

Charter *for the* **National Flood Inundation Mapping** **Requirements Team**

Introduction

Digital geospatial flood inundation mapping can be a powerful tool for flood risk management. Flood risk preparedness, communication, warning, response, and mitigation can be enhanced by flood inundation mapping that shows floodwater extent, depth, and velocity over the land surface. Flood inundation maps that accurately reflect observed and forecasted hydrodynamic conditions enable officials to make timely operational and public safety decisions before and during flood events. Real-time inundation maps, based upon

U. S. Geological Survey (USGS) real-time stream gage observations, National Weather Service (NWS) flood forecasts, and U.S. Army Corps of Engineers (USACE) flood operations, can significantly enhance a community's flood warning and response system. These maps enable local officials to make more informed flood risk management decisions and enhance the communication of these decisions to the public, thereby resulting in savings to loss of life and property. In addition, flood inundation maps developed during the planning process inform all parties of the risks and residual risks associated with the implementation of potential flood risk management alternatives.

The purpose of this charter is to support the collaborative actions required to develop common flood inundation maps, products and services that will help the USACE, USGS, and NWS fulfill their missions. These agencies have complementary operational missions in water science, observation, prediction and management and this charter will support interagency initiatives discussed in the Interagency Memorandum of Understanding (MOU) "Collaborative Science Services and Tools to Support Integrated and Adaptive Water Resources Management" between the three agencies. One goal of the MOU is to develop an *information system* that will serve as a reliable and authoritative basis for adaptive water-related planning, preparedness, and response activities from national to local levels.

NOAA, USGS, and USACE envision building a highly collaborative and integrative modeling and information services framework to establish a common operating picture, improve modeling and synthesis, and to support the production of a new, comprehensive, seamless and consistent suite of high-resolution water resources information, including flood inundation maps. The USACE, USGS, and NWS respective missions are:

- USACE: *to strengthen our Nation's security, energize the economy, and reduce risks from disasters.*
- USGS: *to collect and disseminate reliable, impartial, and timely information that is needed to understand the Nation's water resources in order to minimize loss of life and property from natural disasters.*
- NOAA NWS: *to provide weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the*

protection of life and property and the enhancement of the national economy.

Flooding is the cause of the majority of Presidential disaster declarations and results in greater U.S. economic loss than any other type of weather-related natural disaster. Consequently, there is growing public and private sector demand for information enabling more informed, risk-based decisions to mitigate the loss of life and property and enhance community resiliency. The development and effective use of inundation maps and related geospatial data sets for planning purposes and real-time flood forecasting will assist the nation in addressing specific risk reduction goals as set forth by the USACE's comprehensive National Flood Risk Management Program (NFRMP), the goals of the USGS's National Flood Inundation Mapping Initiative (NFIMI) and National Streamflow Information Program (NSIP), and the goals set forth in the NOAA NWS Strategic Plan for 2011-2020. The availability of flood inundation maps for planning and forecasting will improve our capacity to identify, quantify, and communicate the risk and impacts associated with flooding, thereby facilitating more effective response, mitigation and recovery efforts at the regional, state, and community levels.

Background

In response to the demand for flood inundation maps, the USGS, NWS and USACE have begun to work together to improve our mapping and communication capabilities and strategies. Currently, the most commonly available maps are based on pre-defined inputs and one-dimensional, steady-state hydraulic models. For example, the maps produced by FEMA's National Flood Insurance Program (NFIP) are based on pre-defined hydrologic inputs and on topography and infrastructure conditions at a certain date and time. Still, these "*static*" inundation maps are useful for guiding emergency preparation and floodplain management.

