Guidance for Flood Risk Analysis and Mapping

Base Level Engineering (BLE) Analysis and Mapping

November 2023

FEMA

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Requirements for the 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/guidelines-and-standards-flood-risk-analysis-and-mapping). 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/resource-document-library.

Table of Revisions

Affected Section or Subsection	Date	Description
Section 10, 10.1	November 2023	Updated Section 10 to direct users to FIRM Database Technical Reference for BLE database requirements; Removed all of section 10.1 “Required Tables”.

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1. Introduction

Base Level Engineering (BLE) is an automated and cost-effective engineering approach that uses high-tech modeling software and high-resolution ground data to provide communities with a baseline understanding of their flood hazards. BLE represents the base level of engineering methodology and investment needed for all flood study efforts FEMA will undertake. BLE data outputs can be shared with Federal, State, local and tribal governments as a way to provide stakeholders at all levels with the necessary data to make informed decisions to reduce future flood losses. Without the mapping of flood-prone areas, there can be a lack of information to effectively communicate flood risk to community officials, citizens, and businesses. Because of these overarching goals, the BLE data outputs must be prepared and delivered in such a way to enable their sharing and retrieval.

Engineering models created during a Base Level Engineering assessment are performed at a level of quality that meets the mapping Standards for Flood Risk Projects (FEMA Policy Memo FP 204-078-1) to produce technically credible Zone A (1% annual-chance flood) information. Several analysis options can be used to accomplish this, which are outlined in Tables 1 and 2.

BLE analyses leverage high-resolution topography that meets or exceeds the United States Geological Survey (USGS) 3-D Elevation Program standards and often apply flood engineering at a large scale as opposed to targeting stream reaches within a watershed. BLE analyses can be conducted at any scale and are often conducted for larger areas (e.g., HUC-8 watersheds), but may be performed at the county or local level too. It is encouraged to perform BLE analyses for wider areas in order to build on efficiencies in modeling and ensure cost-efficiency. Using current technologies, multiple watersheds or watersheds with large land areas can be analyzed at a more efficient rate to produce water-surface elevations and site-specific hazard data to replace outdated flood studies shown on existing Flood Insurance Rate Maps (FIRMs). All flood-prone areas within a watershed will have an engineering model calculating multiple flood recurrence intervals and defining floodplains based on high-resolution topography. Please refer to section 3 of this document regarding the minimum considerations for BLE methodologies and features.

For floodplain management purposes, outputs from the BLE analysis should be used as best available information in areas that are designated as Zone A floodplain. These outputs may also be used to regulate development in areas where no Special Flood Hazard Area (SFHA) has been mapped before. Communities should be encouraged to adopt BLE-generated data to support local regulations. Adoption of this BLE data facilitates use of the data in local floodplain management activities, including in the post-disaster environment where a need for updated and/or enhanced flood hazard information may be necessary.

BLE analyses will include all recurrence intervals per standards #84 and #133. As such, hydrologic and hydraulic analyses should be performed to determine the expected water surface elevations for each of the recurrence intervals identified by those standards.

The intent of BLE is to provide communities technically credible flood hazard information in a cost efficient and timely manner. Additionally, BLE analyses provide communities a chance to review

draft modeling information, reflecting the potential changes in hazard within their community. Providing additional flood hazard datasets, like water surface elevation and flood depth rasters, delivers additional information that reinforces the variability of flood hazards within a designated floodplain and supports community requests for a source to determine a Base Flood Elevation in Zone A areas. This document will address the usability guidelines, stakeholder communication, technical issues, feasibility, and data deliverables for BLE analyses and their outputs.

BLE analyses provide information to communities who are currently unmapped and provide a digital entry to communities that are currently un-modernized. BLE data can be used as a measuring tool to allow FEMA to assess the current Zone A inventory identified as unknown or unverified in FEMA's Coordinated Needs Management Strategy (CNMS). BLE modeling is intended to be scalable, meaning that the model produced during the BLE assessment may be refined to produce a more enhanced model with additional manual updates and/or on-the-ground survey. If BLE modeling exists, FEMA will recommend that it be used as the base model for any enhanced studies performed in those areas.

Base Level Engineering benefits Federal, State, local and tribal governments by providing an expansive stream network of available modeling and providing a range of flood hazard data that can help broaden and expand risk awareness conversations with local communities.

2. Background

Base Level Engineering builds on and replaces the concepts of First Order Approximation (FOA) and Large Scale Automated Engineering (LSAE). FOA was first officially defined in November 2014 in the First Order Approximation Guidance document. FOA was intended to take advantage of technology improvements in hydrologic and hydraulic modeling of large areas. FOA was to be used to estimate floodplain boundaries in areas with no existing flood mapping and to estimate floodplain boundary changes in areas with outdated mapping. FOA was also widely used as the Coordinated Needs Management Strategy (CNMS) validation technique. FOA standards were noticeably less stringent than regulatory floodplain mapping standards, especially for topographic data, where 10-meter and 30-meter USGS Digital Elevation models (DEMs) were allowed.

FOA was widely procured by FEMA between 2014 and 2016. As the deliverables of FOA became more familiar to a larger group of people, some concerns arose. These included:

- FOA was too coarse to show critical changes in floodplain limits.
- It was difficult and not cost effective to scale up FOA to a regulatory flood map, especially where USGS DEM topography was used.
- FOA was not perceived as credible data by stakeholders.

In 2016, the term FOA was phased out and replaced with "Large Scale Automated Engineering (LSAE)". Notably, LSAE was only to be developed in areas that had Light Detection and Ranging

(LiDAR) topography or with topography with a resolution better than five meters. While stakeholders were pleased with the requirement to use LiDAR higher resolution topography in LSAE, there continued to be concern about the overall quality and technical credibility of the work, the lack of guidelines and standards, and the ease of conversion to a full regulatory floodplain mapping product.

In FY2015 FEMA piloted several BLE assessments to explore the technological advances in hydraulic modeling to produce useable flood hazard information in a cost-efficient manner. These initial large-scale BLE pilot projects were made in watersheds within the states of Arkansas, Oklahoma, North Dakota, South Dakota, and Texas.

In 2016 and early 2017, the concept of BLE as an improvement to LSAE gained traction. BLE is still intended to be highly automated, but with several key features that make it more accurate, technically credible, and suitable to be easily scaled up (See Tables 1 and 2) to an enhanced study, based on stakeholder requirements. On the continuum, FOA has been replaced by LSAE and now BLE is a new way to complete both the first investigatory flood mapping of an area as well as traditional Zone A regulatory mapping, where desired by the mapping partners.

