DAMS AND LEVEES

C-

2010 Report Card for Pennsylvania's Infrastructure

Due to the establishment of the Pennsylvania Department of Environmental Protection's Dam Safety Program in the late 1970s, Pennsylvania has remained ahead of other states in dam safety. However, about 39% (302) of the state's "high hazard" dams—dams whose failure would cause probable loss of human life and substantial property damage—are considered deficient. The estimated cost to repair all Pennsylvania dams projected to be found deficient over the next five years is more than $1.4 billion. There are 64 levee systems in Pennsylvania, and the average age of those systems is 43 years; about one-third are older than 50 years. The advanced age of the levee systems also casts doubt on their ability to perform without incident or failure. For dams, the C- reflects: positive impact of dam safety and inspection programs; dam conditions above the national D average; $1.4 billion in need for deficient dams; threat a failure would pose to public health, the environment and the economy.

DAMS BACKGROUND

Man-made reservoirs provide substantial benefits to the American public, including water supply for drinking, irrigation and industrial uses, flood control, hydroelectric power, recreation and navigation. However, the dams that impound these reservoirs also represent a significant risk to public safety, local and regional economies and the environment.

Historically, some of the worst disasters in the United States have resulted from dam failures. In 1889, more than 2,200 lives were lost when the South Fork Dam above Johnstown failed in Pennsylvania. During the 1970s, the failures of the Buffalo Creek Dam in West Virginia, Teton Dam in Idaho, and the Toccoa Falls Dam in Georgia resulted in a combined loss of 175 lives and more than $1 billion in damages.

These 1970s dam failures spurred the federal government into action and led to the enactment of the National Dam Inspection Act of 1972. Inspection of all non-federal dams listed in the national inventory began in 1978 under the direction of the USACE. An inspection report was prepared for every dam in the U.S. and the reports categorized the condition of the dams as either good, fair, seriously inadequate spillway or poor. The dams were also classified as high, significant or low hazard depending on the impact that a dam failure would have on downstream residences, infrastructure and residents.

One of the underlying national problems at this time was that many states did not have an established group with regulatory authority or experience for dam safety issues. To address this problem, the Dam Safety and Encroachments Act was enacted in 1978, and the Department of Environmental Resources, which was the predecessor to the Department of Environmental Protection (PADEP), shortly thereafter established the Bureau of Dams and Waterway Management.

After the National Dam Inspection Program inspections were completed, the commonwealth's Dam Safety Program moved forward quickly, making $100 million in funding available for repairs through low-interest loans from the Pennsylvania Infrastructure Investment Authority (PENNVEST) and its predecessor, the Water Facilities Loan Board, with an additional $140 million in upgrades financed by other sources. As a result, Pennsylvania's Dam Safety Program made significant progress earlier than most states. However, the absence of a dam rehabilitation grant or loan program for dams other than those that impounded reservoirs for public water supply limited the pace at which the PADEP Dam Safety Division could address dam safety issues through the 1980s and early 1990s.

The federal government provided some assistance with program improvements through the National Dam Safety Act of 1996. This act was re-authorized as the National Dam Safety and Security Act of 2002, then as the National Dam Safety Program Act in 2006. The most recent version provides funding through grants ranging from $6.5 million in 2007 to $9.2 million in 2011, for distribution among the state dam safety programs. This funding is not available for dam repairs or upgrades; however, the National Dam Repair and Rehabilitation Act has been introduced in both the House and Senate and, if passed, would provide grant funding to public dam owners.

DAMS CONDITIONS

With its early start on the investigation and rehabilitation of its seriously deficient dams, Pennsylvania has remained ahead of most other states in terms of condition of dams statewide. A large number of the commonwealth's high hazard dams—those whose failure could result in loss of life and/or substantial property damage—have been upgraded to current dam safety criteria. Pennsylvania ranks second nationally, behind only California, in terms of annual funding for dam safety—$2.3 million in 2009 and 29 full-time employees in the dam safety program. For these reasons, PADEP had assigned a grade C- for the condition of its dams, as compared to the grade of D assigned for dams nationwide by the *2009 Report Card for America's Infrastructure* from ASCE National.

Despite this relative success, the grade was only a C- because PADEP recognizes that there is still a great deal of work that must be done. Of Pennsylvania's 3,254 dams, approximately 367 are currently considered deficient in some respect. That includes 302 deficient dams, or approximately 39 percent, of the 775 dams that are classified as high hazard and another 65 significant hazard dams.

With estimated average repair costs ranging from $1.5 million to $4 million per dam, the total estimated cost for upgrading the deficient high hazard Pennsylvania dams would be in excess of $800 million. In addition, many of the dams that were upgraded in the early to mid-1980s may soon reach a point where additional upgrades and/or repairs are necessary. PADEP projects that the number of deficient and high hazard dams will increase to approximately 560 by 2015 if needed upgrades are not completed, with an associated repair cost of more than $1.3 billion over the next five years.

