

Final Report
WI Flood Map Maintenance Project

Prepared For

The Wisconsin Department of Natural Resources
Flood Map Maintenance Project

December 2007

TABLE OF CONTENTS

INTRODUCTION	**1**
GIS DATA INVENTORY – RAMONA	**1**
SUMMARY OF PILOT FLOOD MAP MAINTENANCE INITIATIVES	**5**
SUMMARY OF WI RAMONA INVENTORY TO DATE	**TABLE 1**
RAMONA GIS INVENTORY	**ATTACHMENT A**
LAYERS IN RAMONA	**ATTACHMENT B**
ASFPM COMMENTS ON WI SPECIFIC QUESTIONS	**ATTACHMENT C**
STATE SPECIFIC QUESTIONS	**ATTACHMENT D**
LETTER TO MAP MOD COUNTIES	**ATTACHMENT E**
TECHNICAL PROCESSES FOR INCORPORATING LOMRS INTO DFIRMS	**APPENDIX 1**
NORTH CAROLINA MT-2 DELEGATION REPORT	**APPENDIX 2**
NORTH CAROLINA MT-2 DELEGATION – ISSUES PAPERS	**APPENDIX 3**
NC – POLICIES, PROCESSES & PROCEDURES MANUAL FOR LOMCS	**APPENDIX 4**
NC – POLICIES, PROCESSES & PROCEDURES MANUAL FOR RESTUDIES	**APPENDIX 5**
NORTH CAROLINA 3MS BUSINESS PLAN	**APPENDIX 6**
DENVER UDFCD – MAP MAINTENANCE PILOT	**APPENDIX 7**
DENVER UDFCD – MAP MAINTENANCE PILOT	**APPENDIX 8**
DENVER UDFCD – MAP MAINTENANCE PILOT	**APPENDIX 9**
ELOMA FACT SHEET	**APPENDIX 10**

Introduction

FEMA has been funded by Congress to "modernize" their Flood Insurance Rate Maps (FIRMs). Once communities receive digital flood hazard boundary maps, the process of addressing changes begins. How often these changes are incorporated into the linework, if and when these changes have to go out for public comment, and who needs to approve these changes all need to be addressed.

Map maintenance items evaluated under this project include Letters of Map Change (LOMCs), corporate limit changes, streets and street names, general structures (bridges/culverts/dams), base orthophotographs, and elevation reference marks (ERMs).

In this project, the Association of State Floodplain Managers (ASFPM) assisted the State of Wisconsin in evaluating options and establishing processes for updating DFIRMs on a routine basis. In addition, ASFPM assisted in the development of a Statement of Work for an engineering consultant related to Letter of Map Revision (LOMR) processes and worked with the Wisconsin State Cartographers Office to develop a survey related to local government GIS data.

This report includes:

- A summary of the GIS data survey developed.
- A summary of the information received as a result of the survey;
- An identification of counties selected in which a more detailed evaluation will be conducted;
- A description of map maintenance processes associated with each map maintenance item;
- A summary of other national initiatives - specifically DuPage County (E-LOMA), Denver Urban Drainage (LOMR process) and North Carolina (test for maintenance).

Summary of Wisconsin GIS Data Inventory - Ramona

The National State Geographic Information Council (NSGIC) has developed a web based tool (called Ramona) that can be used by State and local governments to inventory GIS data. By answering a series of questions, users generate an inventory with metadata associated with their geospatial data holdings. The Wisconsin State Cartographers Office (SCO) (Wisconsin's NSGIC representative) developed a set of questions to be included with the basic NSGIC survey (Attachment D). The ASFPM reviewed the inventory categories and found that the map maintenance items were included in the basic NSGIC survey with the exception of Letters of Map Change (LOMCs). ASFPM provided the SCO with some suggested items to be included in the Wisconsin specific questions (Attachment C). The items not included in the final Wisconsin specific questions are suggested to be gathered via telephone interviews conducted as part of the detailed evaluations that will be conducted with selected counties. Counties that were going to get their flood hazard maps "modernized" in the upcoming year were sent an email requesting them to complete the Ramona inventory (Attachment E).