Historically, levels of study were referenced by the terminology of “approximate”, “detailed”, “limited detailed”, etc. These terminologies loosely fit the determination of a Zone A or AE on a FIRM. With the advent of new technical methodologies and much superior remote sensing, the idea of study levels can be more easily broken into base or enhanced. Base Level is very much driven by the use of automated methods and very little ground survey or manual input. As one progresses to an Enhanced level of study, there will be more actual ground survey, more manual manipulation of the models, and potentially more flood hazard products and byproducts available for risk assessments. As such, some areas with certain lower populations and straight-forward geomorphology may allow for a mostly automated (Base level) analysis that can lead to the publication of that data as an AE zone (as referenced in Table 1). Figure 1 below shows engineering techniques as they relate to regulatory riverine floodplain mapping and where each of these approaches fits within that spectrum.

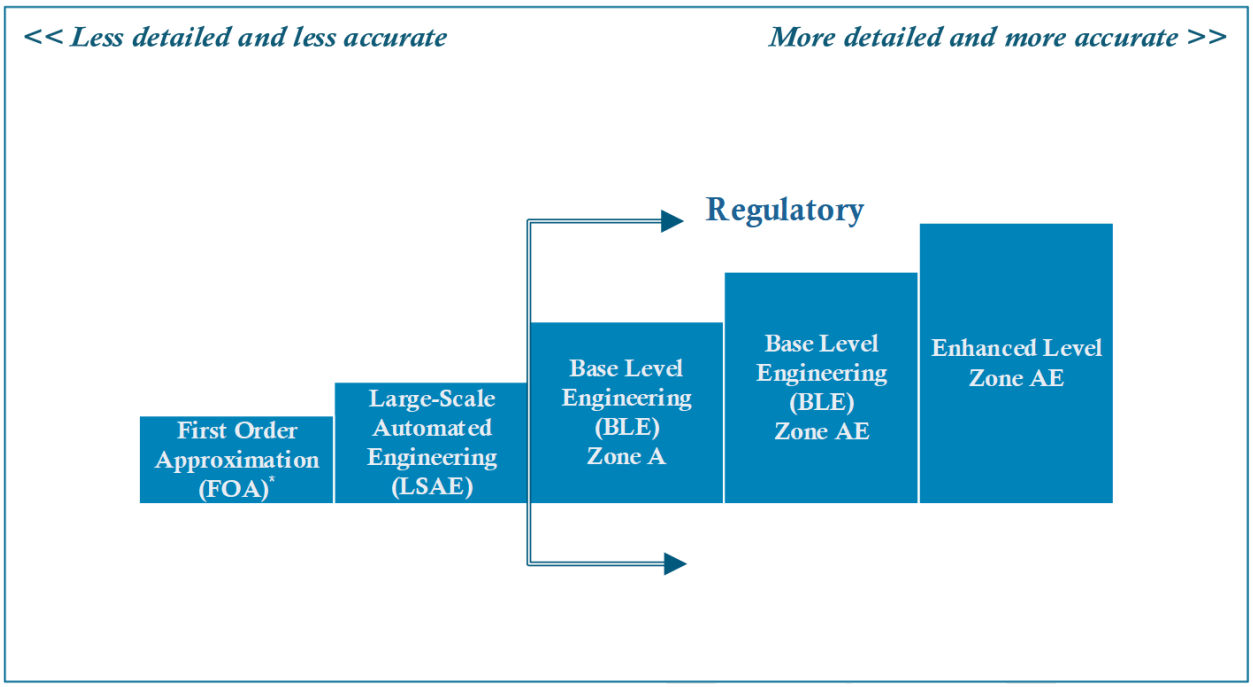


Figure 1. Span of Riverine Flood Mapping Accuracy

2.1. Need for BLE Definition and Standardization

There are several factors driving the need for BLE methodology standardization. These include:

- Consistent engineering model approach and preparation consistent with the Standards for Flood Risk Projects (FEMA Policy Memo FP 204-078-1), resulting in Zone A floodplain information.
- Preparation of engineering models that can be further updated and refined prior to the release of preliminary FIRMs, as identified and required by the community.
- Identification of the minimum delivery items available to communities near a Base Level Engineering watershed assessment.
- Definition of the minimum level of quality and coverage, so products built from the Base Level Engineering watershed assessment may be delivered consistently.

If a Regional office has previously documented their Regional procedures and guidance, they should be reviewed against this national document for consistency. Regions may choose to make additional flood risk dataset purchases. Mapping Partners and Cooperating Technical Partners should consult the Regional Office to determine if additional guidance related to BLE methodology is available. Where more stringent BLE guidance is available, Mapping Partners should follow the Regional approaches provided, but should not reduce the scope of BLE projects any further than outlined in this guidance document.

2.2. Model Backed BLE, Zone A or Zone AE

The level of effort expended in developing a floodplain analysis is generally related to the complexity of the flood hazard type (e.g., riverine split flows, levees, alluvial fans, etc.), the study methodology, the cost and time of acquiring necessary input data (e.g., LiDAR, bathymetry, and survey) and whether any effective regulatory information already exists for the area in question. Typically, at a minimum, the effective study (where applicable) will be the baseline for any future update to the regulatory FIRMs within a community. In contrast, if a FIRM has quite old "enhanced quality" data, BLE methods may still be used in certain conditions.

The cost for performing BLE analyses will vary based on the degree of automation and extent of the manual manipulation required in the modeling effort. Automation processes, technological advancements, and performing of the BLE analysis on high resolution topographic data increase the efficiency and accuracy of the modeling effort.

BLE models must be developed in agreement with the current FEMA Guidelines and Standards (G&S) to support the future creation of regulatory products and flood risk datasets and products. The BLE models should be prepared to encourage future model refinement, allowing the scalable nature of this approach to continue to yield cost effective updates as models are enhanced over time. As such, the tables below document some of the options that can be undertaken that will allow BLE projects and analyses to successfully be leveraged to support advancement to regulatory data, where scoped. Data subsequently implemented as regulatory is subject to the full scope of FEMA G&S, as applicable. For additional details, refer to Guidance Document No. 52, Guidance for Flood Risk Analysis and Mapping - General Hydraulics Considerations Guidance document.

When reading the analysis options in the table below, keep in mind compliance with FEMA Standard #5, which requires that on the regulatory flood map, flooding sources receive at least the same level of flood map product as what currently exists on the effective. For example, if the current study for a particular stream reach is AE with floodway, at a minimum analysis option 'D' would need to be developed for that stream reach if the intent is to replace it in the regulatory products.

For two-dimensional BLE modeling, BLE models must be developed in agreement with the FEMA Standards for 2D Models.

