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FEMA

MEMORANDUM FOR:	Mitigation Division Directors Regions I-X, CTPs, Mapping Partners
FROM:	Doug Bellomo, Director Risk Analysis Division
SUBJECT:	Procedure Memorandum No. 59—Guidance for Implementation of Watershed-Based Studies
EFFECTIVE DATE:	Mandatory immediately for all new FY10-funded study starts; highly encouraged for FY09 study starts that have not yet completed engineering analysis.

Background: Beginning in Fiscal Year (FY) 2010, the Federal Emergency Management Agency (FEMA) initiated the Risk Mapping, Assessment, and Planning (Risk MAP) program. FEMA's vision for the Risk MAP program is "to deliver quality data that increases public awareness and leads to mitigation actions that reduce risk to life and property." To achieve this vision, FEMA will transform its traditional flood identification and mapping efforts into a more integrated process of accurately identifying, assessing, communicating, planning, and mitigating flood related risks.

Building on the success of the Flood Map Modernization (Map Mod) effort, FEMA has begun to collaborate with Federal, State, local, and Tribal stakeholders to achieve the Risk MAP goals summarized below.

1. **Flood Hazard Data.** Address gaps in flood hazard data to form a solid foundation for risk assessment, floodplain management, and actuarial soundness of the NFIP.
2. **Public Awareness/Outreach.** Ensure that a measurable increase of the public's awareness and understanding of risk results in a measurable reduction of current and future vulnerability.
3. **Hazard Mitigation Planning.** Lead and support States, local communities, and Tribal entities to effectively engage in risk-based mitigation planning, resulting in sustainable actions that reduce or eliminate risks to life and property from natural hazards.

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However, the document contains useful guidance to support implementation of the new standards.

4. **Enhanced Digital Platform.** Provide an enhanced digital platform that improves management of Risk MAP, administers information produced by Risk MAP, and improves communication and sharing of risk data and related products to all levels of government and the public.
5. **Alignment and Synergies.** Align Risk Analysis programs and develop synergies to enhance decision-making capabilities through effective risk communication and management.

Issue: To achieve the Risk MAP vision, new products and enhancements to existing products are being developed. Some of these new products and enhancements will require changes to the currently effective sections of the *Guidelines and Specifications for Flood Hazard Mapping Partners (Guidelines).* FEMA will document risk assessment in a new appendix. Although FEMA has begun the planning and production of the new and revised sections of the *Guidelines*, the updated *Guidelines* will not be available until early 2011. In the interim, FEMA has identified several program areas where standards and guidance are needed for the FEMA Regions' use in issuing contractual documents Statements of Work (SOW) for FEMA contractors, Mapping Activity Statements (MASs) for participants in the Cooperating Technical Partners Program (CTPs), Interagency Agreements (IAAs) for other Federal agencies (OFAs); and, requisite funding to Mapping Partners (i.e., FEMA contractors, CTPs in Fiscal Year (FY) 2010.

FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Multi-Year Plan: Fiscal Years 2010-2014 dated March 16, 2009, recognizes the benefits of performing engineering and mapping analyses on a watershed basis and commits to, "Bring communities together to discuss joint risks and consequences around a shared watershed." To accomplish these goals, it is necessary to increase the integration of flood hazard analyses and data around a watershed framework.

Action Taken: To further the Risk MAP program vision and to assist in meeting Risk MAP goals and objectives, the FEMA Regions are to apply the standards and guidance summarized in the attached "Guiding Principles and Processes for Watershed-Based Studies" document when preparing contract documents - SOWs, MASs, IAAs, and related grant and contract documents - for FY 2010 FEMA funded flood studies and flood mapping projects. FEMA Regional Offices and Mapping Partners shall also comply with the "Guiding Principles and Processes for Watershed-Based Studies" in carrying out the assigned work to create and/or maintain Digital Flood Insurance Rate Maps (DFIRMs) and related products as documented in the SOWs and MASs.

The attached guidance document shall be implemented by all Regions and Mapping Partners in accordance with the Effective Date of this Procedure Memorandum.

