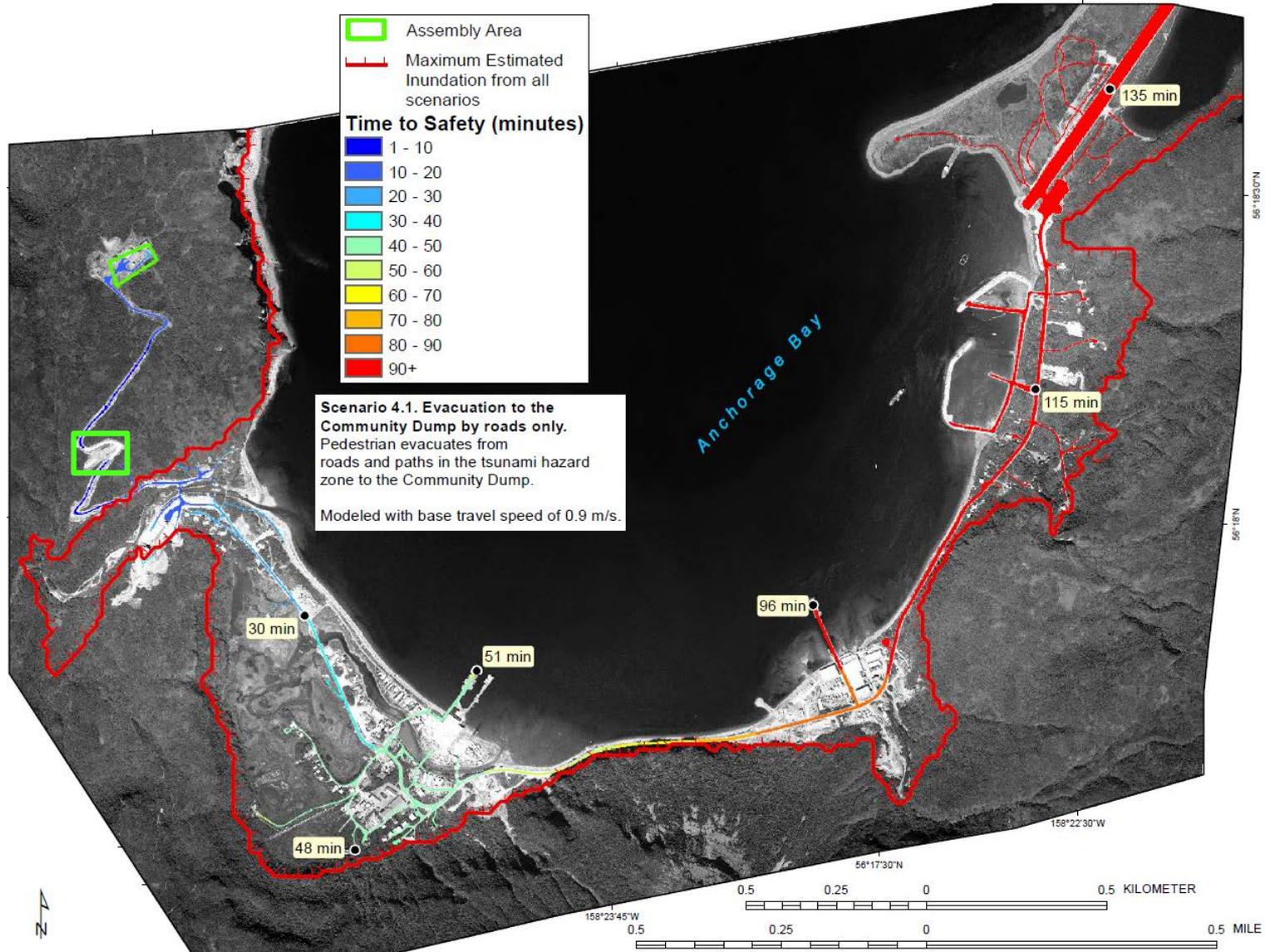
3. Evacuation to *the assembly area* at the community dump across all terrain
4. Evacuation to *the nearest assembly area* across all terrain