BLE is typically performed with automated methods but may also include some manual adjustments where deemed necessary by the Region and/or to enhance the model. Mapping Partners should consult the Regional Office to determine the appropriate methodology for BLE modeling efforts. The following tables present a set of approaches and options for various levels of base (Table 1) and enhanced (Table 2) level analysis, along with associated high-level modeling guidelines (both 1D and 2D) and typical applications for each option. The level of modeling detail increases from Option A to B to C, and so on, with each subsequent option intended to meet or exceed the level of detail of the preceding option. As flood hazards and risks naturally vary across a watershed, watersheds may be comprised of multiple study options or levels, rather than choosing and applying a uniform approach based on only one of these options across the entire watershed.

Table 1: Hydraulic Analysis Options – Base Level Engineering

Option /Class	Cross Sections (1D) or Mesh Refinement (2D)	Structure Representation	Manning's "n" / Land Cover	Flow Path Detail	Best Suited for…	Regulatory Application	Example Land Use	Caution
A	1D: Cross sections auto-placed; may be unnaturally straight with computerized placement or auto-placed by "intelligent" methods 2D: Large Nominal Grid sizing; optional refinement regions, sparse breaklines from pre-established spatial datasets	1D: Not included; cross sections auto-placed without consideration of structures 2D: Model/mesh hydro-enforced/adjusted at structures (via breakline modifications, terrain mods, internal connections, etc.) only where significant water is retained in the channels at crossings	1D: Single "n" value for each cross section 2D: Composite from NLCD or better local data source	1D: Left, right, and channel reach lengths assumed equal 2D: Loosely enforce streams or flow paths	Creating rapid coverage in areas that are unmapped and undeveloped; mostly planning help for very rural areas with limited to no zoning	Zone A in very limited circumstances (e.g. undeveloped areas, flatter terrain, very rural watersheds, etc.); mostly planning and validation of CNMS stream miles	Screening level information for large areas of undeveloped land (e.g., Wyoming) that might see future development (e.g., oil & gas in ND); areas with no dams/reservioirs or complex flow patterns	Inappropriate in any areas of complex terrain, moderate development, or flow regulation - even as screening information
B	1D: Cross sections auto-placed and hand adjusted or auto-placed by "intelligent" methods 2D: Large Nominal Grid sizing; sparse refinement regions, breaklines added at significant ridgelines, transportation and hydraulic features, and important infrastructure	1D: Not included, but cross sections placed to reflect significant constrictions and for future incorporation of structure modeling 2D: Model/mesh hydro-enforced/adjusted at structures where significant water is retained throughout the mesh and to prevent unrealistic backwater in the channel	1D: Overbanks from NLCD or better local source; channel value estimated separately 2D: Composite from NLCD or better local data source	1D: Reach lengths computed by offsetting stream centerline 2D: Enforce streams to at least 1 sqmi (mapped streams) with additional mesh resolution inside flowpath	Undeveloped areas or lower population areas to provide some basic information for planning purposes (e.g., emergency preparedness); also to provide regulatory data where there may be none	Zone A floodplains in undeveloped areas or rural watersheds; also, as a baseline of flood hazard for federal lands (BLM, military installations, USFS, NPS)	This could be a good level of coverage for much of the rural, undeveloped, and unmapped regions of the west	Not suitable for a FIRM in a suburb or urban area; likely adequate for major streams in simple watersheds, but may be inadequate for localized ponding
C	1D: Each section reviewed by engineers 2D: Medium Nominal Grid sizing with additional refinement regions in developed areas, breaklines added at significant ridgelines and features; results reviewed and mesh refined where necessary in locations where ponding or flow is being improperly represented	1D: Hydraulically significant structures included or approximated; estimated using national, state, or other data sources 2D: Model/mesh adjusted at structures where water ponds and flow is restricted in the channel; where data is available, some opening sizes may be estimated and reservoirs and/or long culverts handled with rating curves	1D: Overbanks from NLCD or better data; channel value estimated separately 2D: NLCD (or better local data source) with optional manual refinements or image processing, especially in developed areas	1D: Reach lengths adjusted based on the draft floodplain 2D: Enforce streams to at least 1 sqmi, with additional stream enforcement in developed/urban areas; mesh resolution refined inside flowpath	Watershed wide Zone A floodplain delineation in drainages for regulatory purposes and awareness; best available information (BAI) for pluvial ponding where 2D analyses were performed	Provides a balance in detail and cost for Zone A floodplain delineations of drainages to put on a FIRM; select ponding areas for inclusion	Modeling all streams in a watershed, including rural and non-major suburbs; reliable flow and stage in channels and decent awareness of ponding; can be used for higher complexity slope/flooding sources	Not appropriate for urban flooding; care must be taken if using ponding information for regulatory products

Studies that begin as a BLE study can be enhanced through the incorporation of additional refinement or detailed data into the models. Table 2 describes Hydraulic Refinement Opportunities to create Enhanced Study (Zone AE) modeling input data. This should be considered guidance rather than a required approach. For watershed-scale models, these enhancements could be applied to certain areas or streams within the model while leaving other areas at a more base level, depending on the goals of the project. In other words, watershed models may consist of multiple study options rather than one uniform study level across the entire watershed. Mapping Partners should refer to and follow the applicable Guidelines and Standards for Flood Risk Analysis and Mapping when upgrading a study from Zone A to Zone AE.

Table 2: Hydraulic Refinement Opportunities to Create Enhanced Study (Zone AE) Modeling

Option /Class	Cross Sections (1D) or Mesh Refinement (2D)	Structure Representation	Manning's "n" / Land Cover	Flow Path Detail	Best Suited for…	Regulatory Application	Example Land Use	Caution
D	1D: Each section reviewed by engineers, with additional cross section density considered in developed areas 2D: Medium to small nominal grid sizing with additional refinement regions in study areas and in developed areas, breaklines added throughout mesh and with more detail in study area	1D: Included; structure data from as-builts, design plans, "measured" in the field, or other community datasets with opening information 2D: Model/mesh hydro-enforced/adjusted for small structures; rating curves and/or internal connections for larger structures; consider approximations for underground storm systems	1D: Overbanks from NLCD or better data; channel value estimated separately and calibrated where possible 2D: NLCD (or better local data source), refined manually or with image processing	1D: Reach lengths adjusted based on the draft floodplain 2D: Enforce streams to at least 1 sqmi, with additional stream enforcement in developed/urban areas; mesh resolution refined inside flowpath	Completing watershed wide Zone A floodplain delineations, but with enhanced detail in select drainages and regions.	Helpful for detailed Zone AE in rural areas and Zone A for developed communities; floodway delineation would be needed in AE zones; optional to map some localized ponding as Zone A	Larger developments and suburbs with well-defined stream networks and greenways; helpful for providing 2D information as a tool beyond regulatory purposes (e.g., informing a stormwater master plan)	May not be appropriate to capture all urban flood hazards or for creating regulatory information from localized ponding; will not be adequate where extensive underground storm sewer networks exist
E	1D: Each section reviewed by engineers; channel bathymetry included in sections 2D: Medium to small nominal grid sizing with additional refinement regions in study areas and in developed areas; breaklines added throughout mesh and with detail in study area; additional mesh refinement near buildings and structures	1D: Included; structure data from field survey, as-builts, design plans, "measured" in the field, or other community datasets; stormwater system information incorporated where appropriate 2D: Openings modeling as 2D-storage area internal connections with culverts and/or bridges; underground storm systems can be approximated when small, but need refinement when significant	1D: Overbanks from NLCD or better data and/or field data; channel value estimated separately from field data and calibrated where possible 2D: NLCD (or better local data source), refined manually or with image processing	1D: Reach lengths adjusted based on draft floodplain 2D: Enforce streams to at least 1 sqmi, with additional stream enforcement in developed/urban areas; mesh resolution refined inside flowpath	Flood studies in highly developed areas and for use in evaluating risk to infrastructure or mitigation options	Zone AE applications with a floodway delineation; optional to map some localized ponding as Zone A, AO, AH, AE	A metropolitan area where urban flooding is relevant and infrastructure risk is of interest	This should be reserved only for areas of higher development