Attachments
Guiding Principles and Processes for Watershed-Based Studies

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Guiding Principles and Processes For Watershed-Based Studies
Effective Immediately

I. Guiding Principles and Assumptions

Procedure Memorandum No. 59—Guidance for Implementation of Watershed-Based Studies describes the actions to be taken for the implementation of the FEMA Risk MAP watershed approach. Fiscal Year 2010 projects will proceed using the guidance detailed in this document. Fiscal Year 2011 projects will be planned and executed using additional guidance to be developed and implemented through the remainder of 2010.

The overarching principle for the watershed 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 defined in additional detail below. Gaps between analyses are to be analyzed and addressed as a rule, but in certain watersheds there may continue to be some gaps in analyses for low-risk areas.

The United States Geological Survey (USGS) has defined and cataloged watersheds by unique Hydrologic Unit Codes (HUC). This classification system breaks down the United States into hydrologic units, with assigned numerical values. The basis of FEMA's watershed-based analysis will be the HUC-8 unit. The standard to be used for the definition of HUC-8, HUC-10, and HUC-12 cataloging units is the Watershed Boundary Dataset (WBD), a companion dataset to the National Hydrography Dataset (NHD). Both the NHD and WBD are discussed in detail in USGS Fact Sheet 2009–3054, Revised March 2010, and entitled "The National Map—Hydrography." The NHD and WBD can be viewed in The National Map at http://nationalmap.gov/ and downloaded for use in a Geographic Information System (GIS). The NHD and WBD also can be downloaded from a specialized hydrography portal at http://nhd.usgs.gov/. For data management purposes, the NHD is distributed in units defined by the second or fourth levels of the WBD. The hydrography data also can be downloaded from the Natural Resource Conservation Service at http://datagateway.nrcs.usda.gov/.

The watershed approach requires an evaluation of the risk and need in all areas of the HUC-8 to determine the flood study scope and scale. For flood engineering studies there is flexibility on the scale used for the study, based on the guiding principles listed here and the additional guidance below. The production or revision of regulatory maps will continue to be evaluated on a panel-by-panel basis. The guiding principles for the watershed approach are described below.

- A Risk MAP watershed project will be considered complete when the HUC-8 has been evaluated, the watersheds or subwatersheds chosen for new or updated flood studies are studied, and:
    - All watersheds or subwatersheds requiring new or updated hydrologic or hydraulic analysis have been studied and mapped.

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    - Hydraulics will be performed for an entire stream segment when that stream is selected for study. This means that unstudied areas (or gaps) between studied stream segments must be studied unless those gaps consist of valid study that ties into the new study. However, there can be different levels of study for the different stream segments, as long as all the models tie-in.
    - All other subwatersheds have been evaluated and do not require a new or updated study based on risk and need.
    - All Hydrology within the watershed is consistent. In watersheds where the hydrology is not consistent, additional study is required to create consistency.

- All newly initiated studies after the date of this Procedure Memorandum will be watershed-based, with the exception of small-scale studies related to Provisionally Accredited Levee (PAL) status, and flooding sources related to issue resolution for litigation or Federal legislative or executive inquiries

- A HUC-8 project will be initiated once within the Risk MAP lifecycle. All watersheds or subwatersheds within the HUC-8 will be evaluated, scoped, and have work initiated within that project period. It is understood that coordination with levee and coastal studies may prove challenging, and exceptions to the once per lifecycle guidance here will be considered under those circumstances.

- No stream segment or subwatershed will receive a lower level of regulatory flood map product than what currently exists on effective maps. For example, areas with defined floodways will continue to have defined floodways. Areas with published Base Flood Elevations (BFEs) will continue to have published BFEs. The method of study chosen will be dependent on the level of risk for that flooding hazard.

- Regional implementation of the watershed strategy is to be managed to avoid impacting or delaying implementation of the coastal, levee, or CTP cost-share mandates. The coastal, levee, or CTP cost-share requirements are Congressionally-mandated.

- DFIRMS and all other regulatory flood mapping products shall not be produced using HAZUS Average Annualized Loss (AAL) flood modeling products. The flood modeling methodology in HAZUS does not produce a model than can be archived for future revision.

