Louisville / Jefferson County Metropolitan Sewer District (MSD) COOPERATING TECHNICAL PARTNERS MAPPING ACTIVITY STATEMENT

Mapping Activity Statement No. 1 – Digital Flood Insurance Rate Map Production and Development of Updated Flood Data

In accordance with the Cooperating Technical Partners (CTP) Partnership Agreement dated September 13, 1999 between Louisville / Jefferson County Metropolitan Sewer District (MSD) and the Federal Emergency Management Agency (FEMA), Mapping Activity Statement (MAS) No. 1 is as follows.

SECTION 1—OBJECTIVE AND SCOPE

The objective of the Flood Map Project documented in this MAS is to develop updated Digital Flood Insurance Rate Map (DFIRM) and Flood Insurance Study (FIS) report for Jefferson County, Kentucky. The DFIRM and FIS report will be referenced to the North American Vertical Datum of 1988 (NAVD88) and produced in the enhanced FEMA Countywide Format.

In addition, this project will develop new and/or updated flood hazard data, as detailed in the most recent addendum as agreed upon in writing by FEMA and MSD. The addendum details the number of miles to be studied and the type of effort to be performed, according to the following six categories:

Category 1	Redelineation
Category 2	Incorporation of LOMC
Category 3	Approximate Study
Category 4	Model Conversion
Category 5	Detailed Study
Category 6	Limited Detail Study

This Flood Map Project will include the following mapping partners:

- Louisville / Jefferson County Metropolitan Sewer District (MSD), the Cooperating Technical Partner (CTP);
- the Federal Emergency Management Agency (FEMA) and/or their designated contractor;
- Fuller, Mossbarger, Scott and May Engineers, Inc (FMSM), the Cooperating Technical Partner (CTP) Contractor;
- the Kentucky Division of Water (KDOW); and
- Additional partners may include the Louisville / Jefferson County Information Consortium (LOJIC), a multi-agency organization which includes MSD, that serves as the repository and provides maintenance for Jefferson County's comprehensive Geographic Information System (GIS).

The activities for this Flood Map Project, including required Quality Assurance/Quality Control (QA/QC) reviews, and the Mapping Partners that will complete them are summarized in the table below. The sections of this MAS that follow the table below describe the specific activities, responsible Mapping Partner(s), FEMA standards that must be met, and resultant map components.

Table 1-1. Mapping Activities Summary Table

Activities	CTP Contractor	MSD	KDOW	FEMA
Activity 1 – Field Surveys and Reconnaissance	X			
Activity 2 – Basemap Acquisition and Preparation	X			
Activity 3 – Hydrologic Analyses	X			
Activity 4 – Independent QA/QC Review of Hydrologic Analyses		X	X	X
Activity 5 – Hydraulic Analyses	X			
Activity 6 – Independent QA/QC Review of Hydraulic Analyses		X	X	X
Activity 7 – Hydraulic Model Conversion	X			
Activity 8A – Floodplain Mapping (Approximate, Limited Detailed, Detailed)	X			
Activity 8B – Floodplain Mapping (Model Conversion)	X			
Activity 8C – Floodplain Mapping (Re-delineation and LOMC areas)	X			
Activity 9 – Independent QA/QC Review of Floodplain Mapping		X	X	X
Activity 10 – DFIRM Production (Merging Effective and Revised Information)	X			
Activity 11 – Independent QA/QC Review of DFIRM Product Meeting FEMA Graphic and Database Specifications		X	X	X
Activity 12 – Preliminary DFIRM and FIS Report Distribution	X	X	X	X
Activity 13 – Post-Preliminary Processing	X	X		X

Activity 1 - Field Surveys and Reconnaissance

Responsible Mapping Partner: The CTP Contractor

Scope: The CTP Contractor shall conduct a detailed field reconnaissance of the detailed FIS areas to determine conditions along the floodplain(s), types and numbers of hydraulic and/or flood control structures, apparent maintenance or lack thereof of existing hydraulic structures, locations of cross sections to be surveyed, and other parameters needed for the hydrologic and hydraulic analyses. Spot field reconnaissance will also be performed as needed to address infrastructure changes within model conversion reaches (Category 4). Literature and information research will be performed for all study types.

In addition to the initial field reconnaissance, this task includes conducting field surveys, including obtaining channel and floodplain cross sections, identifying or establishing elevation reference marks (ERMs), and obtaining the physical dimensions of hydraulic and flood control structures. All survey data collected will be in NAVD88, to reflect the vertical datum of the basemap.

Subtask 1.1 – Outreach

Education and Outreach will be conducted through local and county governments, MSD and FEMA in order to properly inform the citizens and provide the due process requirements. In an effort to further describe the Flood Map Modernization Program to the public, outreach activities may include but not be limited to newspaper announcements, speaking engagements, mail outs, public service announcements, radio spots, website content (www.msdlouky.org), and meetings with local communities. All communication and coordination with local governments will be done in accordance with Title 44 Code of Federal Regulations Part 66.

Subtask 1.2 – Reconnaissance and Data Collection

A. Literature and Information Search: The CTP Contractor will conduct a search for pertinent data to locate published reports, digital data and other information relating to flooding in Jefferson County. Search methods to be used include: direct contact and interviews with knowledgeable individuals and local agencies; requests in writing; and internet sources. The types of data to be obtained include previous FIS's. historical hydrologic data, historic flood data, maps, and hydraulic structure data. The list of sources to be contacted consists of the following:

   - City of Louisville
   - Jefferson County Planning and Development Department
   - Metro Louisville Public Works
   - Kentucky Division of Water (KDOW)
   - Kentucky Department of Natural Resources (KDNR)
   - Kentucky Transportation Cabinet (KTC)
   - Federal Emergency Management Agency (FEMA)
   - U.S. Army Corps of Engineers (COE)
   - U.S. Natural Resources Conservation Service (NRCS)
   - U.S. Geological Survey (USGS)
   - U.S. Environmental Protection Agency (EPA)

B. Field Visit: The CTP Contractor will perform a formal reconnaissance visit to obtain data and establish contacts with Metro Louisville and any federal agencies with local offices. Data to be obtained include flood studies. high water marks, existing and future land use and development plans, flooding problems, flood control plans, elevation reference marks, topographic data, photographic evidence of flooding, newspaper articles, structure plans and corporate boundary

data. In addition, the CTP Contractor will conduct a visual survey of the detailed and approximate study (Categories 3 & 5) reaches and adjacent floodplain areas. Significant hydraulic structures and other features will be documented by photo or other suitable means. The list of agencies and others to be contacted consists of the following:

- Metro Louisville Public Works
- NRCS
- KTC
- Courier-Journal newspaper

Subtask 1.3 – Field Survey Data Collection

New cross sections and structures will be surveyed for the purposes of developing the detailed studies (Category 5) and select areas within model conversion reaches (Category 4). Only structural sketches , photos, and dimensions will be gathered for limited detailed studies (Category 6). Digital topography will be used to develop cross sections for these studies. Conventional and GPS-based ground survey techniques will be used to gather bridge surveys and cross sections within the detailed study reaches. Approximate study (Category 3) reaches will be visited to gather representative stream and overbank photographs. For detailed and model conversion studies, data collected will include field measurements of pier widths and structural opening dimensions, unless data is available from existing bridge/culvert plans.

- Bridges will be surveyed to adequately characterize their impacts to the hydraulics of the detailed study stream reaches (Category 5). Structural data that can be utilized from existing, effective models will be mined, field verified, and inserted into the new detailed studies. Survey data will consist of profiles along the upstream and downstream faces of the structure illustrating the top and bottom of the structure (high chord/low chord data), the abutment/approach tie-ins, and the channel.
- The actual survey requirements could vary based on results of the field inspection for each stream. Supplemental surveys may be necessary to gather information on new hydraulic structures for model conversion projects. A Survey Reconnaissance Summary Report explaining the level of detail selected for the surveys will be submitted for FEMA records.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the Technical Support Data Notebook (TSDN) format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- A Survey Reconnaissance Report summarizing the level of detail to be collected during the stream surveys;
- Study notification (newspaper or website);
- Maps and drawings that provide the detailed survey results; and
- Survey notebook containing cross sections and structural data.

Activity 2 - Base Map Acquisition and Preparation

Responsible Mapping Partner: The CTP Contractor

Scope: This task consists of obtaining the digital base map for the project, and includes the following activities:

- Coordination with local mapping agencies and partners;
- Obtain digital files of the base map;
- Secure necessary permissions from Louisville / Jefferson County Information Consortium (LOJIC) to allow FEMA's use and distribution of hardcopy and digital map products using the digital base map, free of charge;
- Import, organize, re-project data layers as appropriate;
- Obtain necessary certification from LOJIC that the digital data meets the minimum standards and specifications that FEMA requires for DFIRM production; and
- Populate the enhanced DFIRM database with the information required by FEMA.