The layers that will be inventoried as part of the nationwide NSGIC "Ramona" survey are included in this report as Attachment A. Following are comments on the layers in the inventory:

1) Parts of all of the framework data layers include components useful for flood map maintenance.

2) Useful components of the "Other" data layers:
    a) Elevation - "Elevation Certificates for Flood Prone Structure".
    b) Inland Waters - Base Flood Elevations, Channel Cross Sections, Shorelines, dam inventory, flood control structures, etc.
    c) Structures - Building footprints & building permits.
    d) Transportation - bridges and culverts.

Ramona is so extensive/comprehensive that it is very unlikely that all of the data layers (especially those in the "Other" category) will be completely filled out. Personal contacts with counties will likely be needed to prompt counties to complete elements of most closely related to flood map maintenance and request information on some items not covered in the Ramona survey.

3) Items not covered:
    a) LOMAs - Does the community track LOMAs? How?
    b) LOMRs - Does the community track LOMRs? How?
    c) Dam breach inundation areas - do they have maps - digital/hardcopy?
    c) Stormwater mgmt. permits - do they issue/track?
    d) How often does the community update map references in their ordinances?
    e) Do digital maps/files have legal standing for ordinance enforcement?
    e) Does the community offer printouts of individual parcel floodplain maps for residents?

4) There are a number of other useful but lower priority data elements included in Ramona.

In follow-up contacts with counties, information should be gathered related to their interest in speeding up the flood map update process. Is it a problem? If it is, would they be willing to be part of a map maintenance pilot project?

An additional gap is stream centerlines. Under hydrography: artificial drainage, flow direction, flow rates, lakes & ponds, rivers & streams, and shorelines are options. NSGIC does not mention centerlines nor does it address connectivity (flow lines through lakes and ponds or caused by gaps in the stream linework). For counties that do have a hydrography data layer, it would be useful to compare their hydrography data attributes with WDNR's Hydrography data layer and the attributes in the National Hydrography Dataset (NHD).

Some counties may also be doing some watershed modeling (County Soil Conservation staff). They may have burned a hydrography layer into a DEM to create a flow accumulation grid.

The State Cartographers Office finalized the Wisconsin specific questions in July 2007 and is now actively encouraging counties, cities and villages in Wisconsin to complete the Ramona survey and inventory their GIS data. A summary of the information received as a result of the survey is attached (Table #1). The Ramona survey is very detailed and asks questions that when answered basically provide metadata on community data holdings and planned future data acquisition and/or development (Attachment A is a set of input screens for a portion of the survey). The attached maps depict the data layers that have been inventoried in Ramona. DOA has agreed to make the completion of the survey a condition of supplemental Wisconsin Land Information Program (WLIP) grants to counties. This could have a significant impact on the number of counties with data inventoried in the system.

Based on these data and other information gathered, the following 7 counties are suggested as the pool from which 5 are ultimately selected for more detailed interviews: Bayfield, Clark, LaCrosse, Oconto, Sheboygan, Waukesha, and Winnebago.

Summary of FEMA Flood Map Maintenance Pilots

FEMA has partnered with three State and local governments to pilot State and local management of the map update process: DuPage County (E-LOMA), Denver Urban Drainage (LOMR process) and North Carolina (test for maintenance).. This report summarizes the results of those pilot projects and highlights particular instances where the map maintenance processes documented in these pilots could be useful to the State of Wisconsin.

North Carolina Floodplain Mapping Program LOMC Pilot Delegation Program

On July 1, 2006, FEMA and the State of North Carolina Floodplain Mapping Program (NCFMP) entered into an agreement to conduct a pilot project that called for the NCFMP to review requests for MT-2 Letters of Map Change (LOMCs). North Carolina retained Dewberry & Davis, Inc. (Dewberry) to provide technical review, processing and programmatic support for LOMC requests.

The NCFMP documented administrative processes developed with FEMA during the pilot project. They also developed mechanisms to evaluate performance and identified the benefits of LOMC review being delegated to the State.

