

# INNOVATIVE FLOODPLAIN MANAGEMENT

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**Abstract.** On-going development and new floodplain protection regulations require communities to take a more active role in managing floodplain activities. More accurate floodplain maps provide better guidance to the development community, better protection from flood damages for homeowners, and less flooding risk for roadways that cross streams. To support such efforts, innovative techniques and tools are available to address floodplain issues faster, more efficiently and with greater value to the community.

## INTRODUCTION

New floodplain protection regulations by the Metropolitan North Georgia Water Planning District (MNGWPD) and Map Modernization efforts by the Federal Emergency Management Agency (FEMA) require communities to take a more active role in managing floodplain activities. To address these issues, improved techniques are available for modeling, mapping and managing floodplains. These improved techniques are based on the use of innovative technologies that improve the gathering, exchanging, and dispersing of information via Geographic Information Systems (GIS) and web-based tools. Such innovations improve communication and cooperation among government agencies, private land developers and the general public – allowing them to address these new floodplain management initiatives in a more productive manner. Also of importance are new programs and partnering/funding opportunities that can help to relieve the economic burden associated with the technical efforts.

## RECOGNIZING THE NEED

Over the past decade, much has changed in the way that floodplains are managed. Local regulations have become more stringent, updating initiatives are occurring on the national level and technical advances have changed the way in which we gather and utilize information.

Understanding what actions are required is the first step in managing floodplains in the most responsive and efficient manner possible.

## Metropolitan North Georgia Water Planning District Model Ordinance

The MNGWPD was established on May 1, 2001 to develop regional and watershed specific plans for stormwater management, wastewater management and water supply and conservation in the 16-county area metropolitan Atlanta area. On October 3, 2002 the District adopted five model ordinances, including the *Floodplain Management / Flood Damage Prevention Ordinance*. One of the more significant features of this ordinance is its applicability to all streams, regardless of their FEMA designation (Zone A, AE, etc.), with 100-acres or more of drainage area. All such stream segments will have the limits of the *Regulatory Flood* defined, which is based on the one-percent chance (100-year) storm, assuming that the drainage basin is *fully developed*. These stipulations require significant efforts to be placed on new floodplain modeling and mapping.

## FEMA Map Modernization

In response to National Flood Insurance Program (NFIP) requirements and public demands, FEMA has implemented a map modernization program to increase the quality, reliability, and availability of flood hazard maps and data. Doing so will help the development community to select areas that are safe for building, allow insurance agents and lenders to determine flood prone properties with greater accuracy, and help home and business owners to determine their flood risk and protect their property.

The Map Modernization Program is an aggressive, 5-year initiative, funded by Congress as the means to create “A Nation Prepared”. In doing so, it is expected that *45 billion dollars* in damages will be avoided over the next 50 years. To ensure that federal funds are spent responsibly, the latest portal technology will be employed to transfer ownership and use of maps and data to state and local levels. The objective is to increase partnerships

and efficiency while reducing response time and costs. Map modernization provides a more comprehensive approach to economic development, mitigation planning, and emergency response.

## ADVANCED TOOLS AND TECHNIQUES

The need for updating floodplain maps and expanding such efforts to smaller streams is clear. Practitioners' familiarity with the latest and most advanced tools and techniques will dictate how quickly, effectively and economically communities can meet these needs. The following section identifies several of the major technical innovations and programmatic advances that floodplain managers and the affected community need to know.

### Improved Base Data

The most important data sets for modeling floodplains are stream alignment, land use and topography. Such information supports both hydrologic and hydraulic modeling, and has historically been difficult, if not cost-prohibitive, to collect and maintain. However, the increasing use of technologically advanced, and cost-effective remote data collection techniques such as Light Detection and Ranging (LiDAR) and high-resolution photography have made such information more available to communities.

Collecting the data by remote means has provided many communities with the ability to develop more accurate modeling data with less effort. Typical data types addressed include: land use designation; channel/floodplain roughness; stream centerline location; bridge/culvert crossing information; enhanced channel shapes (without surveying); and determining lake storage volumes. Furthermore, such data is provided in a digital format, allowing data exchanges among different governmental departments (or entities) and direct importing with automated modeling and mapping tools. One data set can be used for multiple objectives, offsetting the cost and making floodplain modeling practicable for many jurisdictions.

### National Hydrography Dataset

The National Hydrography Dataset (NHD) is a comprehensive digital data set developed by the U.S. Geologic Survey (USGS) and U.S. Environmental Protection Agency (USEPA). The NHD contains millions of watershed features across the nation, developed to promote the exchange of data between users at the national, State, and local levels. A key feature of the NHD structure is its ability to enable shared maintenance and enhancement of data, making it a truly cooperative product, NHD users will help evolve the policies and

procedures that will allow for productive exchanges of data, resulting in a comprehensive and up-to-date data set.

The NHD is available in a database design that allows web-based access, allowing data to be downloaded in various extents. Data requests can be extracted by subbasin, county, congressional district or by topographic map quad, and can be extracted in blocks encompassing several adjacent reference areas. With such data at hand, communities will be able to address local and national floodplain management objectives in a more efficient and effective manner.

