

FLOODPLAIN MANAGEMENT & LIABILITY REPORTER™

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FEATURE ARTICLE

‘SECTION 408’—CHANGING THE LANDSCAPE
OF FLOOD MANAGEMENT PLANNING, PART 1

By Eric E. Nagy and Chris Elliott

A key piece of federal flood management legislation from the 1800s laid in relative obscurity for more than a century. Today, more than 100 years after enactment, it has considerably changed the landscape and planning context for improving our nation’s flood management infrastructure as well as regulation of other activities in federal floodways. This legislation is § 408 of Title 33 of the U.S. Code (33 USC 408), originally enacted as part of the Rivers and Harbors Act of 1899. This article is the first in a two-part installment that will describe the drivers for § 408, the specifics of the statutory language and implementing guidance, and practical implications of § 408 demonstrated through case studies.

Local Interests Driving Increased Flood Protection

The length of time involved in the U.S. Army Corps of Engineers’ (Corps) traditional civil works process for planning, designing, and constructing projects has often been a frustration for local entities seeking to implement improvements to reduce flood risk. For some communities, the process for a traditional Corps civil works project has been initiated in response to a catastrophic flood event, repeated by other similar catastrophic events in the following years or decades before the project is ultimately implemented.

In light of these circumstances, more and more local and state governments and flood management entities have desired to take flood protection infrastructure improvements into their own hands, with the intent to construct projects more quickly than can be achieved through the traditional Corps civil works process. What historically has been a planning, design, and construction process led by the Corps has in many cases become a process where the non-

federal project proponent has taken a more active and aggressive role in leading the process or otherwise participating in a manner to maintain more control and have a stronger voice than in the traditional process.

In some cases, these non-federal project proponents seek to implement flood protection improvement projects where the Corps has not received the authority or appropriations to even consider the proposed project. This role-reversal has often placed the Corps in an awkward continuum of circumstances. At one extreme, the Corps is in a position of applying authorities, regulations, and policies that had been developed in an era when they participated in every project as the lead implementing agency to instead applying this guidance to projects where their involvement is limited. At the other extreme, the Corps may not have a project-specific authorization or appropriation, creating an uncertain nexus for participation.

‘Map Mod’ Has Led to Map Madness

The role-reversal of local interests driving flood protection improvements rather than the Corps has also largely been in response to the Federal Emergency Management Agency’s (FEMA) Map Modernization Program. As local governments face the prospect of having entire or substantial portions of their communities mapped into the floodplain as a result of new studies or insufficient available engineering data to support levee certification, they often decide to implement levee evaluation and improvement programs on their own with the intent to achieve protection from the base flood (one percent chance of occurring in any given year) as quickly as possible. Communities are often placed in competition with one another to fight for limited flood improvement funding and to

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achieve local commerce, development, and growth goals that are affected by flood mapping.

In some cases, these levee improvements to protect from the newly mapped base flood require modifications to federally authorized levees where the Corps maintains an interest in their function, operation, or maintenance. Achieving protection from the base flood may also involve the implementation of flood protection measures beyond those previously authorized by Congress. Under these circumstances, the Corps may be actively studying the nature or extent of federal interest in a flood risk reduction project, which the non-federal interest is actively seeking to implement. Hence, the relationship of Corps leadership and local leadership in the process can be complex and requires coordination and integration for which the statutory framework and traditional Corps process were not originally suited.

Section 408 Enters the Picture

One of the approaches the Corps has employed to address the role of the federal interest is to invoke a long-forgotten provision in the Rivers and Harbors Act of 1899 commonly referred to as “Section 408.” This provision requires the Secretary of the Army to review and approve any proposed alteration to a federally authorized flood protection project. The application of this provision has created a defined role for the Corps as a regulating agency in the implementation of flood protection projects for which until recently they had a limited or, more commonly, no role. In the eyes of some, it has also created a new regulatory hurdle for proposed activities involving federal flood protection facilities, even if the activity is not directly flood related.

The Language of Section 408 and Its Implementing Guidance

The common title, “Section 408,” is derived from its designation in U.S. Code, 33 USC 408. This authority was established through passage of the Rivers and Harbors Appropriation Act on March 3, 1899, in turn commonly referred to as the “Rivers and Harbors Act of 1899.” Perhaps the most well known provision contained in this act is found under § 10 (33 USC 403), which gives the Secretary of the Army authority to regulate work performed in, under, or over navigable waters of the United States. Review and approval by the Corps under § 10 is commonly ad-

ressed in combination with the consideration of permits submitted for approval under § 404 of the Clean Water Act (33 USC 1344), under which the Corps is delegated responsibility to regulate the placement of fill or dredged material into jurisdictional waters of the United States. Section 14 of the Rivers and Harbors Act of 1899 establishes the Secretary of the Army’s authority under § 408 and reads as follows:

That it shall not be lawful for any person or persons to take possession of or make use of for any purpose, or build upon, alter, deface, destroy, move, injure, obstruct by fastening vessels thereto or otherwise, or in any manner whatever impair the usefulness of any sea wall, bulkhead, jetty, dike, levee, wharf, pier, or other work built by the United States, or any piece of plant, floating or otherwise, used in the construction of such work under the control of the United States, in whole or in part, for the preservation and improvement of any of its navigable waters or to prevent floods, or as boundary marks, tide gauges, surveying stations, buoys, or other established marks, nor remove for ballast or other purposes any stone or other material composing such works: *Provided*, That the Secretary of War may, on the recommendation of the Chief of Engineers, grant permission for the temporary occupation or use of any of the aforementioned public works when in his judgment such occupation or use will not be injurious to the public interest: *Provided further*, That the Secretary may, on the recommendation of the Chief of Engineers, grant permission for the alteration or permanent occupation or use of any of the aforementioned public works when in the judgment of the Secretary such occupation or use will not be injurious to the public interest and will not impair the usefulness of such work.

In short, this section authorizes the Secretary of the Army to permit certain modifications or alterations to federally authorized flood protection projects whether they are federally or locally maintained. Under the terms of this provision, any proposed modification or alteration must not be injurious to the public interest and must not impair the usefulness of the federally authorized project. The authority to make such determinations has been delegated by the Secretary of the Army to the Chief of Engineers.

The Corps has published two primary guidance documents regarding application of this provision for the purposes of regulating projects affecting federal flood protection facilities, with the first coming out in 2006. The first memorandum is from CECW-PB, titled, “Policy and Procedural Guidance for the Approval of Modification and Alteration of Corps of Engineer Projects,” dated October 23, 2006. This memorandum provides guidance on which projects uniquely qualify for review under § 408 versus other existing and established Corps’ authorities and procedures. It also establishes a list of topics, which the applicant is required to address as part of their request for permission under § 408. This list of topics, frequently referred to as the “11 Questions,” includes the following: (1) a written request by the non-federal interest for approval of the project; (2) physical and functional description of the existing project; (3) detailed description of the proposed modification; (4) purpose and need for the modification; (5) description of any related on-going Corps studies or projects in the watershed; (6) a determination of public interest; (7) appropriate NEPA documentation; (8) the administrative record; (9) a discussion of indirect effects; (10) a discussion of executive order (EO) 11988 considerations; and, (11) technical analysis including changes in water surface elevation or flow distribution, anticipated impacts on local and system integrity, and residual risk.

