



Dams Sector-Specific Plan

An Annex to the NIPP 2013

2015



Homeland
Security

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COORDINATION LETTER FROM COUNCIL CHAIRS

In 2003, the Federal Government established the Dams Sector as a U.S. critical infrastructure sector, recognizing the significant economic, environmental, and social contributions of its assets and resources. Since that time, the sector has successfully built public-private partnerships, improved information sharing, created forums to share best practices, and developed tools and exercises to improve security and resilience planning, response, and recovery. The Dams Sector recognizes the value of the sector partnership and continues to take steps to improve the security and resilience of Dams Sector operations in the United States.

2015 Sector-Specific Plan Update

This 2015 release of the Dams Sector-Specific Plan (SSP) updates the original plan issued in 2007 and the update of 2010. As with previous plans, this SSP represents a collaborative effort among the private sector; State, local, tribal, and territorial governments; nongovernmental organizations; and Federal departments and agencies to identify and work toward shared goals and priorities to reduce critical infrastructure risk.

The Dams Sector Coordinating Council and Government Coordinating Council jointly developed the goals, priorities (also called objectives), and activities in this SSP to reflect the overall strategic direction for the Dams Sector. The Sector's goals support the [Joint National Priorities](#) developed in 2014 by the national council structures described in the [National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience \(NIPP 2013\)](#).

This SSP also reflects the continued maturation of the Dams Sector partnership and the progress made by the sector since the 2010 SSP to address evolving risk, operating, and policy environments.

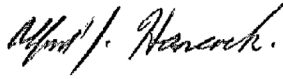
Key Accomplishments

Since 2010, Dams Sector partners in the public and private sectors have taken significant steps to reduce sector risk, improve coordination, and strengthen security and resilience capabilities:

- Developed, piloted, and successfully implemented the Consequence-Based Top Screen (CTS) methodology and supporting Web-based system to facilitate systematic screening and consistent prioritization of high-consequence assets across the sector.
- Revised multiple handbooks, guides, and Web-based training courses that emphasize risk-based assessment, mitigation, and contingency planning to promote resilience.
- Developed simplified blast damage estimation models for dams, navigation locks, and levees, and fostered interagency collaboration on studies to better understand the vulnerabilities of sector assets.
- Conducted several Dams Sector Exercise Series efforts to identify, analyze, assess, and enhance regional preparedness and disaster resilience, using multi-jurisdictional, discussion-based activities involving a wide array of public and private stakeholders.
- Implemented a strong framework for collaboration with stakeholders at the local, State, and regional level, and held the annual Association of State Dam Safety Officials (ASDSO)/U.S. Department of Homeland Security (DHS) National Dam Security Forum as an effective outreach mechanism.
- Created security and resilience outreach material on the ASDSO Website with DHS support.
- Collected performance metrics since 2010 from the ASDSO on State-regulated assets, from the Federal Energy Regulatory Commission (FERC) Division of Dam Safety on its regulated assets, and from the U.S. Army Corps of Engineers and Bureau of Reclamation on their assets to track and evaluate improvements in dam safety programs.
- Operated the Dams Significant Incident Reporting portal on the Homeland Security Information Network (HSIN) since 2010 and consistently populated it with dams failure data.
- Engaged in ongoing efforts to develop the *Dams Sector Security Guidelines*, to update the *2010 Dams Sector Roadmap to Secure Control Systems*, and to develop the *Dams Sector Cybersecurity Guidelines*.

These achievements, which represent the effective collaboration of the Dams Sector Coordinating Council, Dams Government Coordinating Council, and the Dams Sector-Specific Agency, clearly demonstrate progress in working toward a rational sector-wide approach to develop, prioritize, and implement effective security programs and resilience strategies.

In the same shared purpose that guided these actions, Dams Sector partners look forward to continuing their efforts to enhance the security and resilience of our Nation's critical infrastructure assets.



Alfred J. Hancock
Chair
Dams Sector Coordinating
Council



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EXECUTIVE SUMMARY

The Dams Sector delivers critical water retention and control services in the United States, including hydroelectric power generation, municipal and industrial water supplies, agricultural irrigation, sediment and flood control, river navigation for inland bulk shipping, industrial waste management, and recreation. Its key services support multiple critical infrastructure sectors and industries. Dams Sector assets irrigate at least 10 percent of U.S. cropland, help protect more than 43 percent of the U.S. population from flooding, and generate about 60 percent of electricity in the Pacific Northwest. The Dams Sector's significant economic and public safety benefits are countered by the magnitude of potential consequences associated with the failure, damage, or disruption of critical assets.

Dams Sector Assets and Risks

Sector assets include dam projects, hydropower plants, navigation locks, levees, dikes, hurricane barriers, mine tailings, and other industrial waste impoundments. A large and diverse set of public and private entities own and operate these facilities under highly distributed regulatory oversight from Federal, State, and local entities.

The National Inventory of Dams lists more than 87,000 dams, of which the private sector owns about 65 percent and State or local entities own about 31 percent. Individual State dam safety programs permit, inspect, and regulate about 80 percent of U.S. dams. The Federal Government owns and self-regulates only 4 percent of dams, yet these dams account for 80 percent of the largest and highest-consequence U.S. dams. The U.S. Army Corps of Engineers oversees all navigation locks and about 10 percent of U.S. levees. Of the estimated 100,000 miles or more of U.S. levees, 85 percent are locally owned and maintained without Federal oversight. This diversity in ownership and oversight in the Dams Sector requires a large amount of collaboration among private, Federal, State, and local entities to ensure assets are safely operated and maintained.

Complete or partial dam failure could result in sudden downstream flooding that causes casualties; major destruction and property damage; and cascading disruptions to the Electricity, Transportation Systems, Communications, and Water Sectors, among others. A levee breach or overtopping could flood nearby communities, threaten drinking water supplies, and cause major agriculture damage. Inoperable navigation locks could delay valuable domestic cargo shipments. If breached, mine tailings and industrial waste impoundments can harm human health and the environment.

Persistent risks in the Dams Sector include natural disasters, structural issues from internal and external erosion, and deliberate attacks on physical or cyber infrastructure. Recent trends are making some risks more prominent. Population growth and development around dams and levees are increasing the consequences of failure, potentially reclassifying the hazard potential of some assets. Climate change may bring more extreme weather, including droughts that reduce water tables and severe storms that increase flooding. The cyber risk landscape may change as some owners and operators upgrade to modern control systems with standardized hardware or transition to remote monitoring and control processes.

Aging Dams Sector infrastructure only becomes problematic when deterioration is not sufficiently addressed. However, with limited funding for maintenance and rehabilitation, there are now an estimated 4,000 deficient U.S. dams, and 91 percent of federally inspected levees have deficient maintenance.

Partnering to Improve Security and Resilience

The Dams Sector safety community relies on decades of experience identifying structural and operational deficiencies, quantifying the consequences of potential failure, and assessing and mitigating risks to dams and levees, particularly those induced by natural hazards. As risks evolve, the active public-private partnership in the Dams Sector demonstrates that stakeholders find considerable value in partnering to develop tools, guidelines, and best practices that enable each asset owner to better characterize and mitigate those risks.

The [National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience](#) (NIPP 2013) outlines the partnership structure for voluntary public-private collaboration. Non-Federal owners and operators work directly with their peers through the representative Dams Sector Coordinating Council (SCC), and with Federal owners and other Federal, State, and local stakeholders through the Dams Government Coordinating Council (GCC).

Through this partnership, council members share actionable information, exchange best practices, develop guidelines, pursue research and development (R&D), and build awareness of cross-sector interdependencies to make risk-informed decisions. Many of these activities are driven by active Joint Council working groups.

Partners have also established mechanisms to share information on cyber and physical risks, access relevant classified and unclassified threat information, report suspicious activities, and share real-time incident information. An annual Dams Information Sharing Drill tests and improves these processes. Partners continue to develop guidelines and training courses on cyber and physical security topics. Efforts are now under way to develop comprehensive Dams Sector Security Guidelines, update the *Roadmap to Secure Control Systems in the Dams Sector*, and develop a Cybersecurity Capability Maturity Model. These select examples illustrate an active and committed partnership.

2015 Sector-Specific Planning

This Dams Sector-Specific Plan (SSP) sets the strategic direction for voluntary, collaborative efforts to improve security and resilience over the next four years. As an annex to the NIPP 2013, this SSP tailors national strategic guidance to the unique operating conditions and risk landscape of the Dams Sector.

The SSP describes how the Dams Sector manages risks and contributes to national critical infrastructure security and resilience, as set forth in [Presidential Policy Directive 21: Critical Infrastructure Security and Resilience](#). It specifically describes cybersecurity activities that are supporting implementation of [Executive Order 13636: Improving Critical Infrastructure Cybersecurity](#).

Sector Goals, Priorities (Objectives), and Activities

As part of this 2015 SSP, the Dams SCC and GCC have identified goals and priorities (objectives) for the Dams Sector partnership to focus voluntary efforts. The Joint Council (Dams SCC and GCC) set five goals:

1. Strengthen public-private partnerships to maintain and improve coordination and information sharing.
2. Identify and assess sector-specific threats, vulnerabilities, and consequences to support risk-informed decisions.
3. Develop and incorporate sustainable approaches to effectively reduce and manage physical and cyber risks to critical assets and develop response and recovery plans.
4. Enhance Dams Sector security and resilience by advancing R&D solutions that support advance planning and adaptation.
5. Promote continuous learning and adaptation through community-level, cross-sector collaboration to enhance regional resilience.

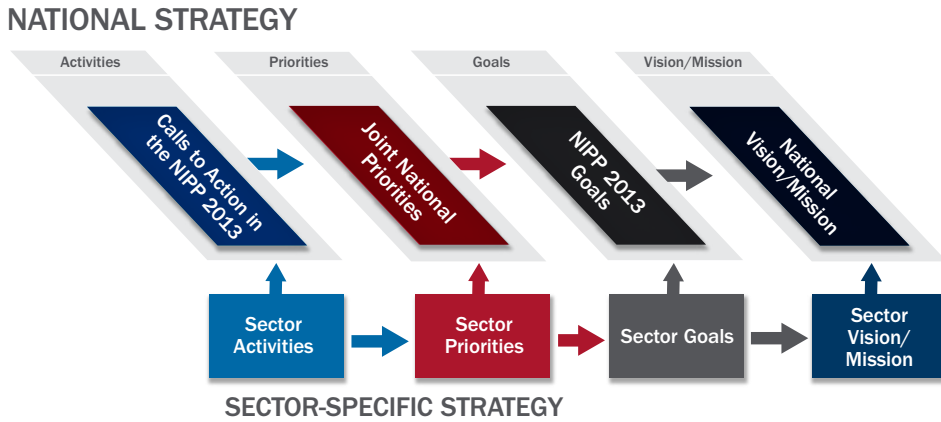
The Joint Council also developed priorities (objectives) for the sector, including:

- Promoting participation in the Dams Sector partnership.
- Increasing the rapid exchange of actionable risk and intelligence information.
- Better characterizing threats.
- Developing analytical tools and capabilities.
- Identifying and addressing infrastructure interdependencies and cascading impacts.
- Promoting integrated cyber-physical risk management.
- Improving cybersecurity capabilities.
- Improving incident response and recovery strategies.
- Coordinating R&D efforts with interdependent sectors.
- Evaluating the effects of climate change.
- Incorporating post-incident and post-exercise lessons learned into training and response planning.

As part of a detailed implementation plan, the councils identified 12 activities that sector partners plan to conduct, as resources allow, over the next one to four years to implement Dams Sector priorities (objectives) and achieve progress toward sector goals. [Chapter 4](#) provides a detailed list of planned sector activities.

The Dams Sector aligned its 2015 SSP with the national planning framework for security and resilience in the NIPP 2013. As a result, progress toward sector goals, priorities (objectives), and activities contributes directly to national achievements under NIPP 2013 (see Figure ES-1). [Appendix B](#) demonstrates the detailed alignment of the SSP to the 5 NIPP 2013 goals, the 5 [Joint National Priorities](#), and the 12 Calls to Action in the NIPP 2013.