Once completed, BLE models provide a broad and consistent set of engineering models for the geography that was studied. BLE models may be further refined through a future FEMA investment or by local communities and the development industry. BLE models can also be leveraged by local communities and the development industry to update and maintain effective FIRMs through the Letter of Map Revision (LOMR) process. The final approach should be selected considering the needs and flood risk within the community, availability of input data, and project funding. BLE studies (along with their associated outputs) should be performed in accordance with all engineering standards and submitted in accordance with the FEMA Technical References. Exceptions to this would need Regional approval.

3. Minimum BLE Considerations

The "Options" listed in Table 1 and Table 2 help provide guidance for developing BLE. Since BLE outputs may need to be used for updating regulatory products, all flood risk project standards should be followed in performing the BLE analysis and producing the associated outputs, regardless of model option undertaken. This includes delivering the relevant modeling-related outputs (cross sections, floodplain boundaries, etc.) following the relevant Technical References. Producing and delivering BLE according to the FEMA Guidelines and Standards is critical to being able to ultimately visualize and share the BLE analyses and data with stakeholders. Please refer to the FEMA Guidelines and Standards for Flood Risk Analysis and Mapping webpage to access the applicable Standards and Technical References.

The following represents a sample of some of the standards and Technical References that must be followed to ensure the creation of BLE outputs that can later be leveraged for regulatory products:

- Use topography meeting SID 43 (LiDAR) with NAVD88 vertical datum.
- Flow profile baseline for 1D models, created from topography, visually compared against aerial imagery, falling within all mapped floodplains, and meeting SID 312.
- Use HEC-RAS or other FEMA approved hydraulic models as the 1-D or 2-D base hydraulic model and validate that it produces reasonable results, meeting SIDs 62 and 90.
- Model all annual exceedance probability (AEP) flood events/scenarios referenced in SID 84. The "1% plus" and "1% minus" annual-chance flows can be used to aid in future comparisons and CNMS validation. For 1D models, care should be taken to check for and correct any crossing profiles that exist between the model results of one AEP event vs. another.
- Produce floodplains for the 0.2%, and 1% annual-chance floodplains, meeting SID 133.
- Upload all data to the relevant Mapping Information Portal (MIP) workflow steps, meeting SIDs 161 and 178.
- Submit all required components of a Hydraulics Data Capture task, in accordance with the Data Capture Technical Reference.
- Submit all relevant BLE components of a Draft FIRM Database Data Capture task (see Section 10 of this document for database schema details), and in accordance with the Data

Capture Technical Reference, ensuring that "show draft data" is selected in the task to allow for the viewing of the BLE data outputs in the Draft NFHL viewer.

- In accordance with SID 74, an appropriately licensed and Registered Professional Engineer must certify that the study meets the standards as described in this guidance for the study to qualify as BLE for use as described herein.
- Generate and submit Water Surface Elevation (WSEL), Depth, and other raster datasets, per SID 417.
- Ensure proper notification to communities of the analysis is done prior to model development in accordance with SID 620.

Although Option A exists, many BLE studies may be able to leverage additional automation and technology to align more closely with the conditions reflected in Options B or C. Performing BLE analyses at the Option B level or higher is encouraged where feasible, as it allows for future updates and enhancements to be performed more efficiently using the existing BLE model, rather than needing to start from scratch or to revise certain model elements that are often more complicated to update in an existing model. Some of these BLE "buy up" or upgrades have been listed below to provide additional context and clarity to what is listed in Table 1. The optional model enhancements and additional data products below may require more manual work during the analysis process and may be specific to certain geographies. These optional components, however, provide Regions with flexibility to meet the stakeholder expectations and usability of the BLE datasets. Mapping Partners should confirm with their appropriate Regional project point of contact, as certain Regions may require that some of these elements be included as part of their BLE project.

Optional model enhancements to elevate BLE analysis quality:

- Review and refine the 1D cross-sections or 2D mesh
  - 1D: Place cross-sections (XS) upstream and downstream of flow structures. Create XS perpendicular to flow and with some degree of bend or curve to simulate manually-drawn XS.
  - 2D: Review and refine the 2D mesh to better reflect flow constrictions caused by significant topographic or hydraulic features.
- Incorporate bathymetric data for fluvially-analyzed flooding sources.
- Develop Manning's n values for each cross-section or across the 2D mesh from a pre-determined table linking land cover types in the National Land Cover Database (NLCD) to Manning's n values in the model.
- Starting water surface elevation of tributary streams for 1D BLE analysis based on normal or critical flow depth.
- For areas beyond the applicability ranges of the USGS regression equations, use gage-derived flows interpolated by drainage area.
- Adjust regression equation values (within the range of applicability) to more accurately match gage flows and/or high-water marks for past flood events, or to modify flows to account for local meteorological effects.

- Supplement modeling with additional structure data, either upgrading from structures “as-weirs”, adjusting the model or mesh to approximate structure openings, or inserting actual structure data.

Optional data products and outputs to extend BLE stakeholder usability:

- In addition to the Draft NFHL viewer, upload digital floodplain data to other appropriate publicly-accessible location (such as a GIS viewer) for use by floodplain managers and other stakeholders.
- Generate other flood risk datasets, such as Flood Risk Assessments and Areas of Mitigation Interests (AoMI), based on the BLE analysis results.
- Develop regulatory-ready Floodplain Mapping deliverables such as special flood hazard areas and lines, FIS components (profiles, floodway data tables, etc., as applicable), and base data for any/all intersecting counties or parishes.