The Corps later supplemented this first policy memorandum with a second memorandum from the CECW-PB, titled, “Clarification Guidance on the Policy and Procedure Guidance for the Approval of Modifications and Alterations of Corps of Engineers Projects,” dated November 17, 2008. This memorandum provides supplemental guidance regarding the contents of the application as well as the process through which it should be reviewed for approval. First, it required that the engineering studies supporting the application include a risk analysis. This risk analysis is limited to the hydrologic and hydraulic parameters; but, it shall be conducted in accordance with Engineering Regulation (ER) 1105-2-101 titled, “Planning—Risk Analysis for Flood Risk Reduction Studies.” Second, the memorandum outlines the review requirements associated with each § 408 application. Although every § 408 application is expected to go through an agency technical review (ATR) likely conducted by the Corps’ District Office receiving the application, some applications may be re-

quired to undergo a safety assurance review (SAR) as outlined in § 2035 of the Water Resources Development Act (WRDA) of 2007. Additional information regarding the requirements associated with each type of review can be found in Engineering Circular (EC) 1105-2-410, titled, “Water Resources Policies and Authorities, Review of Decision Documents.” Finally, the memorandum presents several means through which Corps’ staff may be funded to participate in the review and processing of § 408 applications.

Section 408’s Relationship to Section 208

Until the invocation of § 408 in 2006, the typical procedure for approving projects had been through § 208.10 of Title 33 in the Code of Federal Regulations (33 CFR 208.10), hereinafter referred to as “Section 208.” As stated in the 2006 memorandum, § 208

‘describes local sponsors’ responsibilities for operating and maintaining the structural soundness and functionality of the [federal flood protection] project in order to assure that the project meets its authorized purposes.

One section of this regulation states that:

...no improvement shall pass over, under, or through the walls, levees, or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer.

Many of these actions are likely “minor, low[-] impact modifications” considered as part of the District Engineer’s responsibilities related to overseeing the non-federal sponsor’s normal operation and maintenance responsibilities. The types of minor, low-impact modification which can be approved by the District Commander include the placement of stairs, sidewalks, bike paths, pipes, fences, and power poles. These actions are not likely to adversely affect the functionality of the project or restrict flood-fighting activities. Further, if the proposed changes are limited to restoring the authorized level of protection (as defined by the top of levee corresponding to the design water surface plus appropriate freeboard) or improving the structural integrity of the flood protection system and if these proposed activities do not include

changes to the authorized geometry or hydraulic capacity, they may be approved in accordance with § 208.

The 2006 memorandum continues that "any proposed modification...which would involve significant changes to the project's scope, purpose, or functionality cannot be approved by the District Engineer" under the authority of § 208. These cases must instead be forwarded to the Division Commander for review and endorsement to the Chief of Engineers for approval under § 408. The types of modifications, which fall under the jurisdiction of § 408 include levee degradation or raising, levee strengthening which involves increases in levee geometry, or levee realignments or setbacks. Modifications, which may fall under the jurisdiction of § 408 include retaining walls, fill against a levee including road embankments, bridges, riverside landscaping, and berms. In these cases, an engineering analysis must be conducted which considers the full range of loading conditions in order to determine if the proposed project has any impact on system performance. This review of system performance must include the verification that no adverse impacts have been identified within the watershed either upstream or downstream of the proposed project. An adverse impact is defined as an increase in risk to public safety.

The primary implication of the differing authorities granted under § 408 and § 208 as expressed in the guidance memoranda are that projects that formerly may have been approved through a fast and simple § 208 process are now subject to the more complex and slower § 408; and, because it's not realistic to expect the memoranda to be inclusive of all potentially regulated activities, the distinction is not always perfectly clear and certain.

Section 408 Is Also a Matter of Money

One other important distinction about § 408 relates to a desire by the non-federal sponsor to receive

federal credit for a flood protection improvement project. As discussed above, traditionally the Corps constructs projects. Under this model, the Corps requires payment of a "local share" by the non-federal sponsor. However, local agencies may often seek to construct projects in advance of the Corps. This is true where projects are not yet Congressionally authorized as well as where the Corps does not have funds to construct. In these circumstances, the local agency requests that the funds it expends on construction act as a "credit" toward the local share for future work that may be performed by the Corps.

One of the most familiar credit mechanisms (authorized by § 104 of the Water Resources Development Act of 1986) is known as § 104 credit. It provides that for projects not yet authorized, where the local agency seeks credit, the local agency shall request a credit pre-approval prior to start of work (this has since be interpreted as prior to "contract award"). The actual credit is then determined after construction and after authorization of the project.

This credit would then be secured for application against a future project under study for potential authorization by Congress. However, if the non-federal sponsor wants to retain eligibility to receive this federal credit, the proposed project must be approved under § 408 and may not be approved under § 208 to be eligible for credit. ER 1165-2-29, titled, "General Credit for Flood Control," provides additional information associated with the potential to secure federal credit for the implementation of a flood protection project in advance of Congressional authorization.

Conclusion

In part two of this two-part feature in the next issue, the practical implications of § 408 will be discussed and demonstrated through case studies and the authors will offer a framework through which future actions may be taken by local agencies.

Eric E. Nagy leads the Watershed Planning & Design Section for HDR Engineering, Inc. in Northern California. He has twelve years of experience in the planning, design, and construction of flood risk reduction projects. Prior to joining HDR, Mr. Nagy served as Program Manager, Project Manager, and Construction Manager for the U.S. Army Corps of Engineers.

Chris Elliott is a vice president and project director with the Sacramento, California office of the environmental consulting firm of ICF Jones & Stokes. Mr. Elliott has been consulting in flood management since 1994 for agencies including the U.S. Army Corps of Engineers, California Department of Water Resources, and numerous special districts. His expertise is in the planning and management of multi-objective corridors to integrate objectives for flood control, native ecosystems, recreation, and commerce.

FLOODPLAIN MANAGEMENT NEWS

**‘GREEN’ INFRASTRUCTURE GAINS FAVOR AMONG MUNICIPALITIES
FOR FLOOD CONTROL AND STORMWATER MANAGEMENT**

The use of “green” infrastructure to manage stormwater has become much more widespread in recent years, as municipalities seek to implement alternatives to traditional structural solutions, sometimes known as “gray” infrastructure. The reasons for this shift in emphasis often center on financial concerns as well as environmental considerations. As they seek to address problems pertaining to flood control and water quality, local governments increasingly are realizing that a more holistic approach to preventing flooding and water pollution can provide significant additional benefits, particularly in terms of improved safety and enhanced wildlife corridors, recreational opportunities, and aesthetic considerations. A recently completed storm water master plan (SWMP) for the City of Norman, Oklahoma, features certain green approaches to stormwater infrastructure that many municipalities would do well to consider.

Background

The term “green” infrastructure is frequently used to refer to various approaches that rely on natural features to reduce flooding, manage stormwater, and improve water quality. Such features may include parks and other open areas, wetlands, or smaller-scale stormwater controls created to capture and manage runoff close to its source, often by means of particular vegetation and a permeable soil profile. Throughout the country, population growth and greater urbanization have caused increased flooding, erosion, and various water quality problems in many watersheds, but particularly among urban streams. Before infrastructure solutions—green or gray—can be developed for a particular stream, detailed assessments typically must be conducted of the waterway and its watershed. By facilitating a better understanding of local conditions and the extent to which historical development patterns have affected area streams, such assessments have become an integral component of projects that aim to develop green infrastructure solutions.

**Assessing Streams and Implementing
Planning Corridors**

Detailed hydrologic and hydraulic models can be created for streams based on topographic data, aerial photos, field survey data and reconnaissance visits, delineations of drainage areas, and information related to land use, impervious cover, soils, and rainfall. Such models can be used to depict existing and future build-out flooding conditions, along with the improved flooding conditions that will result from proposed solutions to existing problems. Stream and watershed assessments require a combination of field reconnaissance, reviews of aerial and topographic data to detail stream channel and overbank flow conditions and erosion, as well as the compilation of information pertaining to such details as land use, impervious cover, floodplain locations, and soils. However, the level of detail required may vary depending on the particular stream or watershed and the problems to be addressed.