Figure ES-1: Alignment of National and Sector-Specific Goals, Priorities (Objectives), and Activities



1 INTRODUCTION

This Dams Sector-Specific Plan 2015 (SSP) sets the strategic direction for voluntary, collaborative efforts to improve sector security and resilience over the next four years. It describes how the Dams Sector manages risks and contributes to national critical infrastructure security and resilience, as set forth in [Presidential Policy Directive 21: Critical Infrastructure Security and Resilience \(PPD-21\)](#). As an annex to the [National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience \(NIPP 2013\)](#), this SSP tailors the strategic guidance provided in the NIPP 2013 to the unique operating conditions and risk landscape of the Dams Sector. As such, this sector strategy supports the NIPP 2013 national goals and strategy, the 2014 [Joint National Priorities](#), and implementation of [Executive Order 13636: Improving Critical Infrastructure Cybersecurity \(EO 13636\)](#).

This plan describes the Dams Sector's approach to risk management and national preparedness—considering its distinct assets, operations, and risk profile. In this 2015 SSP, public and private sector members of the Dams Sector Coordinating Council (SCC) and Government Coordinating Council (GCC) identified a shared vision, goals, and priorities for sector security and resilience. They developed a supporting set of collaborative activities they plan to pursue during the next four years, as resources allow.

SSP development answers NIPP 2013 Call to Action #2, which requires each of the [16 designated critical infrastructure sectors](#) to update their SSP every four years to reflect joint priorities, address sector reliance on lifeline functions, describe national preparedness efforts, outline cybersecurity efforts, and develop metrics to measure progress. [Appendix B](#) illustrates how the Dams Sector goals, priorities, and activities support the NIPP 2013 national goals, the 5 Joint National Priorities, and the 12 Calls to Action.

This Dams SSP contains:

- [Chapter 2: Sector Overview](#)—Provides a view of the sector's assets and operating characteristics, its risk profile, and key public and private sector partners.
- [Chapter 3: Risk Management and National Preparedness](#)—Describes the mechanisms to achieve sector goals, including ongoing and planned partnership programs, activities, and resources that support the sector's current risk management approach; R&D priorities; and how the sector supports national preparedness through incident response and recovery.
- [Chapter 4: Vision, Goals, and Priorities \(Objectives\)](#)—Presents the sector's vision, its updated goals and priorities (objectives) for Dams Sector security and resilience for the next four years, and the specific activities that Dams Sector public and private sector stakeholders plan to conduct.
- [Chapter 5: Measuring Effectiveness](#)—Describes the planned approach to measure the effectiveness of individual activities and report on sector progress.

This SSP provides targets for collaborative planning among the U.S. Department of Homeland Security, as the Sector-Specific Agency, and the Dams SCC and GCC members. Partners have a clear and shared interest in ensuring the security and resilience of critical sector assets, systems, and networks, and this plan represents the voluntary, collaborative activities that could greatly reduce sector risk and build resilience during the next four years.

2 SECTOR OVERVIEW

This chapter profiles the Dams Sector’s assets, design, and operating characteristics; identifies its primary risks and interdependencies; and describes how the sector’s public-private partnership operates.

2.1 Sector Profile

Dams Sector assets continuously provide a wide range of economic, environmental, and social benefits, including hydroelectric power; river navigation; water supply for municipal, industrial, and agricultural uses; flood control; efficient water resource management in drought- and flood-prone regions; waste management; recreation; and wildlife habitat protection. Assets range from large hydroelectric dams and river/coastal levee systems that support and protect whole U.S. regions to small, locally owned dams and levees that support and protect individual agricultural communities.

A distinct characteristic of the Dams Sector is the considerable diversity of owners, operators, and regulators and the wide range of sector assets in terms of size, function, and criticality. Each owner or operator has unique assets, a distinct risk profile, and tailored operational processes, business environments, and risk management approaches.

This sector profile provides a snapshot of Dams Sector assets and key characteristics that influence security and resilience in the sector. For a more detailed review of sector assets, see [Appendix D](#).

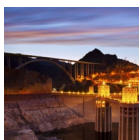
Key Sector Operating Characteristics



Select regions and critical industries depend heavily on Dams Sector assets for hydroelectric power, nuclear plant cooling water, movement of valuable goods on inland waterways, water storage, and protection from catastrophic flooding.



The spatial dimensions of Dams Sector facilities are often significantly larger than those of facilities within other critical sectors. Many are located in remote areas, making them large but relatively inaccessible targets. Their size and location may lead to long response times for local law enforcement authorities during an emergency. Critical components may also be spread over a large area within a single facility, necessitating several different security configurations.



Highly stressed infrastructure and continued population growth are substantially increasing the threat and potential consequences of failure for many sector assets. Safe operations may also be increasingly threatened by extreme flooding and droughts brought on by climate change. As threats evolve, sector partners are actively working to decrease the vulnerabilities and potential consequences of critical assets.



Complete or partial failure of critical dams and levees could result in casualties and substantial environmental and infrastructure destruction—making them a possible aspirational target for terrorism attacks.



The safe operation of Dams Sector assets is often of national or regional interest, as a potential failure may have large, multi-State or international implications for public safety and economic health. Because Dams Sector assets are operated and maintained by a diverse set of Federal, State, municipal, and private entities, security and resilience planning requires extensive public-private coordination among multiple sector partners at all levels.







There is a large diversity of Dams Sector operations and controls. Some Dams Sector facilities use manual controls, electromechanical controls, and/or onsite or remote industrial control systems to monitor and control key operations. For the latter, cybersecurity and reliability are critical to safe operations.



Sector-wide security and safety engineering practices have shifted to a risk-based model for dams design, operation, and rehabilitation that effectively prioritizes limited resources.

DAMS SECTOR SNAPSHOT (2015)

ASSETS AND IMPACTS

Dams					
	100,000 dams estimated with >87,000 in the National Inventory of Dams	10% U.S. cropland is irrigated by dams ¹	6–7% U.S. electricity generated by hydropower facilities ²	60% electricity in the Pacific Northwest generated by hydropower facilities ³	31% of dams have a high or significant hazard potential if they fail or misoperate
Levees		Mine Tailings			
	Estimated 100,000 miles of U.S. levees	43% of U.S. population live by levees that reduce the risk of flooding ⁴		150,000 mine tailings and industrial waste impoundments	Facilitate manufacturing while protecting the environment
Navigation Locks					
	236 lock chambers at 192 U.S. sites in 41 States ⁵	12,000 miles of inland marine highway network controlled by locks	624 million tons of U.S. cargo moved annually by inland marine network ⁶	\$70 billion cargo moved annually by inland marine network ⁷	

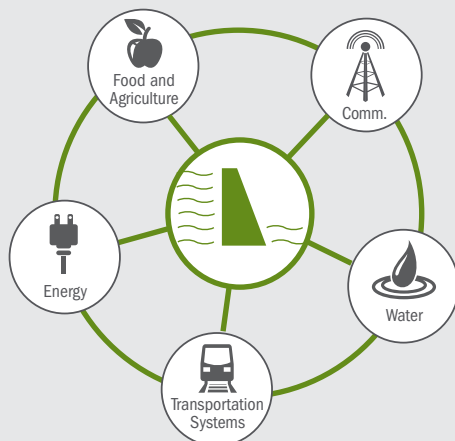
OWNERS AND OPERATORS

- About 65% of **dams** are privately owned; the remainder are owned by Federal, State, local, tribal, and territorial entities.
- **Levees** have diverse Federal, State, local, and private ownership.
- Federal agencies own and operate the vast majority of **navigation locks**.
- Private companies own and operate onsite **mine tailings**.

REGULATION

- 77% of dams are regulated by State dam safety programs.⁸
- The Federal Energy Regulatory Commission (FERC) regulates 2,600 non-Federal hydropower dams.⁹
- Federal agencies own and self-regulate nearly all major navigation locks and 4% of dams—including many of the largest and highest-consequence assets.
- Levees may be subject to Federal, State, and/or municipal regulations; however, many exist in States that do not regulate levee safety.

CRITICAL SECTOR INTERDEPENDENCIES



Water

Dams Sector assets provide drinking water supplies and pumping capabilities.

Energy

Hydroelectric dams provide critical electricity resources and blackstart capabilities, and rely on electricity infrastructure to move power.

Communications

Communications networks enable remote Dams Sector operations and control.

Food and Agriculture

Sector assets provide water for irrigation and protect farmland.

Transportation Systems

Navigation lock systems in the Dams Sector enable all inland and intracoastal waterway freight movements, while major roads may traverse dams.

Sector Components and Assets

Assets in the Dams Sector include dam projects, hydropower plants, navigation locks, levees, dikes, hurricane barriers, mine tailings and other industrial waste impoundments, or other similar water retention and water control facilities. This section provides an overview of sector assets and their functions, identification methods, ownership and regulatory profiles, and key factors affecting security and resilience in the Dams Sector. See [Appendix D](#) for the full taxonomy of Dams Sector assets and a more detailed overview of each asset type.

Dams

Dam projects are complex facilities that may include multiple water impoundment or control structures, reservoirs, spillways, outlet works, powerhouses, canals or aqueducts, and in some cases, navigation locks. They provide:

- **Water storage and irrigation**—Dams create reservoirs that supply water for many industrial, municipal, agricultural, and recreational uses.
- **Sediment and flood control**—Some dams control sedimentation for environmental protection or regulate and contain water flow to reduce or prevent flooding.
- **Electricity generation**—Hydropower dams produce 6 to 7 percent of U.S. electricity—and 60 percent of electricity for the Pacific Northwest—accounting for 52 percent of U.S. renewable energy. The United States is the fourth-largest producer of hydropower in the world behind China, Brazil, and Canada.¹⁰
- **Blackstart capabilities**—Hydropower projects can quickly and efficiently start generating electricity to jumpstart restoration for other non-hydro generators after system-wide blackouts, like the August 2003 Northeast blackout.
- **Peaking power**—Hydroelectric projects can quickly ramp up to help meet peak demand.

Asset Identification

The [National Inventory of Dams](#) (NID) is a congressionally authorized database that documents the location, size, type, and purpose of U.S. dams and tracks regulatory, inspection, and technical information. First published in 1975, the NID is maintained by the U.S. Army Corps of Engineers (USACE) and updated about every two years. The NID was most recently reauthorized in the Water Resources Reform and Development Act of 2014.

The NID collects information from Federal and State regulatory agencies on dams that meet the following criteria:

- High or significant hazard potential; or
- Low hazard potential but are at least 25 feet high (and hold 15 acre-feet of water), or hold at least 50 acre-feet of water (and are at least 6 feet high).

Table 1. Dam Safety Hazard Potential Classification¹¹

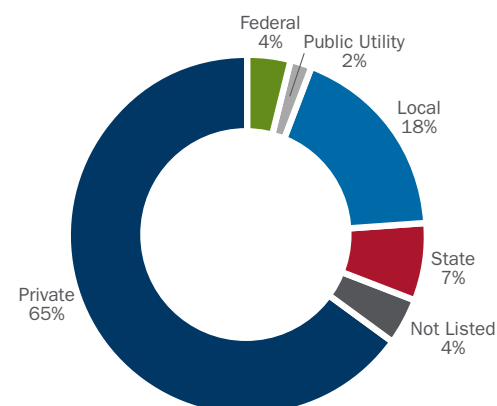
HAZARD POTENTIAL CLASSIFICATION	LOSS OF HUMAN LIFE	ECONOMIC, ENVIRONMENTAL, OR LIFELINE LOSSES
Low hazard potential	None expected	Low, generally limited to owner
Significant hazard potential	None expected	Yes
High hazard potential	Probable, one or more expected	Yes (but not necessary to meet the classification)

Ownership and Regulation

The 2013 NID includes information on more than 87,000 dams, of which more than 65 percent are privately owned.¹² The remainder have a diverse ownership profile (Figure 1).