By roads/paths only:

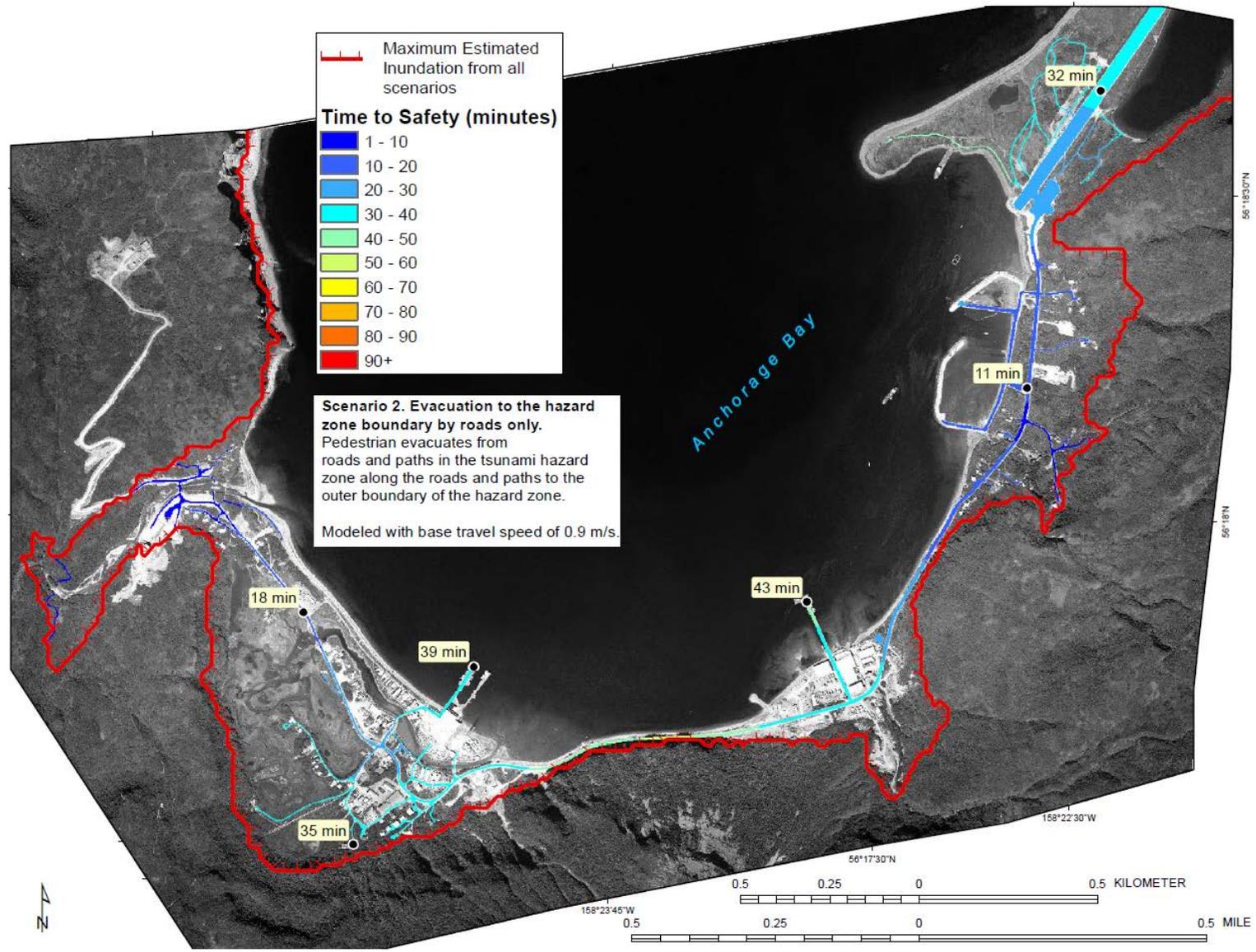
5. Evacuation to *the assembly area* at the community dump by roads/paths only
6. Evacuation to *the nearest assembly area* by roads/paths only

We assumed the walking speed of 0.91 m/s (3 ft/s).