Stream planning corridors offer a viable and sustainable option by which municipalities can improve and protect water quality, while making progress toward other goals, including protecting against flooding, preserving riparian areas, facilitating maintenance access, and providing greenway planning opportunities. Generally, stream planning corridors are a defined area of undisturbed land along both sides of a stream or natural drainage feature. Because they afford ample opportunities for filtering runoff and facilitating infiltration, such corridors can play particularly useful roles in headwater areas. Typically, municipalities must consider the rights of property owner and make certain legal and political changes before they implement stream planning corridors. Therefore, it is recommended that such corridors be created in advance of development, whenever possible.

Selecting Green Solutions

Once stream and watershed assessments have been conducted, the task of selecting solutions for an area’s

water quality and flooding problems may begin. Local ordinances regarding development or redevelopment projects often play a key role in reducing impacts to local streams. In recent years, municipalities increasingly have begun to rely on nonstructural solutions, including establishing water quality zones and buffer areas adjacent to streams and using various low-impact development (LID) methods, to complement traditional structural approaches typically required of developers to control flooding and improve water quality.

Designed to manage stormwater as close to its source as possible, LID seeks to minimize disturbances to the natural landscape, reduce the use of impervious surfaces, increase drainage flow paths, as well as facilitate detention, retention, and infiltration. Common LID measures include rain gardens, green roofs, permeable pavement, and vegetated swales or filter strips. Additional nonstructural measures for maintaining water quality include street sweeping, limiting fertilizer use, and overseeing the installation and operation of septic systems.

When it comes to addressing existing problems in local waterways, a host of geomorphically based stabilization techniques have come into being recently for stabilizing streams. Such approaches include channel grade control, streambank armoring, slope flattening, bank toe protection, and natural channel design techniques to improve or protect stream channel integrity.

The Approach in Norman, Oklahoma

Urbanization in Norman, Oklahoma, has increased flooding and erosion while diminishing local water quality. To address these problems, the SWMP recently developed by the City of Norman identifies nearly 60 problem areas and proposes solutions estimated to cost nearly \$83 million. Among its goals in developing the SWMP, the city sought to protect stream planning corridors for water quality purposes, implement various best management practices, and enhance maintenance of stream areas and stormwater detention ponds.

The SWMP proposes that Norman dedicate stream planning corridors within drainage areas greater than 40 acres in watersheds that contribute to Lake Thunderbird, the city's main source of drinking water. Discussions are under way to establish how to implement these planning corridors into the city's regulatory framework for developing areas. In areas with existing problems, integrated solutions were devel-

oped to address stormwater issues as comprehensively as possible. For example, a conceptual solution for addressing stream flooding would be designed so as to protect the stream from future erosion. At the same time, bioengineering and natural channel design techniques were incorporated to further protect and enhance stream environments.

Another key element of the SWMP involves alleviating a severe shortage of drainage easements and rights-of-way within Norman. Without such legal agreements in place, the city faces considerable obstacles when it comes to maintaining stream areas and stormwater detention facilities, monitoring stream conditions, and constructing capital improvements. Therefore, the SWMP includes estimated costs for obtaining new drainage easements and/or rights-of-way necessary to ensure construction of project improvements.

The city is in the process of deciding how best to implement and pay for the plan's recommendations. Funding for the various elements detailed in the SWMP is expected to come from a proposed stormwater utility—if approved by city voters—as well as general obligation bonds issued by the city. Norman anticipates that the use of green infrastructure, where possible, will significantly reduce costs associated with construction and maintenance of stormwater infrastructure, as well as water supply protection and water treatment.

Conclusion and Implications

Green infrastructure can contribute greatly to municipal efforts to improve water quality, flood control, stormwater management, environmental protection, and recreational opportunities. However, extensive analysis and evaluation are needed to ensure that proper and sustainable solutions are considered and selected for particular tasks at hand. Certain green approaches, such as the adoption of stream planning corridors, require foresight, as they must be implemented before development occurs. Although preventing the degradation of waterways should be a top priority of local governments, numerous methods are also available for restoring and enhancing the natural integrity of stream channels using green approaches. To protect their investments in stormwater management, municipalities would do well to ensure that they possess adequate easements and rights-of-way needed to allow required construction and maintenance in streams or other drainage areas. (David Maurstad, Duke Altman)

‘LIVING’ DATABASE SIMPLIFIES METHOD FOR REVISING FLOOD CONTROL FACILITY DATA, COMPLYING WITH MASTER PLAN UPDATE REQUIREMENTS

Across the country, flood control districts and other entities charged with constructing, maintaining, and operating flood control and stormwater management facilities require a straight-forward process for tracking modifications. In some cases, flood control districts are required by law to review and update their flood control master plans on a regular basis. In areas that have experienced significant population growth and new development, the dynamic nature of these watersheds can complicate efforts to update master plans accurately. As a result, significant investments of time and resources may be required at the onset of a new master plan update to ensure that new conditions and recently completed construction projects are properly accounted for in the updated plan. Fortunately, a new approach has been developed that enables flood control agencies to maintain a “living” database offers a simpler, more cost-effective process for keeping critical information up to date.

Background

Flood control districts routinely use geographic information system (GIS) technologies to maintain GIS data, create custom maps, and provide data and information to local public entities and the general public. Flood control districts also may prepare desktop and web-based GIS applications for internal use by staff or external use by the public.

GIS data and related software are central to efforts by flood control districts to update master plans. For example, GIS data can be used to maintain accurate inventories of flood control facilities and compute input parameters for hydrologic and hydraulic (H&H) models. However, these facilities and the overall watershed context in which they are located are subject to frequent change. For this reason, careful monitoring is needed to ensure that changes are noted and addressed, if necessary. Master plan updates are a common approach for handling this task.

Upon completion, a well-crafted master plan update accurately and reliably represents the flood control facilities within an area. However, the accuracy of such plans tends to decrease over time, as conditions within a watershed change as a result of growth

and development. If several years elapse before the plan is updated, significant time and resources may be needed to understand and document the revised conditions. For example, new information such as planning studies, construction plans, and drainage reports that have been completed since the previous update must be collected and reviewed so that relevant data can be extracted and incorporated into the master plan if necessary.

Continuously Updating Master Plans

GIS-based plans enable managers and staff to share data, rapidly identify problem areas and priorities, and evaluate effects of future development on a case-by-case basis. For these reasons, a system for continuously updating master plans offers significant, tangible benefits to flood control districts. In addition to decreasing overall resource demands, such a system helps to streamline master planning efforts.

To facilitate continuous master plan updates, the underlying GIS data used by a flood control district must be functional, organized, and easy to maintain. Furthermore, the GIS information or database should be capable of generating input for H&H modeling and organizing the output of the models into a useful product for interpretation, reporting, and decision making. The overall intent is that the GIS data become a foundational database, capable of assimilating new data and managing available information in a relatively systematic and efficient way. With efficient database design and organization, the data becomes flexible, extensible, and able to be adapted to meet existing and future user requirements.

One approach that meets these requirements involves the use of “Arc Hydro,” the GIS extension for water resources applications offered by the company, ESRI. A data model for use with ESRI’s Arc GIS software, an Arc Hydro geodatabase can serve as a foundation for the purpose of creating a system for continuously updating master plans.

The geodatabase used in the Arc Hydro context is a relational database, meaning that features in one table can be linked by a standard reference, or look-up, to one or more features in another table. Using the

national standard Arc Hydro data model as a starting point, the geodatabase can be employed to represent regional flood control facilities. Arc Hydro is a GIS data structure that links H&H data to water resources modeling and decision-making methods. This data model establishes a consistent and standard schema that can be used as a starting point to solve water resources problems. If necessary, various modifications can be made to the standard Arc Hydro design to reflect local conditions, such as an urban flood control system that relies heavily on man-made stormwater systems as opposed to a natural river system.