- Stream segments that are selected for study because they connect portions of watersheds that are to be studied for risk and need shall be accomplished using the most basic study method that is appropriate based on the risk and need of those areas. Additionally, it is not necessary to publish FIRMs for the connecting portions, unless risk or need around those segments were to make it appropriate.

II. Evaluation of HUC-8 Watersheds

After a HUC-8 watershed that has been prioritized for study, the first step is to evaluate available information within the HUC-8 watershed, down to HUC-10 and HUC-12 levels. For FY2010

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projects, this process will be completed during discovery. The "Partial Distribution of FY10 Appropriated Flood Map Funding Part 1 of 2" memo dated February 19, 2010 initiated the requirement of scoping/discovery on the watershed level. Projects not aligned with this requirement should be identified and have a plan developed to bring them into conformance. In FY2011 and later projects, this evaluation will be completed prior to project prioritization and study selection.

The factors to evaluate are: 1) the programmatic metrics, 2) the current availability of data, 3) the level of risk, 4) and the level of need. The objective of the evaluation step is to understand the risk and need data at the various watershed levels. This will then enable Regions to determine the appropriate watersheds or subwatersheds for study.

Engineering needs are to be determined by the data available in CNMS. As of the date of the watershed guidance procedure memorandum, CNMS is sufficiently populated to determine the New, Validated, Updated Engineering (NVUE) status of stream segments at a level sufficient for project discovery. The example later in this document was produced using CNMS data in the current state. It is essential that CNMS be fully updated before, during, and after the prioritization and discovery processes so that accurate data is available for the process and for future analysis.

For FY2010, Risk will be based on an updated "Atlanta Factors" decile data set as described in the MHIP version 2.5. A version of this data set, attributed to the HUC-8 level, is available on the Risk Analysis Division (RAD) Sharepoint site. For FY2011 and beyond, risk data will likely be determined from the Average Annualized Loss (AAL) study. This data has been aggregated to the county-wide level, but may also be provided at the census block group, HUC-8, watershed, and subwatershed level.

The discovery of available data would include investigation of available topographic data, aerial imagery data, engineering studies, and other data useful for the production of Risk MAP products. Regions are to make use of partner-supplied data wherever possible, but are also to consider the schedule and cost impacts of doing so.

III. Determining Study Area Within a HUC-8 watershed

After the evaluation step, the next step in the watershed approach is to determine where Regions should focus efforts within the HUC-8 by following these guiding principles.

Within a HUC-8 watershed, Regions are to choose a subwatershed scale to evaluate the need for a new or upgraded study. To supplement the guiding principles, the following business rules shall be used to determine the appropriate study area within a HUC-8:

a. Hydrology will be evaluated for consistency at the HUC-8 level in all cases. Updates to effective hydrologic studies will be evaluated using the guidance in Appendix C of the *Guidelines and Specifications for Flood Hazard Mapping*. The hydrologic analysis for the entire HUC-8 must be consistent and complete, but does not require one model or

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analysis. Multiple hydrologic methods may be used as long as the results tie-in within acceptable confidence levels per Appendix C. If there are inconsistencies, these must be addressed by new study.

b. Hydraulics will be performed for an entire stream segment when that subwatershed is selected for study. Additionally, stream segments will be studied that connect the subwatersheds selected for study, unless a valid study exists and ties-in the studied segments. However, there can be different models for the different study segments, as long as all the models, and all the recurrence intervals within those models tie-in within 0.5' of water surface elevation. Stream segments that are selected for study because they connect portions of watersheds that are to be studied for risk and need shall be accomplished using the most basic study method that is appropriate based on the risk and need of those connecting areas.

   Stream segments that are not selected for study, either because the effective study is valid or there is not sufficient risk to warrant a study, do not need to be studied unless they do not tie into the other studies in both the upstream and downstream subwatersheds. All new or effective flood study must tie into adjacent new or effective flood studies unless there are strong reasons that a tie-in is not required. 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. For steady-state models, the hydraulic analysis must start at the most downstream subwatershed where a new or revised study is identified, and must go all the way upstream to where there are no more new/updated studies identified. See the multi-step example at the end of this document.

IV. Determining Appropriate Study Methodologies

Once the HUC-8 has been evaluated for risk, need, and data, and the study watersheds or subwatersheds have been determined, the next step is to determine the appropriate study methodologies for each study.