> One of the benefits highlighted is titled:
>
> ***DOT related LOMC Request:*** *Includes completed, proposed, or in-progress projects that correlate to DOT activities. The DOT has indicated LOMC activity to increase based upon pending and active projects. The State's larger role in MT-2 issues has raised awareness of the State and Federal regulations governing floodplain development and management.*
>
> *The NCFMP and NFIP staff took part in meetings between the Federal Highway Administration and the NCDOT. The outcome of this meeting led to a series of coordination meetings and efforts, including several training sessions of NCDOT staff.*

North Carolina has developed their own data system that has a web interface for access and downloading floodplain mapping and topographic data. They have developed mechanisms to upload data to and download data from FEMA's Mapping Information Portal.

NCFMP has requested full delegation of the flood mapping activities including MT-1 LOMCs, PMRs, and new or revised Flood Insurance Studies. NCFMP has developed a detailed policies, processes, and procedures manual for both LOMCs and Restudies.

Denver Urban Drainage and Flood Control District (District)

In 2001 FEMA and the District entered into an agreement for the District to review requests for MT-2 LOMCs. The District retained Icon Engineering, Inc. (Icon) to provide technical review and drafting support for the CLOMR and LOMR requests.

In 2005 this pilot project was expanded to include a map maintenance pilot for the City and County of Broomfield, Colorado. In this pilot, Icon engineering provided detailed documentation of the technical processes associated with tie-ins of base map and flood hazard changes into the effective FIRM within FEMA's Map Information Portal (MIP). Specific references have been removed from their documentation to create a "generic" technical processes document (see Attachment #1). Hardcopy and digital copies of the documentation developed by North Carolina and Denver Urban Drainage and Flood Control District are being provided under separate cover.

Appendix 1

TECHNICAL PROCESSES FOR INCORPORATING LOMRS INTO DFIRMS

This document identifies technical processes for incorporating LOMRs in existing FIRMs on the MIP. It was developed from documentation developed by Denver Urban Drainage and Flood Control District by eliminating specific references to the pilot community. It separates community based map maintenance revisions into two major categories:

A. Base Map Changes
B. Flood Hazard Changes

This report also addresses some of the specific changes that can be made to the DFIRM database features, hardcopy printed panels, and tie-ins to the previous effective FIRM.

DEFINITIONS AND KEYWORDS

DFIRM – Digital Flood Insurance Rate Map

LOMC – Letter of Map Change

LOMR – Letter of Map Revision

NFIP – National Flood Insurance Program

Base Map – The community supplied transportation, political, hydrographic, and cartographic features shown on and around the DFIRM flood hazard features.

Annotated FIRM – a scaled, schematic exhibit included in some LOMC documentation intended to display the flood hazard changes; includes the FIRM panel title block, stamped effective date, and Revised Area box drawn around the limits of the flood hazard changes.

(Digital) Work Map – a detailed, scaled, engineering drawing showing hydraulic analysis, topography, and flood hazard information used to document the changes proposed by a LOMR request. It can be a hardcopy map or the digital file of the work map. Often the digital file is a CAD drawing.

Revised Area Box – graphic outline included on the annotated FIRM and/or work map showing the limits of the flood hazard revisions to the effective FIRM.

Draft DFIRM – this is the version of the DFIRM that a community would work within for map maintenance operations. There are several features that are used only in the draft DFIRM to track changes. The Draft DFIRM could periodically be submitted to FEMA to provide official updates to the Final DFIRM.

Preliminary DFIRM – this is the version of the DFIRM and database that is submitted to FEMA and the communities for review. This is the version that includes all current flood hazards and may include map maintenance revisions.

Final DFIRM – this is the effective DFIRM that follows the draft and preliminary versions, the 90-day appeal period, and is officially used to administer the NFIP.

PROCEDURES

The procedures for updating the Draft DFIRM are similar for all cases and are outlined below:

A. In the case of hardcopy source data, scan and rectify the work map. In the case of existing digital files, convert the files to shapefiles and re-project to match base map files within the Draft DFIRM.