Making the Database User-Friendly

The intent of the Arc Hydro geodatabase is to improve the process of updating master plans by centralizing the database associated with a regional flood control system. This approach ensures the quality of the database, facilitates better sharing of the database among various users, and provides a means to catalog and archive historical versions in the data. By mapping out the complete process of master planning and using this database as a foundation, users can design a set of complementary tools and/or web applications to perform database maintenance, regional stormwater modeling, and other tasks useful to flood control districts. Tools can be designed in a user-friendly fashion to maximize accessibility and functionality, thereby encouraging collaboration among GIS personnel, engineers, and managers.

Within the geodatabase, connections (or relationships) among different feature classes are established using attribute fields in the attribute tables. Once the connections are established, the various feature classes become part of a continuous network that can trace the flow of water through the system.

Of course, a key function of this type of database and associated tools is to enable users to edit, update, and maintain the information it contains. However, if mistakes occur while the database is being updated or

revised, the overall quality of the database is degraded. Quality control, therefore, is critical. To ensure that updates are made properly, the geodatabase can be constructed so as to include a variety of quality control tools to verify attribute field values and ensure data integrity and consistency as edits and changes occur over time.

Another key feature of the database is the project history tool. This project history tool enables users to view all of the individual databases that have been modified over time, facilitating the tracking, comparison, and management of changes that have been made to the geodatabase. The tool also enables users to compare and view changes in H&H parameters (such as curve numbers) that have occurred over time.

Conclusion and Implications

Flood control districts must conduct myriad duties, typically on a limited budget. Among others, these duties may include solving flooding problems, creating comprehensive master plans, regulating land use in and around flood hazard areas, and coordinating the design, construction, maintenance, and funding of flood control facilities. Clearly, these duties are of the utmost importance since their underlying purpose is to improve the protection of life and property from the devastating impacts of flooding. Therefore, any approach that helps districts efficiently improve performance, comply with requirements, and conserve scarce resources is worth evaluating. Using a “living” database to track changes to flood control facilities on a continuous basis can greatly simplify the process of updating master plans, saving time and money. Flood control districts also benefit by having up-to-date information regarding their facilities and the dynamic watershed conditions in which they operate. (David Maurstad, Harshal B. Desai, Brian Rowley, and Stephen Bourne)

NAPA RIVER FLOOD CONTROL PROJECT IN NORTHERN CALIFORNIA BENEFITS FROM FEDERAL STIMULUS FUNDING

Earlier in 2009, the local sponsor for the Napa River Flood Protection Project experienced a watershed moment. It learned that its project was selected to receive nearly \$100 million in federal funding through the American Recovery and Reinvestment Act (ARRA) of 2009. This legislation, signed into law by President Obama on February 17th, appropriated approximately \$4.6 billion for the U.S. Army Corps of Engineers' (Corps) Civil Works Program. Its share of these appropriations was directed toward the City of Napa to accelerate the implementation of flood protection improvements intended to provide the city with protection against the 100-year flood event. The \$400 million flood protection project is expected to take a giant step toward completion by using these appropriations to fully-fund the award of several critical construction contracts, while also initiating the designs for a number of additional project elements necessary to complete the overall project.

Background: ARRA

On April 28th, the Corps released the list of Civil Works Projects funded by ARRA. This list included approximately \$2.0 billion in appropriations for 178 projects funded through the Corps' Construction, General (CG) account. The projects selected by the Corps represent a set of investments that will contribute to both economic development and ecosystem restoration. Consistent with U.S. Congressional guidance, the Corps' allocation of ARRA funds maximizes national benefits based on the economic and environmental return of its ongoing projects. The projects also meet the five criteria enumerated in the Congressional report accompanying ARRA. These criteria require that the project investments are: (1) obligated and executed quickly; (2) result in high and immediate employment; (3) have little schedule risk; (4) are executed by contract or direct hire of temporary labor; and, (5) complete a project, phase, element, or will provide a useful service that does not require additional funding.

Primarily intended to stimulate the nation's recovery from a period of economic hardship, ARRA funds invested through the Corps also accomplish work on water resource projects which will benefit the nation

for decades to come. The Corps has estimated that ARRA appropriations expended by the agency will result in the creation or maintenance of approximately 57,400 construction industry jobs and an additional 64,000 indirect jobs associated with the supply and support of the construction industry. Further, investments in flood protection provide the necessary assurances within certain communities sufficient to support economic growth and development. In the case of the City of Napa, the project will reduce flood damages for many businesses and residences downtown which is already a vibrant tourist area drawing visitors from across the nation. Julie Lucido, Flood Project Manager for the Napa County Flood Control and Water Conservation District, notes that businesses are "...now willing to invest in areas of downtown Napa that had previously been vacant due to repeat flooding."

Background: Napa River Flood Protection

The Napa River Flood Protection Project (project) is located in the City and County of Napa, California. The Napa River watershed is just north of San Pablo Bay, a component of the San Francisco Bay System, and approximately 40 miles northeast of San Francisco, California. The population in the City of Napa is approximately 77,000; and, excluding public facilities, the present value of damageable property within the project floodplain is well over \$500 million. The Napa River watershed comprises 426 square miles ranging from tidal marshes to mountainous terrain and is subject to severe winter storms and frequent flooding. In the lower reaches of the river, flood conditions are aggravated by high tides from the San Francisco Bay.

Almost all of the land adjacent to the Napa River through the City of Napa is subject to flooding. The February 1986 flood resulted in three deaths, 27 injuries, 5,000 evacuations, 250 destroyed homes, and another 2,500 residences damaged within the County. Approximately \$100 million in damages (1986 dollars) were attributed to this flood event. The most recent flooding occurred in December 2005. Damages associated with this event totaled \$70 million within the project area.

Although originally authorized by the Flood Control Act of 1965 (Public Law 89-298), construction of the most recent, multi-objective version of the flood protection plan was initiated in 2000. This version is unique and environmentally sensitive in that not only is the project designed to provide flood protection; it also enhances the natural environment by reconnecting the Napa River to its historical floodplain while creating new flood and marsh plain habitat. A few specific elements of the restoration and enhancement of regionally scarce habitats includes improvement to or the creation of approximately: (1) 200 acres of tidal wetlands and associated uplands; (2) 400 acres of seasonal wetlands and associated uplands; (3) over 70 acres of riparian woodlands and willow groves; and, (4) rearing habitat and migration corridor for Steelhead. This habitat will be created through use of a wide-range of environmental flood control features including: the construction of setback levees, river widening through the creation of floodplain terraces contiguous with the river, creation of a large wetland that functions to attenuate flood flows; and, the use of biotechnical bank stabilization.

This latest multi-objective version of the project did not come easily. However, its development through an intense and extensive stakeholder involvement process has resulted in the project enjoying broad support. This concept is echoed by Bert Brown, Project Manager for the Corps' Sacramento District:

This project was designed by a community coalition. The coalition is made up of residents, businesses, community groups, who with the support of outside consultants, resource agencies, City and county staff, and the Corps, developed major concepts for the project to meet the dual objectives of flood protection and environmental quality. The Community Coalition process has been one of unprecedented cooperation between large numbers of individuals and interest groups...

ARRA Funding Impact

The ARRA appropriations received for the project have been allocated to both design and construction activities. The most significant construction components identified for funding through ARRA are the

Bypass Rail Bridge Relocation and the flood protection improvements along Napa Creek. The railroad relocation project includes the construction of two new bridges which must be completed prior to a separate contract that will create a flood bypass channel and new floodwalls. Napa Creek is a smaller tributary that runs through a residential and downtown business district which floods much more frequently than the river itself. The construction of both of these projects will be fully funded through ARRA appropriations. According to Mr. Brown, the Corps obligated over \$54 million dollars in Fiscal Year (FY) 2009 and is on track to obligate the remainder of the funds in FY 2010.

