Guidance for Flood Risk Analysis and Mapping

Contiguous Community Matching

December 2020

FEMA

Requirements for the Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) Program are specified separately by statute, regulation, or FEMA policy (primarily the Standards for Flood Risk Analysis and Mapping). This document provides guidance to support the requirements and recommends approaches for effective and efficient implementation. Alternate approaches that comply with all requirements are acceptable.

For more information, please visit the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage (www.fema.gov/flood-maps/guidance-partners/guidelines-standards).Copies of the Standards for Flood Risk Analysis and Mapping policy, related guidance, technical references, and other information about the guidelines and standards development process are all available here. You can also search directly by document title at www.fema.gov/multimedia-library.

Table of Revisions

The following summary of changes details revisions to this document subsequent to its most recent version in May 2016.

Affected Section or Subsection	Date	Revision Description
Section 5.0	December 2020	Added guidance for evaluation lines in 2D Models

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1.0 Contiguous Community Matching Overview

This document provides guidance for achieving agreement between Flood Risk Project data for contiguous communities. It addresses agreement with data in the National Flood Hazard Layer (NFHL) for surrounding areas, base map matching, agreement of hydrologic analysis, agreement of hydraulic analysis and Water Surface Elevations (WSELs), floodplain and floodway matching, and agreement between non-regulatory Flood Risk Products.

Note that the guidance principles provided in this document apply to matching between stream reaches, communities, counties, and states as well as when conducting studies, restudies, Physical Map Revisions (PMRs), Letters of Map Revision (LOMRs), and appeals.

Additional information about edgematching data can be found in the Base Map and FIRM Panel Layout Guidance, FIRM Database Guidance, and NFHL Guidance documents. In particular, the FIRM Database Guidance document addresses edgematching between the GIS layers of the FIRM Database, agreement between effective and revised data within the county, and agreement between panels or communities within a county. It also provides some helpful information about strategies for resolving any mismatches that are found, including the use of metadata to help determine the provenance and accuracy of data that may not match. The NFHL Guidance document provides additional information about edgematching within the NFHL.

Note that the topology rules that apply to Flood Insurance Rate Map (FIRM) Database features and ensure vertex-to-vertex matching among and between data layers are provided in the FIRM Database Technical Reference. The type of data matching between communities discussed in this document is more general in nature and should result in data that visually matches. FEMA's Risk MAP goals include ensuring that gaps in flood hazard data are addressed so that the available digital flood hazard data provide a solid foundation for risk assessment, floodplain management, and actuarial soundness of the National Flood Insurance Program (NFIP).

FEMA has implemented a watershed approach for flood hazard studies. The goal of this approach is to develop a complete, consistent, and connected flood engineering analysis within a watershed. This does not mean that there must be one model for an entire watershed or stream segment. An acceptable watershed-based study may include multiple hydrologic and hydraulic methods and models, but those methods and models must agree at the transition points between them. The concept of agreement is described in additional detail in the sections below. Gaps between analyses should be analyzed and addressed as part of the study. However, in certain watersheds there may continue to be some gaps in analyses for low-risk areas.

Typically, during Discovery and/or as part of the CNMS reviews, the study methodologies used for stream segments are evaluated to determine if new engineering analyses are needed. Criteria include consistency of hydrology at the Hydrologic Unit Code (HUC-8) level and tie-ins of WSELs for all recurrence intervals between hydraulic models. Gaps or inconsistencies in hydrology or WSELs may indicate that a new study is warranted.

2.0 Agreement with Surrounding Areas

As noted in several of the standards cited above, Mapping Partners need to ensure that all submitted digital data are edgematched to any existing NFHL digital data files for a seamless transition. In general, data that are in the NFHL and not part of the data being revised should be held constant and the jurisdiction that is being revised should be edgematched to the surrounding unrevised NFHL data. Obtaining the most recent version of the NFHL and periodically checking for updates to adjacent data are the first steps of any edgematching procedure.

In the process of achieving agreement with surrounding areas, keep in mind that effective Base Flood Elevations (BFEs), flood depths, flood hazard boundaries, and floodways cannot be adjusted. This is why in general, the surrounding NFHL data should be held constant and the Flood Risk Project being revised should be adjusted to fit the NFHL.

There may be instances where a mismatch, gap, or overlap is identified that is so significant that it must be addressed in the adjacent community as well in order to present the correct information. **This may require initiation of a Letter of Map Revision (LOMR), Physical Map Revision (PMR), or Notice to User (NTU) to address this situation.**

A few suggestions for edgematching between adjacent communities or counties within the NFHL are provided below.