Assumptions: The following conditions were assumed during the creation of this MAS:

- LOJIC will supply the digital basemap.
- LOJIC will allow FEMA's use and distribution of hardcopy and digital map products, free of charge. If LOJIC is unwilling to allow use of base map information in accordance with FEMA's Guidelines and Specifications referenced in Section 5 of this MAS, then the CTP contractor will use available USGS DOQQ's as the base map.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Written certification from LOJIC that the digital data meet the minimum standards and specifications; and
- Documentation that the digital base map can be used by FEMA.

Activity 3 – Hydrologic Analyses

Responsible Mapping Partner: The CTP Contractor

Scope: Hydrologic analyses will be completed for the detailed and approximate flooding source(s) listed in the attached addendum of this MAS. The hydrologic methods used for the detailed study reaches (Category 5) will be based on the HEC-HMS rainfall-runoff model. Peak flood discharges will be calculated for the 10-, 50-, 100-, and 500-year annual chance storms at various locations on the study reaches noted in the addendum. Additionally, fully developed discharges for the 100-year storm will also be calculated within the hydrologic models. Ultimately, the 100-year fully developed floodplain will be mapped as the shaded Zone X on the DFIRMs. The hydrologic methods used for the approximate study (Category 3) reaches will be based on USGS regression equations. Peak flood discharges will be calculated for the 100-year annual chance storm at various locations on the approximate study reaches. These flood discharges will be the basis for subsequent hydraulic analyses of the subject flooding sources. Furthermore, hydrologic discharges for the hydraulic model used in a model conversion study may be updated at the discretion of MSD.

Flood discharges will be calibrated and verified using stream gage data, where available. The results of the rainfall-runoff model and regional regression equations will be compared to applicable gage data by performing frequency analyses of historic gage data and area weighting the results based on the upstream drainage area at the gage. Frequency analyses will be performed on applicable gage data using the USGS PEAKFQ Flood Frequency Analysis or similar software, which applies guidelines contained in *"Guidelines for Determining Flood Flow Frequency," Revised Bulletin 17B of the Hydrology Committee, U.S. Water Resources Council.* A brief report summarizing the hydrologic analysis results will be submitted to the CTP and KDOW for review.

Subtask 3.1 – Approximate Study Reaches (Category 3)

The CTP Contractor will determine 100-year flood discharges at various locations in Jefferson County, which were identified in the attached Addendum. Fully developed discharges for the 100-year storm will also be developed. All hydrologic calculations will be performed using USGS regression equations as published in the USGS Water-Resources Investigation Report 97-219 along with the use of any available stream gage data. The technique presented in this approach utilizes a generalized least-squares regression model to estimate peak stream flows for ungaged sites using contributing-drainage area, basin development factor, and slope of the main channel.

Watershed boundaries will be derived using a Digital Elevation Model (DEM) from the LOJIC basemap and storm sewer infrastructure data, if not already available. The CTP Contractor will use the LOJIC basemap to extract basin limits and regression equation parameters such as contributing-drainage area and main channel slopes from the DEM data. All 100-year discharge calculations and input parameters will be tabulated and linked to a digital sub-watershed layer.

Subtask 3.2 – Detailed Study Reaches (Category 5)

HEC-HMS will be used for hydrologic modeling of the detailed study watersheds' response to design rainfall events unless sufficient gage information is available to develop discharges. Sub-watershed boundaries will be utilized as available and further defined if non-existent. The CTP Contractor will use the LOJIC basemap to extract basin limits and hydrologic parameters such as curve numbers and sub-watershed times of travel. Discharges will be developed in accordance with the KDOW, MSD, and FEMA requirements.

Runoff loss will be calculated using the SCS curve number method. Required input includes a description of land cover and hydrologic soil condition. Digital land cover data will be provided by the LOJIC basemap. Digital soil data will be obtained from an available SSURGO (digital NRCS county soil survey) layer.

Unless hydrologic discharges within a model conversion project are deemed valid, the same detailed study hydrologic methods will be utilized in model conversion.

Subtask 3.3 – Limited Detail Study Reaches (Category 6)

Hydrologic analyses for the limited detailed studies (Category 6) identified in the attached addendum of the MAS, will be performed to establish the 100-year flood discharges for selected reaches. Regional regression equations will be used to calculate these discharges. If a more accurate hydrologic model or gage data is pre-existing, however, flood discharges from these sources will be utilized. Discharge accuracy will be verified using traditional flood frequency analyses approaches and available gage data.

All hydrologic calculations will be performed using USGS regression equations as published in the USGS Water-Resources Investigation Report 97-219. The technique presented in this approach utilizes a generalized least-squares regression model to estimate peak stream flows for ungaged sites using contributing-drainage area, basin development factor, and slope of the main channel.

Watershed boundaries will be derived using a Digital Elevation Model (DEM) from the LOJIC basemap and storm sewer infrastructure data, if not already available. The CTP Contractor will use the LOJIC basemap to extract basin limits and regression equation parameters such as contributing-drainage area and main channel slopes from the DEM data. All 100-year discharge calculations and input parameters will be tabulated and linked to a digital sub-watershed layer. The location of limited detailed studies will be clearly noted on work maps.

Assumptions

- The Muskingum-Cunge 8-Point. Modified Puls, and Reservoir routing method will be used to route hydrographs between watersheds for the detailed studies where appropriate.
- TP-40 will be used for rainfall depth–duration–frequency estimates (a revised report may be available in early 2004, if so, this report will be adopted as the standard).
- Data to develop a digital land cover layer will be provided by Louisville Metro Government, LOJIC, or appropriate mapping partner.
- Digital soil data will be obtained from an available soils layer within the LOJIC basemap.
- Historical rainfall and corresponding known high-water elevations of verifiable events are available for calibration.
- Reservoir rating tables will be available for flood control basins.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS, as well as the 'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program (www.ncfloodmaps.com/pubdocs/limited_detailed.pdf).

Deliverables: Upon completion of detailed hydrologic modeling, the results will be submitted to MSD / KDOW for independent review. The hydrologic results for the approximate studies will be included in the TSDN and submitted to FEMA at the completion of this project.

In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Digital copies of all hydrologic modeling (input and output) files for 10-, 50-, 100-(existing and fully developed), and 500-year annual chance storms;
- "Summary of Discharge" table(s) for each subject flooding source studied with detailed methods;
- Peak discharge summary for flooding sources studied with approximate methods;
- Appropriate application/certification form for hydrology;
- Digital and hardcopy versions of draft text for Section 3.1, Hydrologic Analyses, of the FIS report; and
- All back-up data used in the analysis.

Activity 4 - Independent QA/QC Review of Hydrologic Analyses

Responsible Mapping Partner: Louisville/Jefferson County Metropolitan Sewer District (MSD) or the Kentucky Division of Water (KDOW) (as appropriate state QA/QC capabilities are developed), and FEMA.

Scope: MSD / KDOW shall review the technical, scientific, and other information submitted by the CTP Contractor under Activity 3 to ensure that the data and modeling are consistent with FEMA standards and standard engineering practice and are sufficient to prepare the DFIRM. A list of what was reviewed by MSD, KDOW, or their contractor(s) as QA/QC will be submitted to FEMA. This work shall include, at a minimum, the activities listed below

- Review the submittal for technical and regulatory adequacy, completeness of required information, and supporting data and documentation. The technical review is to focus on the following:
  - Use of acceptable models;
  - Use of appropriate methodology;
  - Correctly applied methodology model(s), including QC of input parameters;
  - Comparison with gage data and/or regression equations, if appropriate; and
  - Comparison with discharges for tributary or receiving streams.
- Maintain records of all contacts, reviews, recommendations, and actions and make them readily available to FEMA.
- Maintain an archive of all data submitted for hydrologic modeling review. (All supporting data will be retained for 3 years from the date MSD submits its final expenditure report to FEMA.)

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- A Summary Report that describes and provides the results of the QA/QC review steps;
- A Summary Report that describes the findings of the independent QA/QC review; and
- Recommendations to resolve any problems that are identified during the independent QA/QC review.

Activity 5 – Hydraulic Analyses

Responsible Mapping Partner: The CTP Contractor

Scope: Hydraulic analyses will be completed for reaches indicated in the attached addendum as detailed studies (Category 5) and approximate studies (Category 3).