The type of study chosen for a specific location will depend on the type of study that is effective at that location, the type of need to be met, and the risk within to the study area. As defined in the guiding principles, current types of study will be maintained or upgraded in all locations. Along a stream segment, various hydraulic modeling methods and/or models may be used. However, the continuity of the computation of WSELs will be maintained. The water surface elevations for all recurrence intervals from the different models must tie-in within 0.5-ft.

V. Meetings, Outreach, Due Process, and Map Adoption for Watershed-Based Studies

Appeal periods and other due-process activities will continue to be administered under current regulations (44 CFR Part 67). Regulatory flood maps will be revised as described in the business rules below. One appeal period per flooding source with a new study is the minimum; one

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appeal period per HUC-8 watershed is desirable but not mandatory. This provides the flexibility to both keep the watershed study both coordinated, and separated, if significant appeals or protests arise on a single flooding source that do not otherwise affect the rest of the watershed study. Regions will be provided with a wide range of flexibility in organizing and running appeals periods to provide the most efficient study work flow.

As it was for the countywide FIRM format in Flood Map Modernization, in Risk MAP, it is recommend that incorporated communities and counties within a HUC-8 watershed adopt individual panels with their effective dates rather than the FIRM index date. By doing so they avoid the need to amend their floodplain management regulations each time a panel is amended elsewhere in the watershed and the index date changes, provided that their regulations are otherwise compliant with the NFIP. The exception would be for large communities with multiple panels. For these communities, it may be easier to readopt the map index and overall Risk MAP watershed project than to adopt individual panels.

In cases where a study or restudy changes the SFHAs on a panel, but the change is not within the corporate limits of a community on the panel, the community would not be required to adopt the new panel since the community meets the minimum requirements of the NFIP by regulating the SFHAs currently mapped and not affected by the study or restudy.

Communities in states where an automatic adoption clause is legal, and is incorporated into the ordinance, will continue to receive informational LFDs notifying them of the new data and advises them that they are expected to enforce their ordinance using the revised FIRM.

VI. Business Rules

The business rules for determining the location of study within a HUC-8 and the type of study within that same area, are defined below.

<u>Location of Study</u>

1) Stream segments with engineering data validated through the NVUE process in CNMS are not required to be restudied, unless they do not tie-in or have inconsistent hydrology. Reaching compliance with the NVUE metrics for all mapped flood studies is to be a driving factor in this consideration as well.
2) Stream segments with invalid engineering data, and high risk levels are required to be restudied. Segments with invalid engineering data and low risk levels may be addressed in later studies, and should be listed in CNMS for future study.
3) Existing procedural guidance will be used to determine which segments containing levees will require study. Segments affected by Provisionally Accredited Levee (PAL) agreements are one example of this. Furthermore, PAL remapping should not be delayed during implementation of the watershed study process.
4) While the level of need in a stream segment will be defined by CNMS data, Regions will have discretion in prioritizing those needs within a specific project area based on things learned during discovery.

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5) Areas with low risk, no needs defined, and minimal potential for future development should not be studied unless necessary to address gaps or to correct inconsistent hydrology.
6) Areas with low risk, less than four secondary needs in CNMS, and minimal potential for future development do not need to be studied, unless necessary to address gaps or to correct inconsistent hydrology.
7) Where hydrology between adjacent stream segments does not agree within the 95% confidence limits of the applicable USGS regression equations, one or both stream segments will be revised to correct the mismatch.
8) Where Water Surface Elevations (WSEL) between contiguous stream segments do not agree within 0.5 foot, one or both stream segments will be revised to correct the mismatch.
9) Where floodplain or floodway widths between adjacent stream segments do not agree within 5% of the total width, one or both stream segments will be revised to correct the mismatch. Special considerations related to this rule may be required where the stream is a boundary between two jurisdictions with different floodway surcharges.
10) It may be necessary to review adjacent HUC-8s for tributary inflows, bordering floodplains from other sources, and other considerations that would affect flow in the subject HUC-8.
11) As noted above, any new study to connect between study areas, or to address hydrologic discrepancies shall be accomplished using the most basic study method that is appropriate based on the risk and need of those connecting areas.