When asked why the project was so successful in securing supplemental appropriations through ARRA, Ms. Lucido's answer is simple:

The Napa Project had the two large construction projects that were ready. The railroad relocation was already in construction but was not fully funded and Napa Creek was nearing the design completion.

Their success also likely has a lot to do with the fact that this new vision for a living river has sustained the enthusiasm of and support for the project by the community at large, the City and County of Napa, the Napa County Flood Control District, the Corps, and Congress.

Prior to the receipt of ARRA funds, the project was suffering from funding levels below the stated capability and was falling behind schedule as a result. Although it's difficult to project how much sooner the project may be completed due to the receipt of these funds, both the Corps and Napa County Flood Control District expect the project to be completed before the previously scheduled date of 2016. The uncertainty is largely due to the unknown outlook for additional federal appropriations in future fiscal years.

Conclusion and Implications

Although public support for the financial investments made by President Obama and Congress through ARRA varies, the Napa River Flood Protection Project appears to be a shining example of how this investment strategy can be successful on a number of levels. Beyond creating and maintaining construction industry jobs through the award

of infrastructure contracts, the infrastructure being constructed is greatly reducing the risk of flooding to a community positioned to respond by continued economic development. Additional information on the Napa River Flood Protection Project can be found on

the Napa River Flood Control and Water Conservation District website at <http://www.napaflooddistrict.org>, or, the US Army Corps of Engineers website at <http://www.spk.usace.army.mil/projects/civil/Napa/Index.html>.
(Eric E. Nagy)

LEGISLATIVE DEVELOPMENTS

**LEGISLATIVE OUTLOOK FOR THE SECOND SESSION
OF THE 111TH CONGRESS**

The U.S. Congress has returned to Washington to kick off the second session of the 111th Congress. Soon work will begin on a host of important legislation for the broader water infrastructure community including: the fiscal year 2011 (FY11) Energy & Water Appropriations bill, reauthorization of the National Flood Insurance Program (NFIP), the Water Resources Development Act (WRDA), and possibly a second stimulus type package. Political factors; however such as the unfinished work on health reform legislation, the retirements of two prominent Senate chairmen, and an election year will no doubt complicate the federal water agenda.

**Senators Dorgan and Dodd
Announce Retirements**

Just after the start of the New Year both Senators Byron Dorgan (D-ND) and Chris Dodd (D-CT) announced that they would not be seeking reelection. These announcements came within one day of each other leaving many to speculate over the delicate balance of the Democratic majority in the Senate. In the upper body a vote count of 60 is the magic number needed for a super majority. (After the writing of this article but before press time, the election of a Republican in Massachusetts resulted in a 59-41 split in the Senate.) On Christmas Eve, Senate Majority Leader Harry Reid (D-NV) narrowly squeaked out the votes needed to pass the Senate Health Reform Bill. Now just a month after the intense passage of his chamber's health bill Reid will face a new sessions of congress with the retirements of two long-time colleagues. In terms of water resource development interests, these retirements will open up the gavels that control funding for the U.S. Army Corps of Engineers (Corps) and NFIP.

Senator Dorgan has been serving the people of North Dakota since 1980. His surprise retirement creates an unexpected opening for the chairmanship of the Senate Energy & Water Appropriations Subcommittee. As chairman, Dorgan has held tremen-

dous influence over how billions of dollars in water infrastructure funding is allocated each year. He has been an ardent support of increasing funds for water projects as well as a vocal champion for reducing the Corps long backlog of projects. Seeing as the FY11 appropriations cycle will be his last Dorgan will likely push ever hard for a much need boost in funding for the Corps.

While Dorgan works to craft the FY11 Bill, his fellow appropriators will be jockeying for his plumb post. Washington State's Senator Patty Murray has emerged as a potential successor. As the current chair of the Transportation, Housing & Urban Development Appropriations Subcommittee, Murray has a solid grip on how to effectively direct funding back to her constituents. She also has a keen interest in supporting her state's water resources through funding hydro-power initiatives. Another possible contender for the top post is subcommittee Mary Landrieu (D-LA). Post-Katrina, Landrieu, Louisiana's senior senator has been on a mission to fund flood damage reduction projects for flood ravaged New Orleans. Should she rise to the subcommittee's helm, the Pelican State would also stand to benefit from her control of energy development funds. California's Senator Dianne Feinstein, a high ranking member on the Senate Appropriations Committee, could be a contender.

The retirement of Connecticut's Senator Chris Dodd opens up the Chair of the Senate Banking Committee. Among other things, this committee has jurisdiction over NFIP. Even before his announcement (which was not all that unexpected) Dodd's focus as chairman had been squarely targeted on addressing the banking crisis. For the remainder of his time in the Senate, Dodd is likely to concentrate on a massive effort to reform the nation's financial regulatory systems. Early speculation over a successor to Dodd has centered on the committee's second in command, Senator Tim Johnson of South Dakota. Up and comer Senator Jack Reed of Rhode Island has also been mentioned as a candidate.

Regardless of continued speculation in Washington circles, successors to Dorgan and Dodd will not be determined until the end of the year.

2010 Election Outlook

In addition to the retirements of Dorgan and Dodd, a tough election cycle could also impact leadership for the Corps authorizing process. Senate Environment & Public Works Committee (EPW) Chairman, Senator Barbara Boxer of California, is facing opposition from prominent republican challengers. Boxer is a battle-tested campaigner and excellent fundraiser; however the 2010 election cycle has drawn three well known contenders: Former HP CEO Carly Fiorina, California state assemblyman Chuck DeVore, and former Bay Area Congressman Tom Campbell.

Congress, alas, is no stranger to retirements of elections. Against this political backdrop members will still forge ahead on efforts to support the nation's water infrastructure needs.

Fiscal Year 2011 Energy & Water Appropriations

With the impending release of President Obama's budget for FY11, the House & Senate Energy & Water Appropriations Subcommittees are readying plans for their annual budget hearings. For the Corps, President Obama's budget provides a detailed list of projects slated to receive funding for studies, construction, and operations & maintenance. Given the presidential election of 2008, the Obama administration's first budget for FY10 was delayed from February to May. This created some procedural challenges for appropriators; however this grace period is generally accepted for a president's first year in office. As of press time, there have been reports that the administration may miss the expected February 1st release of the FY11 budget and that the budget may include a roughly five percent budget cut for the Corps. Already appropriators work under short timelines with limited resources so neither of these potential outcomes are welcome news.

With voters going back to the polls again this November appropriators will want a running start out of the gate. This is because the appropriations process no longer operates precision clockwork of the past. Today the process suffers from the whims of poll

numbers. It has become too easy for Congressional leadership to punt some, if not all, of the annual appropriations bills until after an election.

Despite these political obstacles the FY11 Energy & Water bill could benefit from a couple of factors:

- 1). The FY10 Energy & Water bill was one of the few appropriations bills to successfully make its way through full House & Senate consideration. Unlike the budgets for transportation, law enforcement, and education, funding for the Corps was signed into law by the end of October. This shows that the Energy & Water bill has the ability to muscle its way through political uncertainty; and
- 2). As mentioned earlier the chair of the Senate subcommittee is retiring. Senate leadership will have an incentive to let Dorgan finish out his last year with a completed bill.