Subtask 5.1 – Approximate Study Reaches (Category 3)

The modeling for the approximate study reaches will include the 100-year annual chance event based on peak discharges computed under Task 3.2. Flood depth data for approximate stream reaches will be developed using FEMA approved modeling software. (Note: CHECK-RAS will not be utilized for error rectification due to the coarse nature of the study.)

Parameters for the model will be estimated from data collected during the site visit and published sources. A single Manning's "n" value (roughness coefficient) will be estimated at each cross section to be used for calculation of water depth. Cross section data will be extracted from the DEM data using an automated process and inserted into the HEC-RAS model at the head of each watershed, at major channel junctions and at intervals of between one and five miles along uninterrupted stream reaches. Structure data will not be collected or modeled.

Subtask 5.2 – Detailed Study Reaches (Category 5)

The modeling for the detailed study reaches will include the 10-, 50-, 100-, and 500-year annual chance events based on peak discharges computed under Task 3.1. Additionally, 100-year, fully-developed conditions will also modeled. The hydraulic method used for detailed study reaches will be performed using FEMA approved modeling software. Cross section and field data collected under Task 1 will be used to prepare the hydraulic analyses. The hydraulic analyses will be used to establish flood elevations and floodways (1.0' surcharge) for the subject flooding sources. Model parameters and results will be reviewed using the CHECK-RAS software, if appropriate.

Subtask 5.3 – Limited Detail Study Reaches (Category 6)

Hydraulic analyses will be completed for reaches indicated in the attached addendum as limited detailed studies (Category 6). Parameters for the model will be estimated from data collected during the site visit and published sources. Hydraulic structures will be coded into the model utilizing existing bridge/culvert plans, field measurements, or structural sizing curves based upon drainage area and KDOT/Public Works drainage structure regulations. Manning's "n" values will be estimated at each cross section to be used for calculation of water depth. Cross section data will be extracted from existing DEM data using an automated process and inserted into the hydraulic model at the head of each watershed, at major channel junctions and at intervals of approximately one mile or less along uninterrupted stream reaches. Ineffective flow areas will be inserted as needed. Floodway encroachments will be defined assuming a 1.0' surcharge of the 100-year floodplain. Model parameters and results will be reviewed using the CHECK-RAS software, if appropriate.

Assumptions:

- Elevation model input data provided by the LOJIC basemap is sufficient to create a DEM to delineate resulting floodplains.
- New hydraulic models will be developed with cross section locations that may or may not match stations listed in the current effective FIS models for Subtask 5.1.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS as well as the 'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program (www.ncfloodmaps.com/pubdocs/limited_detailed.pdf).

Deliverables: Upon completion of detailed hydraulic modeling for Jefferson County, the results will be submitted to MSD / KDOW for independent review. The results for the approximate studies will be included in the TSDN and submitted to FEMA at the completion of this project.

In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Digital profiles of the 10-, 50-, 100-(existing and fully developed), and 500-year annual chance water-surface elevations representing existing conditions;
- Floodway Data Table(s) for each subject flooding source;
- Digital copies of all hydraulic modeling (input and output) files;
- All back-up data used in the analysis;
- All input and output data, intermediate data processing products, GIS data layers, and final products in the format of the DFIRM enhanced database structure; and
- Digital and hardcopy versions of draft text for inclusion in the FIS report.

Activity 6 - Independent QA/QC Review of Hydraulic Analyses

Responsible Mapping Partner: Louisville/Jefferson County Metropolitan Sewer District (MSD) or the Kentucky Division of Water (KDOW) (as appropriate state QA/QC capabilities are developed), and FEMA.

Scope: MSD / KDOW shall review the technical, scientific, and other information submitted by the CTP Contractor under Activity 5 to ensure that the data and modeling are consistent with FEMA standards and standard engineering practice and are sufficient to revise the FIRM. A list of what was reviewed by MSD, KDOW, or their contractor(s) as QA/QC will be submitted to FEMA. This work shall include, at a minimum, the activities listed below.

- Review the submittal for technical and regulatory adequacy, completeness of required information, and supporting data and documentation. The technical review is to focus on the following:
  - Use of acceptable model(s);
  - Verification of survey data;
  - Boundary conditions;
  - Cross-section geometry;
  - Manning's "n" values and expansion/contraction coefficients;
  - Bridge and culvert modeling;
  - Flood discharges;
  - Regulatory floodway computation methods; and
  - Tie-in to upstream and downstream effective Flood Profiles.
- Use the CHECK-2 or CHECK-RAS program as appropriate to flag potential problems and focus review efforts.
- Maintain records of all contacts, reviews, recommendations, and actions and make them readily available to FEMA.
- Maintain an archive of all data submitted for hydraulic modeling review. (All supporting data will be retained for 3 years from the date MSD submits its final expenditure report to FEMA.)

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*. MSD and/or the CTP Contractor shall make the following products available to FEMA:

- A Summary Report that describes and provides the results of the QA/QC review steps;
- A Summary Report that describes the findings of the independent QA/QC review; and
- Recommendations to resolve any problems that are identified during the independent QA/QC review.

Activity 7 – Hydraulic Model Conversion

Responsible Mapping Partner: The CTP Contractor

Scope: Hydraulic model conversion (Category 4) will be completed for the stream reaches listed in the attached addendum which have been selected by MSD and the CTP Contractor because they have hydraulic models which represent current stream conditions, and can provide additional value to the community if converted into a better format.

Subtask 7.1 - Verify Current FIS Models

The CTP Contractor will verify the status of the hydraulic models that are currently effective for the list of stream reaches noted in the attached addendum. As a part of this effort, the CTP contractor will collect or develop replacement flow values for the hydraulic models as deemed appropriate as well as verify current structure locations and types. If new flood discharges are developed, 100-year fully developed discharges will be included. All structures needing data will be identified and information for these structures will either be obtained through new structure surveys (described in Activity 1) or as-built plans obtained from appropriate agencies.

The cross section data within the effective model to be converted will also be assessed. It is anticipated that in many cases, the survey data used within these effective models, which is 15 to 20-years in age, will be inconsistent with the base map topography on which the DFIRM will be mapped. If this inconsistency exists, floodplain and floodway top width problems will arise when comparing modeling results to mapping delineation results. Essentially, the hydraulic model becomes disconnected and less useful if this occurs. Therefore, new survey data will be gathered as needed for replacement within the converted hydraulic model to eliminate the inconsistencies. However, the structural data from the effective model will be preserved in the conversion process.

Subtask 7.2 – Model Conversion

The CTP Contractor will compute flood depth data for the stream reaches noted in the attached addendum by converting existing hydraulic models into HEC-RAS modeling format. HEC-RAS is a graphically based computer program that will analyze the hydraulic characteristics of an open channel system. Digital files of the original effective HEC-2 models are available and will be used as the basis for the "new" HEC-RAS models. The CTP Contractor will insert the supplemental flow data and bridge data (collected in Activity 1 or from existing plans) into the converted models. Parameters such as Manning's "n" values and flow coefficients will not be modified unless deemed appropriate. Cross section data will be extracted from the original models and inserted into the converted HEC-RAS models, where appropriate. New cross section survey data will be inserted when necessary. Additionally, the bridge deck and culvert coding used in HEC-2 is not always directly convertible into the format required by HEC-RAS. Therefore, new structure coding will be developed and inserted into the HEC-RAS models.

Assumptions:

- Only available digital effective hydraulic FIS models will be converted. If digital models are not available, Hydraulic Model Conversion will not be performed.
- All existing FIS models in Jefferson County are capable of being used on available HEC-2 software.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Digital and paper water surface profiles for the range of flows supplied in the existing models (developed using RASPlot software);
- Digital copies of all hydraulic modeling (input and output) files; and
- All back-up data used in the analysis.

Activity 8A - Floodplain Mapping (Approximate, Limited Detailed, and Detailed)

Responsible Mapping Partner: The CTP Contractor

Scope: Digital floodplain and floodway boundaries will be delineated for the flooding sources listed in the attached addendum of this MAS. The mapping will incorporate all revised hydraulic modeling and newly acquired topographic information. The floodplain boundaries for the 100-year existing and fully developed conditions recurrence intervals and floodway encroachments with a 1.0' surcharge will be delineated on a digital work map based on topographic data supplied by the LOJIC basemap which will be the basis of the revised FIRM. The 100-year fully developed floodplain will be mapped as 'Zone X' in place of the 500-year floodplain.

Subtask 8A.1 – Delineate Floodplains and Floodways

The CTP Contractor will use contours and spot elevations from the LOJIC basemap to delineate the 100-year existing conditions floodplain and floodway, in addition to the 100-year fully developed floodplain for detailed study areas (Category 5). 100-year floodplains under existing conditions will be produced for approximate study areas (Category 3). Manual adjustments will be made where appropriate to remove any computer-generated anomalies.