State dam safety programs permit, inspect, and enforce regulations for about 77 percent of U.S. dams.¹³ Federal agencies, including the Tennessee Valley Authority (TVA), the Bureau of Reclamation (Reclamation), and USACE own and regulate only about 4 percent of U.S. dams—but these dams account for more than 80 percent of the Nation’s largest and highest-consequence dams. Remaining facilities include non-Federal hydropower facilities regulated by the Federal Energy Regulatory Commission (FERC) and other dams projects that are locally regulated or unregulated.

Figure 1. Ownership Profile of NID Dams



Key Security and Resilience Considerations for U.S. Dams

- Nationally, about 60 percent of high hazard potential dams have developed Emergency Action Plans (EAPs) to facilitate effective response and recovery (Figure 2). Many State dam safety programs require EAPs.
- State dam safety programs exist in all States except Alabama, yet they often have limited resources and personnel to effectively enforce regulatory authority. State assistance under the National Dam Safety Program is intended to help States bring the necessary resources to bear on inspection, enforcement, and emergency planning for dam safety.
- Dams are on average 57 years old, yet, when they are properly maintained and rehabilitated to meet current standards, aging is not a major concern. Many aging U.S. dams, however, have not been adequately rehabilitated or maintained.
 - Dams received a D+ grade in the American Society of Civil Engineers (ASCE) 2013 Report Card for America's Infrastructure.¹⁴
 - The Association of State Dam Safety Officials (ASDSO) estimates that it will cost more than \$57 billion to rehabilitate all Federal and non-Federal U.S. dams, and at least \$21 billion to rehabilitate only high hazard potential dams.
 - Estimates from individual owners are similar. USACE estimates that it will cost more than \$25 billion to address deficiencies in the dams it owns, while Reclamation identified 20 high and significant hazard potential dams that require \$2 billion of risk reduction investment over the next 15 years.¹⁵

Figure 2. Percentage of Significant and High Hazard Potential NID Dams with an Emergency Action Plan

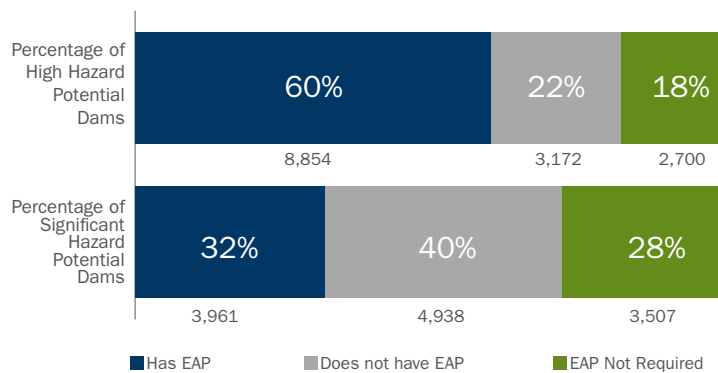
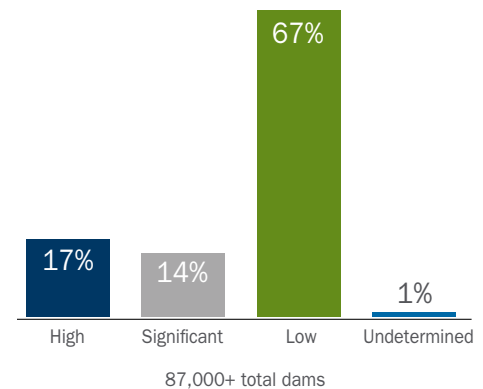


Figure 3. Percentage of all NID Dams by Hazard Potential



Levees and Hurricane Barriers

Levees, hurricane barriers, and other flood protection systems contain, control, or divert the flow of water to reduce public safety risks from seasonal floods, storm surges, rain, and other extreme weather. Levees are manmade structures built parallel to waterways that helped prevent more than \$120 billion in flood damages in 2011.¹⁶ Components may include embankment sections of dams, flood walls, dikes, pumps and pumping stations, interior drainage works, canals, wetlands, and other important elements. Hurricane barriers are typically large steel structures with gates that close during a storm to restrict the flow of storm surges and are open or partially open during routine use.

Asset Identification, Ownership, and Regulation

An estimated 100,000 miles or more of levees exist throughout all 50 States, yet the total number, location, and condition of many levees remains unknown.¹⁷ Levees have diverse ownership and oversight:

- About **85 percent of levees are locally owned and maintained** without Federal oversight.¹⁸
- USACE oversees only about 10 percent of the Nation's levees:** about 14,500 miles of levees in 2,500 levee systems under USACE's Levee Safety Program.¹⁹ USACE program levees include:
 - About 2,800 miles of federally constructed levees maintained by USACE.

- About 9,500 miles of levees that were originally constructed by USACE and later turned over to State and local sponsors to operate and maintain.
- About 2,200 miles of State- or locally constructed levees that are incorporated into the USACE Rehabilitation and Inspection Program at the request of the owners, who continue to maintain and operate the levees.
- The **Bureau of Reclamation is responsible for another 8,000 miles** of levee-like structures along canals.²⁰

The USACE maintains the [National Levee Database](#) to document the location and condition of the Nation’s levees, primarily USACE program levees. The Water Resources Development Act of 2007, as amended, authorized a national inventory of levees, and USACE continues to update and expand its database to include non-Federal levee information.²¹ It incorporates levee ownership, accreditation, and flood protection information for communities participating in the FEMA National Flood Insurance Program.

Key Security and Resilience Considerations for U.S. Levees

- Levee systems often stretch across multiple miles and several different communities or governance units, which can complicate or delay repair, response, and mitigation. The sometimes unclear ownership of levees or levee segments within a system can prevent the coordination and communication required to maintain levee safety and resilience.
- The USACE Levee Safety Program accomplishes three objectives through risk assessments and levee inspections:
 - Develop balanced and informed assessments of levees.
 - Evaluate, prioritize, and justify levee safety decisions.
 - Make recommendations to improve life safety associated with levee systems.
- USACE levees on average are 55 years old, and 91 percent of them have deficient maintenance.²²
- Levees received a D- grade in the ASCE 2013 Report Card for America’s Infrastructure. The National Committee on Levee Safety estimates that \$100 billion is needed to repair or rehabilitate U.S. levees.
- The Water Resources Reform and Redevelopment Act of 2014 establishes a Levee Rehabilitation Assistance Program. It also requires the establishment of voluntary national levee safety guidelines and a hazard potential classification system.

Navigation Locks

Navigation locks make inland waterways viable transportation corridors by allowing commercial and recreational traffic to move safely between river pools. Lock lift heights can range from a few feet to 110 feet. Assets include the locks themselves (single or multiple chambers), the associated dam (unless located in a canal or river), and structures such as approach walls, control rooms, and administration and maintenance buildings. Multiple locks may be part of one navigable river system.

The U.S. waterway system includes 236 lock chambers at 192 lock sites owned and/or operated by USACE.²³ Navigation locks enable companies to ship large volumes of bulk commodities over long distances far more efficiently than via truck or rail, reducing shipping costs and greenhouse gas emissions. The marine highway network stretches from the Great Lakes to Gulf of Mexico ports via the Mississippi River, and the Columbia and Snake Rivers connect to Pacific Northwest ports.

Waterways primarily move coal, petroleum products, grains, and farm exports. Other major commodities include aggregates, such as stone, sand, and gravel used in construction; chemicals, including fertilizers; metal ores, minerals, and products, such as steel; and many other manufactured products.

Key Security and Resilience Considerations for Navigation Locks

- More than half of navigation locks are over 50 years old and received a D+ grade from the ASCE 2013 Report Card for America’s Infrastructure.
- Through the Inland Waterway Trust Fund, the Federal Government and non-Federal users share construction and rehabilitation costs for inland waterways, including locks. The Federal Government covers operations and maintenance costs.

Mine Tailings and Industrial Waste Impoundments

Impoundments for the mining, electric power, and manufacturing industries store tailings or mine waste, which are suspended in water and settle out in the impoundment. Features are similar to dams, including key trenches, internal drains, filters, spillways, and outlet works. They facilitate processing for key industries and protect the public and environment from dangerous waste products.

Impoundments are primarily owned and operated onsite by private industries and can be subject to Federal and/or State regulations depending on type and size.

Key Security and Resilience Considerations for Mine Tailings and Impoundments

- Unlike traditional dams, any breach can release waste material that poses potential health and safety risks and can damage downstream ecosystems.
- Impoundments at mine sites can break through to active or inactive underground mines if not properly constructed.

Cyber Infrastructure

Some Dams Sector assets have no cyber controls, relying on manual operations or electromechanical controls, while other assets use either onsite or remote industrial control systems (ICS) to monitor and/or control the operations of physical processes within Dams Sector facilities. A control system collects information about operations and component status—such as gate position, reservoir level, hydroelectric generator output, and water flow—and sends commands to the system when directed by an operator. Security access control systems and intrusion detection systems may also be cyber-based systems.

Control systems such as Supervisory Control and Data Acquisition (SCADA) systems increasingly manage, command, or regulate key processes by sending signals over digital or wireless networks. To prevent cyber intrusions, these systems are typically completely separated from unsecured networks and the Internet. Integrated cyber and physical protections are important, as physical security measures help restrict unauthorized access to cyber and electromechanical controls.

Key Security and Resilience Considerations for Cyber Infrastructure

- Some Dams Sector facilities are moving toward remote operations to consolidate monitoring or control of several facilities/assets in one location, while others have no remote or cyber controls. Critical processes can typically be manually operated if control systems were compromised or failed.
- Unauthorized control system access could allow insiders or attackers to remotely direct physical processes and cause infrastructure damage, disrupt operations, or cause collateral damage—such as upstream or downstream flooding or power disruptions.
- Strong security controls are critical for all remotely connected control systems, as they all exhibit some vulnerabilities. Modern control systems use commercial operating systems and components, which require frequent security updates and may be more prone to vulnerabilities. Legacy systems use proprietary system designs that require more knowledge for cyberattackers to access, yet may have inadequate password policies, few data protection mechanisms, or less frequently updated security controls.
- Though less critical, an attack on non-control, business/administrative systems could provide access to sensitive information on Dams Sector infrastructure. Without adequate controls to separate business and control systems, business systems could provide cyberattackers an unintended access point to operational controls.

2.2 Sector Risks

The Dams Sector's significant economic and public safety benefits are countered by the magnitude of the consequences that could be associated with potential failure, damage, or disruption of critical assets. Many sector-specific risks are well-understood and the sector has taken critical steps to mitigate them—including infrastructure hardening, developing standards and guidelines, and conducting training and exercises. Evolving threats continually expose risks and create new challenges, described here, which the sector has used to inform its goals, priorities (or objectives), and activities in [Chapter 4](#).

Notable Trends and Emerging Issues

Since the last SSP was issued in 2010, key changes have affected the sector's risk profile:

Population Growth and Development

Substantial population growth means that developed communities increasingly replace the farmland around dams and levees—increasing the consequences of failure and introducing new safety requirements for previously low hazard potential assets. Dams being classified as high hazard potential are on the rise—reaching 14,726 in 2013, up from 11,881 in 2007—as increasing population and development occurs downstream.

Increasing Natural Disasters Brought On by Climate Change

Climate change may bring more extreme weather, reduced water tables, increasing droughts, and greater earthquake threats. Combined with an increased population using sector resources, safe operations may be stressed.

Aging Infrastructure with Limited Maintenance and Rehabilitation

Many Dams Sector assets were built decades ago and require routine maintenance to operate safely. Some may require rehabilitation to meet improved safety criteria or address new risks from extreme weather and downstream population development. Funding for necessary repair and rehabilitation is limited. A Federal Levee Rehabilitation Assistance Program was authorized in 2014.

