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1.0 Introduction

The State of North Carolina, with its population of 8,407,248 (based on 2003 U.S. Census Bureau estimates), faces extreme hazards and consequences from hurricanes, tropical storms, and flooding. Since 1989, there have been 23 federally declared disasters in North Carolina. Damage from Hurricane Floyd alone has reached \$3.5 billion. In 2004, the State was hit with four hurricanes and, as a result, 95 of the 100 counties in North Carolina received disaster declarations. The State's vulnerability to hurricanes and flooding make it crucial that communities and property owners have accurate, up-to-date information about the flood risk.

These hurricanes also revealed flood hazard data and map limitations. In 2000, approximately 75% of North Carolina FIRMs were at least 5 years old and 55% of North Carolina FIRMs were at least 10 years old. Federal funding for flood mapping was inadequate; on average, North Carolina received an updated flood study for only one county per year. Further, most North Carolina counties and communities had indicated that they do not have the resources to take on the responsibility of maintaining their own FIRMs. In August 2000, the State of North Carolina allocated \$23 million toward establishment of the NCFMP and Phase I of statewide remapping. Subsequently, on September 15, 2000, the State of North Carolina, the Federal Emergency Management Agency (FEMA), and numerous other federal, state, and local agencies have entered into the first Cooperating Technical State (CTS) agreement, whereby the state will assume primary ownership of, and responsibility for, the National Flood Insurance Program (NFIP) maps for all North Carolina communities. This project will include conducting flood hazard analyses and producing updated, digital Flood Insurance Studies (FISs) and Flood Insurance Rate Maps (FIRMs).

As a CTS, the North Carolina Floodplain Mapping Program (NCFMP) is conducting statewide flood hazard studies and preparing up-to-date "seamless" statewide Digital Flood Insurance Rate Maps (DFIRMs) and related products using updated flood hazard data, new topographic data, and aerial imagery. Following the signing of the CTS agreement, the NCFMP divided the State's 17 river basins into three phases and assigned the highest priority (Phase I) to six eastern river basins most severely impacted by Hurricane Floyd in 1999—Cape Fear, Lumber, Neuse, Pasquotank, Tar-Pamlico, Chowan and White Oak. Phase II includes six basins in central North Carolina, and Phase III includes the final five basins in western North Carolina. The NCFMP's complete "wall-to-wall" statewide mapping is to be finished by the end of Fiscal Year (FY) 2009 and map maintenance, including Letter of Map Change (LOMC) processing, is scheduled to begin in FY 2005.

As identified in the State of North Carolina Map Modernization Management Support Business Plan, FY2006 - 2010, the NCFMP has developed a plan and program to assume responsibility for the transition of map maintenance from the Federal Emergency Management Agency (FEMA) to the NCFMP. Map maintenance consists primarily of two components: restudies and Letters of Map Change (LOMCs). The State has received Federal and State funds to conduct map maintenance (Federal Funds for MT-2 LOMC Processing and State funds for DFIRM map maintenance). The NCFMP will qualify up to

three restudy contractors to perform restudies. The NCFMP and their restudy contractors will be responsible for restudy activities throughout the State. The processing of LOMCs will be covered in a separate document.

The restudy policies, processes, and procedures outlined in this document define technical requirements, product specifications for National Flood Insurance Program (NFIP) products, and associated coordination and documentation activities with respect to restudy processing.

1.1 Delegation of Restudy Activities from FEMA to NCFMP

The NCFMP's plan for full ownership of the DFIRMs involves assuming additional responsibilities to include all aspects of map production and maintenance are performed by the State and the NCFMP's contractors. Additionally, the NCFMP plans to implement activities that exceed the traditional map maintenance services conducted by FEMA.

The NCFMP's responsibilities will be further enhanced, with implementation of the following activities:

- Preliminary and final DFIRMs to be printed and issued by NCFMP, rather than by FEMA;
- "Virtual Special Flood Hazard Area (SFHA)" to be posted on the NCFMP website (all DFIRM data, including LOMCs depicted spatially, to be posted on the website through the North Carolina Floodplain Mapping Information System (NCFMIS)); and
- The NCFMP will become the repository for all flood mapping and historical flood hazard data.

FEMA will delegate map maintenance activities to the NCFMP through Mapping Activity Statements (MASs), which will provide the NCFMP the authority and funding to complete specified map maintenance activities each year.

1.2 Vision for the State's Map Maintenance Program

The program's vision is for full responsibility for maintenance of the DFIRMs, all DFIRM data, and all aspects of floodplain mapping delegated to the NCFMP, including:

- Map Maintenance – Restudies;
- Map Maintenance – LOMC processing; and
- Serving all DFIRMs and associated data online through the NCFMIS, including implementation of a "Virtual SFHA" whereby the latest changes effected by LOMCs are shown as a thematic layer.

The NCFMP has developed a plan and program design for the transition of map maintenance from FEMA. Revisions to flood hazard data will be stream-based rather than community- or county-based. The seamless statewide mapping currently being produced will allow for updates to individual panels, DFIRM databases, and the associated countywide Flood Insurance Study (FIS) Reports. This process will be a cost-effective and efficient way to make necessary updates to flood hazard data as

depicted on the DFIRMs. Once the initial countywide DFIRM database is created during the statewide mapping effort, an integrated process can be used for revisions — both restudies and LOMCs. In general, the map maintenance transition plan will have a 2.5-3.5-year cycle and consist of framework data changes, flood hazard data updates, and LOMC production. As a part of year-round scoping and outreach, the NCFMP will develop an online database to allow jurisdictions to submit unmet needs at any time of the year. This database will track community requests for revision and unmet needs or revision needs identified by the NCFMP. Information from this database will be used during the ranking and prioritization scoping process. A full county will be re-scoped 2.5-3.5 years after its first set of statewide DFIRM panels become effective. In addition, all DFIRM panels that have been effective for more than 3.5 years will be considered for revision using the online unmet needs process. Annual scoping for those counties with DFIRMs that have effective dates greater than 3 years old will take place to determine which flooding sources should be upgraded, revised, and/or newly studied.

1. Base / Framework Data:

- Includes any changes that affect the DFIRMs but do not change the Special Flood Hazard Areas. An example of a framework data change is new, updated base data, such as aerial images.
- The NCFMP will post all updated framework data to the NCFMIS website for viewing and download as soon as the data become available.
- In general, DFIRMs will not be updated simply for a framework data change; rather, the NCFMP will delay updating the DFIRM with new framework data for a county or community until a restudy is initiated.
- The NCFMP will review existing base data for counties in the map maintenance phase to determine if new imagery should be collected.

2. Flood Hazard Data (Restudies and Upgrades):

- The NCFMP will first assess county and community mapping needs (restudies and upgrades) 2.5-3.5 years after the maps become effective and following major flood events.
- The NCFMP will revise DFIRM panels for each county to upgrade studies for streams that were redelineated, upgrade studies that were limited detailed, or to add new studies for streams that were not studied during the first phase of the mapping program.
- This effort will utilize a similar approach to FEMA's Biennial Report and Mapping Needs Assessment Process, yet will also include additional outreach efforts from NCFMP staff.

3. LOMC Production: See NCFMP LOMC Policy & Procedures Manual.

1.3 NCFMP Production Organization

The North Carolina Floodplain Mapping Program will lead all map and restudy production and conduct outreach activities. The NCFMP has qualified contractors to provide necessary mapping services. Additional contracts may be awarded based on need. These contractors and the services they provide include:

- Engineering and mapping contractors – develop H&H analyses of flooding sources and map the flood hazards to NCFMP and FEMA specifications.
- QA/QC – Preliminary/Post-Preliminary Processing contractor – perform DFIRM review and processing activities.
- LOMC contractor – process MT-1 and MT-2 LOMCs for the NCFMP.
- Restudy contractor(s) – process DFIRM updates for the NCFMP.

Maintenance of online DFIRM and associated data through the NCFMIS is performed by NCFMP staff.

2.0 Restudy Methods

The NCFMP plans to use Letters of Map Revision and Physical Map Revisions to process the majority of the restudies for the State of North Carolina. In some instances, full countywide map revisions may be necessary or prudent.

2.1 Letter of Map Revision

A Letter of Map Revision (LOMR) will be used to make corrections or revisions to small areas that affect less than one full panel. Because community acceptance of a LOMR does not require a 6-month compliance period, LOMRs can be used in cases where community acceptance must be expedited. LOMR requirements and fee-schedule will follow FEMA standards. The NCFMP LOMC Policy & Procedures Manual includes further explanation on when to use and how to process Letters of Map Revision.