4. BLE Data Use

It is highly likely that BLE information may be released to a community for use in local floodplain management activities prior to the release of the preliminary and then effective FIRM. When following the minimum considerations above and producing the FIRM database, checking the box to share the data allows the BLE data to be utilized by local communities by being shared on a FEMA web viewer in a consistent manner. It is important to note that BLE information does not replace the current FIRM until proper due process and adoption by the community has been completed**.** Proper due process would require the BLE information to be released on a set of preliminary FIRM panels with accompanying Flood Insurance Study Report. Following the preliminary release, FEMA would need to administer the formal appeal/comment period and issue a Letter of Final Determination prior to the effective FIRM issuance. Potential uses for the Base Level Engineering results are explained below in Sections 4.1 - 4.6. While the Sections below are not inclusive of *all* opportunities that exist for the use of BLE results and datasets, they do guide stakeholders on potential uses of the data generated by BLE analysis results prior to a future update of the FIRMs.

4.1. Floodplain Management Purposes

For floodplain management purposes, BLE data outputs should be used as available information in areas that are designated as Zone A floodplain. A community is allowed discretion in using this data only to the extent that the technical or scientific validity of this data is in question. BLE data may also be used to regulate in areas where no SFHA has been mapped earlier.

The guidance for use of the BLE data prior to FIRM release are listed below. This guidance should be referred for local use prior to any preliminary or effective FIRM issuance:

- Floodplain Management Bulletin 1-98, Use of Flood Insurance Study (FIS) Data as Available Data, - provides guidance on the use of either FEMA draft or preliminary Flood Insurance Study data as "available data" for regulating floodplain development.

- FEMA Policy: Guidance on the Use of Available Flood Hazard Information, FEMA Policy #104-008-2

- Communities should be encouraged to adopt BLE data to support local regulations. Adoption of BLE data facilitates use of the data in local floodplain management activities, including in the post disaster environment where a need for updated and/or enhanced flood hazard information may be necessary.

FEMA 265: Managing Floodplain Development in Approximate Zone A Areas (April 1995) shall be used only in areas where BLE data is not available.

4.2. Discussion Data for Discovery

If BLE is performed prior to Discovery, it will be used to assess the current flood hazard inventory and made available to communities during the Discovery phase of the Flood Risk Project. BLE data can provide cursory flood hazard analysis results and support data visualization to better engage community stakeholders. The availability of BLE data supports engagement and productive communication:

- To identify potential future investment projects within the BLE project area. Potential projects may include local training sessions, data development activities, outreach support to local communities wanting to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

- To provide an early look at how a community's flood risk may have changed since the last flood study was performed, allowing communities to review their historic floodplain management activities and identify where potential mitigation projects may be warranted.

- To initiate discussions with local communities related to the use of BLE engineering data in advance of information becoming effective on a FIRM.

- Mapping partner could offer draft BLE exhibits with estimated 1% annual-chance floodplain extent and/or estimated Base Flood Elevations (BFEs). Exhibits of this nature could highlight areas where a change in the flood hazard is suggested (e.g., an increase or decrease in depth or spatial extent of the 1% annual-chance floodplain boundary) allowing communities to review BLE results comparing them to their local knowledge and the effective mapping, if available

- BLE analysis can act as a catalyst to unearth available community technical data and hydraulic structure information (e.g., bridges and culverts), that may be incorporated in any future model refinement efforts.

For additional details, refer to Guidance Document No. 5, Guidance for Flood Risk Analysis and Mapping, Discovery Guidance.

4.3. BLE Data on Elevation Certificates

An Elevation Certificate (EC) is an administrative tool of the National Flood Insurance Program (NFIP) which is to be used to provide elevation information necessary to ensure compliance with community floodplain management ordinances or support a request for a Letter of Map Amendment (LOMA) or a Letter of Map Revision based on fill (LOMR-F).

In instances where no modeling information exists for Zone A areas or unmapped areas (see FPM bulletin 1-98), stakeholders can use the 1% annual-chance floodplain data and WSEL rasters produced as part of the BLE analysis. BFEs certified on elevation certificates have historically been required to meet the standards of FEMA 265: Managing Floodplain Development in Approximate Zone A Areas (April 1995). The estimated 1% annual-chance elevations prepared in accordance with this guidance document would exceed the FEMA 265 requirements described for elevation certificate BFE development.

4.4. BLE Data on Floodproofing Certificates

Floodproofing Certification is documentation by a registered professional engineer or architect that the design and methods of construction of a non-residential building are in accordance with accepted practices for meeting the floodproofing requirements in the community's floodplain management ordinance. BFEs and/or 1% annual-chance WSEL rasters generated by the BLE analysis can be used in instances where no modeling information exists for Zone A areas or unmapped areas on the floodproofing certificate.

BFEs certified on floodproofing certificates have been required to meet the standards of Technical Bulletin 3-93: Non-Residential Floodproofing-Requirements and Certification for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program (April 1993).

BLE analyses performed in accordance with this guidance document will meet the Technical Bulletin 3-93 requirements for floodproofing certificate BFE development.

4.5. BLE Data for LOMC (Amendment or Revision) BFE determination

BLE outputs can be used to provide estimated 1% annual-chance elevations and modeling information which is required for various types of Letter of Map Change (LOMC) requests (LOMA, LOMR-F) where such data is not already published on a FIRM. In instances where no modeling information exists for Zone A areas, the BFE and/or 1% annual-chance WSEL raster generated by the BLE analysis can be used for LOMC applications. However, the current effective FIRM still dictates the location of SFHA boundaries, therefore it is recommended that the BLE data be used in coordination with the current effective flood zone designation per the Floodplain Management Bulletin 1-98.

If a BLE dataset is used to determine a BFE for submittal through the LOMA process, the appropriate MT-1 documentation including a reference of where to find and/or how the 1% annual-chance

estimated elevation was determined should be submitted. A reference to a FEMA website with the BLE data published should suffice.

BFEs have historically been required to meet the standards of FEMA 265: Managing Floodplain Development in Approximate Zone A Areas (April 1995). The estimated 1% annual-chance elevations prepared in accordance with this guidance document would exceed the FEMA 265 requirements described BFE development.

If a community or stakeholder wishes to make an update or change the draft FEMA data through a LOMR, they would need to submit newer or refined modeling which would produce a more enhanced model (resulting in Zone AE or Zone AE with floodway).