100-year floodplains and floodways will be produced for limited detailed studies (Category 6) along with published base flood elevations. These study types can be upgraded to fully detailed studies should the need arise. In addition, base flood elevations are published on the maps, which provide another regulatory tool not found in approximate studies. Flood profiles will not be published for these studies.

Subtask 8A.2 – Prepare Work Maps

The CTP Contractor will prepare work maps using the LOJIC basemap. These maps will depict the 100-year existing conditions and fully developed floodplains and floodway boundaries, and shall include cross sections, BFEs, and zone designation labels. Paper work maps will be prepared for the panels identified in the attached addendum in accordance with the appropriate DFIRM panel layout.

Assumptions: The following conditions were assumed during the creation of this MAS:

- The panels in the proposed panel scheme that contain revised flood hazard data are identified in the addendum. These panels will serve as the work map areas for deliverables under this task.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: Upon completion of floodplain mapping for the modeled stream reaches identified in the addendum, the results will be submitted to MSD / KDOW for independent review. The mapping for the remaining flooding sources will be submitted for Quality Assurance/Quality Control (QA/QC) review at the completion of this task.

In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Digital work maps with the 100-year existing conditions and fully developed floodplain and floodway boundaries delineated for the detailed, limited detail, and approximate study reaches (Categories 5, 6, and 3). These maps shall include cross sections, BFEs, and zone designation labels where appropriate.
- Any back-up or supplemental information used in the mapping required for the QA/QC review.

Activity 8B - Floodplain Mapping (Model Conversion)

Responsible Mapping Partner: The CTP Contractor

Scope: Digital floodplain and floodway boundaries will be delineated for the flooding sources listed in the attached addendum of this MAS. The mapping will incorporate all revised hydraulic modeling and newly acquired topographic information. The floodplain boundaries for the 100- and 500-year recurrence intervals and a floodway will be delineated on a digital work map based on topographic data supplied by the LOJIC basemap which will be the basis of the revised FIRM.

Subtask 8B.1 – Delineate Floodplains and Floodways

The CTP Contractor will use contours and spot elevations from LOJIC to delineate the 100- and 500-year floodplain and floodway for the model conversion study areas (Category 4). Manual adjustments will be made where appropriate to remove any computer-generated anomalies.

Subtask 8B.2 – Prepare Work Maps

The CTP Contractor will prepare work maps using the LOJIC basemap. These maps will depict the 100- and 500-year annual chance floodplain and floodway boundaries, and shall include cross sections, BFEs, and zone designation labels. Paper work maps will be prepared for the panels identified in the attached addendum. in accordance with the appropriate DFIRM panel layout.

Assumptions: The following conditions were assumed during the creation of this MAS:

- The panels in the proposed panel scheme that contain revised flood hazard data are identified in the attached addendum. These panels will serve as the work map areas for deliverables under this task.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: Upon completion of floodplain mapping for the modeled stream reaches identified in the attached addendum, the results will be submitted to MSD / KDOW for independent review. The mapping for the remaining flooding sources will be submitted for Quality Assurance/Quality Control (QA/QC) review at the completion of this task.

In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Digital work maps with the 100-year existing conditions and fully developed floodplain and floodway boundaries delineated for the model conversion study reaches (Category 4). These maps shall include cross sections, BFEs, and zone designation labels where appropriate.
- Any back-up or supplemental information used in the mapping required for the QA/QC review.

Activity 8C – Floodplain Mapping (Re-Delineation and LOMC areas)

Responsible Mapping Partner: The CTP Contractor

Scope: The effective FIRMs will be converted to digital format that conforms to FEMA's DFIRM specifications for the flooding sources specified in the attached addendum. The LOJIC basemap will be used for the conversion. This activity covers the re-delineation of the number of panels and linear stream miles indicated in the addendum. LOMCs issued since the current effective FIRM for each affected community will also be incorporated.

Subtask 8C.1 – Re-Delineate Floodplains

The CTP Contractor will use the existing FEMA cross sections as shown on the FIRMs to produce new floodplains that reflect the vertical datum shift from NGVD29 to NAVD88 (Category 1). These cross sections will be used to generate new water surface elevation models that can be intersected with the ground terrain model to produce new floodplains. Manual adjustments and edits will be made where necessary.

Subtask 8C.2 – Incorporate LOMCs and Manual Adjustments

Following the redelineation (Category 1) process, the CTP Contractor will review and incorporate each LOMC that supersedes effective information (Category 2) issued since the current effective FIRM. Prior to the production and release of the preliminary maps, FEMA will be provided the opportunity to submit new LOMCs that were approved during the map development process.

Additionally, manual adjustments and edits will be made to the limits of the flood hazard layers to tie in flood profiles from the effective FIS where necessary and possible.

Subtask 8C.3 – DFIRM Attribute Coding and Metadata

The CTP Contractor will modify the flood hazard data attributes as appropriate to meet FEMA's DFIRM enhanced database specification. Additionally, metadata files that meet DFIRM specifications will be prepared for flood hazard data layers.

Assumptions: The following conditions were assumed during the creation of this MAS:

- FEMA will provide copies of all LOMCs issued since the current effective FIRM, if not readily available ~~with~~ from MSD;
- All work to be conducted under this activity will be completed in accordance with FEMA DFIRM specifications.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- DFIRM mapping files that meet FEMA's Digital Flood Insurance Rate Map (DFIRM) specifications. These files will be provided on CD-ROM.

- Enhanced DFIRM database files that meet FEMA's Digital Flood Insurance Rate Map (DFIRM) specifications. These files will be provided on CD-ROM.
- Metadata files that meet FEMA's Digital Flood Insurance Rate Map (DFIRM) specifications. These files will be provided on CD-ROM.
- A complete set of plots of the DFIRM panels will be provided.
- A QA/QC report that includes a description and the results of all automated or manual quality assurance steps taken during the preparation of the DFIRMs will be provided.

Activity 9 - Independent QA/QC Review of Floodplain Mapping

Responsible Mapping Partner: Louisville/Jefferson County Metropolitan Sewer District (MSD) or the Kentucky Division of Water (KDOW) (as appropriate state QA/QC capabilities are developed), and FEMA.

Scope: MSD / KDOW shall review the floodplain mapping submitted by the CTP Contractor under Activity 8 to ensure that the results of the analyses performed are accurately represented. A list of what was reviewed by MSD, KDOW, or their contractor(s) as QA/QC will be submitted to FEMA. This work shall include, at a minimum, the activities listed below.

- Review the cross sections for proper location and orientation on the work map and agreement with the Floodway Data Table.
- Review the BFEs shown on the work map for proper location and agreement with the results of the hydraulic modeling.
- Review the regulatory floodway widths for agreement with the widths shown in the Floodway Data Table and the results of the hydraulic modeling.
- Review the floodplain boundaries for agreement with the flood elevations shown in the Floodway Data Table and the contour lines and other topographic information shown on the work maps.
- Review the floodplain widths at cross sections as shown on the work maps to ensure they match the Floodway Data Table.
- Review the floodplain boundaries as shown on the work maps to ensure they match the Flood Profiles.
- Review the flood insurance risk zones as shown on the work maps to ensure they are labeled properly.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- A Summary Report that describes and provides the results of the QA/QC review steps:
- A Summary Report that describes the findings of the QA/QC review, noting any deficiencies in or agreeing with the mapping results;
- Recommendations to resolve any problems that are identified during the independent QA/QC review; and
- An annotated work map with all questions and/or concerns indicated, if necessary.

Activity 10 – DFIRM Production (Merging Effective and Revised Information)

Responsible Mapping Partner: The CTP Contractor

Scope: Upon completion of the Floodplain Mapping Activity (Activity 8) for the revised flooding sources for effective areas, the digital floodplain data will be merged into a single, updated Digital FIRM. This work will include tie-in of flood profiles, floodplain boundaries and floodways with contiguous communities that were not studied as part of this project. In addition, the DFIRM will be revised as appropriate to meet the current enhanced FEMA graphic specifications.

Subtask 10.1 – Combine Flood Hazard Information

The CTP Contractor will combine the new digital flood hazard layers with the re-delineated flood hazard layers to create a single, countywide DFIRM product that meets FEMA's specifications. Flood hazard data from the surrounding communities (supplied by FEMA) will be used for edge matching where applicable.