2.2 Physical Map Revision

The NCFMP vision for map maintenance is focused primarily on stream-centric revisions that will be processed as Physical Map Revisions (PMRs). The stream-centric approach relies on the use of the Mapping and Engineering Needs – Community Assessment (MENCA) GIS system to store, display, analyze, and archive various data features for every studied stream in the State. By using a stream-centric approach to map maintenance, the focus shifts from large countywide map revisions that require numerous panel updates (which can be costly and time-consuming) to smaller revisions that include only the panels affected by the stream(s) to be revised (with the intended benefit of saving money and time).

Stream-centric PMRs will be scoped in a similar fashion as full countywide revisions such that jurisdictions will be contacted for their input about flood hazard mapping needs and requests. However, once the scope of work is determined for a particular stream, only the panels, tables, and profiles affected by that stream will be revised. For streams that flow in multiple counties, the panels affected by the stream will be revised once and provided to all affected communities. FIS Reports for all affected counties will still have to be revised and reproduced on a countywide basis. For all restudies except LOMCs, the Map Index for each affected county must be revised, even if only one panel in the county is affected. The Map Index will be revised to show a new effective date and suffix for the panel(s) affected by the revision and to show a new effective date and suffix in the Map Index title block. NCFMP will continue to update CIS with ordinance and contact information for PMRs.

PMRs will be categorized into (1) PMRs that will need to be performed shortly after a map panel becomes effective due to need for immediate action or (2) PMRs that will be performed as part of the map maintenance restudy and (3) PMRs associated with a LOMC. PMRs that may potentially warrant immediate action are map revisions associated with the following items:

- Federal or local regulatory requirements.

- Improved engineering analysis provided by community impacting a large area (>10 miles of stream).
- Occurrence of large scale natural flood related disasters which proved the inaccuracy of the current model or caused changes to the streams channel which invalidates the current model.

When evaluating PMRs associated with a flooding restudy, the following framework data updates will be completed for the impacted panel:

- Municipal boundaries and extra-territorial jurisdiction boundaries (ETJs);
- New street names will be added within 1 inch of the special flood hazard area boundary; and
- New aerial orthophotography (of equal or higher resolution to that shown on the effective panel).

Framework data updates will be performed for the entire area shown on the impacted panel. PMRs associated with the LOMC process are discussed in the LOMC Policy & Procedures Manual. Immediate PMR evaluation criteria and restudy framework data updates made through a PMR are detailed in Table 1.

Parameter
<p>Immediate PMRs</p> <p>Federal or local requirement Improved engineering analysis impacting large area (>10 miles of stream) Large-scale flooding disaster</p>
<p>Physical Map Revisions (PMRs) Framework Data Updates Performed With Restudies</p> <p>Changes to municipal boundaries or ETJs (Framework Data updates) Street names to be added and/or changed within 1 inch flood hazard area (Framework Data updates) Updated orthophotography</p>

Table 1. Immediate and Restudy Framework Data Updates PMR Evaluation Criteria

2.3 Full Countywide Revision

A full countywide revision does not follow the NCFMP vision of a stream-centric approach to map maintenance and therefore will likely be a rare occurrence. However, there are instances where this type of revision will be the most cost-effective and efficient method for updating maps. The following situations would be cause for a full countywide revision:

- Completion of a new surge analysis for a coastline in one county where all panels are affected by coastal flooding.
- Collection or submission of more accurate topographic data for a county or region that would allow for better redelineation of all floodplains in the area.

- A major flooding event that drastically changes the flooding nature of a county; for example, changing the hydrology or modifying the topography or geomorphology.
- Decision by a jurisdiction to regulate floodplain development based on future conditions hydrology (a revision of this nature would be cost-shared between the State and jurisdiction).

When a full countywide revision is employed, all DFIRM panels including the Map Index will be revised to reflect the new flood hazard data, the new effective date, and the map number suffix will be advanced one letter. The first set of statewide DFIRM panels produced by the NCFMP have the suffix "J" and each subsequent revision will advance the suffix by one letter to "K" then "L" and so on. The FIS Report will also be revised to reflect the appropriate changes.

2.4 FIS Reports

Not all revisions require an update to the FIS Report. LOMCs require either no change to the FIS Report or changes only to FIS Report components. The NCFMP LOMC Policy & Procedures Manual outlines the requirements for FIS Report component revision for Letters of Map Change.

Restudies Affecting a Single County

For PMRs, the FIS Report must be revised and re-issued for all revisions that change Base Flood Elevations (BFEs), cross section numbers and/or locations, floodway widths, discharge data, and any other information contained in the FIS Report. Changes to the items listed above result in changes to specific tables in the FIS Report and can cause changes to the Flood Profiles. PMRs that are processed only to show updated base map data (aerial imagery, county boundaries, etc) will also require a revision to the FIS Report; however, the only change will be to the base map source note paragraph. PMRs that are processed to revise floodplain boundaries based on more accurate or more up-to-date topographic data will also require a revision to the FIS Report; however the only change will be to the explanation of topographic data used in the DFIRM mapping. When any portion of the FIS Report is updated, the entire Report will be republished and issued to the affected communities.

Restudies Affecting Multiple Counties

FIS Reports are produced by county and should only include information for stream data within the county boundary. For revisions that affect streams that flow within more than one county, the FIS Reports for all affected counties must be revised to include the new data.

FIS Report Revisions

When the FIS Report is revised for a PMR or full countywide revision, the suffix on the cover must be advanced one letter and the effective date must change. For every revision to the FIS, an explanation of what has been revised must be added to Section 4.5, "Scope of Study." Where appropriate the following sections of the FIS Report must also be revised: Section 5.1, "Hydrologic Analyses," Section 5.2, "Hydraulic Analyses," Section 5.3, "Coastal Analyses," Section 6.2, "Base Map," Section 6.3, "Floodway and Floodplain Delineation," Section 7.5, "Map Revision History," Section 8.1, "Authority and Acknowledgements," Section 8.2, "Consultation Coordination Officer's Meetings/Scoping Meetings," and Section 10.0, "Bibliography and References." Where appropriate, the tables included in each of the sections listed above must be revised, along with the Flood Profiles.

Preliminary Issuance

For preliminary issuance of a revised FIS Report to accompany a PMR, the entire body of the text must be issued; however, only the revised Floodway Data Tables (FDTs), Limited Detailed Flood Hazard Data Tables (LDFHDTs), and Flood Profiles must be included. A note can be added to page iii, "Notice to Flood Insurance Study Users" stating that only revised FDTs, LDFHDTs, and Flood Profiles are included in the preliminary FIS Report. This process saves time (to organize and update all tables and profiles) and money (reprinting costs) during the preliminary processing stage. All FDTs, LDFHDTs, and Flood Profiles (including those not revised with the PMR) must be included in the final version of the FIS Report that becomes effective.

2.5 Unresolved Appeals and Protests

The NCFMP and their QA/QC contractor will review jurisdictional comments submitted on preliminary panels during and after the statutory 90-day appeal period for validity and technical accuracy. The NCFMP will incorporate valid and technically accurate appeals and protests submitted during the 90-day appeal period. The NCFMP will incorporate new models submitted by a community if they are approved by FEMA and submitted during the 90-day appeal period. In cases where data is submitted after the 90-day appeal period, the NCFMP will review the finalization schedule for the affected county to determine if changes can be made to the DFIRMs. If the finalization process is too far along to incorporate changes, the submitted data (appeal, protest, or more accurate model) will be used to revise the DFIRMs during the subsequent map maintenance period for the affected county. A revision can be prioritized to occur shortly after the DFIRMs become effective. Either a LOMR or PMR can be processed, based on the size of the revision. This decision should be made on a case-by-case basis with the support of the NCFMP Engineer and the NCFMP Program Director.

3.0 Map Maintenance Triggers and Prioritization

Restudy project evaluation triggers and prioritization values are an essential component of the map maintenance program. This section details specific criteria that will be used to determine when a stream or coastal segment should be restudied. Additionally, a point system to assess and prioritize restudies once specific criteria are satisfied is addressed and presented. A restudy refers specifically to updating or reevaluating engineering analyses that were performed for a flood mapping project that directly impacts BFEs and/or flood hazard boundary extents or analysis of previously unstudied flood prone area. Restudy triggers will be utilized for assessing what stream segments will be restudied for map maintenance purposes. PMRs associated with restudies will be processed to release restudy and panel specific framework data changes to the public.

Evaluation criteria will be categorized and prioritized to achieve FEMA mapping needs assessment requirements and to accomplish specific goals of the NCFMP. Initial restudy and PMR triggers are developed using the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners* and additional triggers will be added to assist with evaluating program specific goals. A project trigger is any factor that will be assigned a point value that will be tracked and utilized for the assessment of stream segment prioritization during the map maintenance phase. Restudy data triggers and prioritization are discussed in detail in subsequent sections of this report.

Elevation data will be evaluated during scoping based on need. A blind study of the surface model will be performed for the study area to determine the need for updating and/or creating a new surface model for the area.

