

QUARTERLY REPORT

(Second Quarter Federal Fiscal Year 2011: January-March, 2011)

Activities conducted by the U.S. Geological Survey for the project:

FLOOD-FREQUENCY ANALYSES FOR U.S. GEOLOGICAL GAGING STATIONS BASED ON DATA THROUGH WATER YEAR 2009

I. Introduction

This report summarizes planned activities and work conducted by the U.S. Geological Survey (USGS) during the reporting quarters for the project: Flood-Frequency Analyses for U.S. Geological Survey Gaging Stations Based on Data through Water Year 2009. This project is cooperatively funded through Montana Department of Transportation (MDT), Montana Department of Natural Resources and Conservation (DNRC), and the USGS Cooperative Water Program (<http://water.usgs.gov/coop/>).

General project information is presented in tables 1 and 2. Table 1 presents abbreviated versions of the project objectives and tasks for the quarters reviewed. The tasks presented in table 1 are the same as those presented in the Scope of Work to facilitate tracking of project activities and expenses. Table 2 presents the project budget by State and Federal fiscal year as presented in the Scope of Work.

II. Planned activities for the reporting quarters

Work was scheduled to be conducted on the following tasks (table 1) during the reporting quarter:

Second Quarter Federal Fiscal Year 2011 (January-March, 2011)

1. Conduct and document standard log-Pearson III flood frequency analyses for about 650 USGS gaging stations.
 - 1d. Perform flood-frequency analyses.
 - 1e. Construct figures and tables of frequency results and accompanying documentation.
2. Investigate application of record-extension methods for improving flood-frequency estimates for short-term gaging stations.
 - 2a. Identify gaging stations with less than 15 years of record or with longer periods of record but substantially influenced by unusual climatic conditions.
 - 2b. Conduct correlation analyses to determine appropriate index stations.
 - 2c. Conduct Bulletin 17b 2-station analyses and MOVE.1 analyses for record extension.
3. Initiate systematic tracking of stationarity of flood-frequency data for Montana.
 - a. Identify long-term unregulated stations to serve as regional index stations.
4. Investigate application of regional mixed-populations analyses for Montana.
 - 4a. Investigate occurrence of high-outlier peak flows in northwestern Montana and define mixed-population region.
 - 4b. Investigate relative probability of occurrence of independent ordinary peak flows and high-outlier peak flows.
5. Quarterly progress reports.

Work activities conducted on these tasks during the reporting quarter are summarized in the following sections of this progress report.

Table 1. Project schedule by task.

Work tasks	Milestone dates	FY 2011		
		J	F	M
1. Conduct and document standard log-Pearson III flood frequency analyses for about 650 USGS gaging stations		X	X	X
1d. Perform flood-frequency analyses		X	X	
1e. Construct figures and tables of frequency results and accompanying documentation		X	X	X
2. Investigate application of record-extension methods for improving flood-frequency estimates for short-term gaging stations		X	X	X
2a. Identify gaging stations with less than 15 years of record or with longer periods of record but substantially influence by unusual climatic conditions		X		
2b. Conduct correlation analyses to determine appropriate index stations		X		
2c. Conduct Bulletin 17b 2-station analyses and MOVE.1 analyses for record extension		X	X	X
3. Initiate systematic tracking of stationarity of flood-frequency data for Montana				X
3a. Identify long-term unregulated stations to serve as regional index stations				X
4. Investigate application of regional mixed-populations analyses for Montana		X	X	X
4a. Investigate occurrence of high-outlier peak flows in northwestern Montana and define mixed-population region		X		
4b. Investigate relative probability of occurrence of independent ordinary peak flows and high-outlier peak flows		X	X	X
5. Quarterly progress reports		X		

Table 2. Project budget by State and Federal fiscal years as presented in the original Scope of Work.

State fiscal year	USGS	MDT	MDNRC	TOTAL
2011	\$48,750	\$56,875	\$16,250	\$121,875
2012	\$39,800	\$55,950	\$3,750	\$99,500
2013	\$11,450	\$17,175	\$0	\$28,625
TOTAL	\$100,000	\$130,000	\$20,000	\$250,000
Federal fiscal year	USGS	MDT	MDNRC	TOTAL
2010	\$18,000	\$22,000	\$5,000	\$45,000
2011	\$41,000	\$46,500	\$15,000	\$102,500
2012	\$41,000	\$61,500	\$0	\$102,500
TOTAL	\$100,000	\$130,000	\$20,000	\$250,000

III. Project activities conducted during the reporting quarter presented by task

1a. Document regulatory structures that influence peak flows at gaging stations.