The National Flood Insurance Program

The NFIP is currently operating under an extension, which is set to expire at the end of February. This three month extension was attached to the FY10 Department of Defense Appropriations bill, one of the last bills to be passed by Congress in the first session of the 111th Congress. The short-term nature of this extension is purposeful as to keep the pressure on Congress to take up a full-fledged and much needed reauthorization of this legislation. Some would argue that the reauthorization of the NFIP is long overdue. There is an interest from both Republicans and Democrats alike to undertake this process, but there is no set timeline for when this might occur. As both committees of jurisdiction, Senate Banking and House Financial Services, stay focused on financial reform and Wall Street bonuses, the NFIP may be in a holding pattern.

The Water Resources Development Act

In the fall of 2009, the House Transportation and Infrastructure Committee (T&I) commenced its consideration of WRDA. Last authorized in 2007, T&I set forth with the intent of producing a bill in 2010. To accomplish this goal they solicited project requests from all 435 members of the House and followed up with a hearing in November. This hearing allowed non T&I members the opportunity to formally pres-

ent their projects to Chairman Oberstar (D-MN). Given T&I's tremendous track record under the leadership of Oberstar it is likely a bill could make it through the committee process early this year.

Across the capitol the Senate EPW committee has not taken any such steps. The committee has been focused on climate change legislation as well as the reauthorization of the surface transportation bill, SAFETEA-LU. Chairman Boxer is a big proponent of WRDA and her state of California would stand to benefit from a bill. Despite Boxer's endorsement the chances of seeing a WRDA in the Senate this year are slim.

A Second Stimulus Bill?

As one of his first official acts, President Obama ushered in the American Recovery & Reinvestment Act (ARRA). Crafted as a means to stimulate the economy and create jobs, the bill provided funding for a variety of federal agencies including the Corps. \$4.6 billion dollars was provided for shovel-ready Corps projects. Just one year later Congress has their sights set on a possible second stimulus bill.

Last December the House Passed the "Jobs for

Main Street Act." For the Corps, the bill called for \$715 million for construction projects. The Senate has yet to draft its version of Stimulus II; however Democratic Senate leadership has indicated an interest in crafting its own bill. The long, slow road to economic recovery should increase the odds that Congress may in fact enact some type of stimulus bill this year. As stimulus funds are heavily scrutinized by the media and minority party, democrats will be careful to include funds for only those agencies and projects that have performed well under ARRA. The Corps fall into this category, which should have ensured that a second stimulus bill will provide them with additional funding.

Conclusion and Implications

It is always difficult to predict what Congress will accomplish in any given year. The recent retirements of Senators Dorgan and Dodd coupled with the tough reelection of Senator Boxer will handicap the success of water legislation. The FY11 Energy & Water Appropriations bill, NFIP, WRDA and a second stimulus bill are all things Congress can accomplish if politics do not intervene. (Julie Minerva)

CLIMATE CHANGE SCIENCE

RECENT SCIENTIFIC STUDIES OF CLIMATE CHANGE

Moderate Warming Could Melt Ice Sheets and Devastate Low-Lying Areas

A new study published in *Nature* found that moderate global warming could result in a significant melting of Earth's polar ice sheets, causing a large and relatively swift rise in global sea levels. A team of scientists from Harvard and Princeton compiled a substantial database of geological sea level indicators from the last interglacial period about 125,000 years ago, when polar temperatures were approximately three to five degrees Celsius warmer than present temperatures. High sea levels from this period suggest that in the future, large portions of major ice sheets could melt in just centuries of warmer temperatures, dramatically raising future sea levels.

The study found that just two degrees of warming could cause 20 to 30 feet of long-term sea level rise. This would devastate areas in which millions of people live, permanently submerging areas along the United States' Gulf and east coasts and eliminating much of Bangladesh and the Netherlands. Using a model which incorporated data, physics, and statistical analysis of the probability of distribution of past sea level changes, the team found there is a 95 percent probability that global sea level peaked more than 22 feet above present level during the last interglacial period. Research suggests that sea levels rose for several centuries, at a rate at least two or three times higher than the recent rate; however, this does not provide much insight into how long the Earth must be exposed to peak temperatures in order to commit the planet to these higher sea levels.

The team concluded that unless global emissions of greenhouse gases are curbed, global warming could result in committing the Earth to further warming that would trigger this disastrous scenario.

See, Kopp *et al.*, "Probabilistic Assessment of Sea Level During the Last Interglacial Stage," *Nature*, 2009; 462 (7275): 863; DOI: 10.1038/nature08686.

Measuring Ocean Carbon Dioxide Uptake Could Provide Early Warning of Climate Change

An important study published in the December 4, 2009 issue of *Science* reports on newly developed methods for measuring the absorption of carbon dioxide by oceans. The study was led by Professor Andrew Watson of the University of East Anglia, and it relied upon a network of commercial ships carrying chemical sensors in their engine rooms as the ships crossed the North Atlantic. Based on the data collected from the sensors, the researchers were able to construct the first ever map of carbon dioxide uptake for the North Atlantic.

The research shows that carbon dioxide absorption in the North Atlantic varies over periods of years and reacts to changes in regional climatic conditions. The research should contribute significantly to the scientific understanding of carbon sinks in the ocean. It also could lead to better predictions of potential climate change and perhaps even to an early warning system for detecting changes in oceans sinks that may suggest changes in climate conditions.

See, Andrew Watson, et al. "Tracking the Variable North Atlantic Sink for Atmospheric CO₂." *Science*, December 4, 2009, Vol. 326. no. 5958, pp. 1391 - 1393

DOI: 10.1126/science.1177394.

Climate Change Affecting Timing of Winter Growth Cycles

Climate change is affecting the growth of winter annuals in the deserts of the southwest United States according to a new study published in the journal *Global Change Biology*. The team of researchers, led by the University of Arizona's Sarah Kimball, D. Lawrence Venable, and Travis Huxman, and Amy Anger of Colorado State University, analyzed decades worth of data to conclude winter annual species that germinate and grow better at low temperatures are

becoming more common. Venable has led a team of ecologists in an extensive long-term study of desert winter annuals since 1982, and this new research provides insight into how organisms respond and adapt to climate change.

As global warming has shifted annual winter storm tracks, the Sonoran Desert's winter rains arrive later, in November or early December, rather than the warmer October. This has resulted in winter seeds

germinating in much colder temperatures. Cold-weather adapted plants such as popcorn flower, red filaree and storksbill are becoming increasingly common as less adapted species are decreasing in number.

See, Sarah Kimball, Amy L. Angert, Travis E. Huxman and D. Lawrence Venable, "Contemporary Climate Change in the Sonoran Desert Favors Cold-Adapted Species," *Global Change Biology*, 2009; DOI:10.1111/j.1365-2486.2009.02106.x. (Peter Morrisette)

REGULATORY DEVELOPMENTS

**FEMA'S FLOOD MAP REVISIONS LEAD TO CONFUSION
AND CONFLICT IN SOUTHERN CALIFORNIA**

After receiving numerous protests to its plan to add areas of southern California to high-risk flood zones, the Federal Emergency Management Agency (FEMA) has now agreed to delay or reverse the mapping of such areas into flood zones and has informed hundreds of Los Angeles residents that they will not need to buy flood insurance for their homes. More than 2,000 south Los Angeles homes are still considered to be in high-risk zones, and more may be added as the federal agency continues the process of revising its flood maps.

**Flood-hazard Mapping and Insurance
Requirements**

The Federal Emergency Management Agency is responsible for drawing and maintaining flood hazard maps for sites across the nation. The maps identify properties that would be susceptible to flooding in a 100-year-storm—a storm which has one percent chance of occurring in any given year. Due to the scope of the task, FEMA does not update every flood map every year, but prioritizes revisions according to anticipated risk. As such, flood maps can be decades old by the time they are revised and the revision process can result in considerable changes to the boundaries of high-risk flood zones. Inclusion in high-risk flood maps is of particular significance to homeowners because flood insurance is mandatory for any homeowner with a federally-backed mortgage in a high-risk flood zone. Private lenders may also require flood insurance for high-risk properties.