Subtask 10.2 – Prepare Enhanced DFIRM Graphic Specification

The CTP Contractor will apply the enhanced graphic specification to the newly created countywide DFIRM. This work shall include adding all required annotation, line pattern, area shading, and map collar information (e.g., map borders, title blocks, legends, and notes to user). Current panel layout is based on a scale of 1-inch for every 800 ft. In order to comply with FEMA's requirements using the USGS 7.5 minute quad alignment, a revised panel layout is proposed based on a 500 ft scale. Figure 1-1 below illustrates the proposed DFIRM panel layout to be used during this activity.

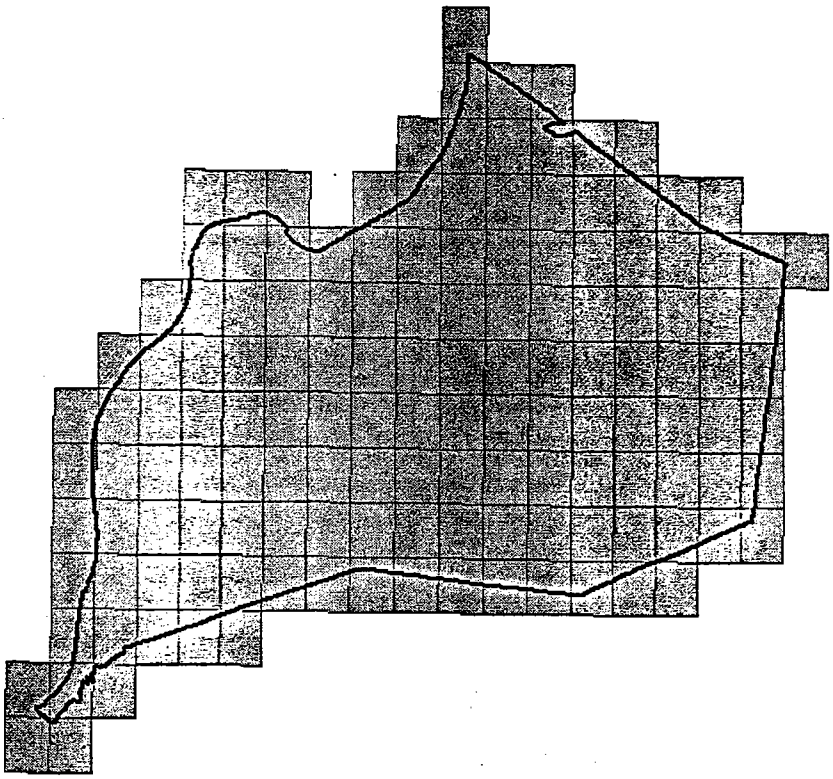
Subtask 10.3 – Prepare County-Wide FIS Report

The CTP Contractor will develop a revised county-wide report for the activities performed in this project. This report will include the project narrative, appropriate floodway data tables, and flood profiles for each study stream in Jefferson County. All elevations reported will be referenced to the North American Vertical Datum of 1988.

Assumptions: The following conditions were assumed during the creation of this MAS:

- FEMA will provide digital information for the surrounding communities for effective areas to be used during the edge-matching process;
- As a responsible partner, MSD, FEMA, and the CTP contractor will coordinate on and review the proposed tiling scheme.

Figure 1-1: Proposed DFIRM Panel Layout



Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- DFIRM mapping files that meet FEMA's enhanced DFIRM specifications. These files will be provided on CD-ROM.
- Metadata files that meet FEMA's enhanced DFIRM specifications. These files will be provided on CD-ROM.
- A complete set of plots of the DFIRM panels will be provided.
- A QA/QC report that includes a description and the results of all automated or manual quality assurance steps taken during the preparation of the DFIRMs will be provided.
- A county-wide FIS report publishing the findings of the DFIRM study in accordance with the *Guidelines and Specifications for Flood Hazard Mapping Partners.*

Activity 11 – Independent QA/QC Review of DFIRM Product

Responsible Mapping Partner: Louisville/Jefferson County Metropolitan Sewer District (MSD) or the Kentucky Division of Water (KDOW) (as appropriate state QA/QC capabilities are developed), and FEMA.

Scope: Upon completion of the floodplain mapping activities (Activity 8) and DFIRM production activities (Activity 10), MSD / KDOW shall review the DFIRM to ensure it meets current FEMA graphic specifications. In addition, MSD / KDOW shall review the DFIRM enhanced spatial database to determine if it meets current FEMA database specifications. MSD / KDOW shall coordinate with other Mapping Partners, as necessary, to resolve any problems identified during this QA/QC review. A list of what was reviewed by MSD, KDOW, or their contractor(s) as QA/QC will be submitted to FEMA. This work shall ensure that the requirements below are met.

- All required DFIRM features are accurately and legibly labeled and follow the examples shown in the FEMA DFIRM specifications. This includes all flood insurance risk zones, BFEs, cross sections, studied streams, mapped political entities, and all roads within and adjacent to the 1-percent-annual-chance floodplains.
- All DFIRM features are correctly symbolized with the appropriate symbol, line pattern, or area shading and follow the requirements in *Guidelines and Specifications for Flood Hazard Mapping Partners.*
- All map collar information is complete, correct, and follows the requirements specified in *Guidelines and Specifications for Flood Hazard Mapping Partners.*
- DFIRM mapping files are in one of the GIS file and enhanced database formats specified in FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners* and conform to those specifications for content and attribution.
- DFIRM database files are in the enhanced database formats specified in FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners* and conform to those specifications for content and attribution.
- Metadata files describing the DFIRM data include all required information shown in *Guidelines and Specifications for Flood Hazard Mapping Partners.*
- The FIS report is prepared in the FEMA Countywide Format as documented in Appendix J of *Guidelines and Specifications for Flood Hazard Mapping Partners.*

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- A Summary Report that describes and provides the results of the QA/QC review steps;
- A Summary Report that describes the findings of the QA/QC review noting any deficiencies in or agreeing with the mapping results and the results of all automated or manual QA/QC steps taken during the independent QA/QC review;
- Recommendations to resolve any problems that are identified during the independent QA/QC review; and
- An annotated copy of the DFIRM with all questions and/or concerns indicated, if necessary.

Activity 12 - Preliminary DFIRM and FIS Report Distribution

Responsible Mapping Partners: Louisville/Jefferson County Metropolitan Sewer District (MSD), Kentucky Division of Water (KDOW), FEMA, and the CTP contractor.

Scope: This activity consists of the final preparation, review, and distribution of the Preliminary copies of the DFIRM and FIS report for community official and general public review and comment. The activities to be performed are summarized below.

Preliminary Transmittal Letter Preparation. Unless instructed otherwise by FEMA, MSD and the CTP Contractor shall prepare letters to transmit the Preliminary copies of the DFIRM and FIS report and related enclosures to all affected communities, all other Project Team members, the State NFIP Coordinator, the FEMA Regional Office, and others as directed by FEMA.

Final QA/QC Review of Preliminary DFIRM and FIS Report: MSD / KDOW shall perform a final QA/QC review of the Preliminary DFIRM and FIS report, including all data tables, Flood Profiles, and other components of the FIS report. The QA/QC review procedures shall be consistent with the *Guidelines and Specifications for Flood Hazard Mapping Partners.*

Discrepancy Resolution: MSD, the CTP Contractor, and FEMA shall work together as appropriate to resolve discrepancies identified during the final QA/QC review.

Distribution of Preliminary DFIRM and FIS Report: MSD and the CTP Contractor shall distribute the Preliminary copies of the DFIRM and FIS report to all affected communities, all other Project Team members, the State NFIP Coordinator, the FEMA Regional Office, and others as directed by FEMA.

News Release Preparation: Unless instructed otherwise by FEMA, MSD shall prepare news release notifications of BFE changes for all affected communities if appropriate and perform QA/QC reviews of the notices for accuracy and compliance with FEMA format requirements. MSD shall file the notifications for later submittal to FEMA for review.

Preliminary Summary of Map Actions (SOMA) Preparation: MSD and the CTP Contractor shall prepare Preliminary SOMAs for all affected communities if appropriate. The SOMA shall list pertinent information regarding LOMCs that will be affected by the issuance of the DFIRM (i.e., superseded, incorporated, and revalidated).

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners* and the requirements documented in Section 1 and Appendix A of the FEMA *Document Control Procedures Manual.* MSD and/or the CTP Contractor shall make the products listed below available to FEMA.

- Preliminary transmittal letters shall be prepared. These letters and any additional letters requested by FEMA shall be prepared in accordance with the current version of the FEMA *Document Control Procedures Manual.*
- Preliminary copies of the DFIRM and FIS report, including all updated data tables and Flood Profiles shall be mailed to the Chief Executive Officer (CEO) and floodplain administrator of each affected community, all other Project Team members, the State NFIP Coordinator, the FEMA Regional Office, and others as directed by FEMA.
- Flood Insurance Study Reports for all limited detailed study streams.

