

# Digital Elevation Model of Port Lions, Alaska: Procedures, Data Sources, and Analysis

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Prepared for the National Tsunami Hazard Mitigation Program (NTHMP) by the NOAA National Centers for Environmental Information (NCEI)

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## Summary

In August of 2016, NOAA’s National Centers for Environmental Information (NCEI) developed an integrated bathymetric–topographic digital elevation model (DEM) of Port Lions, Alaska for the National Tsunami Hazard Mitigation Program (NTHMP) and University of Alaska, Fairbanks (UAF). The 8/15 arc-second DEM will be used to support modeling tsunami generation, propagation, and inundation. The DEM covers Kizhuyak Bay and Settler Cove and the community of Port Lions on Kodiak Island. The extents of these DEM, procedures, data sources, and analysis are described below. The methodologies used by NCEI in developing DEMs are described in the NGDC Technical Report of Kodiak, Alaska (Carignan et al., 2013).

## DEM Specifications

The Port Lions DEM were built to the specifications listed in Table 1. Figure 1 shows the previously developed 8/15 arc-second Port Lions DEM boundary in red and the 8/15 arc-second 2015 Chignik and Ouzinkie DEM boundaries in green and the 2013 Kodiak 1/3 arc-second DEM in blue.

**Table 1. Specifications for the 8/15 arc-second Port Lions, Alaska DEM.**

Grid Area	Port Lions, Alaska
Coverage Area	152.82° to 152.92° W, 57.84° to 57.90° N
Coordinate System	Geographic decimal degrees
Horizontal Datum	World Geodetic System 1984 (WGS 84)
Vertical Datum	Mean Higher High Water (MHHW)
Vertical Units	Meters
Cell Size	8/15 arc-second
Grid Format	ASCII raster grid

