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EVALUATING THE IMPACT OF CLIMATE CHANGE ON THE NATIONAL FLOOD INSURANCE PROGRAM

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At the request of the Government Accountability Office (GAO), the Federal Emergency Management Agency (FEMA) has undertaken a study of the probable effects of climate change on the National Flood Insurance Program (NFIP). The goal of this work is to assess the potential impact of climate change on the financial strength of the program, and to recommend mitigation options to reduce the program's exposure to financial loss. The scope of work includes both riverine and coastal flooding throughout the US, with estimates to be made at intervals through the year 2100. No new climate work, as such, is being performed. Instead, authoritative information such as that of the US Climate Change Science Program (CCSP) and the Intergovernmental Panel on Climate Change (IPCC) has been adopted as the basis of the impact assessment. The study will be completed in Spring, 2010.

Flood levels depend upon storm characteristics and frequencies, and also on the flood basin characteristics. Both of these are altered over time and by climate change. Storms (rainfall, hurricanes) may become more or less frequent, and more or less severe at particular recurrence intervals. The runoff characteristics of riverine basins (watersheds) change with development (changes in population patterns) and with land cover which, in turn, evolves in response to changes in climate. Coastal basins change over time owing to relative sea level changes and long term erosion. All of these factors are regionally dependent, with areas changing in different and sometimes opposing ways. Consequently, the determinations are made separately for a number of US regions selected with both climatological and watershed characteristics in mind. Within regions, a number of representative flood systems (streams, waterways) are selected for analysis, with the results being generalized to estimate effects on similar systems throughout the region.

A probabilistic approach has been adopted in order to capture not only expected values, but also the important uncertainties around those expectations. The general approach is through Monte Carlo simulation of the changes in flood stage resulting from changes in the controlling parameters (storm frequency and intensity, land cover factors, sea level, and so forth). The influence of individual parameters is estimated using transfer functions that relate changes of the input to changes of the response. The transfer functions are based on past studies and on physical models. The characteristic changes of each parameter are described by probability distributions derived from the climate change literature. Random sampling of the parameter distributions gives, through the

intermediate transfer functions, random estimates of response (flood level) which define the probability distribution of flooding.

The altered base flood estimates are then interpreted for their NFIP implications through application of GIS tools and the national database of flood policies, structures, and demographics. This yields the baseline information on changes in expected losses that is needed for guidance in planning mitigating revisions of insurance factors. Additional catastrophic event estimates are being made in order to assess the magnitude and frequency of major departures from normal annual loss patterns.

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