

# Estimating the Value of Partner Contributions to Flood Mapping Projects “Blue Book”

Version 2.0

January 2009



**FEMA**



# Document History

## Document Location

Location
TBD

## Revision History

Version Number	Version Date	Summary of Changes	Team/Author
1.0	August 2006	Draft	Beth Norton
1.1	November 2006	Final	Beth Norton
2.0	January 2009	Draft	Necolle Maccherone
2.0	January 2009	Final	Necolle Maccherone

## Approvals

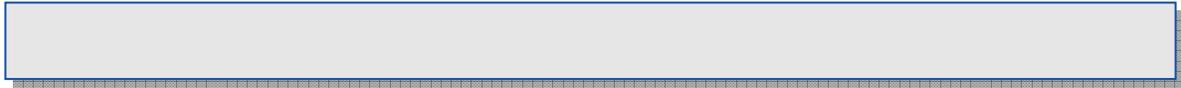
This document requires the approval of the following persons:

Role	Name	Title (CLIN/RMC)	Review Date	Approved Date
Originator	Necolle Maccherone	CTP Specialist	2.13.09	2.13.09
Tech Review	Lori Watson	CTP Specialist	2.16.09	2.16.09

## Client Distribution

Name	Title/Organization	Location
Beth Norton	FEMA	Crystal City





## Table of Contents

1.	Background .....	2
2.	Purpose .....	2
3.	Overview of Approach .....	3
4.	Federal Matching Programs .....	4
5.	Methodology .....	4
6.	Unit Costs .....	5
7.	Definitions .....	8

## List of Tables

Table 1.	Unit Cost Factors .....	5
----------	-------------------------	---

# 1. Background

In 1997, the Department of Homeland Security's Federal Emergency Management Agency (FEMA) created a Flood Map Modernization (Map Mod) plan to modernize the flood hazard mapping effort and eliminate the backlog of outdated flood hazard maps. Since its development in 1997, the plan continues to evolve as FEMA creates new processes and product standards and updated information is gathered about community mapping needs. Over the last several years, FEMA created new processes and product standards and gathered updated information about community mapping needs.

One of FEMA's key goals for Map Mod was to increase local involvement in the development and long-term maintenance of their flood hazard maps. To meet this long standing objective, FEMA created the Cooperating Technical Partners (CTP) program. The CTP program allows communities, tribal nations, regional agencies, universities, and State agencies that have the interest and capability to become active partners in FEMA's flood hazard mapping effort. To date, over 236 partners have entered into formal agreements with FEMA to provide specific contributions to the flood hazard mapping effort for their communities. Through these partnerships, local knowledge and expertise are incorporated into the flood hazard maps, and partners' contributions are maximized to leverage Federal funding to the fullest extent possible, while consistently maintaining national standards.

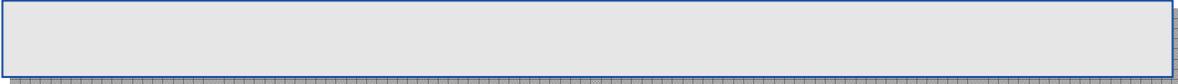
In order to leverage the successes of Map Mod and further enhance the usability and value of flood hazard mapping, FEMA has developed the Risk MAP strategy. Risk MAP combines flood hazard mapping, risk assessment tools and mitigation planning into one seamless program. The intent of this integrated program is to encourage beneficial partnerships and innovative uses of flood hazard and risk assessment data in order to maximize flood loss reduction. As we move forward with the Risk MAP vision, the CTP program will continue to be an essential component.

FEMA has been tracking the extent to which its mapping funds have been leveraged through the CTP program since the first partnership agreements were signed in 1999. To estimate each partner's contribution to ongoing mapping activities, FEMA has applied a series of unit costs that are indicative of FEMA's costs to produce a National Flood Insurance Program (NFIP) map. While leverage is generally associated with the CTP program, other partners who are not members of the CTP program can provide FEMA with flood mapping-related data and thus leverage their data.

# 2. Purpose

The purpose of this document is to outline the unit cost approach FEMA uses in estimating the value of mapping activities contributed by communities, tribal nations, regional agencies, universities, and State agencies for updated Flood Insurance Rate Map (FIRM) production.

The unit cost approach described in this document should only be used to determine the value of a partner's contribution. Because the actual costs associated with individual projects may vary



significantly, **under no circumstances should these unit costs be used to estimate the cost of individual projects.** Resources are available through FEMA's Regional Offices to assist in estimating the cost of individual projects. Please contact the appropriate FEMA CTP Regional Coordinator for more information ([http://www.fema.gov/plan/prevent/fhm/ctp\\_key.shtm](http://www.fema.gov/plan/prevent/fhm/ctp_key.shtm)).