3.1 Restudy Triggers and Prioritization

Riverine floodplain mapping restudy locations will be evaluated using the stream-centric approach discussed in the Restudy Method section based on the map maintenance schedule described in a subsequent section of this report. Coastal studies will be evaluated separately using the trigger approach, assessed by tallying coastal points per beach mile. Coastal areas with the greatest density of map maintenance needs and reasonable restudy sections will be identified. Triggers or criteria that are exceeded and/or satisfied on a stream or coastal level will be assigned specific prioritization points based on program goals. Stream or coastal prioritization points will then be tallied and ranked and specific projects will be selected on a case-by-case basis based on available funding and perceived project need. These triggers apply only to those counties in the 2-.5-3.5 year map maintenance cycle and those streams identified in the online unmet needs database.

Study priority levels and associated ranking points are summarized in Table 2.

Priority Level	Points
High	15
Medium	10
Low	5

Table 2. Priority Level and Points

Riverine and coastal engineering restudies will be evaluated based on criteria grouped according to the following categories:

- Age of the effective analysis/maps;
- Historical flooding information (Riverine);
- Factors affecting hydrology (Riverine);
- Factors affecting hydraulics (Riverine);
- Factors affecting stillwater analyses (Coastal);
- Factors affecting wave height analysis (Coastal);
- Unmapped Area or Study Technical Method Upgrades (Riverine); and
- Community Issues.

Restudy triggers will be assigned point values to reflect the primary flood hazard mapping goals of FEMA and the NCFMP. From the perspective of performing a restudy, the highest priority is assigned to factors that will potentially result in the greatest impacts to BFEs and/or the flood hazard boundary delineation or areas where existing data appears to be inaccurate or outdated, including:

- Areas of dense or anticipated development;
- Studies that update apparent erroneous analyses;
- Areas affected by structural controls or channelization;
- Natural morphological changes in floodplain or beach profile are significant;
- Potential flooding areas previously not studied;
- Studies that will update outdated study methodologies and provide consistency in modeling methods (e.g. eliminating redelineation locations);
- Communities experiencing flooding outside mapped floodplain with significant damage; and
- Community identified flood study needs where the community is willing to cost-share on funding the project.

Triggers and prioritization points for each trigger are outlined below and in Table 3.

Age of the Effective Analysis

Age of the effective engineering analysis is a key factor for determining when a stream study needs to be reevaluated. An interim goal of the NCFMP is the elimination the redelineation study method that was used during the first round

of statewide DFIRM production. In an attempt to meet this goal, effective engineering analyses greater than 10 years were considered to be of medium importance, while studies between 5-10 years were assigned a low priority score. Streams that were previously studied during the first round of statewide mapping or a previous map maintenance revision were assigned a low priority score because of the recent revisions.

Historical Flooding Information (Riverine)

The occurrence of recent significant flooding in a region is a vital component for evaluating the need for new engineering analyses. Flooding information since the previous scoping effort will be evaluated to determine whether an area has experienced an equivalent 100-year storm or 2 storm events greater than a 50-year recurrence interval. If the new data indicate flooding impacts and extents greater than the original analysis, high priority points will be assigned. Restudies will also be initiated if buildings or structures in the area are damaged as a result of either of the aforementioned storm events. The highest priority score will be given to streams that experienced flooding that caused severe damage to buildings and/or infrastructure constructed in accordance with the local flood damage prevention ordinance, while medium to low scores will respectively be assigned to streams with structures experiencing moderate or minimal damage. Damage severity will be rated based on the ratio of the total costs of flood related repairs to the assessed value of the property. A property is considered severely damaged if the ratio is greater than 50%; moderately damaged if the ratio is 5-50%; and minimal for ratios less than 5%.

Additional points will be given in areas where there have been recent NFIP claims or where there are NFIP insured structures that have been damaged repeatedly by previous flood events, known as repetitive loss structures (RLSs). Reevaluating analyses in areas with NFIP claims and/or RLSs claims could potentially lead to reduced numbers of future potential losses. Streams that have greater than 5 NFIP claims and/or 1 RLS claims will be assigned a medium priority and areas with 1-5 NFIP claims will be assigned additional low priority points.

Factors Affecting Hydrology (Riverine)

Factors that affect hydrology can potentially have significant impacts on BFEs and flood hazard areas. The most significant factors that may affect hydrology include development, update of flow regression equations or increase in stream gage record length, alterations to the design storm methodology, and construction or removal of flood control structures.

Development is one the most substantial factors that can result in increases in runoff. Runoff estimates typically increase with development due to the inherent increases in impervious surfaces. Development near a stream will be assessed on a watershed basis based on population based on census tracts. The NCFMP did not consider using impervious surface increase due to the budgetary challenges of identifying these areas on a statewide basis. The NCFMP may

consider using percent impervious at a later date as technologies for identifying these areas become more efficient and cost effective. Total population will be tallied for a particular watershed and a historical comparison will be made based on population data used for previous mapping purposes. Priority level will be graduated by population ranges greater than 10-percent and values between 5-10-percent, which respectively will be assigned medium and low priority levels. All streams within the affected watershed will be designated population priority points associated with the watershed.

Regional regression analyses and equations have been the predominate methods used for developing flood flow estimates for the NCFMP. The USGS will likely update regional regression equations for the State approximately every 10 years. Updates to the regression equations may lead to significant increases or decreases in flood flow estimates. Streams with updated regression based hydrologic analyses will only be restudied if the resulting estimated peak discharge increases greater than 5 percent from the previous estimate, and will be assigned a low level priority score when exceeded.

Increase in the length of the stream gage record may have significant impacts on regression estimates at specific gages, particularly at sites where the period of record was less than 20 years or where a large magnitude flood event has occurred. Increase in stream gage record will only be considered a trigger where the estimated discharge resulting from the additional data is outside of the 90-percent confidence interval predicted from the original data set. A low priority score will be assigned to streams where the regression analysis based on increased gage record used for estimating or weighting discharge exceeds the 90-percent confidence interval.

Changes in design storm can have effects on hydrology when rainfall-runoff models (e.g. HEC-HMS) are employed to estimate peak discharges. Several communities in the State are currently utilizing rainfall-runoff type hydrologic methods for estimating peak discharges including Charlotte-Mecklenburg, Greensboro and Raleigh. Rainfall runoff models are typically employed in urban areas where regression analyses may be inadequate. The design storm estimates in North Carolina for these models are based on the National Weather Service (NWS) Technical Paper 40. If changes to the design storm precipitation totals from Technical Paper 40 result in precipitation estimate increases greater than 5-percent for the 1-percent annual chance event, low priority points will be assigned to the impacted streams.

Flood control structures that could potentially impact hydrology include flood control reservoirs and regional stormwater best management practices (BMPs). Streams where significant flood control structures have been constructed or removed will be assigned a medium level priority score.

Factors Affecting Hydraulics (Riverine)

Numerous items can impact flood hydraulic modeling including the construction of new hydraulic or flood control structures, natural or man-made stream morphological changes, and hydrology. Availability of more accurate topography can result in revised mapping of special flood hazard areas. All of the aforementioned factors can result in significant changes to BFEs and flood hazard areas.

Construction, modification, or removal of minor hydraulic structures, particularly culverts and bridges, will be considered in the stream prioritization and ranking process. Culverts will be assigned a medium level of priority while bridges will be given a low level. Culvert priority will be higher because they typically cause the greatest reduction in overall cross section flow areas, resulting in higher differences in water surface elevations.

Construction, modification, or removal of major hydraulic structures including dams, certified levees and diversion ditches will be a major component of the stream prioritization approach. Flood control structures will be assigned a medium priority score.

Stream restoration projects (North Carolina Ecosystem Enhancement Program (EEP) and the Clean Water Trust Fund projects), channel fill and natural channel movement after a significant storm event are all causes of stream morphological changes, all of which can appreciably impact BFE and flood hazard delineation. All streams subject to major stream morphological alterations will be given a medium level of importance.

A more detailed topographic survey can have considerable impacts on flood hazard area limits and BFE determination by improving either cross-section or channel resolution in the floodplain vicinity. A new topographic survey exceeding the accuracy or detail of the existing analysis will be assigned a medium score for restudy purposes.

Factors Affecting Stillwater Analyses (Coastal)

Items that can impact stillwater elevations include the occurrence of a major coastal storm event and an increase in tidal gage record. The occurrence of a major storm event resulting in water levels exceeding historical inland high water marks may indicate the need to update a coastal analysis. Areas where a major storm event has resulted in water marks greater than historical records will be assigned a medium restudy priority level. In areas where a significant storm event has occurred or where the tidal period of record for an analysis was short, the tidal record may be reexamined if 10-years of additional record are available, and the analysis will be assigned a low level priority.