- Preliminary SOMAs, prepared in accordance with FEMA requirements, shall be provided as appropriate.
- Revised DFIRM mapping files, prepared in accordance with the requirements in *Guidelines and Specifications for Flood Hazard Mapping Partners*, shall be provided on CD-ROM.
- Revised DFIRM database files, prepared in accordance with the requirements in *Guidelines and Specifications for Flood Hazard Mapping Partners*, shall be provided on CD-ROM.
- Revised metadata files describing the DFIRM data, including all required information shown in *Guidelines and Specifications for Flood Hazard Mapping Partners*, shall be provided on CD-ROM.
- A Summary Report that describes and provides the results of all automated or manual QA/QC review steps taken during the preparation of the DFIRM shall be provided.

Activity 13 - Post-Preliminary Processing

Responsible Mapping Partners: Louisville/Jefferson County Metropolitan Sewer District (MSD), the CTP Contractor, and FEMA.

Scope: This activity consists of finalizing the DFIRM and FIS report after the preliminary copies of the DFIRM and FIS report have been issued to community officials and the public for review and comment. The activities to be performed are summarized below.

Initiation of Statutory 90-Day Appeal Period: When required, upon completion of a 30-day community comment period and/or final coordination meeting with the affected communities, FEMA shall arrange for and verify that the following activities are completed in accordance with the current version of the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners* and *Document Control Procedures Manual*:

- Proposed BFE determination letters are sent to the community CEOs and floodplain administrators.
- News release notifications of BFE changes are published in prominent newspapers with local circulation.
- The appropriate notices (Proposed Rules) are published in the *Federal Register.*

Resolution of Appeals and Protests: MSD shall support FEMA in reviewing and resolving appeals and protests received during the 90-day appeal period. For each appeal and protest, the following activities shall be conducted as appropriate:

- Initial processing and acknowledgment of submittal;
- Technical review of submittal;
- Preparation of letter(s) requesting additional supporting data;
- Performance of revised analyses; and
- Preparation of a draft resolution letter and revised DFIRM and FIS report materials for FEMA review.

MSD shall mail all associated correspondence upon authorization and coordination with FEMA. When necessary, dual signatures (MSD and FEMA) may be required for correspondence.

Participating in Public Meetings: When MSD holds public meetings to present and discuss the results of this Flood Map Project, FEMA may attend the meetings and assist MSD in the presentation as required.

Resolving Appeals and Protests: Appeals and protests received during the 90-day appeal period will be reviewed and resolved prior to finalizing the FIRMs and FIS report. MSD will provide support to FEMA in resolving appeals and protests. Activities may include, but not limited to, attending community meetings and assisting FEMA in addressing any issues that may arise in resolving appeals and protests from affected communities. For a typical appeal and protest, the following activities will be conducted: initial processing of the appeal/protest, performing a technical review of the appeal/protest, preparing letters to request additional data, performing revised analyses, and preparing a proposed resolution for FEMA's review. FEMA and MSD will mail all associated correspondence upon authorization by FEMA.

Special Correspondence: Comments received within the 90-day appeal period (referred to as "special correspondence"), will be reviewed, and responses will be drafted by MSD for FEMA's review. MSD will also mail the final correspondence upon authorization and coordination with FEMA. When necessary, dual signatures (MSD and FEMA) may be required for correspondence.

Revision of FIRM and FIS Report: If necessary, FEMA and MSD shall work with those parties responsible for preparing the DFIRM to prepare revised preliminary copies of the DFIRMs and FIS report, including all data tables and flood profiles. MSD will mail all revised preliminary copies of DFIRMs and associated correspondence upon authorization by FEMA

Final SOMA Preparation: MSD shall prepare Final SOMAs for the affected communities as appropriate.

Processing of Letter of Final Determination: MSD shall work with FEMA to establish the effective date for the DFIRM and FIS report. Unless otherwise directed by FEMA, MSD will prepare a Letter of Final Determination (LFD) for FEMA review and signature and prepare a final notice for publication in the *Federal Register,* will mail the LFD with appropriate enclosures and coordinate publication of the final notice in the *Federal Register.*

Processing of Final DFIRM and FIS Report for Printing: FEMA shall prepare final reproduction materials for the DFIRM and FIS report and provide these materials to the FEMA Map Service Center for printing by the U.S. Government Printing Office. FEMA also shall prepare the appropriate paperwork to accompany the DFIRM and FIS report (including Print Processing Worksheet, Printing Requisition Forms, and Community Map Actions Form) and transmittal letters to the community CEOs.

Revalidation Letter Processing. MSD shall prepare the letters and coordinate with FEMA on the distribution to the community CEOs and floodplain administrators to notify the affected communities about LOMCs for which determinations will remain in effect after the DFIRM and FIS report become effective.

Archiving Data: FEMA shall ensure that technical and administrative support data from MSD are packaged in the FEMA required format and stored properly in the library archives until they are transmitted to the FEMA Engineering Study Data Package Facility. MSD will maintain and archive all the technical data for at least 3 years.

Standards: All work under this activity shall be performed in accordance with the standards specified in Section 5 of this MAS.

Deliverables: In accordance with the TSDN format described in Appendix M of *Guidelines and Specifications for Flood Hazard Mapping Partners* and the requirements documented in Section 1 and Appendix A of the FEMA *Document Control Procedures Manual*, MSD and/or the CTP Contractor shall make the following products available to FEMA:

- Documentation that the news releases were published in accordance with FEMA requirements;
- Documentation that the appropriate *Federal Register* notices (Proposed and Final Rules) were published in accordance with FEMA requirements;
- Draft and final Special Correspondence (and all associated enclosures, backup data, and other related information) for FEMA review and signature as appropriate;
- Draft and final Appeal and Protest acknowledgment, additional data, and resolution letters (and all associated enclosures, backup data, and other related information) for FEMA review and signature as appropriate;
- Draft and final LFDs (and all associated enclosures, backup data, and other related information) for FEMA review and signature;
- Final FIS report materials, including all updated data tables and Flood Profiles;
- Draft LOMC Revalidation Letters if appropriate, for FEMA review and signature; and
- Complete, organized technical and administrative support data.

SECTION 2—Technical and Administrative Support Data Submittal

The Mapping Partners for this Flood Map Project that have responsibilities for activities included in this MAS shall comply with the data submittal requirements summarized below.

All supporting documentation for the activities in this Mapping Activity Statement shall be submitted in the TSDN format in accordance with Appendix M of the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners*, dated April 2003, available at FEMA's website at www.fema.gov/fhm/gs_main.shtm. Table 2-1 indicates the sections of the TSDN that apply to each mapping activity.

If any issues arise that could affect the completion of an activity within the proposed scope or budget, the responsible Mapping Partner shall complete a Special Problem Report (SPR) as soon as possible after the issue is identified and submitted to FEMA. The SPR is to describe the issue and propose possible resolutions. (For additional information on SPRs, refer to Appendix M, Subsection M.2.1.1 of *Guidelines and Specifications for Flood Hazard Mapping Partners*.)

Additionally, the CTP Contractor shall collect and maintain a set of products for all activities and shall compile a comprehensive TSDN for the entire project.

Table 2-1. Mapping Activities and Applicable TSDN Sections

TSDN Section	Mapping Activities												
	1	2	3	4	5	6	7	8A, 8B, 8C	9	10	11	12	13
General Documentation													
Special Problem Reports	X	X	X	X	X	X	X	X	X	X	X	X	X
Telephone Conversation Reports	X	X	X	X	X	X	X	X	X	X	X	X	X
Meeting Minutes/Reports	X	X	X	X	X	X	X	X	X	X	X	X	X
General Correspondence	X	X	X	X	X	X	X	X	X	X	X	X	X
Engineering Analyses													
Hydrologic Analyses	X		X	X	X	X	X	X	X				
Hydraulic Analyses	X		X	X	X	X	X	X	X				
Key to Cross-Section Labeling	X		X	X	X	X	X	X	X				
Key to Transect Labeling	X		X	X	X	X		X	X				
Draft FIS Report			X	X	X	X	X						
Mapping Information		X					X	X	X	X	X	X	X
Miscellaneous Reference Information	X	X	X	X	X	X	X	X	X	X	X	X	X

SECTION 3—PERIOD OF PERFORMANCE

See the attached addendum for the Period of Performance for the mapping activities outlined in this MAS. The mapping activities may be terminated at the option of FEMA or MSD in accordance with the provisions of the Partnership Agreement dated September 13, 1999.