B. Within the Draft DFIRM, draw an S_LOMR box (revision box) around area affected by LOMR.

C. Delete Draft DFIRM flood hazard lines and areas (S_FLD_HZ_LN and _AR) within the revision box.

D. Capture (digitize) the new flood hazard features from the rectified work map or digital files.

E. Attribute the digitized flood hazard features, or existing digital shapefiles, using information presented on the images or work maps.

F. Snap all new flood hazard features to match the existing flood hazard features.

G. Re-create flood hazard area polygons (S_FLD_HZ_AR) from flood hazard lines.

H. Attribute flood hazard area polygons.

I. Digitize new base map features (S_TRNSPRT, S_GEN_STRUCT, etc.) or adjust existing base map features.

J. Attribute base map features.

BASE MAP CHANGES

Overview

Updated base map features are often required when updating flood hazard information. Construction of a new road, bridge, or culvert may cause changes to the floodplain. Furthermore, the base map features are the reference layer for map users to orient themselves in the community and make judgments on proximity, effects, and flood insurance rate determinations. The base map shown on a DFIRM is typically a version of the base map maintained by a community's GIS department for purposes beyond flood hazards. Keeping the DFIRM base map up-to-date includes more than just implementing changes shown on LOMRs.

Tracking Base Map Changes

LOMR documents typically include an annotated FIRM exhibit. The annotated FIRM exhibit includes a "Revised Area Box" encompassing the area where the flood hazards were revised. The DFIRM spatial database also includes the "Revised Area Box" by digitizing it onto a layer called S_LOMR. In some instances, base map changes are required for areas outside of the LOMR Revision Box.

In the current hard copy FIRM panels, potential revisions to the base map features outside of the LOMR revision box are not documented. For the DFIRM, changes outside of the revision box can be tracked and documented by attributing the source citation data of each feature that is changed on the base map.

In a community controlled map maintenance situation, the base map, particularly outside of flood hazard areas, would generally be updated more frequently than the DFIRM. Therefore, the DFIRM base map features (such as transportation lines) may differ from the community base map features depending on how often the DFIRM is "maintained" or updated. It is important to note that extreme care must be taken when completing base map updates in areas near or adjacent to flood hazard areas where LOMR revisions have not yet been accepted or put into the DFIRM. The community does not want to show base map improvements in flood hazard areas that have not been updated due to the improvements.

Corporate Limits

In many instances for Countywide DFIRMs, corporate limits can change with development and annexations. This is referred to as a 'corporate limit gap'. Resolution of 'corporate limit gaps' requires investigation of the source data, the rectification process, the corporate limits, and the flood hazards. Investigation of the gaps should start with the source data. The source data should be checked for a base map date. A flight date, stamp date, or other timestamp can be used as clues but should not be relied upon exclusively as a base map date. The source data should be reviewed to determine if the improvements related to the flood hazard change, such as a new interstate interchange, appear to be drawn accurately relative to other features on the source data when compared to the aerial photo were drawn to scale, surveyed as-built, or drafted schematically.

The rectification process should follow the review of the base map data. Any base map data drawn schematically must not be used for establishing rectification control points. Rectification control points should be identified using validated base map features (transportation intersections, benchmark points, structures, or PLSS lines). Root Mean Square Errors (RMSEs) should meet FEMA specifications, but in all cases, the source data (whether scanned or digital work maps) should be viewed for general alignment with the base map features. Community representatives should be consulted regarding the corporate boundaries.

Transportation

The images in these cases were ultimately rectified based on corporate limits and permanent benchmarks, not transportation features.

In some cases, the source data transportation features will not match the DFIRM transportation features. It is then necessary to double check the road-to-floodplain relationship to be sure that the flood hazards made sense with the re-aligned base map features. This is especially true for areas where there are culvert crossings or ponding behind road embankments. In cases where the roads shown on the source data are not in the same place as the roads shown on the DFIRM base map, the roads need to be adjusted to match as-built conditions and then checked against the floodplain delineations.