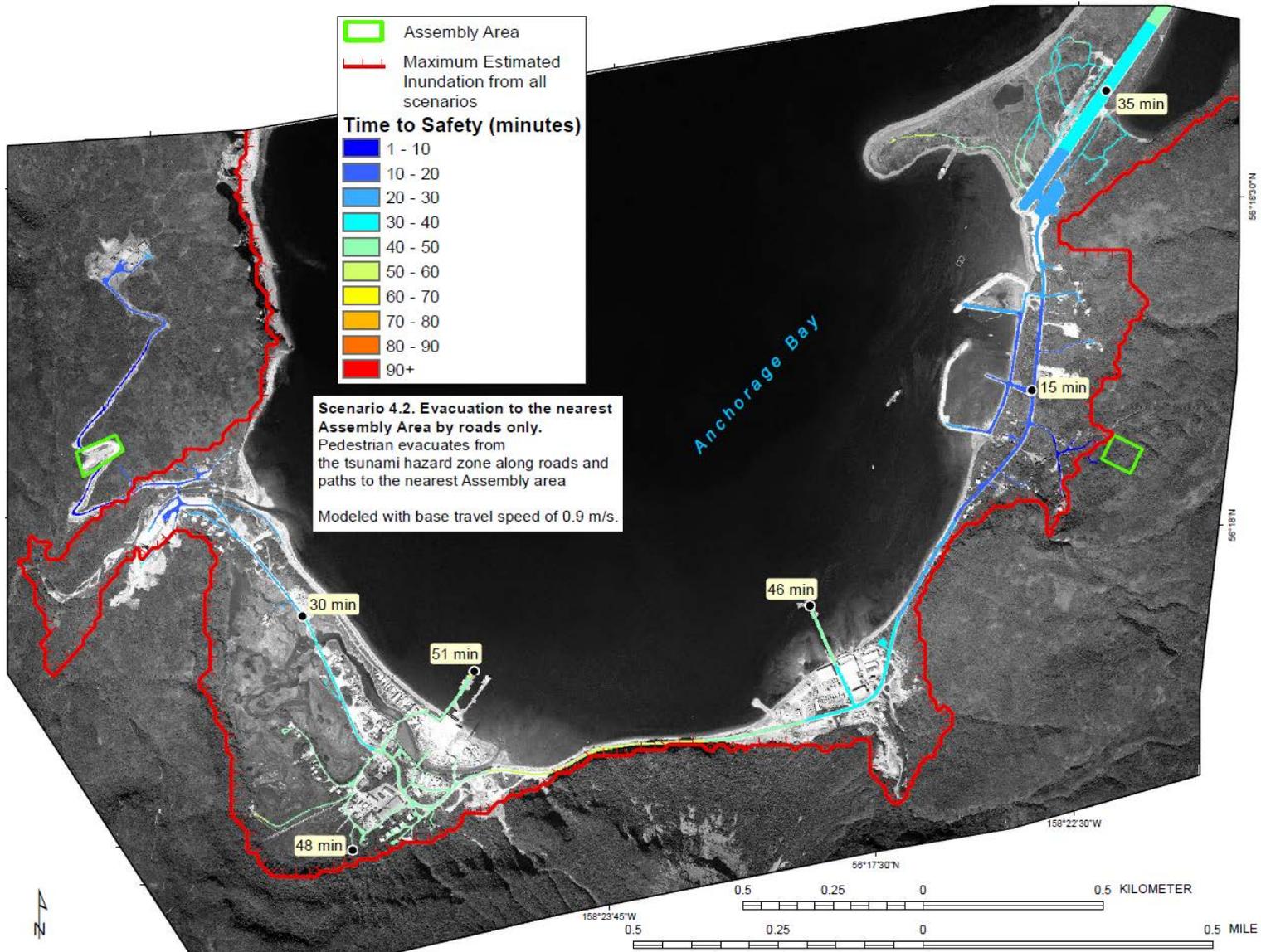
Evacuation to *the assembly area* at the community dump by roads/paths only



