Tsunami Modeling and Mapping: Guidelines and Best Practices

Part IV: Tsunami Evacuation Maps[1]

National Tsunami Hazard Mitigation Program
Mitigation and Education Subcommittee
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Purpose

The purpose of these guidelines is to address the minimum requirements deemed necessary to develop consistent and reliable tsunami evacuation maps. Prior to development of these guidelines, there was not a consistent approach to evacuation map development by agencies producing these products. Inconsistency can lead to confusion among the public and lead to incorrect assumptions about tsunami evacuation maps. Groups and agencies producing tsunami evacuation maps as part of the National Tsunami Hazard Mitigation Program (NTHMP) effort were required to adopt these guidelines for maps produced after January 1, 2012. All other entities are strongly encouraged to adopt them as well.

Intended Audience

These guidelines and best practices are intended for the purpose of developing map products that in turn will provide the basis for public education and outreach to support the goals of reducing the loss of life during a tsunami event. Though these guidelines apply to partners who receive NTHMP funding, they are also recommended for use by other entities with interest in or the intent of producing tsunami evacuation maps.

Expected Results

Adoption of these guidelines will promote a consistent look and feel to tsunami evacuation maps that depict the area(s) affected by a tsunami and represent a thorough assessment of local risks in order to 1) provide information upon which the public may base their actions and 2) facilitate emergency management planning activities.

Tsunami Evacuation Mapping Guidelines

Tsunami evacuation map products may include printed maps, digital map files, or interactive web-based maps. These guidelines incorporate tsunami evacuation map recommendations originally included in the Mapping and Modeling Subcommittee's (MMS) *Tsunami Inundation Maps* (http://nws.weather.gov/nthmp/publications.html). For NTHMP efforts:

- All evacuation maps should include a title, scale, geographic location (coordinates), intended use, and appropriate explanatory information.

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[1] Formerly titled *Guidelines and Best Practices for Tsunami Evacuation Mapping Guidelines*

[2] This document was reformatted as part of the "Tsunami Modeling and Mapping: Guidelines and Best Practices" series in September 2016. Note: The section in the previous version titled "Recommended Guidelines" has been removed as it was taken directly from *Tsunami Inundation Determination for Non-Modeled Regions*. No other significant changes were made.

- Evacuation maps should reference technical documentation on how the map was made and its intended use.
- Evacuation maps should delineate zones that should be evacuated in the event of a tsunami.
- When a detailed tsunami inundation assessment (i.e., inundation map) is available, the evacuation zone should encompass all areas the assessment indicates will be inundated. To create an evacuation zone for operational purposes, the evacuation zone should include a safety buffer that extends the evacuation zone beyond the modeled inundation zone (e.g., to the next street or intersection).
- If this is not the case as determined by collaboration between modelers and emergency managers, then a detailed explanation shall be provided.
- Evacuation maps should include streets, bridges, escape direction arrows, assembly areas, and well-known landmarks to help people identify the avenues of egress and safe locations.
- Evacuation zones should be legible for all users, including people with color vision disabilities.
- When possible, evacuation maps should identify all appropriate modes of evacuation (e.g., via foot, vehicle, vertical, and marine evacuation).
- When possible, maps should identify features that may impede evacuation during or after an event such as terrain obstacles, areas of unstable land, or other earthquake-related ground or structure failures. These areas should be identified by professional geologists with the purpose to inform the public of unstable areas.
- Evacuation zone boundaries should, wherever possible, conform to logical administrative boundaries (e.g., roads, property lines, etc.).
- Communities should consider developing evacuation maps that delineate both distant and local tsunami evacuation zones.
- Communities should consult with the producers of inundation maps when developing evacuation plans so that the intended accuracy and limitations of the tsunami inundation maps are considered.
- In addition to printed form, evacuation maps should be made available digitally, considering the scale limitations and appropriate base maps, to facilitate outreach."
- Where the coastline is not mapped, or has low-hazard, refer to the MMS's *Tsunami Inundation Determination for Non-Modeled Regions*. (http://nws.weather.gov/nthmp/publications.html)

IMPORTANT: Additional guidance for tsunami evacuation maps can be found under "Recommended Guidelines" of Part III: *Tsunami Inundation Determination for Non-Modeled Regions* (http://nws.weather.gov/nthmp/publications.html) and should be considered in conjunction with the guidelines above.