Summary

DFIRM map maintenance using only the LOMR work maps will only update the base map changes in the vicinity of the flood hazard areas. The base map changes beyond flood hazard areas may be updated on a community GIS department map, but would not be updated through a LOMR submittal. A decision then remains for creation of the next Preliminary DFIRM: use a completely updated community supplied base map with no DFIRM attributes, or use the partially updated Draft DFIRM base map with layers already attributed. In the interim, a map maintenance program should show the most accurate flood hazard

information by changing the DFIRM base map to match the revisions shown on the LOMR source data.

FLOOD HAZARD CHANGES

Overview

Revisions to flood hazards are more defined than base map changes due to the established procedures of the LOMR program. However, map users are accustomed to the traditional LOMR hardcopy paper trail. A key to DFIRM map maintenance is re-creating the paper trail in digital form.

Deleting Existing Flood Hazards

Revising flood hazards starts with erasing the effective features from the DFIRM. The "Revised Area" box is important here as it defines the limits of where the effective features are erased. As noted in the Procedures Section of this report, the DFIRM database represents flood hazards with both lines and polygons (S_FLD_HZ_LN and S_FLD_HZ_AR). Both of these features, as well as BFEs, cross sections, and stream centerlines must be deleted within the area revised by the LOMR. Deleted features often must be split into pieces before they can be deleted in order to avoid 're-drawing' the floodplain that is not changed by the LOMR.

It is important to note that deleting the effective flood hazard zones includes adjusting the unshaded Zone X adjacent to other flood hazards. On the DFIRM, and within its database, there is no blank space. The unshaded Zone X, appearing as a white area, is actually a polygon that exists with all of the other flood hazard polygons.

Flood Hazard Revision Source Data

Once the effective information is deleted, the new source data is used to add the new features. In terms of the source data, there are a few important distinctions. Work maps submitted with the LOMR requests are the preferred source data. The other less desirable option is an annotated FIRM submitted with a LOMR request. The weakness of the annotated FIRM is that it uses a scanned copy of the effective base map and a hand drafted sketch of improvements affecting the LOMR. Therefore, the exhibit is at FIRM panel scale (1"=500' at best). When compared with the Draft DFIRM base map, these hand drafted base map features do not always align well, causing an unfavorably high root mean square error in the rectification process. This leads to a skewed image and ultimately skews the flood hazard lines that are digitized from the annotated FIRM. Even the best rectification does not display the flood hazards at any better than the effective FIRM panel scale.

The best source data alternative is utilizing the original work map. The work maps are more likely based on site survey or aerial photogrammetry, cover a larger base map area, and often scale better than FIRM scale (1"=200'+/-). Because the base map features are more accurate, the rectifying process is more accurate.

Existing Flood Hazard Revisions

Deleting effective information from the DFIRM is initially more complicated than working with a paper copy. The digital files provided the most efficient and precise conversion relative to the scanned and rectified hardcopy workmap.

Adding a New Flood Hazard

The work associated with addition of a new flood hazard is comparable to the revision of an

existing flood hazard. In general, the structure of the DFIRM is built to accommodate the additional information exactly as any other revision to the database. The only difference for a new flood hazard is that the revision generates a totally new flood hazard instead of revising an existing flood hazard. In other words, a new floodplain is a revision from un-shaded Zone X to Zone A or AE. This relates to the technical discussion provided in the Procedures Section regarding deleting features from the database. The DFIRM database has the built-in flexibility to accept new flood hazards anywhere in the County.

EFFECTS ON DFIRM SPATIAL DATABASE

Overview

The DFIRM database holds both graphic and tabular data. The graphic changes discussed above can be equated to changes that would be made with hardcopy data. The tabular data changes are more obscure. The tabular information is not visible on the printed maps, but is stored electronically in the DFIRM database. Every graphic change has an equivalent change to the tabular database. Some of the more unique changes to the tabular data are discussed below.

Database Features

The April 2003 edition of FEMA's Flood Hazard Mapping Guidelines and Specifications Appendix L lists 50 features to be populated for the Final Flood Insurance Rate Map database. Page L-20 of Appendix L shows the entire list of Digital FIRM Maintenance layers.