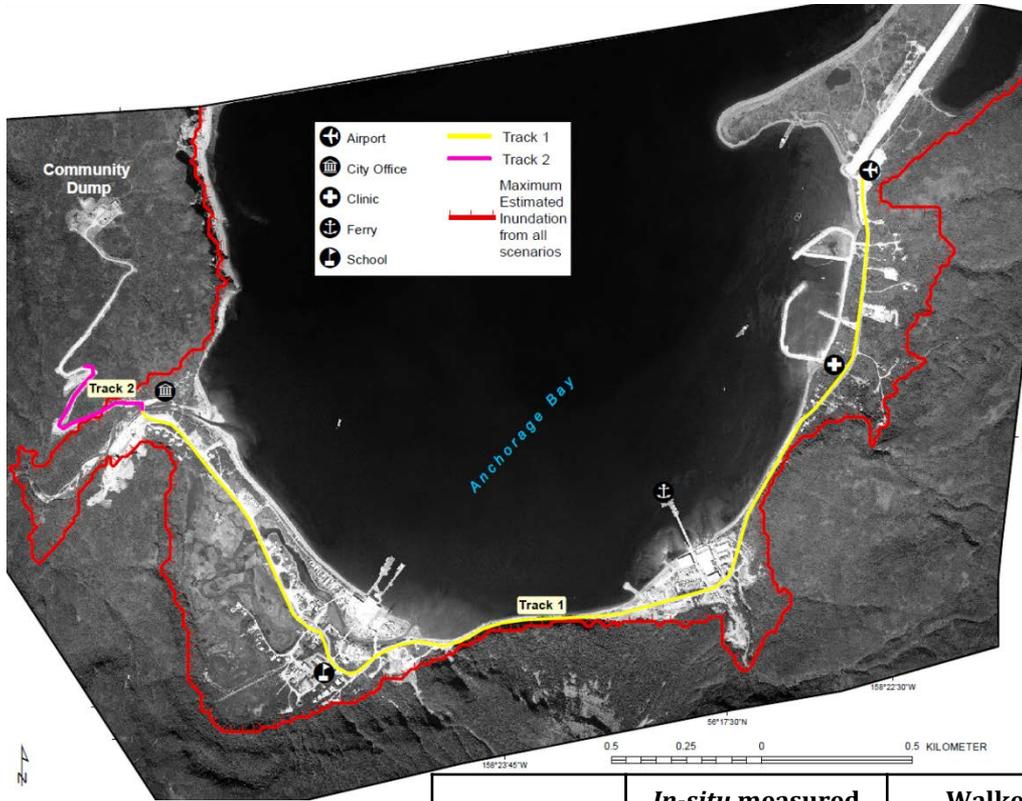
Evacuation to *the hazard zone boundary* by roads only



