BACKGROUND ON THE NATIONAL ACADEMY OF SCIENCE AND THE NATIONAL RESEARCH COUNCIL

Created by an act of Congress in 1863, the National Academy of Sciences (NAS) is a private, non-profit, national institution of distinguished scholars dedicated to promoting the effective utilization of scientific and technologic resources of the country and to advancing the general interests of science. The National Research Council (NRC), established in 1916 by NAS, undertakes studies on the various technologic and scientific questions presented for consideration by federal agencies and other nongovernmental institutions, or by mandates of Congress.

Committee members involved in NRC studies are selected expressly for their expertise in the relevant scientific issues at hand. In this case, the committee will include approximately 12 members and be constituted so as to include cutting-edge researchers and experts with extensive practical experience in the following areas: hydrology; civil, geotechnical, and structural engineering; risk perception and communication; national flood and disaster policy; floodplain management; mapping sciences; and insurance and actuarial statistics.

BACKGROUND ON THE PROJECT

The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program (NFIP), which is a cornerstone in the nation's strategy to assist communities to prepare for and recover from flood disasters. The NFIP was established by Congress with passage of the National Flood Insurance Act in 1968. The NFIP was passed in response to a growing realization that the nation's traditional approach of addressing flood hazards, i.e., construction of civil engineering works such as dams, levees, and floodwalls and seawalls, was not reducing flood losses or discouraging unwise development of floodplain and low-lying areas. The act was passed to help reduce future flood damages through community floodplain ordinances and, to provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for protection and thereby reduce federal expenditures for disaster assistance. The flood insurance is available only to owners of insurable property in communities that participate in the NFIP.

To date, nearly all of the nation's communities with significant flood hazards have joined the NFIP. Communities that adopt floodplain management programs that go beyond minimum NFIP participation requirements may qualify for flood insurance premium discounts. Discounts made available through this Community Rating System (CRS) provide an incentive for comprehensive flood preparedness, planning, and mitigation programs. A key feature of the NFIP is that communities and structures that are determined to be located within the 1% annual chance flood (100-year) floodplain (an area referred to in the NFIP as a Special Flood Hazard Area or SFHA) are subject to mandatory flood insurance purchase requirements.

Levees are earthen embankments constructed by humans intended to prevent discharges from water bodies from flooding adjacent lands. In the U.S., approximately 100,000 miles of levees have been built along rivers and the coasts, 14,000 miles of which have been constructed by or in conjunction with the U.S. Army Corps of Engineers. Under NFIP regulations, structures located in the SFHA of a participating community may be exempted from the mandatory purchase requirement when those structures are located behind a levee that has been recognized by FEMA as providing protection against the 1% annual chance flood event. FEMA is

responsible for setting criteria for levee accreditation (the certification by a federal agency or a professional engineer that the levee complies with FEMA criteria). Most levees provide some flood protection benefits. At the same time, no levee provides absolute protection against all floods. All of these levees are subject to structural failure and overtopping by flood flows and, thus, there are always risks to property, infrastructure, and inhabitants located behind levees. The risk that remains after considering the mitigating effects of structural (levees, floodwalls, etc.) and nonstructural measures (elevation, floodproofing, etc.) is known as residual risk.

This concept of residual risk behind levees confounds and complicates many public policy and investment decisions. For example, a levee may provide benefits in the form of flood damages prevented; but such benefits must be balanced against the potential costs of a levee overtopping or failure. If a levee is capable of passing a 100-year flood event, there is still a 25% probability that levee will be overtopped in the next 30 years. There is also some probability that the levee will not structurally maintain its integrity as the flood waters rise against it. How should these probabilities affect land use and development decisions behind the levee? Moreover, the statistical value of residual risk generally changes over time with changes in land use patterns, development, and hydrologic nonstationarity resulting from climate variability. Another large potential cost associated with protection is that new development behind a levee may greatly increase prospects of catastrophic losses of life and extensive property damages. An additional challenge to federal, state, and local officials is that the concept of residual risk behind levees is not well understood by residents living behind levees.

The uncertainties and changes regarding residual risk behind levees and the absence of high resolution topographic data and data on structure locations make it extremely difficult for FEMA to establish actuarially accurate flood insurance premiums. For example, changes in land use, occupancy, and property values behind levees, and changes and shifts in hydrologic statistics, make it difficult to produce accurate estimates of flood losses behind levees for residential and commercial structures. Accurate damage estimates are an important factor in setting sound flood insurance rates.

Today, the importance of flood insurance as a risk reduction measure is more evident than ever. It has also become clear that FEMA's mapping efforts for flood insurance purposes are insufficient in addressing national flood and levee-related challenges. Most experts agree that a comprehensive approach is required in dealing with risks associated with levees. Improving the risk assessment and mapping techniques for areas behind levees, improving regulations governing levees in NFIP, raising public awareness of the levee risk, and enhancing institutional relationships, all are seen as important to this approach and better management of areas affected by levees.

This NRC committee will examine current FEMA treatment of levees within the National Flood Insurance Program, and provide advice on how those levee-related policies and activities could be improved. The study will address the following topics regarding how levees are considered in the NFIP:

1) risk analysis;
2) flood insurance;
3) risk reduction; and
4) risk communication.