Changing Power Supply Portfolio

In the future, when intermittent renewable resources such as solar and wind make up a larger portion of a region's supply portfolio, generation from hydroelectric dams may be temporarily relegated to backup power during periods of the day when renewable generation is high. In some cases, this could severely reduce efficiency and create operational issues for certain hydroelectric providers. Alternatively, some hydroelectric generators such as pump-storage projects are designed to stop and start quickly, making them ideal for backup or peaking generation as supply portfolios change.

Limited Information on Specific Threats

The inability to accurately characterize the size and likelihood of specific threats to individual facilities makes it difficult to quantify risk.

Insufficient Information Sharing Within and Across Sectors

There are still few secure channels to effectively share sensitive or controlled, unclassified information between the public and private sectors, which can limit information sharing among owners and operators. The Dams Sector and other closely integrated critical sectors, particularly the Energy Sector, often operate in silos, which can prevent coordination on shared risks.

Limited Resources for Security and Resilience

In the absence of major security incidents in the Dams Sector, it is difficult to quantify and communicate the success of past security measures. It also makes it difficult to build the business case for increased security and resilience investments to address evolving risks. Security funding is too often focused only on meeting regulatory requirements.

Significant Dams Sector Risks

Complete or partial dam failure could result in sudden downstream flooding that causes casualties, major destruction and property damage, and catastrophic economic consequences with cascading disruptions to the Electricity, Transportation Systems, and Water Sectors, among others. A levee breach or overtopping could threaten drinking water supplies and reduce pumping system capacity, cause major agriculture damage, and threaten homes and transportation corridors. Navigation lock damage or delay impedes domestic cargo movement of valuable commodities in many sectors. If breached, mine tailings and industrial waste impoundments can harm human health and the environment.

The consequences of any damage or disruption depend on many factors: the length and scope of the incident, the asset's critical functions, system redundancies, downstream population density, regional infrastructure, and seasonal and weather conditions. Below are the key risks affecting the security and resilience of Dams Sector assets, operations, and workforce.

Natural Disasters and Extreme Weather

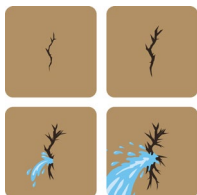


Flooding can overwhelm the flood storage capacity of reservoirs, impoundments, and levee systems, causing a possible dam or levee breach. Severe multi-State floods in the Midwest in 1993, 2008, and 2011 generated record or near-record flood stages that overtopped levees and overwhelmed floodways. In many of these cases, the Dams Sector assets operated as designed to prevent more severe damage. However, more frequent and severe flooding increases potential consequences.

Severe drought can reduce the available water flow in a reservoir and reduce hydropower generation during a simultaneous increase in the demand for irrigation water.

A number of high hazard potential assets are located within active seismic areas, where a severe earthquake could damage dam infrastructure. Despite progress in seismic analysis methods and assessment procedures, predicting the behavior of dams and levees under earthquake conditions remains a significant challenge.

Erosion and Structural Issues



Worldwide, 94 percent of embankment structure failures are due to internal and external erosion; the remaining 6 percent are due to instability.²⁴ About one to two large dams fail every year, along with hundreds of smaller dams and levees worldwide. Possible design or construction flaws, foundation and abutment conditions, seepage potential, and construction material characteristics can all determine dam and levee failure risks.

Settlement of the dam crest, inadequate spillway design, and debris blockage of spillways account for 34 percent of U.S. dam failures. Foundation defects, including settlement and slope instability, have caused about 30 percent of all U.S. dam failures, while another 20 percent are due to piping (internal erosion caused by seepage).²⁵ State dam safety programs reported 173 dam failures between 2005 and 2013.

Lack of operator training or experience or poor maintenance and inspection procedures can create opportunities for accidental malfunctions or failures.

Aging Infrastructure and Workforce



Older dams and levee systems are only problematic when they become deficient as a result of deterioration over time with inadequate maintenance or upgrades. There are now an estimated 4,000 deficient U.S. dams, 2,000 of which are high hazard potential dams.²⁶ Of USACE levee systems, 91 percent have deficient maintenance.²⁷

As scientific and engineering knowledge improves the ability to predict dam performance under extreme events, more dams are deemed deficient. Rehabilitation projects take considerable time to plan, permit, and execute, increasing the urgency for action.

Many Dams Sector jobs are highly technical or specialized and have limited turnover. Facilities are losing institutional knowledge as experienced workers retire.

Cyberattacks



Key cyber risks include cyberattacks that target inadequate security controls, outdated patches, and unknown vulnerabilities; social engineering attempts designed to gain operator credentials; and intrusions from insider threats. All such attempts could allow attackers to access critical control systems and disrupt or control physical components and processes.

Separating controls systems from untrusted networks (known as air-gapping) may no longer be a sufficient security practice. Standardized hardware and communications protocols, the use of USB drives, and the need to deliver operational data into business systems all increase the risk of unintentional outside network connections.

Process control system operators typically have limited experience to distinguish between a system anomaly and a cyberattack. Operators rely on hardware and software vendors, who may not routinely, rapidly, or adequately update and patch process control systems to address cyber vulnerabilities. Some systems must be taken down for updates and can only be patched during planned outages.

Deliberate Attacks and Terrorism



Though the catastrophic failure of a dam would be difficult to achieve through a conventional terrorist attack, recent international events suggest terrorists still consider dams attractive targets because of the potential for significant economic, environmental, and public safety consequences. U.S.-based extremists have been suspected of targeting U.S. dams in the past, and terrorists have targeted dams overseas.

Primary Cross-Sector Interdependencies

Dams Sector operations and services are closely integrated with other critical infrastructure sectors, which creates interdependencies that can cause a disruption in one sector to affect safe operations in another. Local disasters can cascade to multiple jurisdictions and sectors, triggering damage across larger geographic areas. Limited visibility into growing risks faced by interdependent sectors may subject dams facilities to “hidden risks”—spillover risk from other sectors that Dams Sector owners and operators cannot adequately anticipate or manage.

Dams Sector assets depend on critical services provided by other sectors, but also provide essential resources to other sectors during both steady-state and emergency operations. The NIPP 2013 identifies lifeline functions—energy, water, transportation systems, and communications—as services and resources that are essential to the operations of most critical infrastructure partners and communities. Identifying interdependencies with lifeline sectors and other critical sectors can help owners and operators mitigate the effects of losing these services during an emergency. While the Dams Sector may be interdependent in some way with all [16 critical infrastructure sectors](#), its most significant sector interdependencies are with the lifeline functions, which are listed below and followed by a list of other significant interdependencies.

Lifeline Functions: Energy, Water, Transportation Systems, and Communications



In certain regions, hydroelectric generators provide significant amounts of electricity to the transmission grid, in addition to blackstart capabilities that support grid resilience. Disruptions to hydroelectric operations could create serious supply deficits in those regions. Dams facilities may in turn rely on constant electricity to power critical operations.

More than 20 percent of coal used to produce U.S. electricity is shipped via inland waterways that rely on navigation locks. Petroleum products are also the second-largest group of bulk products shipped via inland waterways and include crude oil, gasoline, diesel fuel, jet fuel, heavy fuel oils, and asphalt.



A large percentage of the Nation's drinking water and irrigation water supplies come from reservoirs created by dams. Dams also provide large amounts of water for industrial processes. Disruptions or failures in the Dams Sector could threaten community water supplies.



The Nation's 12,000-mile inland marine highway network relies on navigation locks to move valuable domestic and export commodities throughout the United States and to coastal ports. Failure of Dams Sector assets could also disrupt roadways, bridges, and other transportation routes.



Employee communications and remote monitoring and control rely on uninterrupted Internet and telecommunication networks. Information sharing—both onsite and with critical public and private partners—is essential during an emergency to ensure effective response and maintain public safety. A Dams Sector asset failure could also damage downstream communications infrastructure and trunk lines, especially those running along bridges.

Other Key Interdependencies



About 60 percent of the country's farm exports travel through inland waterways for export overseas. Recent droughts have increased demand for water to irrigate crops, which can strain Dams Sector operations. The Dams Sector (through Emergency Support Functions) can also provide emergency drought measures—including water hauling, temporary construction, and assistance with well drilling—to minimize drought damage and losses.



During a blackout, hydroelectric facilities may provide blackstart capabilities for interconnected nuclear generation facilities. Dams may also store water near nuclear facilities for cooling operations. The owner and operator of an adjacent dam or reservoir would play a key role in containment of contaminated water during a nuclear accident.



Chemicals and fertilizers are major commodities shipped via inland waterways.



Law enforcement and emergency personnel are the first responders during Dams Sector asset failure or disruption, and their response capabilities can determine the extent of event consequences. A Dams Sector asset failure could also impede the ability of emergency services to reach critical areas.



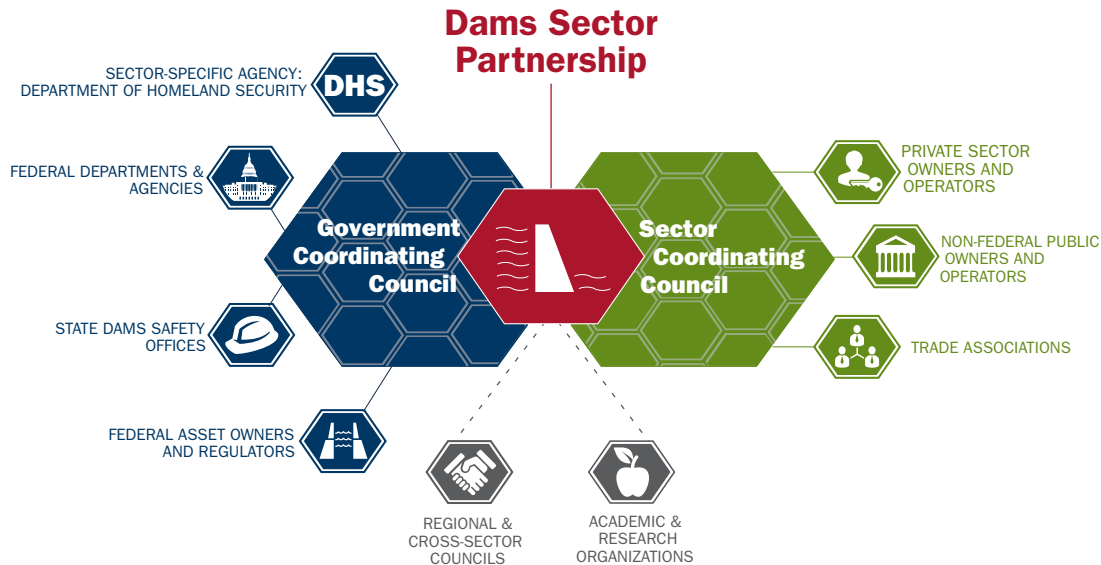
Information technology systems control critical processes, manage day-to-day operations, and store sensitive information in the Dams Sector. Potential vulnerabilities in software and hardware systems could increase susceptibility to cyberattacks. The Dams Sector and its industry and government partners also use IT services to facilitate information sharing and dissemination of security and threat data.

2.3 Critical Infrastructure Partners

Voluntary collaboration between private sector and government stakeholders has been—and remains—the primary mechanism for advancing collective action toward national Dams Sector security and resilience. Like all [16 critical infrastructure sectors](#), the Dams Sector operates under the NIPP 2013 partnership structure, which encourages participation from the private sector; government partners at Federal, State, local, and regional levels; and academic and nongovernmental organizations that support sector security and resilience.

Dams Sector Partnership Structure

Figure 4. Dams Sector Partnership Structure



The NIPP 2013 partnership structure includes representative public and private sector councils that operate under the Critical Infrastructure Partnership Advisory Council (CIPAC) construct. CIPAC facilitates interaction between the community of owners and operators and the sector’s Federal, State, local, tribal, and territorial government representatives to conduct deliberations and form consensus positions for the Federal Government.

The Dams Sector partnership includes the full community of hundreds of U.S. owners and operators, represented by the members of the Dams SCC and GCC. The success of the Dams Sector partnership depends on the ability to leverage the full spectrum of capabilities, expertise, and experience from the sector and its stakeholders through the partnership councils. It also depends on the members’ ability to share information, guides, tools, and best practices out to their networks of stakeholders who do not sit on partnership councils.