Evacuation to *the nearest assembly area* by roads/paths only



Model Validation



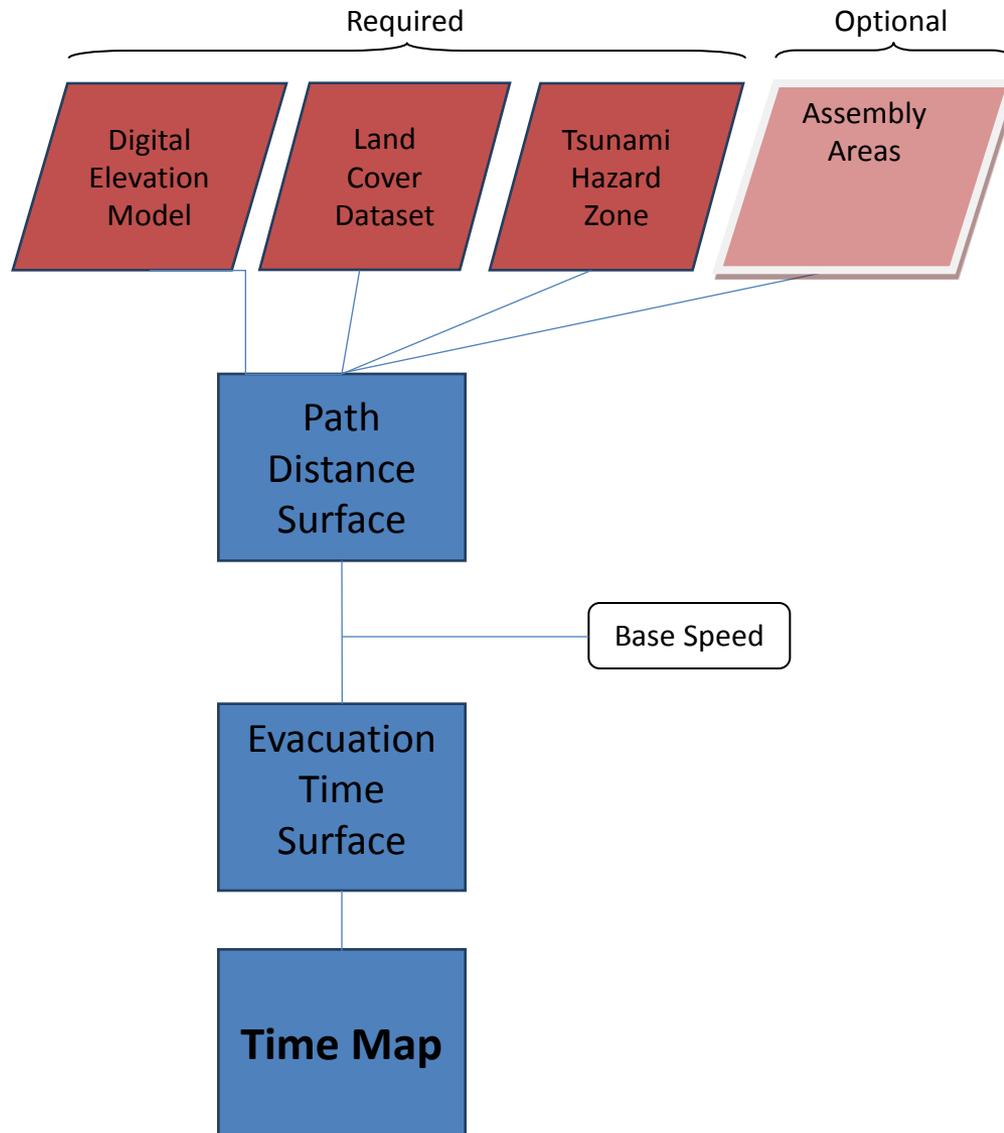
To ensure that our computations are accurate, we compare numerical calculations for Scenario 3 with site visit data (walking and timing the various routes confined to roads).

Track	<i>In-situ</i> measured walking time (minutes)	Walked distance (meters)	Average walking speed (m/s)	Modeled time (minutes)	Recalculated <i>in-situ</i> walking time (minutes)
1	51.27	3,986	1.296	101	73
2	10.05	595	1.014	17	11.2
Homer 1	98.13	7,001	1.189	150	128
King Cove 1	32.25	2,140	1.106	45	39
King Cove 2	28.75	1,883	0.916	42	29
Unalaska 1	42.5	3,890	1.52	69	71
Unalaska 2	17.8	1,160	1.08	22	21

Conclusions

- Some Alaska communities pose a unique situation, as they are small but elongated settlements, stretching along the low coastline.
- The far eastern side of Chignik (near the airport) would face very long walking travel times to reach the designated evacuation gathering point at the community dump.
- Using the USGS toolkit can help to find additional evacuation assembly area at the east side of the community shortens those modeled walking times considerably.

Pedestrian Evacuation Toolbox



Step 1:
Gather and preprocess input data

Step 2:
Compute travel distances from every cell in the study area to safety

Step 3:
Calculate evacuation time by dividing path-distance values by the chosen base speed

Step 4:
Reclassify the surface into an integer raster at 1-minute increment bands