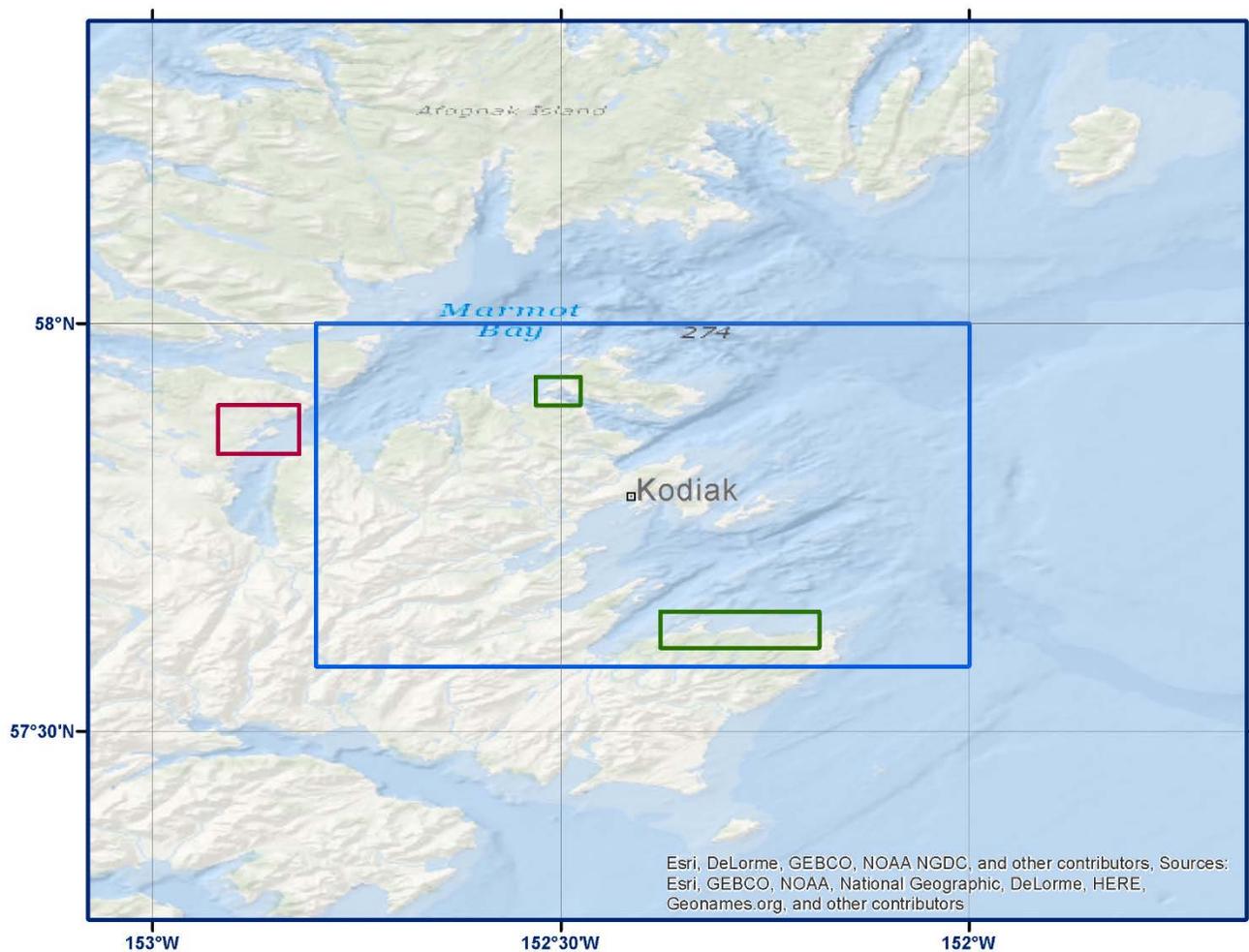
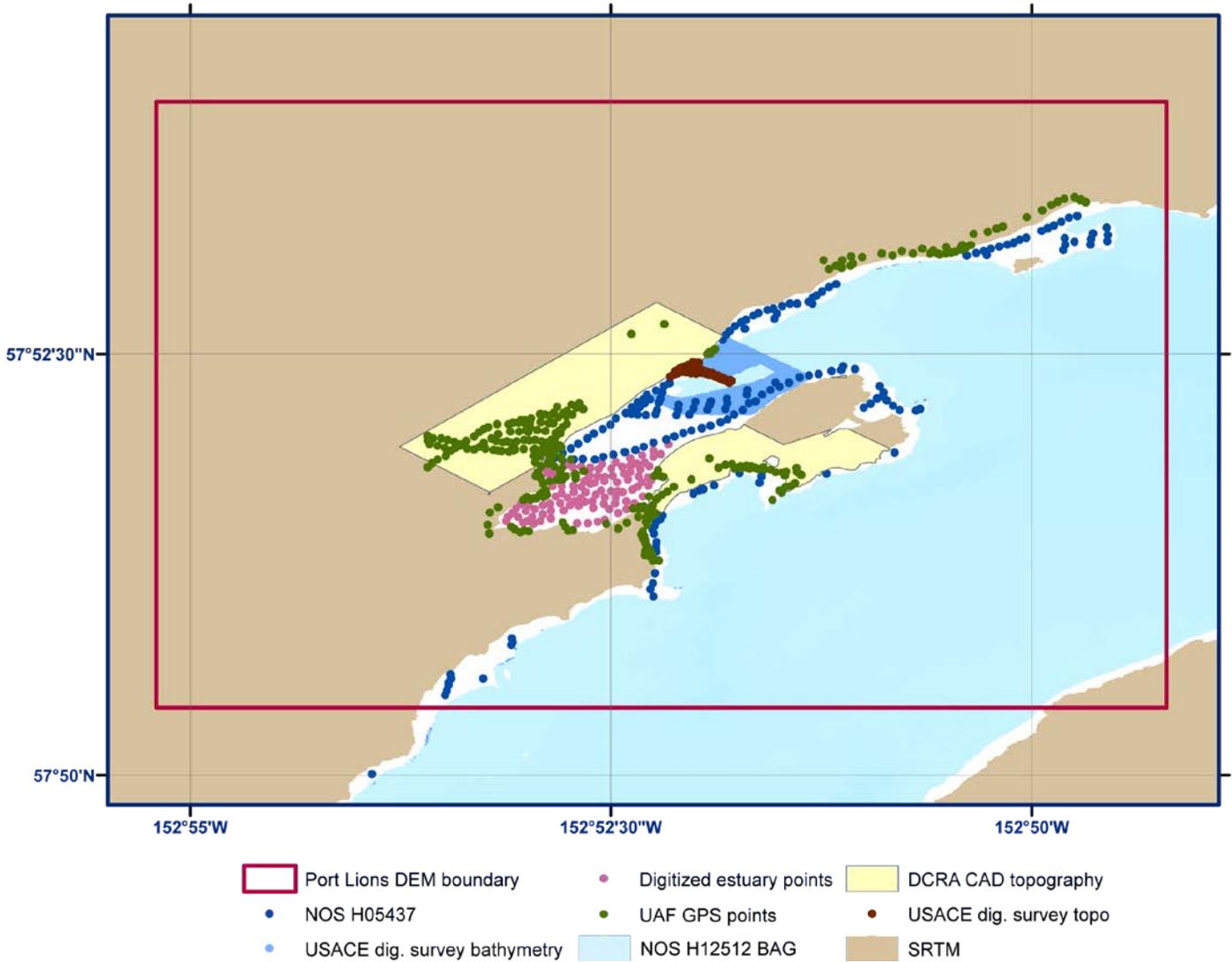