Dams Sector partnership councils meet separately and during Joint Council meetings at least twice per year to exchange information and lessons learned, facilitate sector-level planning, inform resource allocation, establish effective coordinating structures, and develop security and resilience tools, guidelines, products, and programs.

Because the Dams Sector has such a diverse ownership profile and distributed regulatory control, there are a huge number of critical partners. Updated Dams SCC and GCC charters and membership lists can be found on the [DHS Website](#). Sector partner organizations are described briefly in this section, and described in greater detail in [Appendix E](#).

Sector-Specific Agency

Sector coordination is led by DHS, which functions as the Sector-Specific Agency (SSA). DHS serves as the primary Federal interface for sector-specific security and resilience efforts, promotes sector-wide information sharing, and supports implementation of the NIPP 2013 within the Dams Sector.

The DHS Office of Infrastructure Protection (IP) fulfills the role of SSA on behalf of DHS. The Assistant Secretary for Infrastructure Protection chairs the Dams GCC and has designated the Director of the Sector Outreach and Programs Division (SOPD) as the representative on behalf of DHS IP. The SOPD Director designates an alternate to assist as necessary.

Dams Government Coordinating Council

The Dams GCC enables interagency, intergovernmental, and cross-jurisdictional coordination on security and resilience strategies, activities, and policies. Members include Federal asset owners, operators, and regulators; State dam safety offices; and other public security and resilience partners at the Federal, State, local, tribal, and territorial level.

Dams Sector Coordinating Council

The Dams SCC is a self-organized, self-governed council of non-Federal (private, State, and municipal) asset owners and operators that coordinate on strategy, policy, information sharing, and risk management activities. Members also include trade organizations representing non-Federal asset owners and operators.

The Dams SCC serves as the primary private sector interface with the Federal Government on the security and resilience of dams, locks, and levees. Members help determine the nature of Dams Sector risks; facilitate timely information sharing to asset owners; and support development of prevention, protection, mitigation, response, and recovery strategies for the sector. The Dams SCC also facilitates the coordination of sector-wide initiatives and policy-related activities to improve cyber and physical security and resilience. Voting members of the Council include participating non-Federal asset owners and operators, the Chair and Vice Chair of the Levee Subsector Coordinating Council, and one representative from each of the relevant associations.

Levee Subsector Councils

The Levee Subsector Coordinating Council (LSCC) and Levee Government Coordinating Council (LGCC) were established in February 2008 as components of the Dams SCC and GCC, respectively. The LSCC provides a forum in which levee owners and industry associations can collaborate with DHS and other Federal agencies on the security and resilience of levees. As a subcouncil to the Dams SCC, the LSCC closely coordinates its efforts with those of the Dams SCC. The LGCC provides a forum for effective coordination of security and resilience activities related to levees and flood risk reduction infrastructure systems among Federal and State agencies.

Dams Sector Joint Council Working Groups

The Dams Sector forms working groups to substantially research or coordinate on particular topics and advise other Council members. All Dams SCC and GCC members may designate an individual to serve on working groups, which may be formed or disbanded at any time by the Joint Council. Current workings groups include:

- **Security Education Working Group**—Conducts outreach and training activities and develops sector-specific reference documents (such as handbooks, guides, and Web-based training).
- **Information Sharing Working Group**—Develops procedures for information sharing, alerts, warnings and notifications, suspicious activity reporting, open source digests, and exercises. This is the only permanent working group.
- **Research and Development Working Group**—Provides interagency coordination of research and development (R&D) activities and identifies and prioritizes R&D gaps in the Dams Sector.
- **Risk Assessment Working Group**—Supports identification, characterization, and prioritization of sector critical assets; identifies standard attack vectors; and supports a sector-wide conditional risk assessment methodology.
- **Cybersecurity Working Group**—Provides strategic recommendations, reviews and evaluates R&D efforts associated with the cybersecurity of industrial control systems, and provides recommendations regarding cybersecurity risk mitigation technologies.

Dams Government Coordinating Council Voting Members

U.S. Army Corps of Engineers (USACE) within the Department of Defense

Oversees 706 dams, 236 locks, 75 hydropower projects, and 14,500 miles of levees and provides technical assistance to flood-risk communities and the military.

U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)

Provides technical and financial assistance for almost 27,000 NID dams and financial assistance for another 11,000 NID dams designed for agricultural water storage, sediment retention, and flood protection.

U.S. Department of Homeland Security (DHS), Office of Infrastructure Protection (IP)

Leads Federal coordination with the private sector as the SSA and chair of the Dams GCC.

U.S. Department of the Interior (DOI), Bureau of Reclamation (Reclamation)

Owns, operates, and maintains more than 600 dams, reservoirs, and canals built in the 17 western States for water resource management and development. Owns and operates 53 power plants that make Reclamation the second-largest U.S. producer of hydroelectric power.

U.S. Department of State, International Boundary & Water Commission (IBWC)

The U.S. Section, along with the Mexican Section of the IBWC, has jurisdiction over 2 large international dams, 5 small diversion dams, and more than 500 miles of levees and floodways along the Rio Grande.

U.S. Department of Labor (DOL), Mine Safety and Health Administration

Regulates the safety of mining industry dams, including 626 coal mining dams in 11 districts and 1,902 metal and nonmetal dams in six districts.

Federal Energy Regulatory Commission (FERC)

Licenses private, State, and municipal entities to construct and operate non-Federal hydroelectric projects—now numbering about 2,600 dams.

Tennessee Valley Authority (TVA)

Owns and operates 49 dams affecting navigation, flood control, or public lands and reservations in the Tennessee River System.

State Entities or Dam Safety Offices

Regulate 77 percent of NID dams and typically provide safety evaluations, review plans for new dam construction and major repairs, periodically inspect dams and dam construction projects, and review and approve emergency action plans. Current GCC members include:

- Arkansas Department of Natural Resources
- California Department of Water Resources
- Florida Department of Environmental Protection
- New Hampshire Department of Environmental Services
- New Jersey Department of Environmental Protection
- North Carolina Department of Environment and Natural Resources
- Pennsylvania Department of Environmental Protection
- Lower Colorado River Authority

Dams Government Coordinating Council (GCC) Ad-Hoc Members

U.S. Coast Guard (USCG)

Supports maritime transportation safety, security, and mobility.

U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA)

Serves as the lead agency for the National Dam Safety Program and conducts flood mapping to determine risk zones behind levees.

U.S. Department of Interior Bureaus

Plan, design, construct, operate, maintain, and provide oversight for nearly 3,000 dams. Aside from the Bureau of Reclamation (which serves as a voting member), bureaus may include the Bureau of Land Management, the Bureau of Indian Affairs, the U.S. Fish and Wildlife Service, the National Park Service, and the Office of Surface Mining.

U.S. Department of Energy (DOE)

Owns and operates 15 dams at 3 sites. Serves as the Energy Sector-Specific Agency and coordinates security and resilience and emergency response for critical U.S. energy assets.

U.S. Environmental Protection Agency (EPA)

Responsible for protecting water systems that depend on the water stored by dams or conveyed by canals. Serves as the Water Sector-Specific Agency and leads Water Sector security and resilience.

Bonneville Power Administration (BPA)

Markets wholesale electrical power from 31 Federal hydro projects in the Columbia River Basin that are operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation. BPA hydro projects have a capacity of over 22,000 megawatts, or about 53 percent of the total Northwest generation capacity from all sources.

National Weather Service (NWS)

Issues hydrologic forecasts and flash flood/flood warnings for dam and levee operators.

State, Local, Tribal, and Territorial Government Coordinating Council (SLTTGCC) Liaisons

Two designated liaisons participate in Dams Sector quarterly meetings to ensure maximum coordination below the Federal level.

Levee Subsector GCC Members

California Department of Water Resources

DHS Office of Infrastructure Protection

DHS Federal Emergency Management Agency

USDA Natural Resources Conservation Service

International Boundary and Water Commission

U.S. Army Corps of Engineers

Dams Sector Coordinating Council Members

Ameren Services Company

American Electric Power

Brookfield Renewable Energy

Consumers Energy

Dominion Resources

Duke Energy Corporation

Exelon Corporation

Grant County Public Utility District

New York City, Department of Environmental Protection

New York Power Authority

Northwestern Energy

Ontario Power Generation

Pacific Gas & Electric Company

Salt River Project Water and Power

SCANA Corporation

Seattle City Light

South Carolina Public Service Authority

Southern California Edison

Southern Company

Talen Energy

Xcel Energy Corporation

Trade Associations

Represent private, State, and local Dams Sector asset owners and operators and promote education, policies, and activities that mitigate Dams Sector risks.

Association of State Dam Safety Officials (ASDSO)

Represents State and Federal dam safety and levee regulators, dam owners and operators, and others interested in promoting dam safety.

Association of State Flood Plain Managers (ASFPM)

Represents Federal, State, local, academic, industry, and insurance flood hazard specialists involved in floodplain management; flood hazard mitigation; the National Flood Insurance Program; and flood preparedness, warning, and recovery.

Colorado River Energy Distributors Association

Represents consumer-owned electric systems that purchase Federal hydropower and resources of the Colorado River Storage Project.

National Association of Flood and Stormwater Management Agencies

Represents State and local public agencies who protect lives and property from storm and flood waters.

National Hydropower Association

Represents owners, manufacturers, consultants, and attorneys that account for more than 61 percent of non-Federal hydroelectric capacity.

National Mining Association

Advocates public policies to protect and expand U.S. mining operations.

National Water Resources Association

Represents rural water districts, municipal water entities, commercial companies, and individuals concerned with water management and conservation.

United States Society on Dams (USSD)

Serves as the nationwide professional organization focusing on dam and water resources development. Represents the United States as one of the 83 member countries of the International Commission on Large Dams and has served as the private sector member of the National Dam Safety Review Board since its establishment in 1998.

Levee Subsector SCC Members

Arizona, Maricopa County

Association of State Dam Safety Officials

Association of State Floodplain Managers

California, Los Angeles County Department of Public Works

Florida, South Florida Water Management District

FM Global

Louisiana, Southeast Louisiana Flood Protection Authority-East

Louisiana, South La Fourche Levee District

Louisiana State Police, Levee District

National Association of Flood and Stormwater Management Agencies

Ohio, Miami Conservancy District

U.S. Society on Dams

Key Dams Sector Safety Programs

- **The National Dam Safety Program** as it exists today was established in 1996 under FEMA leadership and reauthorized again in 2014 (though the first Dam Safety Program was authorized in 1986 under the Secretary of the Army).²⁸ It provides grants to State dam safety programs that fund training, technical assistance, inspection, and research. No funding is provided for dam rehabilitation. Two advisory boards operate under the program.
- **The National Dam Safety Review Board**, an 11-member advisory board with Federal, State, and private representation, advises the Administrator of FEMA on implementing the National Dam Safety Program and the implications of national policy. The Board also assists FEMA in the review of State dam safety programs that received Federal grants to improve their programs.
- **The Interagency Committee on Dam Safety**, composed of Federal owners and regulators, encourages effective Federal programs, policies, and guidelines to enhance dam safety, and serves as the permanent forum for the coordination of Federal activities in dam safety.

The Levee Safety Initiative was established under the Water Resources Reform and Redevelopment Act of 2014. It will create levee safety guidelines and provide funding to States to establish levee safety programs, similar to the model of State dam safety programs. The initiative follows recommendations for a national levee safety program that were submitted to Congress in 2009 by the National Committee on Levee Safety.²⁹

Benefits of Participation in the Sector Partnership

Active participation in the Dams Sector Partnership provides stakeholders real strategic value. By understanding this value and the resulting benefits, individual owners and operators and other stakeholders are more likely to fully engage in sector planning and coordination. Partners can expect to accrue the following benefits from Dams SCC or GCC participation:

- Receive information on potential threats from government and industry colleagues.
- Exchange information, lessons learned, and best practices with sector and cross-sector partners.
- Obtain direct access to tools and guidance that help operators assess facility risk, plan and prepare for emergencies, manage and reduce individual risks, and increase knowledge on key sector topics.
- Provide direct input to the identification and prioritization of national Dams Sector priorities and needs, which inform government policy, Dams Sector R&D, and risk management programs.