Standard Spatial Database Features

S_BFE

S_FLD_HZ_LN and _AR

S_GEN_STRUCT

S_LOMR

S_TRNSPORT_LN

S_WTR_LN

S_XS

*S_LABEL_LD

*S_LABEL_PT

Source Citation

Spatial database features store the graphic information shown on the printed panels. Of the spatial database features shown in the table, all are printed changes except for the S_LOMR, the S_LABEL_LD, the S_LABEL_PT features, and the Source Citation data. S_LOMR is the digitized Revised Area box and is transparent on the printed panels. The S_LABEL_LD and S_LABEL_PT features are part of the annotation and are not shown on the printed map panels. Source Citation is an attribute field in every database feature and documents the source of the data. It is not a printed graphical feature and, therefore, does not show up on the map.

If needed, features such as political boundaries (S_POL_LN) would be changed using the procedures previously described for making graphical changes. Changes to the political boundary can affect the FIRM panel scheme, PLSS, Transportation layers, and other features and may, in fact, require extensive changes to the panels.

The DFIRM database includes lookup features as well as the spatial features described above. Lookup database features store the attributes of the graphic information and, again, are not shown on the printed panel. There are lookup database features that document the adjustments in hydrology, case numbers, and hydraulic modeling data. These are considered "enhanced" database features not required in the FEMA standard DFIRM database. However, this type of information can be a valuable addition to the Draft DFIRM database and should be included.

BFE Attributes

For the base flood elevations (BFEs), attribute changes are relatively straightforward. If a datum conversion from NGVD29 to NAVD88 is required, the location of BFEs may change. It is possible that an adjusted BFE taken from a LOMR may need to be placed outside of the S_LOMR box. For documenting the revision, it is important to adjust the S_LOMR box to include the adjusted BFE.

Transportation Attributes

Typically in a map maintenance program, the opportunity exists to update, or even populate, portions of the transportation database as LOMR updates are completed. The DFIRM database has a S_TRNSPRT_LN attribute table populated with road names. These features are labeled on the printed panels through the S_LABEL_LD / _PT attributes.

S_LOMR Attributes

S_LOMR is the feature represented on the Draft DFIRM as a polygon around the flood hazard changes; it is a digitized copy of the "Revised Area" box. The attributes of this feature include the case number and effective date. These are the features that are valuable to the DFIRM user in being able to track back to the legal hardcopies of the information used to revise the Draft DFIRM.

There is one attribute of the S_LOMR polygon that requires further discussion. The "Status" field of the database allows for LOMRs to be marked as "effective", "incorporated", or "superseded". Working within the Draft DFIRM database, map maintenance operations would likely attribute LOMRs as "incorporated". Then, upon final submittal of the Preliminary DFIRM, the S_LOMR attribute could be updated to "effective". Any subsequent re-study or re-delineation of the flood hazard in the same area would cause the S_LOMR feature to be attributed "superseded" in the Draft DFIRM.

The S_LOMR polygons are not printed on the preliminary or final DFIRM panels. This spatial database feature is intended only to manage the LOMR data in the Draft DFIRM during a map maintenance program.

LOMA and LOMR-F Attributes

Typically, LOMAs and LOMR-Fs do not change the flood hazard delineations shown on the FIRM or DFIRM. Since there generally are no graphic changes, tracking these types of LOMCs is handled as tabular data in the lookup table called L_MT1_LOMC. Attribution of the L_MT1_LOMC table calls for standard LOMC information such as case number, panel

number, effective date, etc. The "Status" field is also included in the L_MT1_LOMC table, but includes an additional classification of "revalidated". In this case, however, the FEMA Guidelines and Specifications Appendix L schema does include clarification on the attributes. For L_MT1_LOMC, a Final DFIRM database will only include revalidated LOMCs.

Source Citation

Source Citation is a field within every feature of a DFIRM database that links each spatial entity to a citation in the DFIRM metadata. The metadata file should then updated with new citations for each LOMR added to the database.