The Blue Book is a living document. Because of changing conditions in technologies, processes, and the economy, this publication will be evaluated each fiscal year and FEMA will determine whether revisions are warranted.

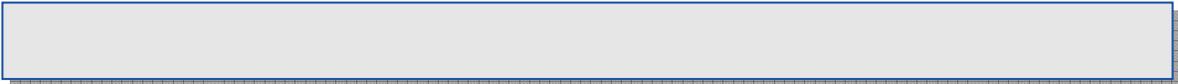
### 3. Overview of Approach

FEMA documents the contributions of its mapping partners (primarily participants in the CTP program) by estimating the value of their contributions to the production of their flood hazard maps. The approach for evaluating partner contributions was originally developed for the CTP program by way of leveraged activity. This approach includes estimates of each partner's contribution to ongoing mapping activities and the overall value of the partner's mapping efforts relative to FEMA's investment in these mapping activities. The methodology uses a series of unit costs and applies them to the number of work units (i.e., linear miles of study) to estimate the cost of various project elements in the map production process.

FEMA developed these unit costs to ensure that the value of each map product reflects only the costs typically incurred by FEMA to produce them. Partners may choose to incur costs above and beyond what FEMA would normally expend for the same activity, and these additional costs should not skew the estimate of the project's value to FEMA. For example, a partner that plans to use the topographic data for additional purposes may choose to include data and information that FEMA would not normally include. Accordingly, the cost to collect and process such data should not be considered when evaluating the value of the topographic data.

Moreover, by using uniform unit costs, the value of partnering with communities, tribal nations, regional agencies, universities, and State agencies can be estimated at any stage of a mapping project. FEMA can determine the extent to which it is leveraging Federal funds while projects are ongoing. This would not be the case if actual costs were used because the full costs would not be known until the project is complete. For example, although a preliminary Digital FIRM (DFIRM) may have already been produced by a partner, the costs incurred will likely change as a result of appeals and/or protests.

FEMA intends to use the unit cost approach (or this Blue Book) to estimate only those partner contributions that will lead to the production of new or updated DFIRMs. It is also important to note that in order to be used and given credit, products submitted by partners must meet the requirements of FEMA's current *Guidelines and Specifications for Flood Hazard Mapping Partners* ([http://www.fema.gov/plan/prevent/fhm/gs\\_main.shtm](http://www.fema.gov/plan/prevent/fhm/gs_main.shtm)). If data are submitted that does not meet the requirements of FEMA's current *Guidelines and Specifications for Flood Hazard*



*Mapping Partners* the contribution may be devalued based on additional costs incurred by FEMA to bring that data up to specifications.

Unit costs have been developed for the following mapping project elements:

- Scoping
- Outreach
- Field surveys
- Topographic Data Development
- Base Map Preparation
- Detailed Riverine Methods
- Redelineation of Detailed Study Areas
- Limited Detailed Riverine Methods
- Perform Coastal Analysis
- Detailed Alluvial Methods
- Approximate Analysis
- Develop Draft DFIRM Database
- Independent QA/QC Activities for Mapping Project Elements

## 4. Federal Matching Programs

The Federal government has several matching grant programs available to partners, where the government and the partner each agree to fund a certain percentage of the total cost of a given project. In these cases where a Federal financial contribution is met by a matching (whole or partial) financial contribution from the partner, and those monies are used to accomplish a flood mapping task, FEMA will evaluate the percentage of the unit cost attributed to the task that will be credited to the partner. The partner will not receive 100 percent of the credit for that task unless the task is completely non-Federally funded. For example, a Federal agency and the partner participate in an 80/20 grant program, where the Federal agency funds 80 percent of the project and the partner funds 20 percent of the project. In this example, the project entails completing field surveys for X miles. FEMA would consider the partner's leverage to be 20 percent of the unit cost for X miles of the field survey activity. For the purposes of the CTP program and leverage calculations for all mapping partners, only the 20 percent match would be credited for leverage.

## 5. Methodology

FEMA's Blue Book was first published in 2002. The unit costs in this original version of the document were developed from FEMA's Mapping Needs Update Support System. In 2003, there was the need to adjust these unit costs for inflation. An inflation rate of 2.2 percent was assumed and used to update the unit costs. The Blue Book was updated again in 2006. The 2006 update was based on the availability of additional cost data and not merely an adjustment for inflation.