- If two adjacent counties are being updated at the same time and there is disagreement between the two datasets, the more accurate data should be preserved and the less accurate data should be adjusted. If the accuracy of the two datasets is similar, then the older data should generally be adjusted to fit the newer data.
- If it appears that the adjacent county data in the NFHL have somehow lost vertices and spatial resolution causing gaps or overlaps with the study being revised, it may be necessary to address this by initiating a LOMR, PMR, or NTU for the adjacent county rather than degrading the data for the study being revised.
- If new countywide political boundaries are provided to the Mapping Partner and are being submitted with a PMR, edgematching of the political boundaries should be performed around the entirety of the revised S_Pol_Ar layer. Edgematching of the flood hazard data would only be performed around the edges of the PMR footprint.

3.0 Base Map Matching Guidance

See the Base Map and FIRM Panel Layout Guidance document for information regarding base map data including spatial layers that are included in a base map, minimum contents, differences between raster and vector base maps, information about orthoimagery, metadata, and quality control. See also the FIRM Database Guidance document for additional information about agreement between data layers, including between base map layers such as surface water features, political boundaries, Public Land Survey System (PLSS), and transportation features.

In general, base map data chosen for FIRM production should cover the entire project area and provide seamless coverage for all jurisdictions included in the project area. Aerial imagery that meets FEMA's base map requirements is readily available and it is not expected that gaps in coverage will be encountered. However, if there are gaps in aerial imagery, they may be filled in using an alternate source. Tone matching between images is not required.

Vector base map layers may be provided by individual counties or communities. The process by which Mapping Partners should coordinate with state or local entities to obtain base map (or other) information is discussed in the state standard operating procedure documents that can be found on the Mapping Information Platform (hazards.fema.gov/) under the "Tools & Links" tab . These documents list the default base map data for each state, available base map and Discovery data, points of contact, and preferred methods of coordination within each state.

If graphical mismatches are encountered between counties or communities where roads or other features cross jurisdictional boundaries, they should be resolved. If mismatches between base map layers provided by different entities are encountered, such as streams that do not match orthoimagery or political boundaries that do not match rivers where the river is the dividing line between communities, an alternate source of base map data may need to be found or modifications may need to be made to individual features to effect an alignment.

Differences in stream names crossing through multiple communities should be resolved.

In some instances, countywide political boundaries may be provided with the data for a PMR. In this case, the entire countywide political layer should be incorporated into the NFHL. This can reduce or avoid political boundary mismatches between a PMR and adjacent unrevised areas.

4.0 Hydrology Matching Guidance

As noted above and in Standard #189, the hydrologic analysis for an entire HUC-8 watershed must be consistent and complete, but multiple hydrologic methods may be used as long as the results are consistent between stream segments. Consistency is defined as follows. Where hydrology between adjacent stream segments does not agree within the 95 percent confidence limits of the applicable U.S. Geological Survey (USGS) regression equations, one or both stream segments should be revised to correct the mismatch. If 95 percent confidence limits are not reported in the applicable regression equations, conversion to confidence limits can be accomplished using alternate reported values such as standard error or equivalent years of record. If necessary, USGS can provide technical assistance on how to determine the 95 percent confidence limits.

Any new study to address hydrologic discrepancies should be accomplished using the most basic study method that is appropriate based on the risk and need of those connecting areas.

Per Standard #390, revision requests involving hydrology must demonstrate that the results of revised hydrologic analyses match those for contiguous areas and analyze the same recurrence interval floods as those studied for the effective FIRM.

5.0 Hydraulic Analysis and Water Surface Elevation Matching Guidance

Ideally, hydraulic analyses should be updated on a watershed basis to achieve consistent analyses on a given flooding source and to minimize the effects of any mismatches across community, county, and state boundaries. However, this may not always be possible or feasible. At a minimum, the hydraulic analysis for a flooding source must be consistent and complete.

Different hydraulic models can be used for different stream segments, as long as all of the models and all of the recurrence intervals within those models tie in within 0.5 feet of WSEL. This may require extending a model beyond the proposed study reach in order to tie into an established elevation. Stream segments that are selected for study because they connect portions of watersheds that are to be studied for risk and need should be accomplished using the most basic study method that is appropriate based on the risk and need of those areas. WSELs must tie into effective models exactly at the downstream end when backwater computations are used. Additionally, WSELs in the model must tie into the WSELs of tributaries that confluence with the main stem.