It is important to note that the Draft DFIRM metadata is likely to be revised for the next Preliminary DFIRM. In the course of preparing preliminary and final DFIRMs, the LOMRs are incorporated into the new study and attributed as such. Therefore, the "LOMR#" source citations should be included in the attribute fields of the database and in the metadata as placeholders. Then, as the preliminary and final DFIRMs are developed, the flood hazard changes can be easily identified by the source citation attributes. These can be incorporated into the Preliminary DFIRM source citation and metadata.

HARDCOPY PRINTED PANELS

The annotation changes that would be required to maintain a print-on-demand level of map maintenance should be identified. Annotation appears on the black and white printed panels as the labels for the base map and flood hazard features. For community and floodplain management uses, the color symbology of digital overlays on community data, custom color printing, and automated labeling functions of shapefiles would not require FEMA specification annotation.

There are several administrative hurdles to clear in regard to releasing the custodial duties of the Draft DFIRM database to a CTP or community. However, regardless of who maintains the DFIRM between final printing of the hardcopy panels, the digital version can be plotted for information and floodplain management purposes for the affected community.

TIE-INS TO PREVIOUS EFFECTIVE FIRM

The relationship between a LOMR and a DFIRM conversion is perhaps the leading reason for deploying a map maintenance program as soon as possible after a DFIRM is effective. Both processes take several months to gain approval from FEMA. The DFIRM process requires a 30-day comment period and a 90-day appeal period. As a result, a LOMR and a DFIRM conversion could be in progress simultaneously. If a LOMR is approved before the DFIRM is submitted as Preliminary (i.e. prior to the 30-day comment period and 90-day appeal period), there is a chance that the changes could be included in the Final DFIRM. However, if a LOMR is approved during the 90-day appeal period (or even several weeks prior) and there is not an appeal filed, the DFIRM will be published as effective without incorporating the LOMR. In that case, the LOMR must be tied-into the new DFIRM as part of a map maintenance program.

The tie-ins are important in both the horizontal and vertical dimensions. Horizontal tie-in issues are characterized by changes in floodplain delineations between the effective FIRM and new DFIRM. These changes are created when a DFIRM conversion includes a new hydraulic study, re-delineation of the flood hazards using updated topography, or an adjacent LOMR. Vertical tie-in issues are primarily related to the vertical datum conversion between NGVD29 and NAVD88. NAVD88 is the FEMA standard vertical datum for all DFIRM

conversions. Vertical tie-in issues can also relate to BFE and Cross Section water surface elevations, but these issues should be resolved in the review and processing of the LOMR.

SUMMARY

First, it is important to understand that map maintenance on a community or CTP level occurs on the Draft DFIRM database not the Preliminary DFIRM or Final DFIRM. The Draft DFIRM is a working copy that holds community level updates and changes, may be used by the community for floodplain management purposes, and ultimately can be used as a starting point for the next Preliminary DFIRM submittal.

Second, the versions of the community base map must be identified. The DFIRM version of the community base map is different from the community version because it is attributed to match FEMA specifications and it is not typically maintained on the same schedule as the community base map. 'Base map updates' to the Draft DFIRM may require graphic edits, re-attribution, and re-annotation.

Third, the source data used to make the revisions is important. Using digital files or work maps, instead of annotated FIRM exhibits results in the least amount of error.

Fourth, versions of the flood hazards must be identified. There must be some analysis of the LOMR changes to determine which flood hazard they are tying into: the old effective or the new DFIRM.

Fifth, all of these issues must use proper source citation. The Draft DFIRM is a placeholder, and when the Preliminary DFIRM conversion is submitted, the source citation field and metadata fields will be the only link between the changes and the source data.

Finally, as previously noted the map maintenance program works on the Draft DFIRM and does not make official map changes. Legislation and advancements in spatial databases may ultimately allow on-the-fly changes to the effective map. Until then, a map maintenance program that builds upon a well-documented Draft DFIRM can be a useful tool for producing the next DFIRM.