FEMA's Map Modernization Program

In 2003 FEMA received funding to begin a nation-wide effort to update and modernize its flood hazard maps. The process involves changes that are intended to result in better-targeted and more accurate flood data, which will aid federal, state, and local agencies in floodplain management. One goal of the program is to digitalize the flood maps: when the modernization process is complete, FEMA anticipates

that digital flood maps will cover 92 percent of the nation's population and 65 percent of the land area of the continental United States.

The map revision and modernization process is meant to be collaborative. State, regional, and local stakeholders may work with FEMA to help improve and maintain the quality of the maps, and to aid in tasks such as collecting and updating flood data. Cities and counties are encouraged to inform homeowners about proposed revisions and provide them with an opportunity to comment. Local flood-control officials are given an opportunity to point out errors in the maps, and any private or public party with scientific or technical data regarding a flood map may submit that information to FEMA at any time to support a request that FEMA revise the map.

The Current Disputes

FEMA's revision and modernization process has recently arrived in southern California. The revisions have affected tens of thousands of properties in more than 150 communities so far. In many cases the result has been controversy and outcry from homeowners whose properties are added to high-risk zones.

For example, in Oxnard, California, FEMA proposed adding 1,800 homes to the flood zone. A group of residents protested, arguing that FEMA had rushed the new maps and relied on faulty data. In late 2009, FEMA responded by announcing that it would delay adopting the new flood zones in Oxnard for three years in order to allow time for more studies.

In south Los Angeles, the decertification of a railroad berm that had previously been identified as a flood-control structure resulted in thousands of homes being added to a high-risk zone. Residents began complaining to local officials after receiving notification that they were required to buy flood insurance. Many long-term residents questioned why they were forced to buy flood insurance after living in their homes for decades without ever seeing anything more than minor street flooding. City officials eventually-

asked the U.S. Army Corps of Engineers for a grant to conduct its own study of the flood risks. In response to the protests, FEMA reviewed the topographic data and decided to remove 876 properties from the high-risk zone.

Conclusion and Implications

More than 2,300 other homes in south Los Angeles and countless others across California and the nation are still considered to be in high-risk zones. It is possible, if not likely, that more homes will be added to high-risk zones as FEMA continues to revise and modernize its flood maps. An additional compli-

cating factor is the fact that the U.S. Army Corps of Engineers has recently announced that it will begin enforcing standards regarding vegetation and trees on levees in 2012. Failure to comply with the standards could make the levees deficient in the eyes of the U.S. Army Corps of Engineers, which may in turn make them deficient in the eyes of FEMA. Recent events in southern California, however, show that FEMA is willing to revisit its map updates if enough residents protest the revisions. As flood insurance can cost up to \$1700 dollars per year, homeowners and local officials alike are well advised to follow the federal process of improving flood control measures so they will know if and when they may be affected. (Andrea Clark, Amanda MacGregor Pearson)

U.S. DEPARTMENT OF AGRICULTURE REPORT DOCUMENTS CLIMATE CHANGE IMPACTS ON U.S. LANDS AND ECOSYSTEMS

At the Copenhagen climate change talks in December of 2009, the U.S. Department of Agriculture (USDA) released a report entitled "The Effects of Climate Change on U.S. Ecosystems." The report finds that documented impacts to U.S. ecosystems have occurred and that, based on strong scientific consensus, such changes are the result of human activity. According to the report, not only have climate related changes already occurred throughout U.S. ecosystems, but, even with reductions in new emissions, ecological changes are very likely to continue and even accelerate because of the current level of greenhouse gases in the atmosphere. These changes are likely to affect the functioning of U.S. ecosystems, and can ultimately have an effect on human health. The report further finds that current systems for the study of climate change are inadequate and recommends development of new systems that are capable of documenting and forecasting further climate related changes to U.S. ecosystems in order to better inform ecological management strategies and policies.

Background

The USDA commissioned a full climate change study, published in 2008, known as the Synthesis and Assessment Product 4.3: "The Effects of Climate

Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the U.S." (SAP 4.3). The study was led and coordinated by the National Center for Atmospheric Research as part of the U.S. Global Change Research Program. The purpose of the full SAP 4.3 study was to support informed discussions and policy decisions regarding climate change by integrating existing scientific climate change knowledge for use by policy makers and stakeholders. The study was specifically commissioned to examine how climate change has affected U.S. resources in the recent past, and to determine whether noted trends are expected to continue. In conducting the SAP 4.3, ecological experts surveyed over 1,000 separate publications to assess the impacts of climate change on U.S. land, water, biodiversity, and agricultural resources. At the December Copenhagen climate change talks, the USDA released the report, which is a concise version of the SAP 4.3 that includes some additional recent information not previously released.

USDA Findings Regarding Impacts of Climate Change on U.S. Ecosystems

The report lists many likely or very likely results of human-caused climate change. The authors attempt to list both the likely results and the expected cause,

if known, of climate change throughout U.S. ecosystems. The report examines the effects of climate change in the following areas: agriculture, land resources, water resources and biodiversity.

Agriculture

According to the report, scientific consensus points to human-caused climate change as a direct cause of changes to U.S. pastures, rangelands, plant life, and livestock. Variable temperatures, changes in precipitation patterns, and increased concentrations of carbon dioxide may result in changes to growth patterns, migrations, and alterations in plant chemical compositions. Grain and oilseed crops are projected to experience failure over time and some plants will become more sensitive to disease. Conversely, some perennial crops will enjoy longer growth seasons, which may however create a risk of frost damage as these plants will begin to grow earlier in the spring, and crops such as soybeans, cotton, tomatoes, and beans are projected to grow larger and consume water more efficiently.

Lands

In examining the effects of climate change on U.S. lands, the report focuses on changes to forests and arid lands. Climate change produces complex effects in forests, as some changes are beneficial while others are detrimental. According to the report, climate change will increase the size and number of fires and insect infestations in the short term due to increasing temperatures. Yet, increases in carbon dioxide levels and temperatures are anticipated to increase photosynthesis, resulting in enhanced wood production in young, nutrient rich forests and increased forest growth when water is adequate.

Arid lands are a sensitive habitat and are expected to be heavily impacted by the effects of climate change. These effects include intense area thunderstorms, higher temperatures, and susceptibility to wildfire and drought. Arid flora, which survive at their physiological limits, will very likely decrease in numbers and leave the land susceptible to wind and erosion.

Water Resources

The report finds that the observation systems in place make it difficult to detect climate effects on wa-

ter resources. However, the report finds that drought severity and duration increased in the southwestern and western portions of the U.S., although most of the country experienced increases in precipitation and decreases in drought severity. Likely due in part to long term global warming trends, reduced snowpack and early spring water runoff in the western U.S. has been occurring and will likely continue. These trends indicate that runoff increased in the eastern U.S. with the effect of decreasing runoff in the western U.S. This may change river water levels and affect water supplies, although climate change will not likely effect water quality. Additionally, warming trends may result in increased stream water temperatures that could change stream ecosystems.

Biodiversity

Climate change did not have a large impact on biodiversity (the variation of life among ecosystems) in the recent past, but the report indicates that it will likely increase in importance in the near future. Climate change may affect the variation of life in U.S. ecosystems through changes in species' growing seasons, production, distributions, and diversity. For example, as a result of global warming, spring onset is 10-14 days earlier in temperate regions and may result in lengthier growing seasons. The effects of such changes are difficult to ascertain, but may cause changes in how ecological systems perform and deliver the resources upon which we and other species depend. Because lost biodiversity is difficult to replace once it is gone, the report urges a specific assessment of the relationship between climate change and biodiversity. Species that have already been impacted by global warming trends include subtropical and tropical coral, and polar bears.