Exceptions to tie-in requirements may be made in rare cases if there are strong reasons. For example, if a stream passes through a large section of federal lands that does not require a flood risk analysis; some discontinuity in flood elevations may be tolerated. Other examples might be a significant change in flood characteristics or if an error in the existing data can be documented. If an agreement between WSELs or floodplain boundaries cannot be achieved, the mismatch must be documented in the CNMS database after the discontinuity has been accepted by the FEMA Project Officer. Coordination between the Mapping Partner, community(ies), Regional Service Center (RSC), and FEMA Regional Engineer should also be included in the process whereby discontinuities are documented and accepted.

Where WSELs between contiguous stream segments do not agree within 0.5 feet, one or both stream segments should be revised to correct the mismatch. Mismatches should be resolved in favor of the one that is considered to be most recent and accurate. As noted above in Section 2.0, mismatches in WSELs with surrounding NFHL data may require a LOMR, PMR, or NTU for the adjacent county if it is determined that the adjacent data are older or less accurate.

Where a flooding source has been delineated as a Zone AE in one community but has not been studied or has been delineated as a Zone A in an adjacent community, Zone AE with BFEs should be extended into the adjacent community. This scenario may occur even if the subject flooding source does not physically lie in the adjacent jurisdiction, but its associated floodplain extends across jurisdiction boundaries.

Revision requests must eliminate discontinuities between the flood hazard information shown for revised and unrevised areas both on the FIRM and on the flood profiles shown in the FIS Report. This may require the hydraulic model to be extended enough to ensure a logical transition between the revised and unrevised areas. The revised and unrevised WSELs must match within 0.5 feet but FEMA would prefer that the transitions match within 0.1 feet if possible.

Cross sections or evaluation lines should be continuously lettered or numbered from the downstream to upstream study limits of the flooding source. As noted in the FIRM Graphics Guidance document, new cross sections/evaluation lines inserted between existing lettered cross sections/evaluation lines may be numbered with an alphanumeric sequence to avoid re-lettering cross sections/evaluation lines upstream (i.e., cross sections/evaluation lines A1 and A2 might be inserted between existing cross sections/evaluation lines A and B). This scenario is likely to occur only when a portion of a stream is restudied.

6.0 Floodplain and Floodway Boundary Matching Guidance

Any existing differences in flood hazard data across boundaries of adjacent jurisdictions must be identified and resolved as part of a FIS Report/FIRM update. This includes gaps or overlaps in flood hazard data between communities, counties, or states as well as consistency between adjacent FIRM panels. Revised floodway data must match any effective floodways at the limits of the Flood Risk Project. And per Standard #70, if a stream forms the boundary between two or more states and/or tribes, either the 1.0-foot maximum allowable rise criterion or existing floodway agreements between the parties shall be used.

Where floodplain or floodway widths between adjacent stream segments do not agree within 5 percent of the total width, one or both stream segments should be revised to correct the mismatch. Mismatches should be resolved in favor of the one that is considered to be most recent and accurate. Special considerations related to this guidance may be required where the stream is a boundary between two jurisdictions with different floodway surcharges.

If more than one community is affected by a floodway, all affected communities should be included in any discussions that lead to an agreement among the communities as to the maximum surcharge and the floodway configuration to be applied to the shared reaches. That agreement should be fully documented. When the floodway has been established for either or both upstream or downstream communities, coordination with all involved communities is required to create a smooth transition of floodway surcharges and ensure the surcharges are within the maximum allowable limit. Coordination between the Mapping Partner, community(ies), RSC, and FEMA Regional Engineer should also be included in the process whereby floodway matching is achieved.

Flood hazard data are normally depicted within areas subject to federal or state jurisdiction (e.g., parks, national forests, game preserves, certain military bases). If the existing flood hazard data are truncated at the boundary of one of these areas, available modeling and terrain data may be used to extend the flood hazard information into the area in question. If there is an “Area Not Included” due to a military installation or other area that cannot be mapped due to security reasons, available flood hazard data may be depicted in the area at the discretion of the FEMA Project Officer.

7.0 Flood Risk Products Matching Guidance

Since the Flood Risk Products are based on data used to create the FIRM Database and/or derived from FIRM Database data, they should be edgematched to contiguous communities at least to the extent that the underlying FIRM Databases are edgematched. It is a best practice to edgematch the Flood Risk Products to adjoining FIRMs and Flood Risk Databases.