4.6. FEMA Floodplain Inventory (NVUE) validation for Zone A

During CNMS assessments of existing effective Zone A studies, BLE data should support directly Refined Zone A Engineering study (A5) validation. For additional details about the A5 validation process, refer to Appendix C in the Technical Reference No. 8, Coordinated Needs Management Strategy (CNMS) Technical Reference. BLE data prepared in accordance with this guidance document will meet the standards for comparison against effective floodplains as described in the CNMS Technical Reference.

5. Stakeholder Engagement

Stakeholder engagement is vital to the acceptance of the BLE analysis, which in turn is essential to the development of successful Flood Risk Projects. If BLE data is available and will be used, it is critical for the stakeholders to understand the future path to be followed that will meet their expectations for the Flood Risk Project. Section 4 of this guidance provides additional details about the scenarios based on the current effective floodplain analysis inventory.

BLE data supports FEMA standard #29 that requires flood risk data to be provided in the early stages of a Flood Risk Project.

SID #620 requires that, if the model or models that will be used to update the flood hazard information shown on the FIRM are known at this stage, then each community affected by the update must be notified of the planned model(s) to be used and provided with: (1) An explanation of the appropriateness of using the model(s) and (2) A 30-day period beginning upon notification to consult with FEMA regarding the appropriateness of the mapping model(s) to be used.

BLE analyses performed in accordance with this guidance document will meet SID #29 and SID #620 requirements. If the BLE analysis is performed prior to Discovery, then notification should be made to the community of the modeling being prepared to provide the opportunities under SID #620 at that time. For example, the mapping partner could send a letter to the communities letting them know that an evaluation of their flooding is underway that may or may not result in a new FIRM update, but the study methodology being used is as follows and they have 30 days to comment on

that methodology. It can go on to tell the community that if the area is investigated for a FIRM update based on the results, they will be contacted about setting up a Discovery Meeting.

For additional details about this, refer to Guidance Document No. 22, Guidance for Flood Risk Analysis and Mapping, Stakeholder Engagement – Discovery Phase Guidance.

If BLE analysis and data development is planned during the "Data and Product Development" phase of the Risk MAP Project lifecycle, rather than during Planning or Discovery phases, additional stakeholder engagement may be necessary. The Mapping Partner should evaluate the need to have additional outreach to establish clear expectations and build stakeholder understanding and ownership of the BLE data.

For additional details, refer to Guidance Document No. 61, Guidance for Flood Risk Analysis and Mapping, Stakeholder Engagement - Data and Product Development Phase Guidance.

If a Regional office has previously documented their Regional procedures and requirements for stakeholder engagement and BLE studies, the Regional documents, shall be reviewed by Mapping Partners active in that Region. Where Regional messaging, release procedures, training materials and more advanced guidance is available, Mapping Partners should coordinate with the FEMA Regional point-of-contact (POC) and should follow the Regional approaches provided. Mapping Partners may not reduce the delivery scope of BLE delivery if the scope has been established by a Regional office.

6. Decision Tree

This section provides guidance for two common scenarios as to how to use BLE data outputs from the early stages of the BLE project to final data delivery. As referred in the introductory section of this guidance, BLE analysis is often conducted for larger areas (HUC-8 watershed or county level) to take advantage of economies of scale, irrespective of communities' current NFIP participation status. Below are the main scenarios based on the current effective floodplain inventory (Decision Trees are provided at the end of this document):

- Scenario 1 – No Mapping for County (subset NFIP participating versus not).
- Scenario 2 – County has SFHA Zones (subset digital maps versus paper).

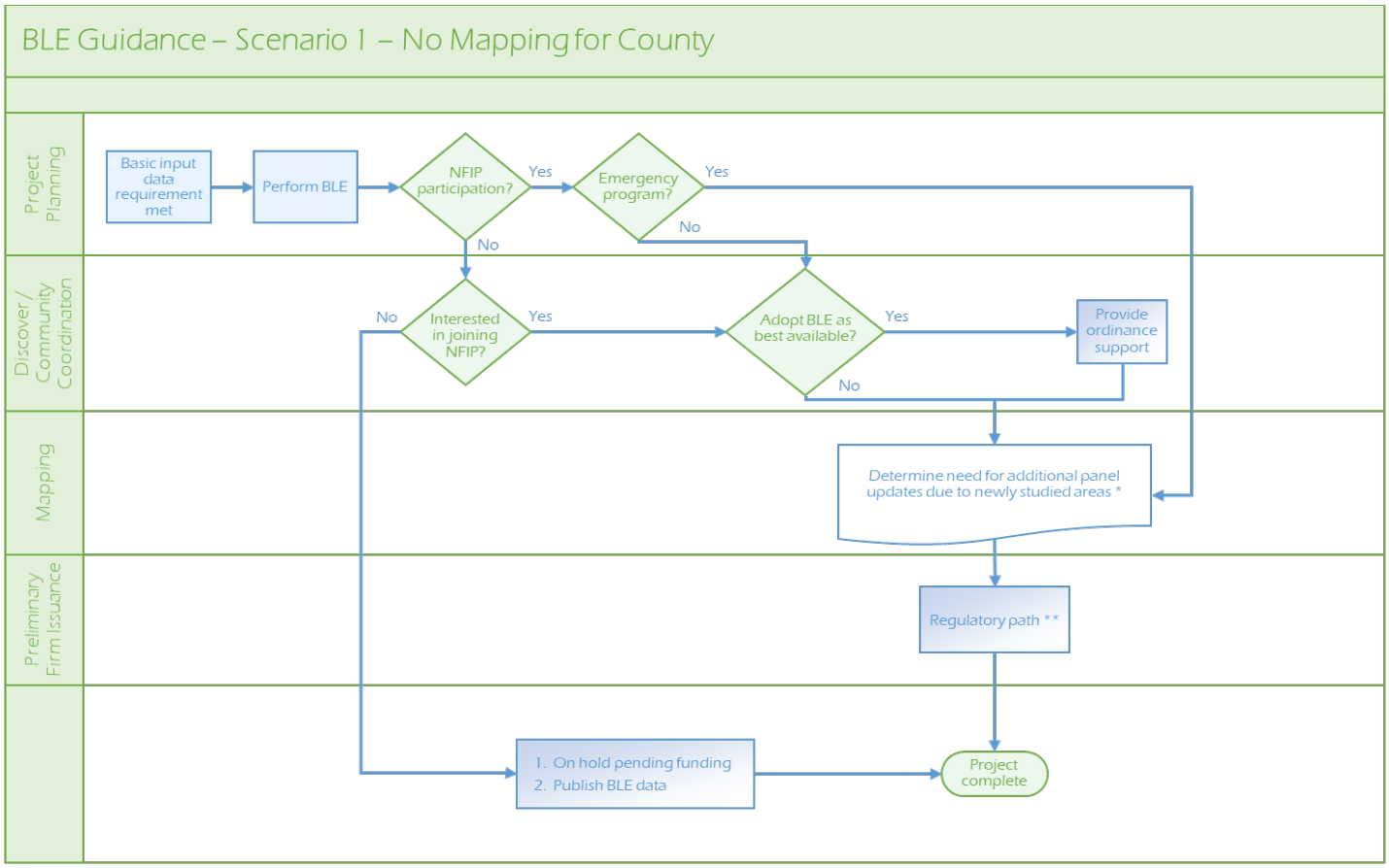
If a community and FEMA decide to attempt to streamline the floodplain mapping process (outlined in scenarios above), there must be close coordination with all affected local governments prior to this decision. A decision may be made based on low risk or minimal community impacts to utilize more automated techniques when it comes to the graphical specifications to ensure a quicker and less expensive path to final FIRM products. Additionally, a county and the communities within it, may provide in writing a request to streamline outreach activities to accelerate the delivery of their final floodplain mapping product. Regions should coordinate with their FEMA Headquarters POC if these streamlined processes are to be requested.