Figure 1. Map image of the boundary for the 8/15 arc-second Port Lions DEM in red.

## Data Sources and Processing

Data for the DEM were provided by UAF, the Alaska Department of Commerce, Community, and Economic Development Division of Community and Regional Affairs (DCRA), the U.S. Army Corps of Engineers Alaska District (USACE), USGS/NASA, and NOAA. Figure 2 shows the source and data coverage for the Port Lions DEM.



**Figure 2. Source and coverage of the datasets used in compiling the Port Lions DEM.**

Table 2 lists the bathymetric source data used in developing the Port Lions DEM. The NOS hydrographic survey data were extracted from NEXT, NCEI Data Extract System (<http://www.ngdc.noaa.gov/next-web/cart.html>). The NOS BAG survey, H12512, was downloaded in BAG format separately to retain the full resolution. The USACE Alaska District hydrographic condition survey for Port Lions Harbor was downloaded in PDF format, georeferenced, and soundings were hand digitized. Bathymetric data were transformed to WGS 84 and MHHW as needed using NOAA tide station #9457391 conversion value (Table 3) and where recent, higher resolution data exists, older data were deleted. No bathymetric data were available for the estuary at Settler Cove so in order to retain a surface depth consistent with GPS points, additional points were manually digitized and assigned an elevation using the GPS points as a guide. A bathymetric pre-surface grid at 8/15 are-second was generated using all the bathymetry data and an xyz file of the coastline set to zero elevation. The surface was clipped to the coastline before using as an input in the final grid.

**Table 2: Bathymetric data sources used in compiling the Port Lions DEM.**

<i>Source</i>	<i>Date</i>	<i>Data Type</i>	<i>Spatial Resolution</i>	<i>Horizontal Datum</i>	<i>Vertical Datum</i>
NOAA NOS H05437	1933	Hydrographic survey soundings	1:20,000	Unknown	Mean Lower Low Water (MLLW)
NOAA NOS (BAG) H12512	2012	Hydrographic BAG survey	1:40,000	NAD 83 UTM Zone 5 North	MLLW
USACE	2014	Project survey map digitized bathymetric survey points	~4 meter point spacing	NAD 83 AK (CORS96) State Plane Zone 5 (feet)	MLLW