For the current update, a request was made to the ten FEMA Regional Offices, the National Service Provider's ten Regional Management Centers, and subject matter experts to suggest updates to unit costs based on their experience and supported by data. Updated unit costs derived in this manner were received for the Topographic Data Development and Perform Coastal Analysis, mapping project elements.

Updates to Base Map Preparation were derived from a consensus estimate from several Federal agencies and state government projects.

Because no data-supported changes for the remaining project elements were suggested, those project elements were adjusted for inflation only, with three exceptions. The first exception is for Pre-scoping. This mapping project element was removed as it is no longer eligible for credit through the Blue Book. The second exception is the Outreach element. This element was changed to reflect a one-time credit per project. The third exception is for the Quality Assurance/Quality Control (QA/QC) components of the mapping project elements. Unless there was specific data to support otherwise, these unit costs were updated to be 15% of the unit cost of the mapping project element that they are associated with. The Consumer Price Index was used to adjust for inflation. All unit costs were rounded to the nearest ten dollars. These unit costs are summarized in Table 1.

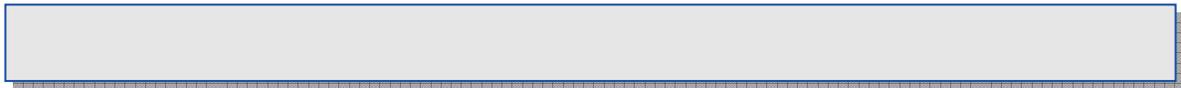
It is important to note that the unit costs provided in the following table are based on certain assumptions that reflect “typical” study conditions and may not accurately represent actual site-specific conditions. **Under no circumstance should these unit costs be used to estimate the cost of individual projects. These figures are intended to provide an estimate of the value to FEMA, and not the actual cost incurred for the activity.**

Any questions about these or other unit costs should be presented to FEMA for consideration. If additional unit costs are warranted, suggestions and the associated data should be presented to FEMA for future versions of this document.

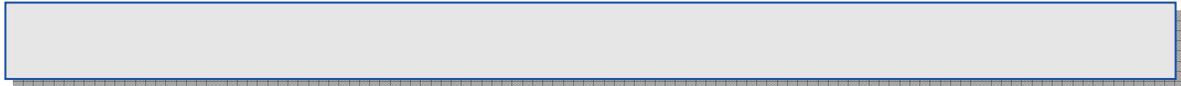
## 6. Unit Costs

Table 1. Unit Cost Factors

Project Element		Unit	Unit Cost (\$/unit)
Scoping	Scoping	Panels	\$650
Outreach	Project Outreach	Project	*\$10,000
Field Surveys	Field Surveys	Linear miles	\$3080
	QA/QC of Field Surveys	Linear miles	\$460
Topographic Data Development	Very Flat Terrain		
	<ul style="list-style-type: none"> <li>Less than 1000 sq. mi.</li> </ul>	Square miles	\$500
	<ul style="list-style-type: none"> <li>Greater than 1000 sq. mi</li> </ul>	Square miles	\$300
	Independent QA/QC Very Flat Terrain		
	<ul style="list-style-type: none"> <li>Less than 1000 sq. mi.</li> </ul>	Square miles	\$80