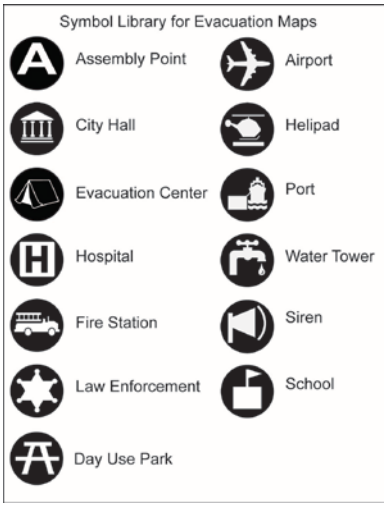
Basic Map Content

- Indicate the evacuation zone using the color yellow (ensure contrasting colors are used for the surrounding landscape). Multiple evacuation zones can be used, depending on local hazard (for instance, local and distant source tsunamis). In the case where multiple evacuation zones are used to delineate between local and distance source tsunamis, use the color yellow for local and orange for distant tsunami evacuation zones.
- Indicate designated evacuation routes with bolded streets and directional arrows leading away from the coast.
- Include bilingual text where possible, with English and a secondary language.
- Include brief instructions on what to do in event of a tsunami.

- Develop a GIS-based shape or KML overlay file of the evacuation route to make evacuation maps available electronically. Communities that do not have the resources to create these files can contact their state NTHMP partners for support (http://nws.weather.gov/nthmp/documents/OfficialDesignees.pdf).

Symbols

- The NTHMP recommends a modified adoption of the Homeland Security Mapping Standard symbols in ANSI INCITS 415-2006. These symbols are available as a true type font at http://www.fgdc.gov/HSWG/index.html.
- Symbols should be black. If they are against a dark background, a line of white should separate the symbol from the background image.
- Symbols should be easily perceived in terms of size and scalable according to the size of the final map product.
- Symbols should have precise meaning without a need for explanation on the map other than in the legend.



Standardized mapping symbols for evacuation mapping

Palette for tsunami evacuation mapping guidelines

	RGB Values	CMYK Values	Hexidecimal
Yellow	255 242 0	0 0 100 0	#FFF200
Orange	251 169 25	0 38 100 0	#FBA920
Red	230 6 15	3 100 100 1	#E6060F
Blue	12 7 248	88 78 0 0	#0C07F8
Cyan	0 174 239	100 0 0 0	#00AEEF
Dark Green	74 140 3	75 23 100 8	#4A8C03
Light Green	161 187 132	40 13 60 0	#A1BB84

Suggested standardized colors for evacuation mapping

Colors

- Every effort to ensure that the map is readable by the color blind should be made in the event that a color palate other than that suggested is chosen.
  - Avoid putting the color red next to the dark green color.
- Ensure the map is reproducible in black and white.

Resources

Oregon Evacuation Maps
http://www.oregongeology.org/tsuclearinghouse/pubs-evacbro.htm

Color Blind Image Corrections
http://www.vischeck.com/daltonize/

Del Norte County, California, Evacuation Maps
http://preparedelnorte.com/tsunami-zones/

Field Guide to Humanitarian Mapping https://mapaction.org/wp-content/uploads/2016/12/mapaction_field_guide_to_humanitarian_mapping.pdf

Homeland Security Working Group Emergency Symbology
http://www.fgdc.gov/HSWG/index.html

This document is part of the "Tsunami Modeling and Mapping: Guidelines and Best Practices" series. All the documents in this series are available on the NTHMP website at http://nws.weather.gov/nthmp/publications.html:

- *Part I: Tsunami Inundation Modeling*
- *Part II: Tsunami Inundation Maps*
- *Part III: Tsunami Inundation Determination for Non-Modeled Regions*
- *Part IV: Tsunami Evacuation Maps*
- *Checklist for Tsunami Modeling and Mapping Reports and/or Metadata*