Type of Study

1) As defined in the guiding principles, the existing effective study will be the baseline for future study. For example, if an area has published Base Flood Elevations (BFEs), it will continue to do so. Likewise, once a floodway has been defined, a floodway shall be maintained on future flood maps. An effective floodway cannot be eliminated or downgraded
2) Along a stream segment, varying hydraulics methods (within the Acceptable Models list)[1] may be used, however, the continuity of the computation of WSELs will be maintained within the required tie-in of 0.5 feet for all recurrence intervals in the models.
3) As noted above, any new study to connect between study areas, or to address hydrologic discrepancies shall be accomplished using the most basic study method that is appropriate based on the risk and need of those connecting areas.

Regulatory and Non-Regulatory Flood Mapping

1) Regulatory flood map updates (DFIRM updates) are required wherever Base Flood Elevations (BFEs) change by more than one foot in either direction.
2) Regulatory flood map updates (DFIRM updates) are required wherever floodplain widths increase or decrease by more than 10% percent on average across the stream segment.
3) All other studies not requiring regulatory flood map updates may have as their final product, workmaps distributed to the affected communities through Risk MAP outreach and product production processes. Disclaimers on these non-regulatory maps should indicate they are Best Available Data and may only be used for selected purposes under the community's floodplain ordinance.
4) When a watershed project requires modeling or Flood Insurance Rate Map (FIRM) revisions within an unmodernized county, a countywide digital conversion will be performed for the

[1] http://www.fema.gov/plan/prevent/fhm/en_modl.shtm

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unmodernized county to bring all data into the modern platform. If cost or other factors prohibit this, then a partial countywide digital conversion or physical map revision (PMR[2]) on the unmodernized panel may be performed.

5) Risk MAP products will be produced based on "Procedure Memorandum No. **58**—Guidance for Acquisition of Risk MAP Products in FY10" and additional guidance and Guidelines and Standards updates, as they become available.
6) Upon a justifiable request of the community, FEMA will update regulatory products, even if not otherwise required. Justifiable requests include those which permit the community to enforce existing floodplain management ordinances in high-risk areas, or to undertake activities that will reduce or eliminate future flood losses.

VII. Special Contracting and Cooperating Technical Partner Provisions

Regions are directed to contract work for connections between study areas and correction of hydrologic discrepancies as a "priced option." Therefore, stream miles selected for connectivity purposes shall be a separately priced and negotiated line item in all proposals from stream miles selected for risk and need. Stream miles selected for risk and need shall be procured using FY10 funds. Execution of the priced options shall be coordinated with the appropriate PTS COR to ensure national consistency in this process.

When working with CTPs, work for connections between study areas and corrections of hydrologic discrepancies should be identified separately from study areas selected for risk and need in Discovery and Project Planning. Study areas selected for risk and need will be executed in this year's Mapping Activity Statement (MAS). Execution of the work related to stream miles selected for connectivity will occur under a separate MAS and execution of this MAS will be coordinated with the National CTP Program Office Representative to ensure national consistency in this process.

The work for connection and hydrologic connection may be delayed to subsequent fiscal years, deleted altogether, or authorized for production, depending on the budget available and overall cost impacts to the program.

VIII. Determining Study Areas for Watershed Based Studies - Example

The process for determining study areas begins by identifying the subwatersheds and/or stream segments with the highest risk and highest need. These subwatersheds and segments must be studied. The second step in the process is to identify the subwatersheds and stream segments with low risk and low need. These subwatersheds and segments generally do not need to be studied. Moderate need, but low risk subwatersheds and segments also generally do not need to be studied unless needed for tie-in or to correct inconsistent hydrology. Moderate risk, and moderate need segments, and moderate risk, high need subwatersheds and segments in this example were chosen for study, but this could change due to other regional priorities. Finally,

[2] http://www.fema.gov/plan/prevent/fhm/en_modl.shtm

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once all the risk and need of the subwatersheds and segments have been determined, the gaps should be evaluated for continuity.