	<ul style="list-style-type: none"> <li>Greater than 1000 sq. mi</li> </ul>	Square miles	\$50
	Rolling to Hilly Terrain		
	<ul style="list-style-type: none"> <li>Less than 1000 sq. mi.</li> </ul>	Square miles	\$250
	<ul style="list-style-type: none"> <li>Greater than 1000 sq. mi</li> </ul>	Square miles	\$200
	Independent QA/QC of Rolling to Hilly Terrain		
	<ul style="list-style-type: none"> <li>Less than 1000 sq. mi.</li> </ul>	Square miles	\$40
	<ul style="list-style-type: none"> <li>Greater than 1000 sq. mi</li> </ul>	Square miles	\$30
Base Map Preparation	Greater than 4' contours	Square miles	\$60
	Base Map Preparation	Square miles	\$10
	Independent QA/QC of Base Map	Square miles	\$2
	Base Map Data 1 meter Orthophoto	Square miles	\$20
Detailed Riverine	Base Map Data 1 foot Orthophotos	Square miles	\$100
	Hydrologic Analysis	Linear miles	\$1,880
	Independent QA/QC of Hydrologic Analysis	Linear miles	\$280
	Hydraulic Analysis	Linear miles	\$3930
	Independent QA/QC of Hydraulic Analysis	Linear miles	\$590
	Floodplain Mapping	Linear miles	\$3,860
	Independent QA/QC of Floodplain Mapping	Linear miles	\$580
Limited Detail Riverine	Redelineation	Linear miles	\$1,360
	QA/QC of Redelineation	Linear miles	\$200
	Hydrologic Analysis	Linear miles	\$420
	Independent QA/QC of Hydrologic Analysis	Linear miles	\$60
	Hydraulic Analysis	Linear miles	\$660
	Independent QA/QC of Hydraulic Analysis	Linear miles	\$100
Perform Coastal Analysis	Floodplain Mapping	Linear miles	\$3700
	Independent QA/QC of Floodplain Mapping	Linear miles	\$560
	Grid Development	Node	\$0.70
	Independent QA/QC of Grid Development	Node	\$0.10
	Surge/Setup Analysis	Square miles	No data use actual costs
	Independent QA/QC of Surge/Setup Analysis	Square miles	No data use actual cost
	East Coast/Gulf Wave Height/Runup/Erosion Analysis	Coastal miles	\$3,100
	Independent QA/QC of East Coast/Gulf Wave Height/Runup/Erosion Analysis	Coastal miles	\$470
	West Coast Wave Height/Runup/Erosion Analysis	Coastal miles	\$10,300
	Independent QA/QC of West Coast Wave Height/Runup/Erosion Analysis	Coastal miles	\$1550
Coastal Mapping	Coastal miles	\$3,100	
Independent QA/QC of Coastal Mapping	Coastal miles	\$470	



Detailed Alluvial	Engineering Analyses	Square miles	\$3,790
	Independent QA/QC of Engineering Analyses	Square miles	\$570
	Floodplain Delineation	Square miles	\$5,480
	Independent QA/QC of Floodplain Delineation	Square miles	\$820
Approximate Analysis	Hydrologic Analysis	Linear miles	\$150
	Independent QA/QC of Hydrologic Analysis	Linear miles	\$20
	Hydraulic Analysis	Linear miles	\$280
	Independent QA/QC of Hydraulic Analysis	Linear miles	\$40
	Floodplain Mapping	Linear miles	\$630
	Independent QA/QC of Floodplain Mapping	Linear miles	\$95
	Redelineation	Linear miles	\$180
	Independent QA/QC of Redelineation	Linear miles	\$30
DFIRM Production, Distribution, and Finalization	Develop Draft DFIRM Database	Project	No data use actual cost
	Preliminary DFIRM Production	Panels	\$1230
	QA/QC Preliminary DFIRM Production	Panels	\$190
	Post-Preliminary DFIRM Production	Panels	\$1,690

**\* For the Outreach Project unit cost, if the actual cost of outreach exceeds the unit cost by more than 50%, provide costs and details to FEMA so they may evaluate if additional credit is warranted.**

## 7. Definitions

**Scoping:** Evaluate the effective flood data, available base data and selected needs to determine the scope of project to be approved by FEMA as well as other scoping activities identified in the Mapping Activity Statement.

**Outreach Activities:** Includes informational mailings, community meetings, website development and update, multi-media promotions and other related activities.

**Topographic Data Development of very flat terrain and rolling to hilly terrain:** Generate new topographic data for areas where the floodplains are being updated as part of mapping project. Topographic data includes contour mapping and or digital elevation models developed from LIDAR or other means that meet the requirements of *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners* Volume 1, Section 1.4 and Appendix A, Sections A.1, A.2, A.3 and A.4. Address all concerns or questions regarding the topographic data development and processing that are raised during the independent QA/QC review. FEMA's topographic requirements generally call for vertical accuracy roughly equivalent to 4' contours (37cm NSSDA).

In exceptionally flat areas, the FEMA project lead may determine that accuracy roughly equivalent to 2' contours is needed (18.5 cm NSSDA).

Value for this element will only be given to topographic data acquired in the past 5 years or acquired since the last time the map was updated. Also, only the area being updated by the project is eligible for credit.

**Topographic Data Development of greater than 4' contours:** Utilize existing topographic data and integrate it into the mapping project.

**QA/QC of Topographic Data Development of very flat terrain and rolling to hilly terrain:** Review the mapping data generated Topographic Data Development to ensure that these data are consistent with FEMA standards and standard engineering practice, and are sufficient to prepare the DFIRM.