While static inundation maps can be and have been used for flood risk management, planning and emergency operation purposes, because of their initial assumptions they may not accurately represent actual flooding, where topography, hydraulic and hydrologic conditions change frequently - especially in coastal regions and in areas impacted by backwater effects. Ideally, "*dynamic*" inundation maps generated in real-time, and based on in situ and forecasted unsteady-state simulations of evolving flood events, would be created during emergency response situations. However, these complex and computationally intensive products are not yet generally available. The potential for generation and availability of these maps for selected locations, in addition to the static inundation maps, will be the major focus for this team. The team will consider the approach FEMA has taken where in some locations, through its MapMod and RiskMap programs, they have produced "*live*" hydraulic models that reflect updated topography, hydrology, and hydraulic analyses suitable for flood inundation mapping and other purposes.

A primary goal of the MOU signed by the three agencies is to leverage the expertise of the member agencies to develop mutual information services and modeling frameworks that enable the efficient and effective generation and provision of comprehensive water resources products and services, including flood inundation maps. Presently the agencies' existing enterprise inundation mapping solutions (consisting of decision support systems, models, data, products and services) largely operate independently of one another. Collectively, these modeling and information services frameworks could constitute a common operating picture in which

interagency decision support systems, data, models, and workflows are interoperable, seamless and transparent. Within such a modeling framework, high-resolution forecasts of water resources parameters would be synergistically linked with point-specific in-stream flow forecasts and used to initiate dynamic inundation map generation. Static and dynamic flood inundation maps, generated (1) within a single, robust, scalable, coherent, extensible, and variable-resolution operational modeling framework, and (2) within an interagency common operating picture, help fulfill the goals of the MOU.

Purpose and Scope

This Charter is entered into by and amongst USGS, NWS, and USACE (the Parties) to establish a Flood Inundation Mapping (FIM) Requirements Team. The Team's purpose is to accomplish the following goals:

1. Define the requirements and technical specifications for static and dynamic flood inundation mapping products and services.
 - a. Develop a set of technical specifications, standards, and methods for creating and disseminating flood inundation maps, geospatial data sets and metadata, including a consistent visual and electronic file format in appearance and functionality for all inundation map products.
 - b. Define the current relationship of static flood inundation mapping products to FEMA Digital Flood Insurance Rate Maps (DFIRM) and specify, if appropriate, how this relationship can be improved to better leverage resources for map development and maintenance.
 - c. Define functionality required to accommodate stakeholders' interactions with these products and what web-based and desktop Geographic Information Systems (GIS) response and mitigation tools will be required (e.g., flood damage consequences and loss estimation).
 - d. Develop strategies for working with our partners and stakeholders to assure new mapping services meet their evolving needs.
 - e. Establish a Quality-Assurance/Quality-Control review and approval process to ensure inundation mapping products meet the proposed set of technical specifications, standards, and methods, including map update frequency and maintenance criteria.
2. Evaluate and propose a viable flood-mapping concept of operations that efficiently and effectively leverages each agency's assets to generate inundation products.
 - a. Define the respective roles, contributions, and interactions of participating agencies.
 - b. Define the respective roles, contributions, and interaction of the participating agencies and the soon to be implemented National Water Center, recognizing that all participating agencies may not participate or function in this center.
 - c. Define the operational requirements, criteria and methodology for the routine production of static and dynamic flood inundation maps. Example items to address would include:
 - i. Extent of the mapping; e.g., for the entire country, wherever and whenever flooding occurs, including dam- and levee-breach situations, extreme storms, floods of record, and varying river regulations.
 - ii. The acceptable latency and forecast range

- iii. Resolution and accuracy
 - iv. Assimilation of in-situ observations (e.g., USGS stream gage data) and forecasts (e.g., NWS river forecast data)
 - v. Quality-assurance
3. Evaluate and specify the general requirements for the mutual modeling and information services frameworks (or common operating picture) to support the flood inundation mapping concept of operations.
- a. Define the modeling framework inputs (e.g., elevation model, grid spacing, cross-sections, observational data) required for accurate flood inundation maps.
 - b. Define the modeling framework outputs, including uncertainty estimates, that are required as inputs to the flood inundation mapping methodology described in the concept of operations.
 - c. Define required integrative, scalable, reproducible modeling framework capabilities (i.e., the system should be scalable from one to two dimensions and in the future, three dimensions as appropriate. These capabilities need to be integrated in the same modeling framework so they can share data, parameters, etc.).
 - d. Define required information services framework capabilities to support the seamless and transparent production of flood inundation maps across agency boundaries.
 - i. Data and workflow management
 - ii. Interoperability and data synchronization
 - iii. Internet and web services, system and data security, access to the internet across firewalls.