When advancing to the "Determine need for additional panel update due to newly studied areas" shown in Scenario 2, the Region should look at the cost for updating the area and whether providing the information as Best Available Information will be sufficient to ensure risk awareness and mitigation opportunities are available. The situation should be evaluated relative to the following criteria:

1. Is the unmapped stream/panel in a populated area?
2. Is the unmapped stream/panel in an area of current or near-term growth?
3. Could you streamline the graphic specs to allow for a more automated mapping to allow for additional updated FIRM panels but maintaining lower costs to produce?
4. Is the community capable of accessing the Best Available Information if not located on the FIRM?

When a project reaches the "Regulatory Path", it can advance as a full Risk MAP project with the identified flood risk products, or it can continue as a Paper Inventory Reduction as discussed and approved during Regional allocation process.

It should be noted that BLE analyses are often performed to help support a FIRM update, with the understanding that the FIRM update timeline will be dependent upon resource allocation and available funding. Regulatory updates may need to go "on hold" if priorities for the community are low or if risk is low in the given area. BLE output data, however, can still be leveraged by the community while regulatory updates are "on hold".



* When advancing to the "Determine need for additional stream/panel updates," the Region should look at the cost for updating the area and whether providing the information as Best Available Information will be sufficient to ensure risk awareness and mitigation opportunities are available. The situation should be evaluated relative to the following criteria:

- Is the unmapped stream/panel in a populated area?
- Is the unmapped stream/panel in an area of current or near-term growth?
- Could you streamline the graphic specs to allow for a more automated mapping to allow for additional updated FIRM panels but maintaining lower costs to prodce?
- Is the community capable of accessing the Best Available Information if not located on the FIRM?

** Project area is selected for FIRM production

Figure 2. BLE Scenario 1, No Mapping for County

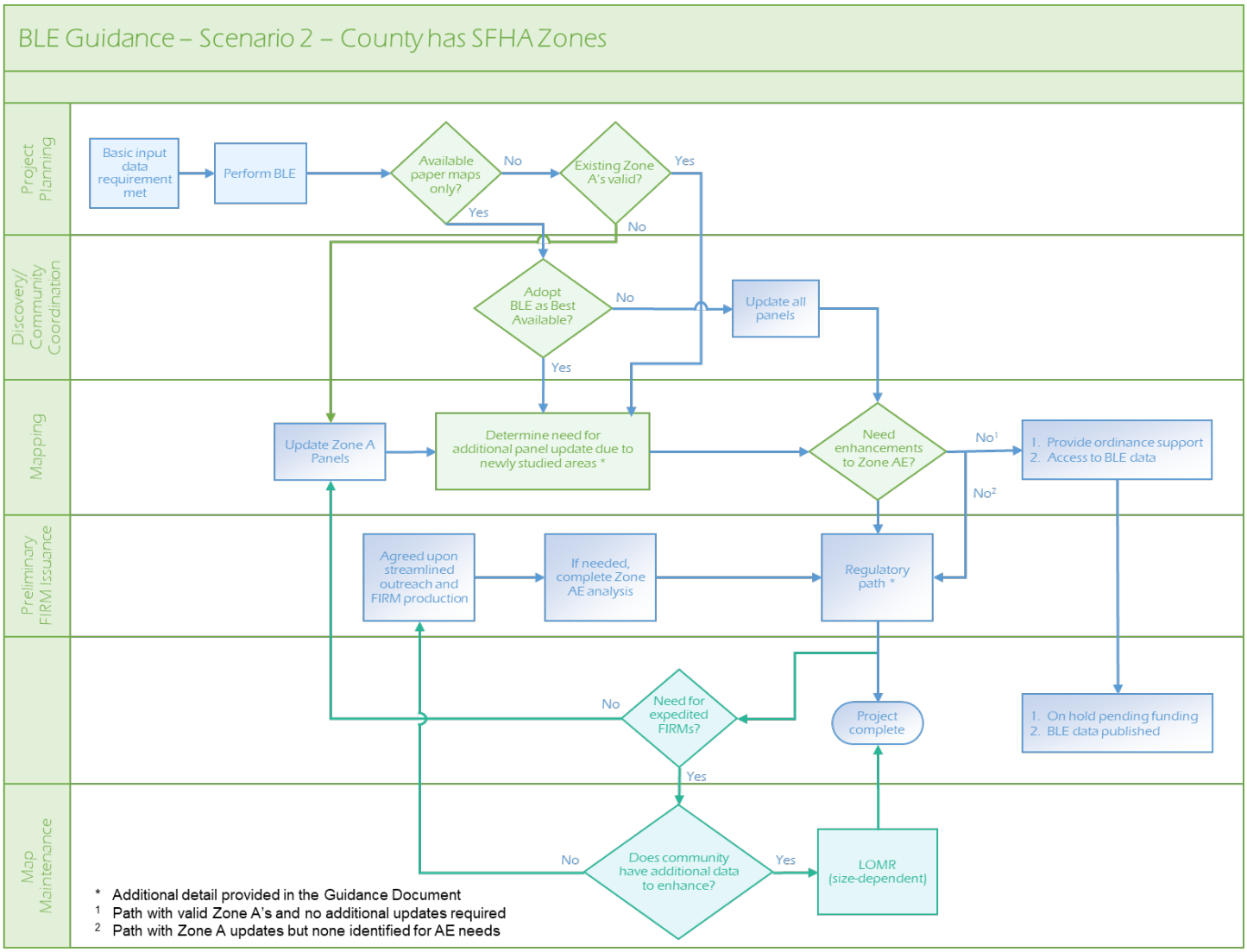


Figure 3. BLE Scenario 2, County has SFHA Zones

7. Data Deliverables

BLE studies represent a significant investment within the Risk MAP program and as such, it is critical that the work product therein is preserved in a sustainable fashion for future retrieval and usage, whether for regulatory product development or high-level decision making. In order for a BLE study to be considered complete, all deliverables and supporting data must be uploaded to the MIP, per SID 161. There are several options for implementing the structure of MIP purchases and tasks in order to ensure proper delivery of BLE studies. For all BLE studies, the Hydraulics Data Capture and Draft FIRM Database tasks should be created in the MIP. The Hydraulics Data Capture task should be utilized for the delivery of all BLE models, engineering reports, and supporting data. The Draft FIRM Database task is necessary so that BLE results may be viewed in FEMA's draft data viewer. However, the associated Draft FIRM Database submittal schema has been modified for BLE to include only those layers and tables that are necessary to support publication of the draft BLE data to the Draft National Flood Hazard Layer (NFHL) viewer, via the Draft FIRM Database task in the MIP.