Factors Affecting Wave Height Analysis (Coastal)

Many factors can affect the wave height analysis component of a coastal flooding analysis including the occurrence of a major storm event, rapid development in

the VE zone, construction of a seawall, and improved or updated topographic data.

The occurrence of a major storm event can significantly impact wave height analyses by causing major changes to beach profiles, beach or dune erosion, and setting a new high water mark. Changes to beach profiles and beach or dune erosion can increase BFEs or extend the bounds of the inland floodplain limit, and accordingly will be assigned a medium level priority score. Seawall / jetty construction can also result in changes to beach profiles; however, construction of these structures is currently illegal in the State. Additionally, a topographic survey exceeding the accuracy of the existing analysis can have similar impacts on BFEs and floodplains, and will thus be assigned a medium coastal restudy score.

Rapid development in the VE zone can also result in alteration of wave height analysis results. Similar to the approach used to assess growth on riverine hydrology, development in VE zones will be assessed based on percentile increases in population from the date of previous scoping completion. Areas with population increases greater than 10-percent will be given medium priority, while areas with growths between 5 and 10-percent will be assigned a low priority score.

Construction of a seawall is currently illegal in the State of North Carolina and will likely not be a restudy issue for the program.

Unmapped Area or Study Technical Method Upgrades (Riverine)

The presence of a previously non-designated flood prone area or various study technical method upgrades will be considered when assessing restudy priority. A key goal of the NCFMP is the elimination of areas that were previously studied using approximate methods (unnumbered A zones), the vast majority of which were eliminated during the first round of statewide DFIRM production. Certain areas will not be upgraded from approximate methods unless there is a significant potential threat to life or there is a specific request from the jurisdictional entity, including areas in National Forests and National or State Parks, military installations or tribal lands. Any remaining unnumbered A zones that are not part of the aforementioned categories will be assigned a high level priority score. The presence of identified flood prone areas previously not mapped will also be assigned a high level of priority, but will generally be limited to watersheds greater than 1 square mile in rural areas and greater than 0.5 square miles in urban areas. The program will attempt to avoid mapping small, localized flood-prone areas that would be better administered locally through stormwater management related ordinances.

Upgrades to certain technical methods will also be considered in the prioritization process. The concept is to provide incentive for certain technical method updates based on changing program goals. As discussed earlier, a map maintenance goal will be to eliminate areas that were mapped during the first

round of statewide DFIRM production using redelineation, due to the age of the associated analyses and difficulties with hydrologic matches and water surface tie-ins. As a result, medium level priority points will be assigned to flooding source reaches that were studied using the redelineation study method. Studies that convert a limited detailed study to a detailed study or provide mapping of future conditions will be assigned a low priority level.

Community Issues

Several community related issues will be considered as part of the prioritization process, including development and implementation of community mitigation plans, community provided engineering study funding, addressing unmet community identified mapping needs from previous scoping meetings, and participation in the Community Rating System (CRS). Streams in communities that have adopted or are in the process of implementing a formal mitigation plan will receive prioritization points. Communities with existing plans will receive a medium score and communities in the process will receive a low score.

A major goal of the floodplain mapping maintenance program is the encouragement of project cost-sharing and joint-funding of projects; therefore, engineering analyses performed where a community is willing to cost-share with the State will receive a high level priority score. Streams or coastline with previously identified unmet scoping needs will be given medium level priority points.

The CRS is a voluntary program established by FEMA to provide incentives for communities to exceed the minimum NFIP participation requirements. Streams within a community participating in the CRS with a CRS class rating between one and four will receive a medium priority score, while communities with a class rating between five and 9 will get a low score. Non-participating communities are designated by a CRS class rating of ten by FEMA and will receive no priority points.

Parameter	Points
Age of Effective Analysis <u>Analysis</u> <ul style="list-style-type: none"> • >10 years old • 5-10 years old • <5 years old 	 10 5 0
Historical Flooding Information (Riverine) Area experienced approximate 100-year event or 2 events larger than 50-year event (since previous scoping period) <ul style="list-style-type: none"> • Results in flooding greater than the SFHA boundary • Severe damage to buildings and/or infrastructure • Minimal to moderate damage to buildings and/or infrastructure • Little to no damage to buildings and/or infrastructure NFIP Claims or NFIP Insured Repetitive Loss Structures (RLSs) <ul style="list-style-type: none"> • >5 NFIP Claims or >1 RLSs • 1-5 NFIP Claims, 0 RLSs • 0 Claims, 0 RLSs 	 15 15 10 5 10 5 0
Factors Affecting Hydrology (Riverine) Population growth (since previous scoping period) <ul style="list-style-type: none"> • >10 % • 5-10% • <5% New North Carolina regression equations resulting in flow increase or decrease <ul style="list-style-type: none"> • >5 % • <5% Increase in stream gage length of record <ul style="list-style-type: none"> • Calculated discharge resulting from increase in stream record length is outside the 90-percent confidence interval for the effective study Change in design storm methodology <ul style="list-style-type: none"> • > 5 % Increase or decrease in precipitation estimates • < 5% Increase or decrease in precipitation estimates 	 10 5 0 5 0 5 5 0

Table 3. Restudy Trigger Prioritization and Point Assignment

Parameter	Points
Factors Affecting Hydraulics (Riverine)	
Construction or removal of minor hydraulic structures	
• Culverts	10
• Bridges	5
Stream morphological changes (e.g. Stream restoration projects or Fill)	10
Construction or removal of major hydraulic structure (e.g. Dams, certified levees, diversions ditches)	10
New more accurate topography becomes available	10
Factors Affecting Stillwater Analyses (Coastal)	
Occurrence of major storm event	
• Historical high water marks exceeded	10
• Historical high water marks not exceeded	0
Increased length of tide gage record	
• >10 years	5
• <10 years	0
Factors Affecting Wave Height Analysis (Coastal)	
Occurrence of major storm event	
• Major changes to beach profile	10
• Significant beach or dune erosion	10
• New high water marks	10
Rapid growth in VE zone	
• >10 %	10
• 5-10%	5
• <5%	0
Updated more accurate topographic data	10
Unmapped Area or Study Technical Method Upgrades (Riverine)	
Zone A to Zone AE	15
Unmapped areas (unshaded X) to Zone AE	10
Redelineation to detailed study	10
Detailed study without floodway to detailed study with floodway	5
Limited detailed study to detailed study	5
Future conditions mapping	5
Community Issues	
Community mitigation plan	
• Adopted a formal mitigation plan	10
• Implementing formal mitigation plan	5
Partner funding investment (e.g. NCDOT, CORPS, etc.)	15
Unmet need from first round scoping	10
Community Rating System (CRS) Class	
• Class 1-4	10
• Class 5-9	5
• Class 10	0

Table 3. Restudy Trigger Prioritization and Point Assignment

The point assignments will be tallied by stream for each county and reviewed against the State guidelines for restudy prioritization. See Table 4 below for the restudy point thresholds.

Points	Decision
0-25	Do Not Perform New Study
25-75	Perform New Study if Funding is Available
75+	Perform New Study

Table 4. Restudy Thresholds

All flooding sources will be studied at the method requested by the community or higher (more detailed). See Tables 5 and 6 for details on selecting the appropriate technical method for study.

4.0 Selecting Technical Methods

As part of the NCFMP, there historically have been five options for studying each flooding source segment in a given area:

1. Limited Detailed Study (Riverine) - This method entails using the Digital Elevation Models (DEMs) that are produced as part of the project, without field surveyed bathymetry or bridge/culvert opening geometry, to conduct approximate Hydrology and Hydraulic (H&H) analyses. 1% annual chance floodplain boundaries are delineated and BFEs are mapped; non-encroachment areas are provided in place of regulatory floodways, and though not mapped, the data is provided for all cross sections of the LDS streams in the FIS report.
2. Redelineation - This method involves no new engineering analyses, but uses the DEMs and effective FIS profiles and/or BFEs to remap the floodplain boundary. This approach may be used for coastal flooding sources.
3. Detailed Study (Riverine) - This method entails using the DEMs, with field surveyed cross sections, channel bathymetry and bridge/culvert opening geometry, to conduct detailed H&H analyses and floodplain mapping. Detailed study methods involve the determination of 10%, 2%, 1% and 0.2% flood profiles and publication of BFEs and delineation of the 1% annual chance floodplain, the 0.2% annual chance floodplain, and the regulatory floodway. If a stream currently was studied by detailed methods for the previous FIRM and is being restudied, the new study must be detailed (i.e., cannot perform limited detailed study).
4. Detailed Study (Coastal) - This method entails using the DEMs, with field surveyed transects and offshore bathymetry, to conduct detailed erosion, wave height, and wave runup analyses and floodplain mapping. Detailed coastal methods involve the determination and publication of BFEs, designation of the

coastal high hazard area (V zone), and mapping of the 1% annual chance floodplain boundary.