Report Synthesis

In conclusion, the report links human activities that have increased atmospheric greenhouse gases to documented changes in U.S. ecosystems. The report recommends implementation of new research systems to specifically study impacts of climate change, given that most of the research surveyed used systems that were originally designed for purposes other than climate change research. Moreover, the authors of the report make it clear that it is important to tailor any new systems to the task of adequately creating long

term ecological management techniques to assist with climate change issues and policy.

Additional Recent Climate Change Actions of the USDA

The USDA has not confined its involvement to surveying climate change research, but conducts its own climate change experiments, created its own climate change office, weighs in on pending legislation, and is an active participant in global climate change talks.

Research scientists in the USDA's Agricultural Research Service are currently replicating the effects of climate change on soybean and wheat plants. As part of the study, scientists raised the levels of carbon dioxide to projected 2050 levels within 16 chambers to determine the effects on both the plants and soil.

The Climate Change Program Office (CCPO) now operates within the USDA's Office of the Chief Economist. The stated mission of the CCPO is to act as the coordinator of climate change program and policy issues facing the USDA and "ensure that USDA is a source of objective, analytical assessments of the effects of climate change and proposed response strategies."

In 2009 the USDA reported that HR 2454 (the 2009 U.S. House of Representatives climate change bill that included a cap-and-trade provision) might result in increased production costs for U.S. crop farmers and livestock producers. According to the USDA, HR 2454 would cause mild cost increases on these producers in the short term, but higher costs in

the medium and long terms would be counteracted by payments for carbon offsets that might produce potential profits.

The Secretary of the USDA, Tom Vilsak, visited Copenhagen during the 2009 Copenhagen climate change talks and vocalized the Obama administration's commitment to investigating climate change effects. Secretary Vilsak also stated that:

...climate change poses significant threats and challenges for farmers, ranchers, and those who make a living off the land, which will have a serious impact on our ability to feed the people of the United States and the world.

Additionally, Secretary Vilsak spoke about food security and climate change at an event hosted by the Danish government.

Conclusion and Implications

The report, along with other recent actions, indicates that the USDA will take an increasingly visible role in climate change research and policy in the U.S. and abroad. Not only is the USDA commissioning scientific reports, but the agency appears to be engaging in the climate change question by conducting climate change experiments, researching the potential effects of legislative actions upon U.S. agriculture and ecosystems, and promoting awareness of climate change generally. Information about ongoing USDA climate change studies, reports, and activities is available at http://www.usda.gov/oce/climate_change/index.htm. (Mala Subramanian)

LAWSUITS FILED OR PENDING

POST-KATRINA LAWSUIT TESTS THE OUTER LIMITS
OF LIABILITY IN FLOOD EVENTS

When Hurricane Katrina struck land on the Gulf Coast of the United States on August 29, 2005, much of the infrastructure in New Orleans was not ready to withstand the eventual wind and flooding. Today, institutions across the nation may be wondering the same about themselves, as a major case testing the limits of liability goes before the courts in Louisiana. A New Orleans hospital is being sued by the family of a patient who died after the hospital generators failed in the flooding that occurred after Hurricane Katrina. The case raises questions about the level of preparation necessary for hospitals and other groups charged with action in times of emergency. (See, *LaCoste v. Pendleton Methodist Hospital*, Civil District Court for the Parish of Orleans).

Background

Hurricane Katrina struck southwest Louisiana on August 29, 2005. One of the six strongest Atlantic hurricanes on record, Katrina caused severe destruction along the Gulf coast, most catastrophically in New Orleans where over 1,800 people were killed. Nearly 80 percent of the city was flooded after the levee system failed.

The family of Althea LaCoste, a 73-year-old patient who died in New Orleans' Pendleton Memorial Methodist Hospital after the storm, is suing the hospital because for lack of preparation for flooding. According to the family, Ms. LaCoste died after the emergency electricity generators the hospital relied upon cut out. They allege that her respirator stopped and the hand-pumping efforts of nurses, in the heat and dark, failed. The lawsuit seeks \$11.7 million in damages. Over 100 deaths occurred in New Orleans area hospitals and nursing homes after emergency backup power systems failed.

There is already one major ruling on the case that sets precedent in Louisiana: the state's Supreme Court held that the allegations are based in general negligence, not medical malpractice. The two major consequences are that the state's medical malpractice

damages cap of \$500,000 does not apply and that it signals the possibility that this theory of negligence, *i.e.* emergency preparedness, could extend to any number of organizations.

Methodist Hospital is arguing in the case that Hurricane Katrina was an "act of God" that could not be foreseen, and therefore the hospital was not negligent in failing to prepare for such a catastrophe. However, in letters from 2002 that are now evidence in the suit, a former senior executive assessed the hospital's vulnerability to a flood event. The hospital had two main generators, one located on the roof, the other at ground level. The assessment indicated that a tunnel connecting the hospital to the power system could also flood. The executive's estimate was that it would cost \$7.5 million to raise the ground level generator and seal the tunnel, but that the system would fail with only two-feet of flood water. Some parts of city had twenty feet of water in the aftermath of the hurricane.

General Negligence and the 'Act of God'

The law of negligence requires a plaintiff to prove five things. First, the plaintiff must show that defendant had a duty of care to the plaintiff, or in this case that the hospital owed Ms. LaCoste a standard of treatment. Second, the plaintiff must show that the defendant breached that duty, or in other words did something to violate the standard of treatment. In the context of emergency preparedness, the organization assessing its potential liability must consider to whom it owes a duty of care, what the level of that care is, and what would constitute a violation of that care.

Even if a defendant has a duty of care and breaches that duty, the plaintiff must also show that the breach was caused an injury to the plaintiff. Therefore, the third thing the plaintiff must show is that the breach was the actual cause of an injury. This simply means that the defendants actions played a role in causing the injury. The fourth requirement, that the breach

be the proximate cause of the injury, prevents the defendant from being liable for things that are too remote to the injury or when an act outside the defendant's control interceded. Fifth, the plaintiff must prove that he or she suffered damages of some sort, such as physical injury, lost wages, or pain and suffering, from the injury.

Proximate Cause and 'Foreseeability'

In the case of Methodist Hospital, the element of proximate cause will loom large. The hospital will argue that the flood from the hurricane was so great and so devastating, that it was not foreseeable. The act of God doctrine applies when the court finds that forces of nature were a proximate cause, that the forces were extraordinary, that the extraordinary forces were not reasonably foreseeable, and that no human conduct contributed to the destructives of the forces of nature.

Here the issue will be whether or not the flood was foreseeable. Despite the fact that all sides will agree that Hurricane Katrina was extraordinary, parties outside of the hospital and staff in the hospital have

long acknowledged the threat posed to the city by its locations and ancient levees. Therefore, the hospital may have a difficult time relying on the act of God doctrine as a defense.

Conclusion and Implications

If Methodist Hospital is held liable for the death of Ms. LaCoste, the case will have immediate implications for hospitals in Louisiana and across the country. It should also cause organizations that people rely upon in times of emergency to reconsider their own liability. For hospitals, it will mean that they should be on notice that failing to take steps to maintain operations during times of extreme but foreseeable natural disasters will open them up to lawsuits for negligence. Because most states do not have caps on damages for simple negligence, the costs associated with paying damages could rival the costs of preparedness. Most importantly, though, it should serve as warning that the act of God doctrine may not apply in times of catastrophic natural disaster if and when the disaster is actually foreseen. (Andrea Clark, Monica Bauman)

Floodplain Management & Liability Reporter
Argent Communications Group
P.O. Box 506
Auburn, CA 95604-0506

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