CHAPTER ENDNOTES

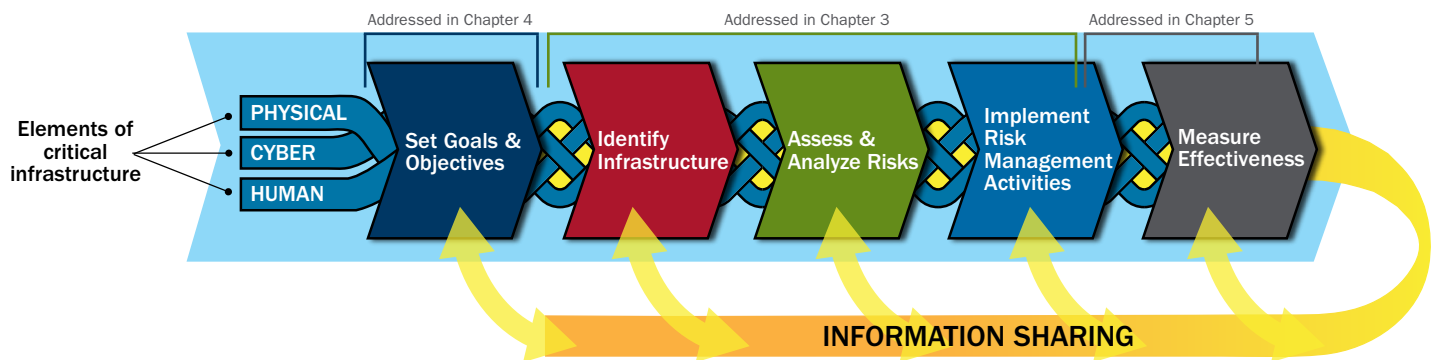
1. Association of State Dam Safety Officials, "Dams Are a Vital Part of the National Infrastructure," accessed April 2015, <http://www.damsafety.org/news/?p=09a34183-4894-4781-9bfb-d4ce980d8cd1>.
2. U.S. Energy Information Administration (EIA), *Monthly Energy Review*, Table 7.2a Electricity Net Generation: Total (All Sectors), (EIA, February March 2015), http://www.eia.gov/totalenergy/data/monthly/pdf/sec7_5.pdf.
3. U.S. Army Corps of Engineers, Bonneville Power Administration (BPA), and U.S. Bureau of Reclamation, *Federal Columbia River Power System* (BPA, August 2003), http://www.bpa.gov/power/pg/fcrps_brochure_17x11.pdf.
4. American Society of Civil Engineers (ASCE), "Dams and Levees Infographic," 2013 *Report Card for America's Infrastructure* (ASCE, 2013), <http://www.infrastructurereportcard.org/a/#e/dams-levees-infographic-01>.
5. U.S. Army Corps of Engineers, "Navigation," accessed April 2015, <http://www.usace.army.mil/Missions/CivilWorks/Navigation.aspx>.
6. U.S. Department of Transportation Maritime Administration (MARAD), *Waterways: Working for America* (MARAD, n.d.), accessed April 2015, http://www.marad.dot.gov/documents/water_works_REV.pdf.
7. U.S. Department of Transportation Maritime Administration (MARAD), *Waterways: Working for America* (MARAD, n.d.), accessed April 2015, http://www.marad.dot.gov/documents/water_works_REV.pdf.
8. Association of State Dam Safety Officials, "Dam Safety Regulation in the U.S.," accessed April 2015, <http://www.damsafety.org/news/?p=95446bff-9706-419b-917e-f0758fc37e74>.
9. Federal Energy Regulatory Commission (FERC), "Origin of Hydroelectric Regulation," updated November 18, 2011, <http://www.ferc.gov/industries/hydropower/gen-info/regulation/origin.asp>.

10. Institute for Energy Research, "Encyclopedia Entry: Hydroelectric," last updated July 2014, http://instituteforenergyresearch.org/topics/encyclopedia/hydroelectric/#_edn1.
11. Federal Emergency Management Agency, *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams* (FEMA 333, October 1998, reprinted January 2004), <https://www.fema.gov/media-library/assets/documents/3909>.
12. U.S. Army Corps of Engineers, "National Inventory of Dams," 2013, <http://nid.usace.army.mil>.
13. Association of State Dam Safety Officials, "Dam Safety Regulation in the U.S.," accessed April 2015, <http://www.damsafety.org/news/?p=95446bff-9706-419b-917e-f0758fc37e74>.
14. American Society of Civil Engineers (ASCE), "Dams," 2013 Report Card for America's Infrastructure (ASCE, 2013), <http://www.infrastructurereportcard.org/a/#p/dams/overview>.
15. American Society of Civil Engineers (ASCE), "Dams: Investment and Funding," 2013 Report Card for America's Infrastructure (ASCE, 2013), <http://www.infrastructurereportcard.org/a/#p/dams/investment-and-funding>.
16. U.S. Army Corps of Engineers (USACE), "Levee Safety Program," accessed January 2015, <http://www.usace.army.mil/Missions/CivilWorks/LeveeSafetyProgram.aspx>.
17. National Committee on Levee Safety, *Recommendations for a National Levee Safety Program* (2009), draft report, http://www.leveesafety.org/docs/NCLS-Recommendation-Report_012009_DRAFT.pdf.
18. Federal Emergency Management Agency (FEMA), *The Facts about Levees* (FEMA, 2012), <https://www.fema.gov/media-library/assets/documents/22886>.
19. U.S. Army Corps of Engineers (USACE), "USACE Program Levees," accessed January 2015, <http://www.usace.army.mil/Missions/CivilWorks/LeveeSafetyProgram/USACEProgramLevees.aspx>; U.S. Army Corps of Engineers Rock Island District, "Levee Safety Program," accessed January 2015, http://www2.mvr.usace.army.mil/projects/dsp_factsheet.cfm?ProjID=F608A460-1143-30FB-26F4E3B9DF3F34A9.
20. National Committee on Levee Safety, *Recommendations for a National Levee Safety Program* (2009), draft report, http://www.leveesafety.org/docs/NCLS-Recommendation-Report_012009_DRAFT.pdf.
21. U.S. Army Corps of Engineers (USACE) Levee Safety Program, "National Levee Database," presentation, April 2012, <http://www.fgdc.gov/participation/coordination-group/meeting-minutes/2012/april/national-levee-database-cg-20120410.pdf>.
22. American Society of Civil Engineers (ASCE), "Dams and Levees Infographic," 2013 Report Card for America's Infrastructure (ASCE, 2013), <http://www.infrastructurereportcard.org/a/#e/dams-levees-infographic-01>.
23. U.S. Army Corps of Engineers, "Navigation," accessed April 2015, <http://www.usace.army.mil/Missions/CivilWorks/Navigation.aspx>.
24. J.R. Courivaud, J.J. Fry, S. Bonelli, N. Benahmed, P.L. Regazzoni, et al., "Measuring the erodibility of soil materials constituting earth embankments: a key input for dams and levees safety assessment.," *Hydro* 2009, (October 26-28, 2009): 9, <http://hal.univ-nantes.fr/hal-00516263/document>.
25. Association of State Dam Safety Officials, "Dam Failures and Incidents," accessed January 2015, <http://www.damsafety.org/news/?p=412f29c8-3fd8-4529-b5c9-8d47364c1f3e>.
26. American Society of Civil Engineers (ASCE), "Dams," 2013 Report Card for America's Infrastructure (ASCE, 2013), <http://www.infrastructurereportcard.org/a/#p/dams/overview>.
27. American Society of Civil Engineers (ASCE), "Dams and Levees Infographic," 2013 Report Card for America's Infrastructure (ASCE, 2013), <http://www.infrastructurereportcard.org/a/#e/dams-levees-infographic-01>.
28. Association of State Dam Safety Officials, "Dam Safety History," accessed April 2015, <http://www.damsafety.org/media/Documents/Legislative%20Handouts/2007-08/National%20Dam%20Safety%20Program%20Act%2006.pdf>.
29. National Committee on Levee Safety, *Recommendations for a National Levee Safety Program* (2009), draft report, http://www.leveesafety.org/docs/NCLS-Recommendation-Report_012009_DRAFT.pdf.

3 RISK MANAGEMENT AND NATIONAL PREPAREDNESS

Risk management is the cornerstone of the NIPP 2013 and of the national effort to strengthen security and resilience. It focuses on enabling owners and operators to make risk-informed decisions that best allocate limited resources to the most effective mitigation solutions. The critical infrastructure risk management framework (Figure 5)—outlined in the NIPP 2013—enables the critical infrastructure community to focus on those threats and hazards that are most likely to cause harm, and employ prioritized approaches that are designed to prevent or mitigate the effects of incidents. It also increases security and strengthens resilience by identifying and prioritizing actions to ensure continuity of essential functions and services during incidents and supports rapid response and restoration.

Figure 5: NIPP 2013 Critical Infrastructure Risk Management Framework



The Dams Sector goals and priorities (which the sector also calls objectives) are directly rooted in the NIPP 2013 risk management framework. Updated goals and priorities (objectives) reflect the maturation of the partnership and the significant progress made toward 2010 SSP objectives. This chapter presents the Dams Sector’s ongoing efforts and planned approaches that support risk management and national preparedness. For more information on sector resources, visit the [Dams Sector Webpage](#) or email Dams@hq.dhs.gov.

3.1 Risk Management

The NIPP 2013 defines risk as the potential for an adverse outcome from an event, determined by the event’s likelihood—a function of the specific threats and vulnerabilities—and associated consequences if the event occurs.³⁰ While individual owners and operators are responsible for managing risk to their individual assets, Dams Sector partnership activities can improve understanding of threats, vulnerabilities, and consequences and provide owners and operators with tools, guidelines, information, best practices, and resources to facilitate more effective risk assessments and risk management decisions at all levels.

The dam safety community has long-standing and well-established risk management programs and approaches to assess, mitigate, and respond to the potential damages caused by catastrophic dam and levee failures, particularly those induced by natural hazards. Sector partners share a large body of knowledge and experience in identifying structural and operational deficiencies with respect to the extreme demands imposed by natural hazards and quantifying the consequences of potential failure. The following sections outline the sector’s approach to identifying infrastructure, assessing and analyzing risks, and implementing risk management activities.

Identify Infrastructure

Sector partners have developed a number of tools and programs to support asset owners and operators in identifying their most critical assets—determined by the most severe potential consequences from asset failure. Asset owners and regulators can report asset data to two national databases that inventory infrastructure information and identify the most critical assets from a national perspective.

Infrastructure Inventories

The National Inventory of Dams (NID) is an online database that is voluntarily populated by Federal and State agencies under scheduled updates. All dams designated as having high hazard potential or significant hazard potential are to be included in the NID, as well as low hazard potential dams meeting the size criteria (see [Table 1. Dam Safety Hazard Potential Classification](#) in Section 2).

The 2013 NID lists 14,726 dams with high hazard potential classifications, 12,406 dams with significant hazard potential classifications, 58,956 dams with low hazard potential classifications, and 1,271 dams with an undetermined hazard potential.

The National Levee Database is a dynamic, searchable inventory of information about levee systems and serves as a key national resource supporting decisions and actions affecting levee safety. It currently has information on more than 14,700 miles of levees. USACE is working with other Federal and State regulatory agencies to expand the database to include all U.S. levee systems.

Asset Identification Tools and Programs

The Dams Sector uses several tools that employ consequence assessments to identify the most critical Dams Sector assets. Consequence assessments are discussed further under [Assess and Analyze Risks](#). Registered Homeland Security Information Network – Critical Infrastructure (HSIN-CI) users can access information on the following methodologies through the HSIN-CI Dams Portal.