5. Use of Effective Information - This method involves no new analyses or floodplain mapping; rather, the effective FIS and FIRM data is digitized "as is" and registered to the new base map.

The NCFMP will only perform limited detailed (riverine), detailed (riverine), detailed (coastal), and coastal redelineation analyses as part of the map maintenance program.

In general, the selection of a technical method is based on:

- How the area is designated on the effective FIS and FIRM;
- Existing and anticipated floodplain development in and near the flooding source segment of interest;
- How the effective flood hazard information compares to actual flooding experience; and/or
- The adequacy or currency of the methods used to prepare the effective FIS and FIRM.

When evaluating each flooding source segment and selecting the most appropriate technical method, the following should also be considered:

- Although detailed and limited detailed studies shall normally be terminated where the 1% drainage area of the flooding source is less than one square mile or one-half square mile for urban areas, decisions to terminate studies at these points shall be guided by consideration of actual flood hazards and development projections.
- Future conditions analyses, to the extent possible, should be based on future conditions hydrology as determined from a community's zoning map and/or comprehensive land-use plans. Examples of future conditions to be considered are future land-use conditions and public works projects in progress (e.g., channel modifications, hydraulic control structures, storm-drainage systems, or other flood protection projects).
- Are flood control structures credited on the effective FIRM that should not be? Examples include levees that do not meet certification criteria or poorly maintained channelization projects. Conversely, are there flood control structures not credited on the effective FIRM that should be? It is the responsibility of the community to supply all information necessary to determine whether a flood control structure can be credited on the FIRM with providing protection from the 1% annual chance flood event.
- Is any existing flood hazard mapping information available from another source that is not reflected on the effective FIS and FIRM?

Table 5 summarizes the suggested guidance for selecting the most appropriate technical method for riverine and lacustrine flooding sources. Table 6 summarizes suggested guidance for selecting the most appropriate technical method for coastal areas (open

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shoreline, barrier islands, and embayments). Boxes marked in black in Tables 5 and 6 indicate that the technical method is not appropriate for the effective FIRM designation.

Technical Method	Effective: Approximate (Zone A)	Effective: Redelineation	Effective: Limited Detailed Study	Effective: Detailed Study with Floodway
Limited Detailed Study	<ul style="list-style-type: none"> • Areas of dense development • State or National park request 			
Detailed Study (Riverine)	<ul style="list-style-type: none"> • Areas of dense development • State or National park request 	<ul style="list-style-type: none"> • Study is greater than 10 years old • Hydrology and/or hydraulic methods outdated • Flood experience indicates that discharges and BFEs are outdated (e.g., USGS gage information indicates discharges out of date) • New floodplain projects (e.g., channelization, bridges) • New Flood control structures 	<ul style="list-style-type: none"> • Additional years of record available for stream gage analysis • Hydrology and/or hydraulic methods outdated • Flood experience indicates that discharges and BFEs are outdated (e.g., USGS gage information indicates discharges out of date) • Watershed development has significantly altered discharges • New floodplain projects (e.g., channelization, bridges) • New Flood control structures • Community wishes to add floodway 	<ul style="list-style-type: none"> • Additional years of record available for stream gage analysis • Hydrology and/or hydraulic methods outdated • Flood experience indicates that discharges and BFEs are outdated (e.g., USGS gage information indicates discharges out of date) • Watershed development has significantly altered discharges • New floodplain projects (e.g., channelization, bridges) • New Flood control structures • Future conditions hydrology

Table 5. Guidance for Selecting Appropriate Technical Method (Riverine and Lucustrine Flooding Sources)

Level of New Study/Restudy	Unmapped (Zones C, X, D)	Approximate (Zone V)	Detailed (Zones A1-A30, AE, V1-V30, VE)
Redelineation			<ul style="list-style-type: none"> Effective stillwater elevations and BFEs appear accurate based on past events, but SFHA or V zone boundary seems inaccurate compared to existing topographic data V zone does not extend to inland limit of primary frontal dune system
Detailed Coastal	<ul style="list-style-type: none"> Areas of moderate or dense development 	<ul style="list-style-type: none"> Areas of moderate or dense development 	<ul style="list-style-type: none"> Flood experience indicates that stillwater elevations and/or BFEs are outdated; Significant changes have occurred to the shoreline and transect profile since effective FIS analysis; Wave height and/or runup methods not used at all in effective FIS analysis; <u>and/or</u> Outdated wave height and runup methodologies used for the effective FIS analysis
Use Effective Information	<ul style="list-style-type: none"> Areas of minimal or no development 	<ul style="list-style-type: none"> Areas of minimal or no development 	<ul style="list-style-type: none"> Effective BFEs, SFHA, and V zones appear accurate based on past events

Table 6. Guidance for Selecting Appropriate Technical Method (Coastal Flooding Sources)

5.0 Performing Restudies

The NCFMP performs the following activities in producing statewide DFIRM panels that will apply to restudy procedures:

Scoping → Engineering Analysis and Review → DFIRM Production and Review → Outreach → Preliminary Issuance and Due Process → Post-Preliminary Processing.

The NCFMP DFIRM production process flowchart available in the NCFMP Reference Manual outlines the timing, order, and responsibilities for the activities listed above. Standard submittal procedures and deliverables for these activities are outlined in the NCFMP "Submittal Procedures and Deliverables" and "Post-Preliminary Submittal Procedures and Deliverables" document available in the NCFMP Reference Manual. The following sections of this report outline these activities.

5.1 Scoping

The NCFMP scoping process entails meeting with each jurisdiction to discuss the accuracy of the flood maps and their current and future flood hazard mapping needs. During scoping, existing community needs are researched in FEMA archives (including the Mapping Needs Update Support System) and incorporated into the scoping process. Data from each Scoping Meeting are compiled on a basin-wide basis and are presented in a Basin Plan for the first round of statewide scoping. Meetings are held on a countywide basis and results are presented in an annual Map Maintenance Plan. The Basin Plan and Map Maintenance Plan provide an overview of the scope of work to be conducted to update the flood hazard maps within the scoped area. They identify flooding sources to be updated and methods that will be used for each update, base map to be used, and the proposed schedule of mapping activities. They also document unmet mapping needs in a table of community-requested studies that are not included in the mapping contractor's scope of work. A Basin Plan is provided to the scoped communities for their review and the plan is finalized based on this input prior to the initiation of any mapping activities within the basin. The Maintenance Plan is provided to the Public once the scope of work is finalized.

MENCA is a GIS tool created by the NCFMP to store, display, analyze, disseminate, and archive scoping data for the entire State. The use of MENCA during the scoping phase allows the NCFMP to collect effective information and community requests for every studied stream in the State. These data are compared against ranking and priority factors to determine the final scope of study for each stream. The information from MENCA is currently disseminated to the public in reports that are created by MENCA. Future scoping efforts performed for stream-centric revisions will be captured, stored, analyzed, disseminated, and archived in MENCA.

For map maintenance, scoping will not be performed by river basin but by county every 2.5-3.5 years after the previous effective date. Scoping will focus on streams with restudy needs within those previously effective counties rather than on full countywide restudies. The information stored in MENCA for map maintenance will be used along

with the triggers and priorities outlined in Section 3 of this report to determine restudy reaches and priorities. The guidance provided in Section 4 of this report will be used at the scoping stage to select technical methods for restudy reaches to develop the scope of revision.

For the map maintenance phase, an updated version of MENCA that supports map maintenance scoping will be used. This updated version of MENCA allows users to import existing scoping files from the previous rounds of scoping performed by the NCFMP into a new project to retain historical scoping information. This will allow the NCFMP to ensure that unmet needs area addressed and to keep all scoping information together for decision making and reference.

5.2 Engineering Analysis and Review

The NCFMP hydrology and hydraulics (H&H) engineering studies are produced in a modern GIS-enriched process that includes a production phase and a QA/QC review phase.

The NCFMP's engineering and mapping contractors develop the H&H studies using models included on FEMA's "Nationally Accepted Models List", primarily the most current versions of HEC-RAS in combination with a variety of automated GIS environments developed specifically for floodplain mapping. The studies combine traditional field surveyed cross sections with digital LIDAR based cross sections as the base data for the hydraulic modeling. USGS regression equations developed for the State of North Carolina are used as the primary method for flood discharge determinations, but HEC-HMS has been used in highly urban areas. Many of the traditional steps in H&H modeling, such as data entry, have been automated in GIS environments.

Types of Studies

The NCFMP employs three (3) primary study types: detailed study, limited detailed study, and redelineation.