**Table 3: Relationship between MHHW and other vertical datums in the Port Lions region.**

<i>Vertical Datum</i>	<i>Port Lions, Kodiak Island</i>	<i>Uzkosti Point</i>
	#9457391	#9457376
MHHW	2.852	3.446
MHW	2.574	3.160
MTL	1.465	1.838
MSL	1.457	1.851
MLW	0.355	0.516
MLLW	0	0

Topographic data used in developing the Port Lions DEM are listed in Table 4. UAF provided the DCRA topographic data in CAD format. SPOT elevation points, DTM elevation points, and contour lines were extracted from the CAD file with ArcGIS. The topographic contours lines transformed to point format using the “vertices to points” tool.

**Table 4: Topographic data sources used in compiling the Port Lions DEM.**

<i>Source</i>	<i>Date</i>	<i>Data Type</i>	<i>Spatial Resolution</i>	<i>Horizontal Datum</i>	<i>Vertical Datum</i>
SRTM	2001	Topographic DEM	1 arc second	WGS 84 geographic	WGS84/EGM96 Geoid
UAF		GPS points		WGS 84 geographic	MHHW
DCRA	2008	Extracted CAD contours and DTM points	2 foot contour interval	NAD 83 AK State Plane Zone 5 North (feet)	Geoid 06 NAVD 88
USACE	2013	Project survey map digitized topographic survey points	~25 feet point spacing	NAD 83 AK State Plane Zone 5 (feet)	MLLW

These DCRA data were transformed from NAVD 88 Geoid 06 to MHHW by first transforming to Geoid 12a with VDatum then from Geoid 12a to MHHW with the Alaska Tidal Datum Portal using a constant value of 2.533 m (Table 5).

**Table 5: DCRA control points conversion from Geoid12A to MHHW.**

<i>LONG</i>	<i>LAT</i>	<i>Geoid12A</i>	<i>MHHW</i>	<i>Geoid12A to MHHW (AK Portal)</i>
-152.851584	57.883658	13.5509	11.018	2.5329
-152.859098	57.861244	5.7399	3.207	2.5329
-152.884676	57.864971	10.9002	8.367	2.5332
-152.88363	57.857053	5.59	3.057	2.533
-152.892735	57.865648	31.1011	28.568	2.5331
-152.866305	57.862728	12.8336	10.301	2.5326
-152.865005	57.864329	20.5122	17.979	2.5332
-152.856575	57.862201	10.0135	7.481	2.5325
-152.867964	57.873448	5.7954	3.262	2.5334
				2.532977778

Digitized USACE survey topographic points provided additional elevation information for Port Lions Harbor breakwater. The SRTM 1 second DEM provided elevation data for all the area outside of the DCRA data boundary. Conversions to MHHW were done using values based on the tide station information.

## DEM Development

Development of the Port Lions DEM followed procedures documented in NGDC Technical Report of Kodiak, Alaska (Carignan et al., 2013). Gridding weight was modified to Table 6.

**Table 6: Data hierarchy used to assign gridding weight in MB-System.**

<i>Dataset</i>	<i>Relative Gridding Weight</i>
NOS BAG survey	1000
USACE digitized topographic points	1000
USACE digitized bathymetric points	1000
UAF GPS	100
DCRA topographic contours and SPOT points	10
Bathymetric pre-surface	10
Digitized bathymetric points	10
NOS hydrographic survey	1
Coastline	1
Topographic pre-surface	.1

# DEM Analysis

The completed 8/15 arc-second Port Lions DEM were compared to nautical charts, topographic maps, and high resolution imagery. Inconsistencies were evaluated and resolved based on most reliable data available.

## Acknowledgement

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## Reference

Carignan, K.S., S.J. McLean, B.W. Eakins, M.R. Love, and M. Sutherland (2013) Digital Elevation Model of Kodiak, Alaska: Procedures, Data Sources and Analysis, NGDC Technical Report, pp. 7.

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