In the example that follows, for the HUC-8 watershed, there are 98 HUC-12 subwatersheds. Of those, 37 have been selected for study. Of those selected for study, 14 are High Risk High Need, 4 are Moderate Risk High Need, 4 are Moderate Risk Medium Need, and 15 are studied for connectivity purposes only.

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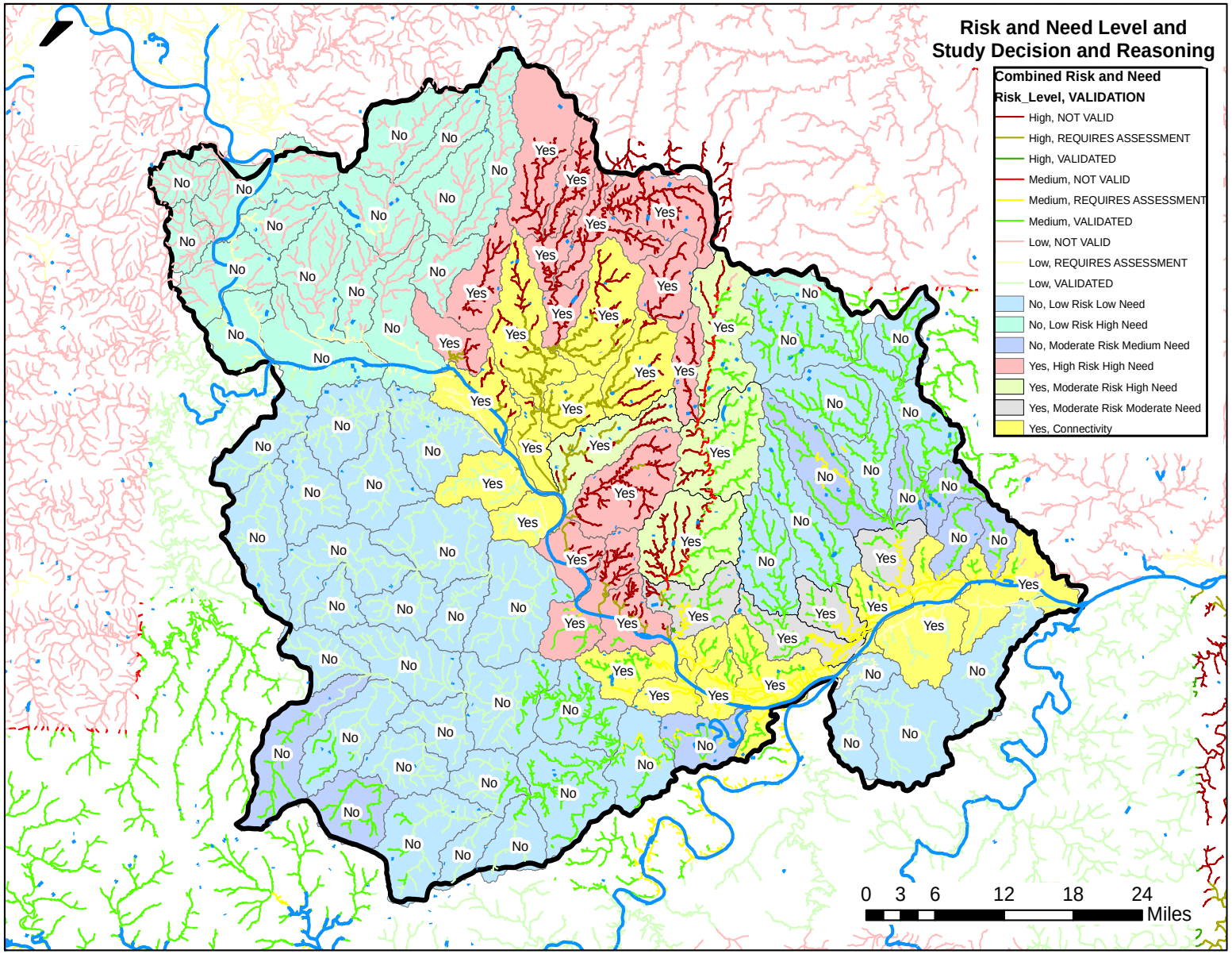

Figure 1: Risk and Need With Selected Subwatersheds to Study and Reasoning

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