Detailed studies include the most effort by the NCFMP engineering and mapping contractors and have the highest data requirements. Detailed studies require field survey of all stream crossings and critical floodplain cross sections. The field survey cross sections are augmented with LIDAR based sections so that the average cross section spacing on most streams is 500 feet. The H&H modeling includes the 10%, 5%, 1% and 0.2% (10-, 50-, 100-, and 500-year) annual chance discharges and an optimized floodway determination.

Limited detailed studies are studies of the 1% annual chance discharges for BFE determination. Instead of floodways, these studies also include non-encroachment areas that are developed for inclusion in the FIS report, but are not shown on the DFIRM. Cross section data is developed from the LIDAR data and stream crossings are visited and measured in local reference, but are not surveyed.

Redelineation uses the effective model and flood profile to generate new 1% and 0.2% annual chance floodplain and floodway boundaries on the LIDAR elevation data. These studies assume that the effective data is still accurate and uses the LIDAR, which in most locations is much more accurate than the topographic data previously used for mapping. Much of this process is automated and the mapping is not distinguishable from the mapping of new detailed studied streams.

Review Process

Once the engineering and mapping contractors have developed the draft H&H studies, the NCFMP engineers and the independent QA/QC contractor concurrently review the data. This process typically involves submittal of draft data, a 1st draft review, revisions to the original data per the review comments, and a verification review of the 2nd draft data. All comments and responses to comments are captured in a standardized memorandum that is signed by the engineering and mapping contractor and the NCFMP Engineering Manager after finalization of H&H studies. The final signed memos are included in the Technical Support Data Notebooks (TSDNs), developed to meet FEMA's requirements as outlined in their *Guidelines and Specifications for Flood Hazard Mapping Partners*, which are submitted to the NCFMP and the QA/QC contractor before the preliminary issuance date of the revised DFIRM panels.

5.3 DFIRM Production and Review

DFIRM production and review as outlined below includes obtaining the base map, producing and reviewing the DFIRM panels and components, creating the FIS Report, Summary of Map Actions (SOMAs), news releases, and DFIRM database. The North Carolina Center for Geographic Information and Analysis (CGIA), the engineering and mapping contractors, and the QA/QC contractor are responsible for DFIRM production and review activities.

Base Maps

The NCFMP serves as the main repository for base data and acquires county/municipal aerial images in the State, where available. Locally produced digital orthophotography is used as the base map for statewide DFIRM production, provided that it meets FEMA's base map standards. If local imagery is not available, the U.S. Geological Survey (USGS) Digital Orthophoto Quadrangles (DOQs), based on 1998 aerial photography, are used. The base maps are supplemented with stream and river centerlines, shoreline, political boundaries, and road name data from other sources; this may include locally available GIS data. Memorandums of Agreement (MOAs) are signed with counties or communities that provide base data to clearly outline the terms for use and release of base data for flood mapping purposes. In areas where county/community base data meeting FEMA's minimum specifications are not available, USGS DOQs are acquired and used as DFIRM base data.

The engineering and mapping contractors provide two separate DFIRM submittals to CGIA for review and comment. The first is the base data submittal that includes all DFIRM panels in the subject county with base map data (aerial imagery, corporate limits, road and stream names, etc.) and without flood zones mapped. CGIA provides review comments in the form of hardcopy annotated maps and a summary comment memorandum. CGIA also performs a review of the pre-preliminary DFIRM panels to ensure that all base data comments were incorporated and that there are no additional concerns with base data on the DFIRM panels. Again, CGIA provides review comments in the form of hardcopy annotated maps and a summary comment memorandum.

CGIA will only acquire new base data and perform base data and pre-preliminary DFIRM reviews for full countywide revisions and for framework data updates (PMRs/revisions processed only to update base data). CGIA will not acquire or perform reviews of base data and pre-preliminary DFIRM panels for revisions processed as PMRs.

Map Production and Review

The engineering and mapping contractors use the base data supplied by CGIA, the LIDAR data, the engineering models created for detailed and limited detailed studied streams, and existing effective data for redelineated streams to create the pre-preliminary DFIRM panels and FIS components. The pre-preliminary DFIRM panels include all base data and all flood hazard data. The FIS components include all tables, profiles, and summaries of the hydrologic and hydraulic analyses.

Pre-preliminary and preliminary-ready reviews of DFIRM panels and FIS components are performed by the QA/QC contractor. The DFIRM panels and FIS components are reviewed to check the following:

- Redelineation of floodplains and incorporation of effective data for redelineated streams;
- Correct mapping of newly studied streams (detailed and limited detailed);
- Technical accuracy and agreement between the DFIRM panels and the tables and profiles in the FIS Report;
- Correct tie-in of effective data (for redelineated streams) with new data (for detailed and limited detailed studied streams);
- Compliance with FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners; and
- NCFMP technical and graphic standards.

Concerns with the DFIRM panels and FIS components are annotated on the hard copy maps and noted in comment memorandum that is distributed to the NCFMP, CGIA, and the engineering and mapping contractor.

Corrections are made by the engineering and mapping contractor based on the annotated maps and comment memorandum and the revised submittal is

provided to the QA/QC contractor within two weeks of receipt of pre-preliminary comments. This submittal, the preliminary-ready submittal, is reviewed to ensure that all concerns identified during the pre-preliminary review were addressed and to ensure that no additional changes or errors were made. Annotated hard copy DFIRMs and a revised comment memorandum are supplied to the NCFMP, CGIA, and the engineering and mapping contractor within two weeks of receipt. After the engineering and mapping contractors resolve all outstanding issues, the DFIRMs are approved by the NCFMP and prepared for preliminary issuance.

Once the DFIRMs are approved, the engineering and mapping contractor provides raster DFIRMs in PDF format to the QA/QC contractor for printing and to the NCFMP for posting online. The QA/QC contractor sets the preliminary date, prepares the copies, and issues the maps preliminary.

Map revisions during the map maintenance phase shall follow the same review procedures outlined above.

FIS Report Creation

The FIS Report is a document that accompanies each study and it contains both narrative and numerical data in support of the map panels. It contains information about the watershed, historic flood events, base maps, scope of the new studies, hydrologic and hydraulic narratives for the old and new studies, as well as Floodway Data Tables, Limited Detailed Flood Hazard Data Tables, and Flood Profiles.

The QA/QC contractor compiles the FIS Report for each county starting with a template and the current effective FIS Reports for the Unincorporated Areas and any incorporated communities in the county. Data that is not revised as part of the new study are taken from the effective FIS Reports and incorporated into the new document. The engineering and mapping contractors provides information for the areas being revised to the QA/QC contractor with their pre-preliminary and preliminary-ready submittals. The QA/QC contractor ensures that these tables and profiles are incorporated into the FIS Report correctly.

The FIS Report is revised and reissued with PMRs and countywide restudies. LOMCs require either no change to the FIS Report or revisions to specific components. Refer to Section 2.4 of this report for the detailed information regarding FIS Report revisions for restudies.

SOMA Creation

SOMAs list all valid LOMCs that have been issued since the previous FIRM effective date for each community. LOMCs are organized to show which will still be valid after the map revision is complete, which will be incorporated into the new maps, and which are superseded (invalidated) by the new maps. These documents are sent to the communities affected by a map revision with the

preliminary FIS and DFIRM and with the Letter of Final Determination (LFD) which starts the six month compliance period.

The QA/QC contractor currently compiles each SOMA for the jurisdictions affected by the statewide DFIRM production. For map maintenance, SOMAs must be prepared for all communities affected by the revision, even if no LOMCs were issued for a jurisdiction since the effective date. If no LOMCs were issued, "None" should be placed in every category. The SOMAs should be prepared for only the panels and streams affected by the revision. If a LOMC has been issued for a jurisdiction affected by a revision, but the LOMC is for a stream that is not located on a revised panel, the LOMC should not be included in the SOMA.

DFIRM Database Production and Review

The NCFMP engineering and mapping contractors produce countywide DFIRM databases in the NCFMP format for preliminary issuance and during the post-preliminary processing stage. The QA/QC contractor reviews the database, edits the information to add the effective date and to change any preliminary references to effective, and to finalize the format. This final NCFMP-format DFIRM database is reviewed through the NCFMP validation tool and submitted to the NCFMP for validation and upload to the NCFMIS for public viewing and download.

The QA/QC contractor also uses an automated conversion tool to create and review the FEMA Standard format DFIRM database. The FEMA Standard format DFIRM database is submitted to Harvard Design and Mapping (HDM), FEMA's independent database QA/QC contractor, for automated and visual review. Following resolution of HDM concerns, the QA/QC contractor submits the final FEMA Standard format DFIRM database to FEMA's Map Service Center (MSC) for distributing to the public.

For future map revisions, new NCFMP and FEMA Standard format DFIRM databases will not have to be created. The existing versions of each database can be edited and modified to include the new data created from the map revision, the new effective date, and the new DFIRM panel suffixes. Both formats will be updated and reviewed before submission to the NCFMP and FEMA's MSC.