SECTION 4—FUNDING/LEVERAGING:

FEMA has agreed to provide funding to support these activities as identified in the attached addendum. MSD shall provide additional resources in the form of existing basemap data, LOMC, LOMR, and studies / models required to complete the assigned activities for this Flood Map Project. The amounts of additional MSD funding or leverage will be detailed in the attached addendum.

SECTION 5—STANDARDS

The standards relevant to this Mapping Activity Statement are provided in Tables 5-1 and 5-2. Information on the correct volume, appendix, section, or subsection of the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners* to be referenced for each mapping activity is summarized in Table 5-2.

Table 5-1. Applicable Standards for Project Activities

Applicable Standards	Activities												
	1	2	3	4	5	6	7	8A, 8B, 8C	9	10	11	12	13
Guidelines and Specifications for Flood Hazard Mapping Partners, February 2002	X	X	X	X	X	X	X	X	X	X	X	X	X
American Congress on Surveying and Mapping (ACSM) procedures	X												
Global Positioning System (GPS) Surveys: National Geodetic Survey (NGS-58), "Guidelines for Establishing GPS-Derived Ellipsoid Heights," November 1997	X												
EM 1000-1-1000, *Photogrammetric Mapping*, March 31, 1993	X												
EM 1110-2-1003, *Hydrographic Surveys*, October 31, 1994	X												
Numerical Models Accepted by FEMA for NFIP Usage, January 11, 2002			X	X	X	X							
HEC-RAS Procedures for HEC-2 Modelers, April 2002							X						
Content Standards for Digital Geospatial Metadata (Federal Geographic Data Committee, 1998)		X						X	X	X	X	X	X
Document Control Procedures Manual, December 2000										X	X	X	X
'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program (			X	X	X								

Table 5-2. Project Activities and Applicable Portions of FEMA Guidelines and Specifications

Activity Number	Activity Description	Applicable Volume, Section/Subsection, and Appendix
1	Field Surveys and Reconnaissance	Volume 1, Sections 1.2, 1.3, 1.4 (specifically Subsection 1.4.2.1) Appendix A, Sections A.5, A.6, A.7, and A.8 Appendices B, C, and M
2	Base Map Acquisition and Preparation	Volume 1, Section 1.3 (specifically Subsection 1.3.1.8) and 1.4 (specifically Subsection 1.4.3) Appendices A and B
3	Hydrologic Analyses	Volume 1, Section 1.4 (specifically Subsections 1.4.2.2 and 1.4.2.4) Appendix C, Sections C.1 and C.7 Appendices E, F, G, H, and M 'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program
4	Independent QA/QC Review of Hydrologic Analyses	Volume 1, Section 1.4 (specifically Subsection 1.4.1) Appendix C, Section C.2 Appendices E, F, G, H, and M 'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program
5	Hydraulic Analyses	Volume 1, Section 1.4 (specifically Subsections 1.4.2.2 and 1.4.2.4) Appendix C, Sections C.3 and C.7 Appendices B, E, F, G, H, and M 'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program

Table 5-2. Project Activities and Applicable Portions of FEMA Guidelines and Specifications (Cont'd)

Activity Number	Activity Description	Applicable Volume, Section/Subsection, and Appendix
6	Independent QA/QC Review of Hydraulic Analyses	Volume 1, Section 1.4 (specifically Subsection 1.4.1)
		Appendix A, Section A.4 (specifically Subsection A.4.7)
		Appendix C, Section C.5
		Appendices B, E, F, G, H, and M
7	Hydraulic Model Conversion	Volume 1, Section 1.4 (Subsections 1.4.2.2 and 1.4.2.4)
		Appendix A, Section A.4 (Subsection A.4.7)
		Appendix C, Sections C.3 and C.7
		Appendices B, E, F, G, H and M
8A, 8B, 8C	Floodplain Mapping	Volume 1, Section 1.4 (specifically Subsections 1.4.2.2 and 1.4.2.3)
		Appendix C, Sections C.4 and C.6
		Appendices K, L, and M
		'Limited Detailed Study Methods' guidance document published under the North Carolina Floodplain Mapping Program
9	Independent QA/QC Review of Floodplain Mapping (Revised Areas)	Volume 1, Section 1.4 (specifically Subsection 1.4.2.3)
		Appendix C, Sections C.4 and C.6
		Appendices K, L, and M
10	DFIRM Production (Merging Revised and Revised Areas)	Volume 1, Section 1.4 (specifically Subsections 1.4.2.2 and 1.4.3)
		Appendices K, L, and M

Table 5-2. Project Activities and Applicable Portions of FEMA Guidelines and Specifications (Cont'd)

Activity Number	Activity Description	Applicable Volume, Section/Subsection, and Appendix
11	Independent QA/QC Review of DFIRM Product Meeting FEMA Graphic and Enhanced Database Specifications	Volume 1, Section 1.4 (specifically Subsections 1.4.2.3 and 1.4.3.3) Appendices K, L, and M
12	Preliminary DFIRM and FIS Report Distribution	Volume 1, Section 1.4 (specifically Subsections 1.4.2 and 1.4.3) Appendix C, Sections C.4 and C.6 Appendices J, K, L, and M
13	Post-Preliminary Processing	Volume 1, Section 1.4 (specifically Subsection 1.4.2 and 1.4.3) Appendices J, K, L, and M

SECTION 6—SCHEDULE

The activities documented in this MAS shall be completed in accordance with the project schedule included in the attached addendum. The "Deliverables" identified in each Activity will be due to FEMA on the dates indicated in the schedules portion of the attached Addendum. If changes to this schedule are required, the responsible Mapping Partner shall coordinate with FEMA and the other Mapping Partners in a timely manner.

SECTION 7—CERTIFICATIONS

The following certifications apply to this MAS:

Activity 1 (Field Surveys and Reconnaissance)

A Registered Professional Engineer or Licensed Land Surveyor will certify topographic data, in accordance with 44 CFR 65.5(c). Certification of topographic data by the American Society for Photogrammetry and Remote Sensing is also acceptable.

Activity 2 (Base Map Acquisition and Preparation)

- A community official or responsible party will provide written certification that the digital data meet FEMA minimum standards and specifications.
- The responsible Mapping Partner will provide documentation that the digital base map can be used by FEMA.

Activity 3 (Hydrologic Analyses), Activity 5 (Hydraulic Analyses), and Activity 8 (Floodplain Mapping)

- A Registered Professional Engineer or Licensed Land Surveyor will certify hydrologic and hydraulic analyses and data in accordance with 44 CFR 65.6(f).
- A Registered Professional Engineer or Licensed Land Surveyor will certify topographic information in accordance with 44 CFR 65.5(c).
- Any levee systems to be accredited will be certified in accordance with 44 CFR 65.10(e).

Activity 8 (Floodplain Mapping), Activity 9 (Independent QA/QC Review of Floodplain Mapping), and Activity 10 (DFIRM Production {Merging Effective and Revised Information})

The DFIRM metadata files will include a description of the horizontal and vertical accuracy of the DFIRM base map and floodplain information.

SECTION 8—TECHNICAL ASSISTANCE AND RESOURCES

Mapping Partners may obtain copies of FEMA-issued LOMCs, archived engineering backup data, and data collected as part of the Mapping Needs Assessment Process from FEMA and/or their designated contractor.

General technical and programmatic information, such as FEMA 265 and the Quick-2 computer program, can be downloaded from the FEMA Web site (www.fema.gov/fhm/). Specific technical and programmatic support may be provided by FEMA and/or their designated contractor; such assistance should be requested through the FEMA Project Officer specified in Section 11 of this MAS.

Mapping Partners also may consult with the FEMA Regional Project Officer to request support in the areas of selection of data sources, digital data accuracy standards, assessment of vertical data accuracy, data collection methods or subcontractors, and GIS-based engineering and modeling training.

SECTION 9—CONTRACTORS

Louisville / Jefferson County Metropolitan Sewer District (MSD) intends to use the services of Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) as a contractor for this Flood Map Project. MSD shall ensure that the procurement for all contractors used for this Flood Map Project complies with the requirements of 44 CFR 13.36.

Part 13 may be downloaded in PDF or text format from the U.S. Government Printing Office Web site at http://www.access.gpo.gov/nara/cfr/waisidx_02/44cfr13_02.html.

SECTION 10—REPORTING

Financial Reporting: Financial reporting requirements will be in accordance with Cooperative Agreement Articles V & VI.

Status Reporting: Status reports will be submitted on a quarterly basis in accordance with the financial reporting submittals. At a minimum these reports will include a summary of the work that was completed during the quarter and a comparison for the % work completed to the % of funds expended. The Project Officer, as needed, may request additional information on status.