The “show draft data” option should be selected for this task to enable this functionality. Section 10 summarizes the BLE submittal and overviews the DFIRM Verification Tool (DVT) rules applied for BLE submittals.

Study teams may also be required to deliver additional components that are created in the course of a BLE study within additional Data Capture tasks in the MIP, depending on the scope and type of BLE analysis. Some of these additional Data Capture task types that could be included for the proper delivery of BLE studies are: Terrain, Hydrology, Floodplain Mapping, and Flood Risk Products. Regional requirements or preferences may dictate the additional Data Capture task types that should be included in the MIP for BLE study delivery. However, the Hydraulics and Draft FIRM Database Data Capture tasks and their associated deliverables applicable to BLE analysis should be included at a minimum for all BLE studies. Coordination with the Regional program manager should occur if there are any expected variations from these minimums. Mapping partners should always consult their scoping documentation in order to determine which additional tasks are the most appropriate for MIP delivery. Per SID 180, all MIP Data Capture tasks included in a BLE study must be created and assembled in accordance with the Data Capture Technical Reference. For more information please refer to the Data Capture Technical Reference, the Data Capture General Guidance, the Data Capture – Workflow Details Guidance, and the MIP Guidance.

For both 1D and 2D studies, the output raster data (WSEL, depth, velocity, etc.) also provides an incredibly valuable source to use as best available data. These rasters should be delivered as part of the BLE project. It is recommended that this raster data is delivered to a Flood Risk Products Data Capture task in the MIP. For more information on these raster datasets, please refer to the Flood Depth and Analysis Grids Guidance document.

8. Data Storage and Sharing

One of the major objectives of the BLE process is to make the data accessible to stakeholders for use. Below are some possible solutions to sharing the data.

- Standalone GIS databases
- Workmap format with minimal graphic standards
- Community meetings and training
- FEMA’s Geo-platform
- ArcGIS Story Maps
- State/Local Data Portals

Regional Risk Analysis Branches should coordinate closely and early (preferably during scoping) with their Floodplain Management divisions to determine the appropriate distribution and data formats for a specific community.

9. Data Maintenance

To take full advantage of the BLE data generated, it is important to document and share the BLE inventory so that all stakeholders are aware of the data availability. As of the February 2018 issuance of the CNMS Technical Reference, the CNMS Inventory now includes fields for tracking location and status of BLE studies. Further explanation of the BLE tracking fields, business rules, and touchpoints can be found in the CNMS Technical Reference.

Consideration should be given to the capabilities of communities and other landowners or lessees in a community to appeal or request Letters of Map Change based on the BLE data. When developing rasters based on the BLE results, ensuring that there is a way to break out smaller subsets of the modeling to deliver to communities for map maintenance should be considered.

Once BLE data is available for communities, there are several ways that the data will progress through the regulatory process. Draft BLE data in the stages prior to Preliminary FIRM issuance may be used to make changes as follows:

- If a community wishes to make update or change the draft FEMA data to submit the newer or changed data as a LOMR, that is acceptable.
- All other FEMA generated data will follow the standard mapping timelines. Communities may provide concurrence on data and request an expedited outreach process to get through the regulatory process sooner; this will be coordinated with the FEMA Regional POC.

Based on the scenarios outlined in Section 4 of this document, FEMA can attempt to expedite portions of the process such as graphical specifications or outreach depending on community specifics. The community should use the BLE data in accordance with the criteria set out in the FPM Bulletin 1-98 and other floodplain management guidance as with any “newer data” until it becomes effective data on the FIRM.

10. BLE Draft FIRM Database Submittal

In order to streamline the publication of draft BLE data to the Draft NFHL viewer via the Draft FIRM Database task in the MIP, several modifications to the FIRM Database schema and DVT rules have been implemented for BLE submittals that are not currently planned to be placed on a FIRM. Only a few spatial layers and tables will be required (or required if applicable), whereas most tables will not need to be included in the Draft FIRM Database. Note: the portions of your project planned to be placed on a FIRM will need to meet the full database schema when the project is ready to move toward the issuance of a preliminary FIRM.

10.1. Table Attribution

Since BLE footprints may encompass multiple CIDs and Counties, the normal rules for choosing a single DFIRM_ID for the database do not apply. The DFIRM_ID for each BLE database may be a CID or county FIPS+"C" code, but it does not need to be. It must, however, be exactly 6 characters long and contain only letters and numbers.

Additionally, slight modifications have been made to the field attribution requirements for some of the Draft FIRM Database tables to also help streamline publication of the draft BLE data to the Draft NFHL viewer. In order to simplify database preparation and delivery for BLE projects, some database fields can be considered optional and do not need to be populated. Table 2 found in the FIRM Database Technical Reference includes the list of each of the Draft FIRM Database tables/layers that are required (or required if applicable) for BLE submittals. Section 11 of the FIRM Database Technical Reference indicates which database fields (if any) in each of those tables/layers are optional and do not need to be populated for the BLE Draft FIRM Database MIP data capture task. All other attribution requirements as outlined in the FIRM Database Technical Reference must be followed.

10.2. Database Verification Tool (DVT) Rules

Database Verification Tool (DVT) Quality Assurance (QA) rules for BLE submittals will be applied as follows:

- "Required" tables/layers – must be submitted to pass QA.
- "If Applicable" tables/layers – should be submitted if there is data to complete them based on the scope of the BLE project, but if they are not present DVT will not generate an error.
- All other tables/layers – may be submitted if desired; data will not be part of the viewer but would be available on the MIP for access via FRiSEL.
- For all tables/layers submitted, the table structure and fields must follow the FIRM Database schema.

Section 11 "FIRM Database Tables" in the FIRM Database Technical Reference identifies required and applicable fields within the features class description and tables for BLE submittals.