DAMS POLICY OPTIONS

The main issue preventing the PADEP Dam Safety Division from achieving its goals and many owners from improving their dams is a lack of funding for dam rehabilitation projects. The Association of State Dam Safety Officials (ASDSO) estimates that $50 billion is needed to rehabilitate dams across the nation, based on the current national inventory of non-federally owned dams. This statistic highlights the need for a national dam rehabilitation program, a goal that is the driving force behind the formation of the Dam Safety Coalition.

This coalition is comprised of a number of national agencies, including the American Society of Civil Engineers (ASCE), ASDSO, the National Society of Professional Engineers, the National Watershed Coalition and the U.S. Society on Dams. The Dam Safety Coalition supports the creation of a federal funding program to repair the nation's unsafe dams, addressing the critical issue of deteriorating dam structures that pose a severe threat to many communities throughout the country. The coalition has been a strong supporter of the Dam Repair and Rehabilitation Act, which would provide $350 million over four years for the repair, rehabilitation or removal of non-federal, high hazard, publicly owned dams. Although the bill was not passed in 2005, the failure of the Kaloko Reservoir Dam in Hawaii spurred Hawaiian Senators Daniel Akaka and Daniel Inouye to re-introduce the bill as the Dam Repair and Rehabilitation Act of 2006, and Congress followed suit by introducing legislation to re-authorize the National Dam Safety Program. This bill has not yet been passed into law, but has been re-introduced on several occasions, most recently on March 26, 2009. This bill would establish a program through the Federal Emergency Management Agency (FEMA) to provide grant assistance for the rehabilitation and repair of deficient state and locally owned high hazard dams. Grant funds would be distributed through state dam safety agencies based on the number of high hazard publically-owned, non-federal dams in the state.

In addition to federal funding, the H2O PA Act was passed in 2008, establishing funding of up to $800 million for water infrastructure projects, including a minimum of $35 million for unsafe, high hazard dams. To date, approximately $48 million has been awarded for rehabilitation of 18 of these dams. The Council for Safe Dams, a committee of the Northeast Region of ASDSO, has also been pursuing a funding program for Pennsylvania dam owners to rehabilitate their dams. Several other states, including New Jersey and New York, have such funding programs, which increase the number of owners who are financially capable of undertaking these rehabilitation projects. A bill that would provide funding for dam safety was introduced in the state House of Representatives in 2009, but this bill has not progressed beyond introduction.

DAMS RECOMMENDATIONS

The Pennsylvania sections of ASCE recommend that the following measures be taken to promote dam safety within Pennsylvania:

- Passage of state legislation to provide separate funding for rehabilitation of Pennsylvania dams, which will be needed for leverage of any federal funding programs that may be enacted;

- Introduction and passage of federal legislation to create a load fund for the repair, rehabilitation and maintenance of non-federal dams, such as the Dam Repair and Rehabilitation Act of 2009; and

- Re-authorization of the National Dam Safety Program Act beyond 2011.

LEVEES BACKGROUND

Pennsylvania has a long history of floods, notably the Susquehanna River Basin, which is one of the most flood-prone watersheds in the nation with more than 80 percent of the basin's 1,400-plus communities having areas that are considered flood-prone. Overall, there are approximately 40,000 miles of minor and major streams in Pennsylvania, and it is estimated that 10,000 to 15,000 miles of these streams are considered flood-prone. Sixty-four levee systems have been constructed in Pennsylvania, providing a local protection length of approximately 134 miles, and are included in the U.S. Army Corps of Engineers (USACE) Rehabilitation and Inspection Program. The average age of the federally authorized levee systems in Pennsylvania is 44 years, while the average age of the non-federally authorized levee systems in Pennsylvania is 41 years. At the system's most recent assessment, approximately one-third of the existing levee systems in Pennsylvania were constructed more than 50 years ago and several were constructed more than 70 years ago. Four levee systems had an unacceptable rating and are in inactive status, while the remaining 60 levee systems are currently in active status. Despite the significant number of these systems in active status, levees cannot eliminate all flood risk. A levee that is designed to withstand a 1-percent-annual-chance, or 100-year, flood has a roughly one-in-four likelihood of being overtopped by a flood during a 30-year period.

From a historical perspective, levees have long been constructed to protect property rather than people, a purpose expressed by the economic criteria controlling the engineering design of levees even today. Evacuation has been seen as the primary means for preventing loss of life and the structural soundness of levees has traditionally been viewed in this context. However, over the past 100 years, there have been 4,523 deaths recorded nationally caused by the failure of levees, compared to 816 fatalities recorded for dam failures over the same period. More than five times more fatalities have been caused by the failures of levees than dams. As recent as 2005, levee failures in New Orleans from Hurricane Katrina resulted in 874 fatalities.