SECTION 11—POINTS OF CONTACT

The points of contact for this Flood Map Project are Laura Algeo, PE, the FEMA Regional Project Officer; Randy Stambaugh, PE, the Project Manager for MSD; or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities. When necessary, any additional assistance from FEMA should be requested through the FEMA Regional Project Officer.

Each party has caused this MAS to be executed by its duly authorized representative.

Randy Stambaugh, PE
Project Manager
Louisville / Jefferson County Metropolitan Sewer District (MSD)

9/23/03
Date

Laura Algeo, PE
Regional Project Officer
Federal Emergency Management Agency, Region IV

9/24/03
Date

Art Clay, PE
Water Resources Branch Manager
Kentucky Division of Water

9/23/03
Date

Louisville / Jefferson County
Metropolitan Sewer District (MSD)
COOPERATING TECHNICAL PARTNERS
ADDENDUM 2003

Addendum 2003 - Map Modernization Project Prioritization for Fiscal Year 2003

In accordance with the Cooperating Technical Partners (CTP) Partnership Agreement dated September 13, 1999 and Mapping Activity Statement No. 1 between Louisville / Jefferson County Metropolitan Sewer District (MSD) and the Federal Emergency Management Agency (FEMA), Addendum 2003 is as follows.

SECTION 1—Priority Flood Study Summary

Preliminary research indicates that there are 410.7 miles of streams in Jefferson County that have been identified for remapping or study for Fiscal Year 2003. The miles of priority stream and category of floodplain study areas summarized as follows:

- Category 1: Redelineation of Existing Effective Maps - Stream miles: 276.05
- Category 2: Incorporation of LOMCs, LOMRs, and Existing H&H Studies
  Stream miles: 60.79; # of LOMCs: 286
- Category 3: New Approximate Studies – Stream miles: 0
- Category 4: Hydraulic Model Conversion – Stream miles: 0
- Category 5: New Detailed Studies – Stream miles: 67
- Category 6: Limited Detail Study – Stream miles: 6.9

SECTION 2— 2003 Priority Stream Project Information

The parties hereby recognize and agree that FEMA and MSD funding of the Mapping Activities Statement No. 1 will support the following prioritized projects. Based on FEMA's commitment

Upon FEMA approval of tiling scheme, approximately 144 panels (scale: 1" = 500') will be prepared to DFIRM specifications throughout the duration of these activities.

Table 2-1. FY03 Jefferson County Prioritized Project List

Study Category		Mileage	Total Cost	Running Total
Category 1- Redelineation Reaches		276.05		
1	BEARCAMP RUN	1.17		
1	BEUCHEL TERRACE CREEK	2.15		
1	BIG BEE LICK CREEK	2.25		
1	BIG RUN	3.37		
1	BIG RUN CREEK	1.81		
1	BIG RUN DIVERSION	6.19		
1	BISHOP LANE DITCH	1.02		
1	BLACK POND CREEK	4.14		
1	BLACK RUN	2.71		
1	BOXWOOD DITCH	1.44		
1	BRIER CREEK	2.44		
1	BROAD RUN	0.95		
1	BROOKLAWN TRIBUTARY	1.31		
1	BRUSH RUN	2.52		
1	BRUSH RUN B	3.23		
1	BUECHEL BRANCH	4.36		
1	CANDELIGHT DITCH	0.86		
1	CANE RUN	7.49		
1	CANE RUN DITCH	2.11		
1	CEDAR CREEK	7.87		
1	COOPER CHAPEL BRANCH	1.45		
1	EAST BRANCH BOXWOOD DITCH	1.66		
1	FERN CREEK	7.32		
1	FILSON FORK	1.56		
1	GARDENS TRIBUTARY	1.17		
1	GARRISON DITCH	1.38		
1	GREASY DITCH	2.46		
1	HIGHVIEW FORK	1.45		
1	HUFF LANE TRIBUTARY	1.15		
1	INDIAN TRAIL DITCH	0.57		
1	LANG RUN	0.37		
1	LITTLE BEE LICK CREEK	2.18		
1	LITTLE CEDAR CREEK	2.39		
1	LYNNVIEW DITCH	2.40		
1	MANSLICK BRANCH	1.23		
1	MEDORA BRANCH	0.56		
1	MIDDLE FORK BEARGRASS CREEK	14.32		
1	MILL CREEK	9.30		
1	MILL CREEK CUTOFF	2.31		
1	MUD CREEK	3.87		
1	MUDDY FORK BEARGRASS CREEK	7.26		
1	OHIO RIVER	30.70		
1	OLD MANS RUN	1.63		
1	OXMOOR DITCH	0.83		
1	PICADILLY RUN	1.62		
1	PONDER CREEK	0.52		
1	REARDON HOLLOW DITCH	0.80		
1	ROBERSON RUN	2.58		

1	SAINT GABRIEL BROOK	0.94	
1	SALT BLOCK CREEK	0.85	
1	SHAKES RUN	2.93	
1	SHECKELS RUN	2.79	
1	SINKING FORK	0.31	
1	SLATE RUN	1.48	
1	STEPHAN DITCH	1.71	
1	STRAWBERRY YARDS DITCH	1.05	
1	TATER RUN	0.51	
1	UNNAMED TRIBUTARIES	85.57	
1	UPPER MILL CREEK	2.89	
1	VALLEY CREEK	3.48	
1	WEAVER RUN	3.97	
1	WHEELERS RUN	3.13	

Study Category			Mileage	Total Cost	Running Total
Category 2 – Incorporation of Existing Data/Studies			60.79		
2		FISHPOOL CREEK	2.07		
2		FLOYDS FORK	32.67		
2		HARRODS CREEK	5.76		
2		LITTLE GOOSE CREEK	9.80		
2		NORTHERN DITCH	1.67		
2		OHIO RIVER**	30.70		
2		PENNSYLVANIA RUN	5.60		
2		SOUTHERN DITCH	3.21		

Study Category			Mileage	Total Cost	Running Total
Category 5 - Detailed Studies List			67.0		
5	1	BRUSH RUN A	3.0		
5	2	WILSON CREEK*	5.5		
5	3	CITY PARK DITCH	2.8		
5	4	FISHPOOL CREEK*	3.1		
5	5	SOUTHERN DITCH*	3.7		
5	6	NORTHERN DITCH*	5.1		
5	7	BLUE SPRING DITCH	2.1		
5	8	WEICHER CREEK	3.2		
5	9	HEATHERFIELD DITCH	1.7		
5	10	HITE CREEK	4.8		
5	11	SOUTH FORK BEARGRASS CREEK*	15.3		
5	14	POND CREEK*	16.7		

Study Category			Mileage	Total Cost	Running Total
Category 6 - Limited Detailed Studies List			6.9		
6		LONG RUN	6.9		

Total **410.74** **miles**

* Cost Reduction due to Existing Data

** Floodway only

SECTION 3 — Schedule

The activities documented in this MAS shall be completed in accordance with the project schedule below. If changes to this schedule are required. the responsible Mapping Partner shall coordinate with FEMA and the other Mapping Partners in a timely manner.

ACTIVITIES	RESPONSIBLE PARTNER(S)	Days from NTP
Activity 1 – Field Surveys and Reconnaissance	CTP Contractor	120
Activity 2 – Basemap Acquisition and Preparation	CTP Contractor	60
Activity 3 – Hydrologic Analyses	CTP Contractor	150
Activity 4 – Independent QA/QC Review of Hydrologic Analyses	MSD/KDOW/FEMA	180
Activity 5 – Hydraulic Analyses	CTP Contractor	270
Activity 6 – Independent QA/QC Review of Hydraulic Analyses	MSD/KDOW/FEMA	300
Activity 7 – Hydraulic Model Conversion	CTP Contractor	N/A
Activity 8A – Floodplain Mapping (Approximate, Limited Detailed, Detailed)	CTP Contractor	300
Activity 8B – Floodplain Mapping (Model Conversion)	CTP Contractor	N/A
Activity 8C – Floodplain Mapping (Re-delineation and LOMC areas)	CTP Contractor	300
Activity 9 – Independent QA/QC Review of Floodplain Mapping	MSD/KDOW/FEMA	300
Activity 10 – DFIRM Production (Merging Effective and Revised Information)	CTP Contractor	360
Activity 11 – Independent QA/QC Review of DFIRM Product Meeting FEMA Graphic and Database Specifications	MSD/KDOW/FEMA	420
Activity 12 – Preliminary DFIRM and FIS Report Distribution	CTP Contractor/ MSD/KDOW/FEMA	450
Activity 13 – Post-Preliminary Processing	CTP Contractor/MSD/ FEMA	720