The flood inundation mapping team should work toward producing a concept of operations and requirements document.

Deliverable

Subject to the availability of funds, the FIM Requirements Team will develop a requirements document which a) defines the requirements and technical specifications for static and dynamic flood inundation mapping products and services; b) outlines a viable flood-mapping concept of operations that efficiently and effectively leverages each agency's assets to generate inundation products; and c) specifies the general requirements for the mutual modeling and information services frameworks to support the flood inundation mapping concept of operations.

Authority

The parties rely upon the following authorities, and any others that might be applicable, to enter into this charter.

The authorities of the USACE:

- Economy in Government Act (31 U.S.C. § 1535)
- Interservice and Intragovernmental Support (DoD Instruction 4000.19)

The authorities of the USGS:

- Public Law 99-591--provides in fiscal year 1997 and thereafter that the USGS has permanent authority to "prosecute projects in cooperation with other agencies, Federal, State, and private" (43 U.S.C. § 36c)
- The USGS Organic Act of March 3, 1879, as amended (43 U.S.C. § 31 et seq.)
- Cooperative Water Program. 43 U.S.C. 50 (USGS)
- National Streamflow Information Program, Omnibus Land Management Act of 2009, Section F. Secure Water Act (USGS)

The authorities of NOAA:

- Department of Commerce (NOAA) authority (33 U.S.C. § 883a et seq.)
- National Weather Service Organic Authority (15 U.S.C. § 313)
- Inland Flood Forecasting and Warning System Act of 2002, Public Law 107-253 (NWS)

Interagency Communications

To provide consistent and effective communication between the Parties, each party shall appoint a point of contact (POC) to provide general oversight of the team and direct respective agency team members to meet charter goals. The POC's for this effort are:

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The POC's will approve team members and facilitate the selection of a team leader. Quarterly conference calls of the POC's and the team leader will be conducted. Subject to the availability of funds, each Party will provide a minimum of two and a maximum of four representatives to serve on this Team. The team leader will chair team meetings. The team leader is also responsible for organizing, conducting and documenting team actions and progress. Team

meetings will be conducted as necessary to address the Charter goals established above. Meetings should be conducted remotely via teleconferencing or virtually with web capabilities, whenever appropriate. If in-person meetings are necessary, each agency will be responsible for their respective representatives' travel costs.

Interagency Participation

It is the intent to invite other federal agencies to join the flood inundation mapping team and become charter members, including agencies such as the Federal Emergency Management Agency (FEMA), and the U.S. Bureau of Reclamation (USBR) which both have complementary flood inundation mapping efforts and their expertise and experience will provide value.

Charter

Survival: The provisions of this Charter which require performance after the expiration or termination of the Charter shall remain in force notwithstanding the expiration or termination of this Charter.

Survivability: If any provision of the Charter is determined to be invalid or unenforceable, the remaining provisions shall remain in force and unaffected to the fullest extent permitted by law and regulation.

Effective Date: This Charter shall become effective when signed by the Parties. Termination of the Charter can happen at the discretion of any of the Parties.

All commitments and participation by the Parties in the actions and activities covered by this Charter are contingent upon the availability of appropriated funds and budget priorities. Nothing in this Charter, in and of itself, nor any decision made by the team obligates the parties to expend appropriations or to enter into any contract, assistance agreement, interagency agreement or other financial obligation.

National Weather Service



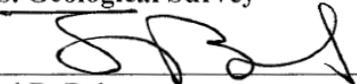
Don Cline
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U. S. Geological Survey



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