5.4 Preliminary Issuance and Due Process

The processing of preliminary issuance and due process outlined below applies to both full countywide revisions and PMRs. The QA/QC contractor is responsible for all activities outlined in this section.

The NCFMP/FEMA preliminary transmittal letter is a letter with joint signatures by the NCFMP Program Manager and FEMA. This letter contains background about the NCFMP statewide mapping program and its joint partnership with FEMA and initiates the 90-day

appeal period for the basin being processed. The letter also contains the following jurisdiction specific information, if applicable:

- Notification of the newspaper and publication dates as well as a discussion about the 90-day appeal period, if the jurisdiction is affected by new or changed BFEs;
- Invitation to join the NFIP, if the jurisdiction is not participating; and
- Discussion about future processing of additional basins, if the jurisdiction is affected by more than one basin.

The enclosures that accompany the transmittal letter include three color sets of the FIRM panels affecting each jurisdiction; two sets sent certified/return receipt to the Chief Executive Officer (CEO) and one set to the jurisdiction floodplain administrator. The county receives three complete sets of the FIRM panels being processed for that basin. In addition, the jurisdiction receives informational handouts and pamphlets explaining the 90-day appeal period, background about the NFIP, and answers to frequently asked questions.

If new or modified BFEs are shown in the Preliminary copies of the new or revised FIS report or FIRM, a 90-day appeal period is initiated in accordance with current statutory and regulatory requirements for that jurisdiction. As discussed above, the official notification of the proposed or proposed modified BFEs is included in the preliminary transmittal letter sent to the CEO of the jurisdiction. Two public notices are then published in a prominent local newspaper, the first within one week of issuance of the Preliminary FIS and FIRM notifying the jurisdiction about the revision, and the second one week after the first. The 90-day appeal period begins with the second newspaper publication. In addition, the proposed BFEs are also published in the *Federal Register*.

The public notice published in the jurisdiction's newspaper includes a brief background, information about where the jurisdiction can view the revised FIRM and FIS, and the address of the jurisdiction's map repository. FEMA recently created a website called "BFEs on the Web", located at <http://www.floodmaps.fema.gov/bfe/> which allows communities to view the proposed BFEs without FEMA having to incur the costs of listing all of the BFEs in the newspaper. The jurisdiction is also given the option of calling the FEMA Map Assistance Center to receive a hard copy of the changes if someone does not have access to the internet.

During the 90-day appeal period, community officials, or other interested parties working through community officials, may submit a formal challenge to the proposed BFEs. These challenges, which are referred to as appeals, must be supported by technical data that show the proposed BFEs are scientifically or technically incorrect. During this appeal period, community officials or other interested parties also may submit comments regarding flood hazard information other than BFEs and non-flood hazard information. Such comments are considered protests.

At the end of the 90-day appeal period, all appeals of BFEs and protests of other flood hazard and non-flood hazard information submitted by jurisdiction officials and other

interested parties will be reviewed. If necessary, additional information will be requested from the jurisdiction or appellant.

For a PMR during the map maintenance phase, DFIRM panel issuance and due process will be stream-centric rather than countywide. Therefore, if a restudied stream crosses county boundaries, both counties will receive copies of the DFIRM panels at preliminary issuance and will be provided due process at that time.

5.5 Post-Preliminary Processing

Post-preliminary processing activities outlined below apply to both full countywide revisions and PMRs. The QA/QC contractor is responsible for all activities outlined in this section.

Once the 90-day appeal periods for all basins affecting the county have ended and all appeals and protests have been resolved, the Letter of Final Determination (LFD) can be issued for the County and incorporated municipalities. The LFD notifies the jurisdiction CEO, floodplain administrator, and all appellants that any and all appeals and protests have been resolved and that the BFEs are considered final. The LFD also initiates the six-month compliance period for the jurisdiction and announces the effective date for the flood map and flood insurance study report which is six months from the date of the LFD.

During the compliance period, community officials must revise the jurisdiction's floodplain management ordinances to ensure they are compliant with NFIP regulations. Close coordination usually occurs between the jurisdiction and the state to ensure the appropriate regulations are adopted before the FIRMs become effective.

Approximately 90 days and 30 days prior to the effective date, FEMA issues "reminder" letters to the non-compliant jurisdictions reminding them of the ordinances they are required to update prior to the effective date.

The compliance period ends on the same date that the final FIS report and FIRM become effective. By this date, the affected jurisdictions are to have updated floodplain management ordinances and received approval from the state/Region. If an affected jurisdiction has not updated its floodplain management ordinances by this date, sanctions may be applied by FEMA.

Preparation of the final report and map products will be completed and delivered to the FEMA MSC approximately four months before the effective date. The MSC works with the U.S. Government Printing Office to obtain final printed copies of the new or revised FIS report and FIRM. These printed copies are then distributed to local, regional, and State officials and other interested parties prior to the effective date.

For a countywide revision, if flood hazard data is shown on a multi-county panel across county boundaries, only the data on the portion of the panel in the subject county is finalized. The data shown in the contiguous county is disclaimed and cannot be used for

insurance rating purposes. The data on the multi-county panel in the contiguous county is finalized with the rest of that county at a later date and the DFIRM panel is reprinted.

For a PMR during the map maintenance phase, DFIRM finalization will be stream-centric rather than countywide. Therefore, if a restudied stream crosses county boundaries, the flood hazard data for both counties on the subject panel will be finalized at the same time and the subject panel will not have to be reprinted at a later date.

5.6 Outreach

The NCFMP developed and implements an outreach strategy with the goals of: establishing two-way communication with stakeholders impacted by the floodplain remapping; ensuring compliance with due process and other regulatory requirements; minimizing the number of technical appeals and protests; ensuring public understanding of the benefits of new maps; interacting with technical representatives to ensure production of quality maps; enhancing ownership and use by communities; ensuring that other users know how to use the new maps; and tracking/monitoring/evaluating outreach activities and adjusting efforts according to feedback received and evolving project needs.

For the first round of statewide DFIRM production, the following activities were utilized in the NCFMP outreach strategy:

- Scoping Meetings;
- Preliminary Meetings, held with NCFMP, the North Carolina Floodplain Management Branch (NCFMB), FEMA, and county and community officials 2-4 weeks after preliminary issuance of DFIRMs;
- Public Participation Meetings, held with NCFMP, NCFMB, FEMA, county and community officials, and the general public 4-8 weeks after preliminary issuance of DFIRMs;
- Implementation of the NCFMP website to provide an overview of the mapping project, access to preliminary and final flood hazard data, and contacts and links for further information on the NCFMP and FEMA to the general public, technical audiences, and other stakeholder groups;
- Development of various papers, presentations, and articles for conferences and newsletters, also posted on the NCFMP website;
- Fact sheets provided at Preliminary and Public Participation Meetings and available online; and
- Publication of the Safer Development in Floodprone Areas guidebook and brochure, created by the NCFMP and available to the general public. It includes information and guidance about safer floodplain development beyond minimum NFIP standards.

The above-listed outreach activities should be used for any full countywide revisions during the map maintenance phase and should be considered for PMRs. Smaller PMRs that affect a few panels may not require Preliminary and Public Participation Meetings.

This should be decided on a case-by-case basis with the NCFMP Program Manager and the NCFMP Community Development Planning Manager.

5.7 Responsibility of Restudy Partners

FEMA Responsibilities

FEMA is responsible for providing funding, guidance, and support to all CTP activities through Mapping Activity Statements and regular coordination. FEMA currently provides funding for DFIRM production activities and map maintenance activities and participates in regular coordination efforts. FEMA also assists in the resolution of major appeals and protests and performs printing and shipping activities during the post-preliminary processing phase of production.

NCFMP Responsibilities

Through the CTP agreement with FEMA, the NCFMP is responsible for all activities related to DFIRM production, review, and maintenance except printing and shipping. The NCFMP is responsible for the preliminary and public meeting schedule and funding requirements outlined in their agreements with FEMA. The NCFMP staff is responsible for leading all production activities from scoping to outreach, with the support of CGIA and NCFMP contractors.

CGIA Responsibilities

CGIA gathers and supplies base data to the NCFMP engineering and mapping contractors, and reviews the base data and pre-preliminary DFIRM panels. CGIA determines the best source of base data for each county, compiles this data, and provides it to the engineering and mapping contractors for DFIRM production.

Engineering and Mapping Contractor Responsibilities

The NCFMP engineering and mapping contractors are responsible for performing ground surveys, hydrologic, and hydraulic analyses for newly studied & limited detailed studied streams and for creating DFIRM panels, components, and databases. They are also responsible for making revisions based on quality review comments.