- **The Dams Sector Consequence-Based Top-Screen (CTS)** methodology is a quick screening approach designed to effectively identify and characterize high-consequence facilities in the Dams Sector—those in which failure or disruption could potentially lead to the most severe impacts, either for the sector or individual asset owners. By focusing on potential consequences and decoupling the analysis from the threat and vulnerability components of the risk assessment process, the CTS approach can serve as an effective all-hazards preliminary prioritization process. The CTS approach also helps identify those assets that could potentially attract higher adversarial interest.
 - The CTS process is implemented through an interactive, Web-based questionnaire using parameters that characterize human impacts, economic impacts, and impacts on critical functions under a “worst reasonable case scenario.” It identifies high-consequence assets at the facility level, but also supports aggregation of sector information to identify the most critical sector assets.
 - The scenario represents total or extremely severe damage to the facility, but does not consider compounding factors of current events or human error. The CTS also does not consider the structural condition or vulnerability of the facility or the likelihood of an incident triggering the worst reasonable case scenario. The resulting estimates thus represent a reasonable upper bound of potential consequences, regardless of the triggering event.
- **The Portfolio Prioritization Tool (PPT)** supports the prioritization of those facilities identified through the CTS process under all hazards. PPT information can support owners and operators in prioritizing certain assets for additional analyses or particular attention from emergency management partners during disaster response. For example, an owner with a large portfolio of dams could use CTS and PPT data to identify high-consequence facilities that would benefit from additional detailed flood inundation studies or risk assessments. In disaster planning or preparation for an incoming weather event, the CTS process can inform decision-makers in the emergency management community about which facilities have the highest potential for significant damage at the local and regional levels.
 - The PPT is scalable and may be used for various portfolio levels (i.e., national, regional, and State) by adopting different severity thresholds and relative weights for individual consequence categories. The PPT computes a numerical score, referred to as the Potential Consequence Index, which ranges from 0 to 100 and represents the combined potential for severe impacts. This index is based on the perceived relative importance of the different consequence categories.
 - CTS and PPT results also support regional impact assessments that the Dams SSA develops during natural disasters or manmade incidents.

- **The DHS National Critical Infrastructure Prioritization Program (NCIPP)** conducts an annual data call with all critical infrastructure sectors and uses cross-sector consequence to identify assets with the potential for regional or national catastrophic effects, using criteria developed by the Office of Cyber and Infrastructure Analysis (OCIA). The Dams Sector uses CTS data to validate the Dams Sector results of the NCIPP data call.

Assess and Analyze Risks

Facility-specific risk assessments explicitly take into account the specific vulnerabilities of each asset and the local and regional consequences of asset failure, while factoring in relevant information about Dams Sector threats from operational experience and intelligence information. The result of risk assessments informs the development of facility-specific security and resilience measures that reduce individual owner and operator risk and collectively contribute to regional and national resilience. The Dams Sector also assesses sector-level consequences using combined results of individual consequence assessments.

Vulnerability and Consequence Assessments

The vast majority (81 percent) of the Nation’s most critical Dams Sector assets³¹ are owned (72 percent) or regulated (9 percent) by Federal agencies that have their own established security risk assessment methodologies to identify facility-specific security vulnerabilities. Several Federal organizations provide standards and conduct site assessments under their regulatory authority:

- USACE, the Bureau of Reclamation, and TVA conduct comprehensive risk assessments at federally owned dams and levees under their self-regulating authorities. USACE also conducts risk assessments of non-Federal dam and levee assets that it oversees.
- Private and municipal hydroelectric utilities under the jurisdiction of FERC also complete mandatory vulnerability and security assessments at their critical facilities that are consistent with FERC and industry-developed security guidance.
- Hydroelectric utilities also comply with the Critical Infrastructure Protection reliability standards established by the North American Electric Reliability Corporation (NERC).

Outside of those regulatory inspections, DHS has conducted **voluntary security assessments** of 70 percent of critical Dams Sector assets³² through two initiatives:

- During voluntary **Site Assistance Visits (SAVs)**, Federal subject matter experts examine a facility’s security and resilience measures, help identify potential vulnerabilities, and provide feedback on potential risk mitigation measures. SAVs may be done as part of larger regional efforts to help identify regional interdependencies among critical infrastructure and improve coordination with emergency planners and first responders.
- **Enhanced Critical Infrastructure Protection (ECIP) Security Surveys** are conducted by the DHS IP Protective Security Advisors (PSAs) to assess asset-specific and sector-level vulnerabilities. The ECIP security surveys collect, process, and analyze facility assessment data in near real-time. Data collected during the ECIP security surveys is weighted and scored, enabling DHS to conduct sector-by-sector and cross-sector vulnerability comparisons. Critical infrastructure owners receive a detailed analysis of the resilience of their asset compared to similar facilities, while comparisons enable DHS to identify sector security gaps and trends.

The DHS National Protection and Programs Directorate (NPPD) Office of Cybersecurity & Communications (CS&C) also provides tools and approaches for cybersecurity vulnerability assessments. Resources include:

RISK ASSESSMENT

Dams Sector risks are assessed at the facility and sector level as a function of threats, vulnerabilities, and consequences associated with a particular event:

Threat

Natural or manmade occurrence, individual, entity, or action that has or indicates the potential to harm life, information, operations, the environment, and/or property.

Vulnerability

Physical feature or operational attribute that renders an entity open to exploitation or susceptible to a given hazard.

Consequence

Effect of an event, incident, or occurrence.

- **The Cybersecurity Evaluation Program and Cyber Resilience Review (CRR)** process is a no-cost, non-technical, voluntary self assessment or onsite-facilitated assessment that helps an organization to measure its cybersecurity capabilities against ten domains.
- **The Cyber Infrastructure Survey Tool and Cybersecurity Evaluation Tool (CSET)** are both no-cost, voluntary technical assessments that owners and operators can download and use to assess their network infrastructure and components that directly support control system operations and processes.

The majority of the Nation's dams (and about 19 percent of the sector's most critical assets) are **regulated and may be inspected by State dam safety offices**. The scope of these programs is different from State to State; however, they typically encompass safety evaluations of existing dams, reviews of plans and specifications for dam construction and major repairs, periodic inspections of construction of new dams or at existing dams, and review and approval of emergency action plans. Despite the valuable role of State dam safety agencies, they are almost uniformly understaffed and generally lack the resources for risk assessment, particularly when the majority of their assets have a low hazard potential.

Information Sharing to Support Threat Assessments

Sector partners have identified several information sources and information-sharing mechanisms that support broad public-private information sharing, which plays a key role in owner and operator assessment of facility-specific and sector-level threats. In 2005, the Dams Sector established the Information Sharing Working Group, which actively addresses multiple issues related to information sharing across the sector's broad spectrum of owners and operators.

Several sources of intelligence and risk information sharing are available to the Dams Sector:

- **The HSIN-CI Dams Portal** is the sector's primary information-sharing mechanism and vehicle for conveying lessons learned. This portal is an effective Web-based tool through which trusted and vetted public and private sector partners, including owners and operators, can obtain sensitive but unclassified information that is relevant to a number of sector issues. Owners and operators post documents, templates, and model forms on the HSIN-CI Dams Portal that can be used by others.
 - The Dams Sector also develops unclassified communications that can be distributed more broadly through existing communication channels, such as the notification systems of the National Hydropower Association, USSD, the National Mining Association, ASDSO, and FERC. In addition, hydropower generation facilities have the capability to tie into the Electricity Sector Information Sharing and Analysis Center (ES-ISAC), which issues regular threat alerts regarding computer systems and cybersecurity.
- **USACE has been sharing information related to suspicious activity at dams** with Federal dam owners and the collective homeland security community since November 2001 via the Incident Reporting System, which resides on the USACE corporate emergency management system, ENGLink Interactive. This tool is a dynamic information-sharing system with the following functions: user-friendly data entry of threatening or suspicious activity and criminal activity; geospatial mapping of activity; general posting of situation reports; file attachment capabilities (e.g., digital media); permission to revise, modify, and/or update reporting; immediate dissemination of email alerts; and a communications check status for command and control purposes. This incident reporting system is used by various agencies in developing intelligence reports.
 - Federal partners leverage this incident reporting system to report suspicious activities. Select members meet monthly to review events, conduct preliminary analysis of reported events, and produce scheduled activity summaries. Product summaries are not only distributed within sector organizations, but also to selected agencies in the DHS intelligence and law enforcement communities for aggregate analysis.
- The Dams Sector implemented a **Suspicious Activity Report online tool** within the HSIN-CI Dams Portal to provide users with the capability to report and retrieve information pertaining to suspicious activities that may potentially be associated with pre-incident surveillance, activities exploring or targeting a critical infrastructure facility or system, or any possible violation of law or regulation that could compromise the facility or system in a manner that could cause an incident jeopardizing life or property. The online tool does not replace existing agency or organizational reporting mechanisms, but instead enhances them by providing a broader, horizontal approach to reporting suspicious activities. While suspicious activities should always be reported to the appropriate authorities, this online tool is used to provide an extra opportunity for real-time situational awareness across the sector.

- Each **Federal Bureau of Investigation (FBI)** field headquarters has a **Joint Terrorism Task Force** that is generally available as a resource to dam owners to assist them in identifying potential threats to their facilities. The FBI Threat Review Unit reviews and attempts to resolve suspicious activities and threats reported to the bureau.
- **The National Infrastructure Coordinating Center (NICC)** is a DHS watch operations center that maintains operational awareness of the Nation’s critical infrastructure and provides mechanisms and tools for sharing critical information among government and industry partners in response to infrastructure incidents. The Dams Sector Information Sharing Working Group collaborated with the Dams SSA to implement effective mechanisms for notification of urgent alerts and warnings using the Executive Notification Service managed by the NICC.
- **The National Cybersecurity and Communications Integration Center (NCCIC)** shares information among the public and private sectors to provide greater understanding of cybersecurity and communications vulnerabilities, intrusions, incidents, mitigation, and recovery actions. The NCCIC comprises several branches that encompass the authorities and capabilities to address cybersecurity at the operational level:
 - **The United States Computer Emergency Readiness Team (US-CERT)** leads efforts to improve the Nation’s cybersecurity stance, coordinate cyber information sharing, and proactively manage cyber risks to the United States. US-CERT is responsible for analyzing and reducing cyber threats and vulnerabilities, disseminating cyber threat warning information, and coordinating cyber incident response activities. The sector’s participation in efforts such as the Cross-Sector Cybersecurity Working Group provides additional opportunities for effective information sharing on critical issues related to cybersecurity.
 - **The Industrial Control Systems Cyber Emergency Response Team (ICS-CERT)** mitigates the risk to the Nation’s critical infrastructure by strengthening control systems security through public-private partnerships. The Industrial Control Systems Joint Working Group provides the Dams Sector an additional opportunity for information sharing on cybersecurity-related issues pertaining specifically to control systems.

Implement Risk Management Activities

Security programs, resilience strategies, and specific security measures for individual sector assets will vary greatly depending on the level of risk that encompasses the specific threat to the asset, its vulnerability, and the consequences of failure. Dams Sector partners may develop emergency action plans, business continuity plans, and disaster recovery plans to support incident response and restoration.

Owners and operators also typically undertake a number of safety and security measures that include, but are not limited to, the installation of boat and vehicle barriers, enhanced access control measures, expanded closed-circuit television (CCTV) coverage, increased use of alarm systems, enhanced measures to secure control systems (both physical and cyber), the integration of security into existing emergency action plans, and expanded personnel screening programs. Security measures at dams, levees, and other sector assets also include contingency planning and increased liaison with all levels of law enforcement and emergency response agencies. Nonstructural protective measures such as zoning, strengthened building codes, floodplain management ordinances, development fees, flood risk education programs, and relocation of flood-prone communities and infrastructure are examples of security and resilience measures that can substantially decrease the impact of a levee break.