### FEMA Multihazard Information Platform

Flood maps and data may now be accessed online via FEMA's FEMA Multihazard Information Platform (MIP) (<http://hazards.fema.gov/wps/portal>). The MIP is a new technology platform, promoting data sharing with all mapping partners. The MIP is being released in phases, allowing access to the latest flood hazard data and maps via the Internet. Users can browse data by using a geospatial data viewer, which gives access to other engineering, mapping, and program tools. The MIP will allow for multiple participants to use and contribute data, making it the collaborative tool needed to meet program objectives. Among the available tools are a GIS-based model to create watershed models for stormwater and floodplain management; a scoping tool that explains FEMA's optimized process for conducting flood map update projects; and digital FIRM (DFIRM) production tools. The current version of MIP (Phase I) includes the following DFIRM Production Tools:

**JTX.** A guide through the DFIRM creation process, identifying best practices and GIS tools, acting as a geodatabase manager.

**GeoPop Pro.** Assistance for creating and editing data while maintaining database structure and quality of content.

**WorkMap Pro.** Increased ease of creating engineering work maps while automatically rendering and labeling all standard DFIRM features.

The MIP Phase II release will include an Enhanced Map Viewer. Other future tools will be made available that offer the ability to produce DFIRM-compliant Flood Insurance Rate Map (FIRM) panels.

### Advanced Modeling Tools

With better datasets and data management tools available, advanced modeling tools can be utilized to a greater degree on a wide range of projects. GIS tools are no longer limited to creating maps, or providing limited support to generate modeling input data. Now, there is a more direct and user-friendly link between the data

management/analysis systems and the modeling tools. These applications are available in both public domain and proprietary formats – the individual’s needs and skill sets will determine which are best suited for the project at hand. Below is a brief description of a few public domain tools:

**GeoRAS/GeoHMS.** The long-standing hydrologic (HEC-1) and hydraulic (HEC-2) models developed by the U.S. Army Corps of Engineers have not only been upgraded to a new platform (HEC-HMS & HEC-RAS, respectively), but the models can now be developed directly from GIS databases. The GeoHMS and GeoRAS GIS interfaces increase the efficiency in which the basic modeling structure is developed and floodplain and floodway limits are mapped.

**NHD Watershed.** NHD Watershed is a GIS extension that enables users to delineate a watershed from any point on any NHD reach in a fast, accurate, and reliable manner. The application works in 8-digit subbasins (formerly known as cataloging units) where appropriate supporting data layers have been collected and preprocessed.

**NHD Watershed Characteristics.** NHD Watershed Characteristics is another GIS extension that enables users to compute and summarize characteristics of choice for watersheds delineated using NHD Watershed. Users are required to prepare datasets of interest (i.e. land cover, elevation derivative data, census data) in an 8-digit subbasin and load them into a project-specific workspace, to be accessed by the NHD Watershed Characteristics tools.

## FUNDING AND PARTNERING OPPORTUNITIES

Beyond the technical and partnering aspects is the necessity of funding to implement floodplain management efforts. Numerous opportunities are available, a few of which are identified below:

### Cooperating Technical Partners

Map modernization is a collaborative process, and leveraging partnerships will allow states and communities to choose their level of involvement. The Cooperating Technical Partners (CTP) Program is a way to develop such partnerships. The CTP Program promotes faster and more accurate updating of maps and improved hazard identification and risk management. Each CTP community will share “best practices” to promote greater effectiveness and efficiency, providing a stronger foundation upon which to perform mapping and floodplain management activities. With over 20,000

communities in the NFIP, the number of potential partnerships and the benefits from sharing data and collaborating play a significant role in addressing map modernization and floodplain management objectives.

### Natural Resources Conservation Service (NRCS)

The NRCS Watershed Protection & Flood Prevention Program provides funding to address problems related to watershed protection, flood mitigation, water supply, water quality, erosion and sediment control, wetland creation and restoration, fish and wildlife habitat enhancement, and public recreation on a watershed basis.

### FEMA Mitigation Grants

The *Pre-Disaster Mitigation Program* (PDM) provides technical and financial assistance to States and local governments for cost-effective pre-disaster hazard mitigation activities that complement a comprehensive mitigation program. The *Flood Mitigation Assistance Program* (FMA) grants funds to States and communities for planning and mitigation projects to reduce the risk of flood damage.

## DISCUSSIONS & RECOMMENDATIONS

Although many of the issues presented in this paper are of nationwide importance, it is important to emphasize their relevance to Georgia communities.

### Cooperation

The MNGWPD *Floodplain Management/Flood Damage Prevention Ordinance* addressed future build-out conditions, and applies to sites along streams once considered too small for defining floodplains. Furthermore, the Ordinance states that only detention ponds with government ownership can be reflected in hydrologic studies. Both requirements should promote more interaction between developers and local governments in order to provide the most beneficial floodplain management policies – for all stakeholders.

### Collaboration

Georgia was one of the first states to express an interest in developing high-resolution NHD for the entire state, and completed that effort in 2002. In addition to having a completed data set, the stream reach information in the Georgia NHD includes complete feature identification and flow direction information. This allows for flow tracing and other network-related spatial analyses, providing added value to the user. By sharing such data among Georgia communities, floodplain management in Georgia can be performed in a swift and more economical manner.

## **Implementation**

FEMA's Map Modernization Program has been developed to shorten the timeline in which flood maps are updated. Furthermore, the Georgia State Floodplain Management Office (Department of Natural Resources) is a CTP and receives funding from FEMA for map modernization efforts. This provides additional means to comply with MNGWPD *Floodplain Management/Flood Damage Prevention Ordinance* requirements.

The referenced advances in GIS-based data management and modeling can be used efficiently for projects of all sizes – from the site-level assessment to comprehensive basin-wide studies. Examples of each will be presented at the April 2005 conference.

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