LEVEES CONDITIONS

There are 64 levee systems in Pennsylvania included in the Rehabilitation and Inspection Program (RIP), including three levee systems that were federally constructed and are federally operated and maintained; 16 levee systems that were federally constructed and are non-federally operated and maintained; and 45 levee systems that are state constructed and maintained. The levees systems consist of various combinations of rolled earthen embankments, L-walls, T-walls, and I-walls sections, plus 50 pump stations, 105 separate closure structures and approximately 200 separate relief wells.

Within the 64 levee systems, there are 318 separate levee segments which provide a local protection length of 133 miles. The 64 levee systems provide a total protected area of about 22.5 square miles. Approximately 75 percent of the levee systems provide a protected area of less than 0.25 square miles, 12.5 percent of the levee systems provide a protected area of between 0.25 and 0.5 square miles, and 12.5 percent of the levee systems provide a protected area greater than 0.5 square miles. Eight levee systems provide a protected area greater than one square mile. The largest protected area is the Wyoming Valley: Kingston to Wyoming

System, which provides a protected area of more than 4.6 square miles. One hundred and eighty-one levee segments (57 percent) are located in the Susquehanna River basin, 85 levee segments (27 percent) are located in the Ohio River basin, 47 levee segments (15 percent) are located in the Delaware River basin, four levee segments (1 percent) are located in the Potomac River basin, and one levee segments (less than 1 percent) is located in the St. Lawrence River basin. Levees have been constructed on 118 separate rivers or creeks within Pennsylvania. Forty-nine (73 percent) of the 67 counties in Pennsylvania have levees. The Pennsylvania counties with the most levees are Luzerne with 32, Lackawanna with 25 and Lycoming with 23. Approximately 25 percent of all Pennsylvania levee segments are located in these three counties.

The average age of the federally authorized levee systems in Pennsylvania is 44 years, with the oldest system constructed in 1939 and the most recent system constructed in 2006. Approximately one-third of the federally authorized levee systems constructed in Pennsylvania are at least 50 years old. The average age of the non-federally authorized levee systems in Pennsylvania is 41 years, with the oldest system constructed in 1940 and the most recent system constructed in 2009. Approximately one-third of the non-federally authorized levee systems constructed in Pennsylvania are at least 50 years old.

Despite the success of the Rehabilitation and Inspection Program and the fact that an effective levee safety program is executed by at PADEP and USACE, a grade of C- was assigned due to the advanced age of the levee projects, the numerous flood-prone watersheds existing in Pennsylvania, the residual flood risk inherent in flood damage reduction projects designed to the current flood protection standard, the population at risk, and the often under-appreciated threat to public safety resulting from catastrophic levee failure.

LEVEES POLICY OPTIONS

Each year, PADEP typically awards $500,000 to $1 million in state grant funding to sponsors of federal and non-federal (state) flood protection projects. For the past several years, PADEP awarded grant monies to an average of 20 to 30 recipients and in 2009, PADEP awarded 35 projects in 23 municipalities totaling nearly $1 million. The grants reimburse local flood protection project sponsors up to 65 percent of project improvements and non-routine maintenance costs and 50 percent for specialized equipment to monitor, operate and maintain their flood protection project. Pennsylvania flood protection projects are typically funded through the capital budget and on average, $10 million per year is available for construction. During the FY07/08 and FY08/09 budget years, $10.42 million and $17.64 million was available for construction of flood protection projects, respectively, with additional funding released for design. In addition, PADEP funds flood protection through an annual line item in the budget. The line item was $5.475 million in the FY08/09 budget year and is $4.175 million in the FY09/10 budget year.

LEVEES RECOMMENDATIONS

The Pennsylvania sections of ASCE recommend that the following measures be taken to promote levee safety within Pennsylvania:

- Passage of state legislation to establish a statewide levee safety program , including legislation to allow for non-structural alternatives for flood damage reduction projects within the Commonwealth;

- Passage of state legislation to provide funding for levee certification for the 45 non-federal levee systems designed and constructed by PADEP;

- Continuation of state legislation to provide capital funding for new flood protection projects and legislative approval of flood protection funding through the annual PADEP flood control projects line item in the budget;

- Continuation of funding for the PADEP grant program for levee improvements, non-routine maintenance, or specialized equipment needs for the 64 federal and non-federal (state) levee systems constructed in Pennsylvania.

SOURCES FOR BOTH DAMS AND LEVEES

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ASCE Policy Statement 511: *National Levee Safety Program (PS 511)*

ASCE Policy Statement 280: *Responsibility for Dam Safety (PS 280)*