The USGS received a GIS coverage of dams from the Montana Department of Environmental Quality in November 2010. This GIS coverage is an extensive list of reservoirs and diversion dams in Montana and includes 3,667 dams. Each of these dams have several attributes including the name, owner, year built, storage capacity and drainage area which are essential attributes for completion of this task. The USGS has not previously used such an extensive list of reservoirs to determine which stream gages have upstream storage and thus may be affected by dams. A systematic approach was developed to evaluate the effect of these dams on each gaging station. This systematic approach requires a large amount of GIS work which began in late December and has been completed for approximately 94 of 813 gages as of January 10, 2011.

The GIS specialist for Montana Water Science Center is currently working on this task; however additional issues have been identified which will delay this task. A majority of the dams in the provided database do not have accurate latitude and longitude positions. Without accurate latitude and longitude positions the GIS work cannot be easily automated. The Montana Water Science Center is working with other Federal and state agencies to attain a dams database with accurate latitude and longitudinal positions.

1b. Construct table of regulating structures and stations influenced.

The systematic approach being used in task 1a will result in a table of regulatory structures for each gage. Although Task 1b has been completed for 94 gages as of January 10, 2011, these gages will need to be re-evaluated when a new dams database is acquired.

1c. Retrieve and format peak flow data.

Peak flow data have been retrieved and formatted for all of the stream gages beginning with 06 (part 6 gages) having 10 or more years of record. This accounts for approximately 570 gages. Until task 1a can be completed, regulation is determined from WRIR 03-4308 (Parrett and Johnson). For a majority of these gages the regulation status will not likely change.

1d. Perform flood frequency analyses.

Flood frequency analyses using the standard Bulletin 17B (B17B) approach has been completed for all of the part 6 gages having 10 or more years of record (~570 gages). For those gages which include a historical analysis, the number of years assigned to the historic analysis is being reviewed. Determining the number of years and peak value for a historic analysis requires subjective decisions based on knowledge of the system, drainage area, and history of localized and or regional floods. The Montana Water Science Center has recently received direction from the USGS Office of Surface Water to use PeakfqSA for gages which use a historic analysis. PeakfqSA employs a more general parameter-estimation method, specifically the Expected Moments Algorithm (EMA), to permit efficient use of interval data while performing historic analyses. In addition to incorporating interval data, PeakfqSA also uses EMA to assign more accurate confidence intervals. While PeakfqSA is not the approved B17B method for performing historic analysis, it is being recommended by the Hydrologic Frequency Analysis Work Group for adoption into B17B revisions. Thus, the Montana Water Science Center will present historic analysis using both B17B and EMA methods.

1e. Construct figures and tables of frequency results and accompanying information

An internal document has been created to track the results and accompanying information for each gage when the flood frequency analyses are performed. This document will be used to develop presentation quality figures and tables upon completion of the analyses task. Intermim documents and analyses are being loaded to an ftp site for use by MDT and DNRC. These intermim analyses are not final and are subject to revisions.

2a. Identify gaging stations with less than 15 years of record or with longer periods of record but substantially influenced by unusual climatic conditions

This task is performed while performing the basic flood frequency analyses for each gage. Approximately 170 of the part 6 gages have been identified as having between 10 and 15 years of record. Record extension methods will be evaluated for each of these gages. Additional gages identified for record extension included those with records restricted to post-1985 and those which are on the same major stream corridor. For example, there are 14 streamgages along the main-stem of the Milk River. The records for many of these gages may be restricted to shorter periods (10-25) years. Record extension will be used where possible to extend the record for these gages to ensure that flood frequency analyses will align appropriately in downstream order. For those gages where record extension methods are employed, the flood frequency analysis using record extension will be provided in addition to the basic B17B analysis using the systematic and historic record.

2b. Conduct correlation analyses to determine appropriate index stations

No correlation analyses have been evaluated.

2c. Conduct Bulletin 17b 2-station analyses and MOVE.1 analyses for record extension

No 2-station analyses or MOVE.1 analyses have been performed.

3a. Identify long-term unregulated stations to serve as regional index stations for systematic tracking of stationarity of flood frequency data.

Several long-term unregulated stations, or index stations, have been identified for systematic tracking of stationarity. Additional stations may be included as index stations once the GIS database of dams is complete and can be used to evaluate regulation impacts.

4a. Investigate occurrence of high-outlier peak flows in northwestern Montana and define mixed-population region

High-outlier peaks have been identified for all of the part 6 gages in Montana. These gages are not restricted to the northwestern region of Montana as several gages have been identified in central and south-central Montana as having high-outlier peaks. While flood frequency analyses are just beginning in western Montana, many gages were previously identified in this region to have high-outlier peaks and previously analyzed using a mixed population analysis. Many of these gages will likely be identified for inclusion in the mixed-population region.

4b. Investigate relative probability of occurrence of independent ordinary peak flows and high-outlier peak flows.

Determination of independent ordinary peak flows and high-outlier peak flows has not begun. Flood frequency analyses for all gages will be completed before this task will begin.

5. Quarterly progress reports.

A progress report detailing work completed from project inception to December 2010 was completed and emailed to cooperators on January 24, 2011.