**Base Map Preparation:** FEMA does not typically spend money on the acquisition of base maps. But because partners often have a level of effort to prepare the base map data, credit will be given for completing the following: Coordinate with potential base map sources; secure necessary permissions to allow FEMA's use and distribution of hardcopy and digital map products free of charge; obtain and review base map data; review and supplement content to comply with G&S requirements; for the base map components that have a mandatory data structure convert the base map data to format required in G&S, certify that digital data meets the minimum requirements for DFIRM production. Products should meet the requirements of *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners* and follow the *Geospatial Data coordination Policy and Implementation Guide*.

**Independent QA/QC Review of Base Map:** FEMA does not typically spend money on the acquisition of base maps. But because partners often have a level of effort to prepare the base map data, credit will be given for completing the following: Review base map acquired to ensure that it includes data consistent with FEMA standards and is sufficient to include on the DFIRM.

**Base Map Data 1 meter Orthophoto and 1 foot Orthophoto:** Supply a State or community produced digital orthophoto. A digital orthophoto is an aerial photo that has the accuracy properties of a map. In order to receive credit for this element, the base map cannot have been used on the last map update and be less than five years old. Also, only the area being updated by the project is eligible for credit.

**Detailed Riverine Hydrology:** Review and recommend appropriate methodology; delineate drainage area; limited detailed methods (research on land-use data and basin characteristics for regression equations obtain gage records, compute 10%, 2%, 1% and 0.1% annual chance flood discharge) or detailed hydrologic analyses (research on land-use and precipitation data, compute channel routing, detention routing, build hydrologic model, calibrate/validate models); prepare draft FIS text; internal quality review; and incorporate comments from independent quality reviewer. Products should meet the requirements of *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners*.

**Detailed Riverine Hydraulics:** Field visit to verify roughness coefficient and verify structural details (inlet types, conditions, etc.); integrate field survey data into modeling; prepare multi-frequency models; prepare a floodway model; calibrate/validate models; prepare draft FIS text, prepare floodway data tables; prepare FIS profile; internal quality review and incorporate comments from independent quality reviewer. Products should meet the requirements of *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners*.

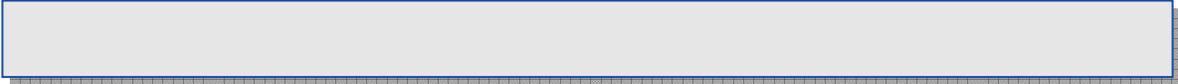
**Detailed Riverine Floodplain Mapping:** Delineate the 1- and 0.2-percent-annual-chance floodplain boundaries and the regulatory floodway boundaries (if required) and any other applicable elements for the flooding sources for which detailed hydrologic, hydraulic, and/or coastal analyses were performed. Incorporate all new or revised hydrologic, hydraulic, and/or coastal modeling and shall use the topographic data acquired to delineate the floodplain and regulatory floodway boundaries on a digital work map.

**Limited Detail Riverine:** H&H analyses using digital elevation data obtained by LIDAR. Use digital elevation data and orthophoto imagery to estimate opening area of structure without visiting the structure to determine opening geometry. Where bridge or culvert data are available, such from a DOT, use these data. Otherwise field measure structures. Limited detail will not include mapping of regulatory floodways.

**Perform Coastal Analysis:** Delineate the 1- and 0.2-percent-annual-chance floodplain boundaries, VE and AE Zones, Primary Frontal Dune, Limit of Moderate Wave Action, and base flood elevations and any other applicable elements for the flooding sources for which detailed coastal analyses were performed. Incorporate all new or revised coastal modeling and shall use the topographic data acquired under Topographic Data Development to delineate the floodplain boundaries, VE and AE Zones, Primary Frontal Dune, Limit of Moderate Wave Action, and base flood elevations and any other applicable elements on a digital work map.

**Detailed Alluvial:** See *Appendix G: Guidance for Alluvial Fan Flood Analyses and Mapping in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners*.

**Approximate Analysis:** Delineate the 1-percent-annual-chance floodplain boundaries for the flooding sources. Use existing topographic data or the topographic data acquired under



Topographic Data Development to delineate the floodplain boundaries on a digital work map. May expand on the approaches for analyzing Zone A areas outlined in *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners* and in FEMA 265, *Managing Floodplain Development in Approximate Zone A Areas* (April 1995), and/or develop new approaches. Such approaches must be coordinated with and approved by the FEMA before analysis and mapping begin.

**Develop Draft DFIRM Database:** Prepare the database and metadata file in accordance with *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners*, for upload to the MIP. Coordinate with appropriate Mapping Partners, as necessary, to resolve any problems that are identified during development of the DFIRM Database.