QA/QC Contractor Responsibilities

An extensive independent third-party quality review process was developed by the NCFMP to ensure consistency and accuracy in the engineering models. The NCFMP manages the reviews and ensures consensus with the QA/QC contractor before providing feedback to the contractor. Feedback is provided in the form of a standard comments memorandum that is signed by the NCFMP when the engineering models and DFIRM panels are approved. These reviews serve to ensure that all flood studies comply with FEMA technical and regulatory specifications, NFIP regulations, accepted engineering practices, and NCFMP standards.

Map revisions (countywide revisions and PMRs) will require independent third-party reviews during the preliminary and post-preliminary processing stages. These reviews should follow the current procedure in place for reviews of statewide DFIRM panels (see DFIRM Production and Reviews section above).

6.0 Allocation of Funding for Restudies

Funding

Project funding will be allocated according to community identified scoping needs and project ranking based on restudy prioritization points. Restudy points are tallied by stream or coastal reach length. Coastal and riverine projects are ranked separately, since triggers used to evaluate coastal and riverine studies are not identical. As mentioned previously, a community's effective DFIRM panels will be reevaluated approximately 2.5-3.5 years after the effective panel date. Program funding will be distributed between coastal and riverine studies on a case-by-case evaluation basis and will be allocated to areas of greatest need or flood risk. Program funding needs will be estimated based on the current statewide mapping completion schedule, an assumed percentage of total panels that will be updated per year, an estimated number of stream or coastal miles that will need to be updated per panel, adjusted historical NCFMP engineering and mapping contractor engineering costs per mile and DFIRM production costs per panel.

The current statewide mapping initiative will be complete by the FY 2009, with an estimated 11,000 effective map panels. It is assumed that only a portion of effective panels will have map maintenance needs. Approximate 15% of the panels in the map maintenance phase will be assumed to have flood data related map maintenance needs. Not all streams or coastlines on a panel will be updated; therefore, it was assumed that only on average 1.5 miles of restudy will be performed per panel. Restudy miles are used to estimate components of the engineering and mapping costs for flood data updates, discussed in further detail below. Table 7 provides a 5-year map maintenance panel update schedule for the NCFMP.

Fiscal Year (FY)	Total Effective Panels	Flood Data			Framework Data	
		% Updated	Panels	Restudy Miles*	%	Panels
2006	4,990	7	350	530	7	350
2007	4,890	7	730	1,100	7	340
2008	8,500	15	1,280	1,920	7	600
2009	10,000	15	1,500	2,250	7	700
2010	10,000	15	1,500	2,250	7	700

* - Based upon 1.5 miles of restudy per panel

Table 7. 5-Year Map Maintenance Panel Update Schedule

Adjusted annual costs will be separated into values associated with engineering and DFIRM production for flood data updates, DFIRM production for framework data changes, and base map production costs. Historical NCFMP program costs for all of the aforementioned items will be used for unit cost estimation, which will then be adjusted to 2/3 of their Blue Book value, consistent with the FEMA methodology documented in the "Cost Estimate for the Flood Map Modernization Plan". The unit costs will be reduced to account for cost savings resulting from the use of GIS for engineering and mapping analyses and declining costs of remote sensing technologies.

Contracting

The NCFMP's contractors are assigned tasks through delivery orders, which specify deliverables that are based on the scope of work identified in the Request for Delivery that is prepared and issued by the NCFMP. The NCFMP and contractors negotiate cost and schedule and finalize the delivery order. Delivery orders are set at a firm fixed price. Once these delivery orders have been completed, the NCFMP updates the Mapping Activity Statement, which details the work that the NCFMP will be conducting through its partnership with FEMA. The agreements describe all mapping activities and the party responsible for management and oversight through completion.

7.0 Dissemination and Archiving of Restudy Data

The NCFMP will provide supporting data for the preliminary and effective DFIRMs online for public use and will archive the data for future revision. The NCFMP will also coordinate directly with FEMA to share data.

7.1 NC Floodplain Mapping Information System

The DFIRM data for the North Carolina statewide DFIRM production are currently posted on the NCFMIS by the NCFMP. The data posted online for public use includes:

- FIS reports in PDF format submitted by the QA/QC contractor;
- Raster images of DFIRM panels in PDF format submitted by the engineering and mapping contractor;
- Aerial imagery submitted by the engineering and mapping contractor;
- Base data in GIS format submitted as part of the NCFMP-format DFIRM database by the engineering and mapping contractor at the preliminary stage and submitted by the QA/QC contractor at the post-preliminary stage;
- Flood hazard data in GIS format submitted as part of the NCFMP-format DFIRM database by the engineering and mapping contractor at the preliminary stage and submitted by the QA/QC contractor at the post-preliminary stage;
- Terrain data (bare earth and digital elevation models) submitted by the engineering and mapping contractor; and
- SOMAs created and posted by the QA/QC contractor.

The NCFMP plans to include the following data in the future:

- Engineering models;
- Inventory data;
- LOMCs; and
- The Virtual SFHA, which will be the flood hazard data files that are updated each time a revision occurs.

The data posted online is available for viewing in the NCFMIS viewer, printing, and download. DFIRM panels can be downloaded in raster format (that match the printed DFIRM exactly) or the associated map layers for the DFIRM can be downloaded in vector format (for example: SFHAs can be downloaded in an ESRI shapefile to be used with a different base map).

The restudy contractors will be responsible for submitting the products listed above to the NCFMP at the preliminary and post-preliminary stages for posting online.

7.2 Virtual Special Flood Hazard Area

The virtual SFHA concept assumes that the flood hazard area is the digital floodplain boundaries rather than the hard copy DFIRM panel. The digital floodplain boundaries become the data used for permitting, planning, and insurance rating and can be integrated into a GIS to overlay with a variety of data, including parcels.

The NCFMP was instrumental in obtaining Congressional support of the adoption of digital data in lieu of paper maps by presenting the draft statutory language changes to Congressional delegates in 2003 and 2004. FEMA has not yet proceeded with developing requirements or processing studies to support the adoption of the digital data in lieu of the hard copy paper maps. The NCFMP still must coordinate with the State Attorney General to ascertain whether the digital data may be adopted by North Carolina counties and municipalities in lieu of paper maps. This will determine if the virtual SFHA will be an additional form of DFIRM data that the NCFMP provides to the public or if the virtual SFHA will become the legal representation of the floodplains.

If the virtual SFHA becomes the legal representation of the floodplains and the hardcopy DFIRM panels are no longer a requirement, changes to the floodplains can be made more quickly and efficiently than the traditional map revision process. Changes to flood hazard areas from LOMC requests and restudies can be immediately incorporated into the digital floodplain boundaries, which are available online for public use.

In order for the NCFMP to implement the virtual SFHA concept during the map maintenance phase of DFIRM production, a separate document must be prepared to outline the requirements and standards for use. The benefits of the virtual SFHA are many and include: efficient updates to floodplain data, ease of dissemination to the public, and availability to use data in a GIS. However, the lack of precedent in the use of virtual SFHA will require the NCFMP to develop specific standards to ensure that all requests for revision (from the public) are handled in a timely and accurate manner, that versioning of data is clearly defined and implemented, that archival procedures are updated to account for the frequent digital data changes, and that users without internet access have an alternative method to obtain the most up-to-date floodplain data.

7.3 Submission of Data to FEMA

The NCFMP will house all DFIRM supporting data and will supply it to the public free of charge via www.ncfloodmaps.com. The NCFMP will coordinate with FEMA to ensure that the online FEMA Flood Map Store provides a link directly to www.ncfloodmaps.com for online users to access all supporting data at no cost.

The NCFMP is working with FEMA to develop a method to transfer DFIRM supporting data to FEMA's Mapping Information Platform (MIP) via the NCFMP Web Mapping Services (WMS) portal. This will allow the NCFMP to house all DFIRM supporting data (including base data, LIDAR, engineering models, inventory data, FIS Reports, DFIRM panels in raster format, and DFIRM databases) on NC FMIS. FEMA's MIP would access

this data through the WMS and will display the data but will not house the data on the MIP.

7.4 NCFMP Archiving Procedures

All the original data (base data, map data, DFIRMs, FIS reports, and image data) have been loaded and stored on NCFMIS SAN drives. These data are organized/archived based on submission dates and the current version of the data (including downloadable data) are displayed on the NCFMP website. NCFMP plans to implement data versioning during geodatabase re-design, which is presently being developed by an outside contractor. Data versioning will enable NCFMIS to display different versions of data. NCFMP will develop more comprehensive data archiving procedures after implementing the data versioning system.

Hydrology models have been submitted by engineering and mapping contractors, but are not currently loaded to NCFMIS SAN drives. NCFMP plans to develop applications to display/view these models and to link the models to GIS coverages. The models will ultimately be loaded and archived based on application requirements.