Dams Sector partners work collaboratively with the SSA to develop guidance and reference materials that support security and resilience, participate in voluntary programs that increase resilience, and conduct training for sector partners to improve risk management capabilities and support individual risk reduction measures, including:

- **Guidelines and Web-based Training:** The Security Education Working Group led the development of online training modules based on the three sector handbooks (Security Awareness, Protective Measures, and Crisis Management) it developed to provide sector stakeholders with information on security vulnerabilities, enhance their ability to assess the risks to their respective facilities, and improve their incident response capabilities. [Appendix C](#) contains a full list of guidelines developed by Dams Sector partners.

This training initiative is of great importance because the sector is extremely large in scope and includes owners and operators with limited funding. As such, these individuals are often unable to attend conferences and training sessions to obtain state-of-the-practice information. The online training modules will help to ensure that all sector

stakeholders have the information needed to assist them in enhancing security and ultimately reducing risk at their respective facilities. Upon successful completion of any of the three training modules, users will be provided with a certificate of completion for their records. In addition, the SSA will maintain a record of all who have completed the training for metrics purposes.

- **Instructor-Led Training:** The Security Education Working Group also developed an instructor-led course on Protective Measures for Dams Sector owners and operators.

All Dams Sector partners can benefit from additional training, exercises, outreach, and educational opportunities on such topics as risk assessment, risk management, cost-benefit analysis, and cybersecurity strategies. Training developed by an institution such as the Federal Law Enforcement Training Center (FLETC) or its partner organizations would be particularly helpful to build personal relationships among Federal and private security personnel. Security officers and State and local law enforcement could benefit from training on protection- and response-related topics ranging from countersurveillance to vehicle searches. Red-teaming exercises (i.e., testing a facility's security measures using trained teams of simulated adversaries) can help asset owners and operators determine the effectiveness of their security programs and prepare staff to respond quickly and properly in the event of an actual incident.

The Federal Government also supports risk mitigation activities at the regional level through its **Protective Security Advisor (PSA)** Program. PSAs are DHS security and vulnerability assessment specialists assigned as DHS liaisons for the Federal, State, local, tribal, and territorial governments and the private sector. PSAs are responsible for sharing risk information and providing technical assistance to local law enforcement and critical infrastructure owners and operators within their respective areas of responsibility.

3.2 Managing Cyber Risks

The Dams Sector actively addresses cybersecurity risks in a coordinated way by sharing risk information, developing sector-specific guidelines, and facilitating robust cybersecurity planning. The Dams Sector Cybersecurity Working Group includes public and private sector cybersecurity experts who primarily lead and coordinate the sector's voluntary cybersecurity activities under directives from the Dams SCC and GCC. Four key Dams Sector activities are now under way to improve cyber risk management for owners and operators:

- **Update the Roadmap to Secure Control Systems in the Dams Sector by 2015.** Originally released in 2010, the updated roadmap provides a strategic vision and recommended strategies to advance the sector-wide security and resilience of industrial control systems. It sets milestones designed to drive and coordinate public and private cybersecurity R&D and information sharing. The roadmap also helps owners and operators understand cyber risks, identify practical risk mitigation solutions, and improve sector-wide awareness of cybersecurity concerns.
- **Develop the Dams Sector Cybersecurity Guidelines by 2015.** The Cybersecurity Working Group is developing guidance for owners and operators that promotes industry best practices and identifies voluntary standards and guidelines most applicable to Dams Sector cyber infrastructure.
- **Promote the National Institute of Standards and Technology (NIST) Cybersecurity Framework and participate in the Critical Infrastructure Cyber Community (C³) Voluntary Program.** The 2014 NIST Framework for Improving Critical Infrastructure Cybersecurity provides a voluntary, flexible approach to managing cyber risks. Rather than prescriptive steps, it offers a repeatable framework to assess cybersecurity risk and prioritize cost-effective solutions. To promote sector-wide implementation, the Cybersecurity Working Group is developing a Dams Sector Cybersecurity Framework Implementation Guidance that tailors the Cybersecurity Framework approach to Dams Sector assets and operations.
 - **The Dams Sector also promotes participation in the DHS C³ (pronounced “C Cubed”) Voluntary Program** established in February 2014 under EO 13636. The Dams Sector periodically hosts the C³ Voluntary Program at its Joint Council meetings, distributes C³ resources, and provides various engagement opportunities. The Dams Sector also promotes awareness of other Federal resources and programs to promote security and resilience of physical and cyber infrastructure, such as the DHS Cyber Resilience Review (CRR) process and the Cybersecurity Assessment and Risk Management Approach (CARMA), among others.

- **Develop the Dams Sector Cybersecurity Capability Maturity Model (C2M2).** The C2M2 is a voluntary tool that owners and operators can use to assess their cybersecurity practices, and identify and prioritize the most effective cybersecurity enhancements for each facility’s individual risk profile and cyber infrastructure design.

In addition, Federal partners are planning to conduct an integrated cyber and physical risk assessment of Dams Sector infrastructure. While facilities typically manage risks on an individual basis or with a few key partners, a sector-wide risk assessment can identify shared risks and inform collaborative mitigation strategies. Cyber risks in particular, when taken collectively, may require mitigation approaches or coordinated efforts that extend beyond the capabilities of individual industry and government organizations.

The DHS Office of Cybersecurity and Communications (CS&C) plans to work with the Dams Sector to develop a work plan and timeline to conduct an integrated cyber-physical risk assessment. Sector partners developed notional Dams Sector critical functions and services as part of the 2013 Cyber-Dependent Infrastructure Identification (CDII) effort required by Executive Order 13636. DHS plans to coordinate with the Dams Sector Cybersecurity Working Group to:

1. Validate Dams Sector critical physical and cyber functions and services with subject matter experts.
2. Evaluate interdependent threats, vulnerabilities, and consequences to these critical functions.
3. Establish the sector’s risk priorities.

This will enable the sector to take a risk-informed approach to sector planning and stakeholder outreach over the coming years to make the most of limited government and industry resources.

Members of the Dams SCC and GCC, as well as the SSA, also serve as members on the Cross-Sector Cybersecurity Working Group and the Industrial Control Systems Joint Working Group. These working groups provide cross-sector coordination and expertise on cyber-specific issues, such as common vulnerabilities, risk mitigation measures, and the design and development of more secure control systems across sectors.

Cyber risks are primarily managed at the facility level. Individual facilities may be subject to cybersecurity measures or standards required by their Federal or State regulators. In particular, hydroelectric facilities that contribute to the bulk electric system are subject to the mandatory North American Electric Reliability Corporation (NERC) [Critical Infrastructure Protection \(CIP\) reliability standards](#). CIP standards have been updated periodically by NERC since their enactment in 2005, and are ultimately approved and enforced by the Federal Energy Regulatory Commission (FERC). They require bulk power system entities to:

- Identify and document cyber risks and vulnerabilities.
- Establish controls to secure critical cyber assets from physical and cyber sabotage.
- Report security incidents.
- Establish plans for recovery in the event of an emergency.
- Certify their level of compliance.

Per the December 2014 signing of the Cybersecurity Enhancement Act, the Dams Sector SSA and other Dams Sector partners will provide data for the U.S. Government Accountability Office (GAO) cybersecurity assessment. The law prescribes the GAO to assess the extent to which critical infrastructure is protected from cyber threats by successfully using voluntary standards. In addition, the GAO is responsible for assessing associated risk reduction.

3.3 Mitigating Disruptions from the Loss of Lifeline Functions

The Dams Sector is tightly integrated with the Energy and Water Sectors and dependent on essential services provided by the Transportation Systems and Communications Sector. Because dams asset disruptions and failures can have cascading impacts throughout multiple sectors in the surrounding region, the Dams Sector risk assessment methodologies—in particular the Comprehensive Facility Report (CFR) module—support the identification of not only other local critical assets and

associated interdependencies, but also the potential for significant impacts associated with severe project disruption. In addition, the CFR module captures system-wide information on the watershed, including identification of other dams along the same river basin. Intended to capture historical information on flood events and other incidents, this module seeks to enhance the understanding of potential impacts to the surrounding region in the event of an attack, natural disaster, or other emergency.

Addressing critical dependencies requires active engagement and information sharing with cross-sector security partners to identify complementary risk management practices, programs, and R&D that can improve local and regional resilience and mitigate consequences from the loss of lifeline sector functions. Two of the Dams Sector priorities (objectives) specifically focus on further addressing critical sector interdependencies:

- Identify and address critical infrastructure interdependencies and associated cascading impacts that influence local and regional disruptions.
- Improve coordination of ongoing and planned relevant R&D efforts by Dams Sector partners and pursue complementary R&D efforts with interdependent sectors.

3.4 Research and Development Priorities

Risk management in the Dams Sector is supported by ongoing R&D to better understand structural risks and to develop tools that support the safe design, construction, operation, and maintenance of Dams Sector assets. The R&D Working Group maintains a current list of sector-wide R&D priorities to inform and coordinate R&D efforts among all government and private sector dams partners. R&D priorities were updated in 2015:

1. Validated blast damage prediction tools for sector assets

The Dams Sector needs validated prediction tools that can quantify blast-induced damage in sector assets—such as earthen, concrete, and steel structures—to support the accurate identification of their vulnerabilities to attack scenarios including vehicle-, water-, and person-borne explosives. Significant progress has been made in quantifying blast damage and validating prediction tools; but work continues on improving computer models based on the latest research results.

2. Effective technologies for mitigation, strengthening, and resilience of assets

The Dams Sector needs to develop mitigation strategies that can offer a solution for mitigating blast damage to Sector assets. These blast-mitigation technologies must be consistent with the operational characteristics of the site without interfering with critical project functions. Additionally, a systematic methodology is needed to evaluate and compare potential mitigation alternatives based on their damage reduction effectiveness versus associated cost and maintenance requirements. Additionally, there is a need to investigate alternatives for strengthening to determine the applicability, feasibility, and constraints of each alternative along with operational restrictions. Finally, there is a need for methods and alternatives to add or increase the resilience of critical assets, to promote reduced consequences and rapid recovery.

3. Rapid condition assessment of critical infrastructure

There are currently no well-developed methodologies for rapidly characterizing the condition of sector assets. The sector has a need to develop remote, non-intrusive, rapid technologies for determining an asset's current condition while at the same time developing decision support tools (e.g., neural networks) to quantify future performance.

4. Methods and techniques to enhance emergency response (e.g., emergency closures, rapid repair, innovative materials)

The Dams Sector needs capabilities to quickly prevent or repair the uncontrolled release of water to protect the integrity of the impounding structure and to minimize consequences resulting from uncontrolled water flow conditions. There is a need to develop methods, techniques, and materials to rapidly close a breach, repair a damaged section, or provide temporary containment until permanent repairs can be made.

5. Detection and deterrence of water-borne attack scenarios

The Dams Sector needs affordable, effective, sustainable, and practical means of interdicting water surface and subsurface approach and effective hardening measures for dams and water control structures.

6. Cybersecurity

The Dams Sector needs secure wireless communications for surveillance and monitoring systems and improved SCADA security.

7. Treatment of emerging threats (e.g., climate change, aging infrastructure, mechanical attack, earthquake, aircraft)

The Dams Sector has a need to develop methods and technologies to appropriately quantify and account for the occurrence of emerging threats or extreme events. Some of these threats or events occur slowly over a prolonged period of exposure and do not lend themselves to immediate, obvious responses. Other threats or events are unique and complicated and require focused attention to determine appropriate methods to address their occurrence.

These Dams Sector R&D gaps and technology needs contribute to and align with the cross-sector research and development priority areas identified in the 2015 [National Critical Infrastructure Security and Resilience Research and Development Plan](#). Below are the National R&D priorities:

- Develop the foundational understanding of critical infrastructure systems and systems dynamics.
- Develop integrated and scalable risk assessment and risk management approaches.
- Develop integrated and proactive capabilities, technologies, and methods to support secure and resilient infrastructure.
- Harness the power of data sciences to create unified, integrated situational awareness and to understand consequences of action.
- Build a crosscutting culture of critical infrastructure security and resilience R&D collaboration.

The Dams Sector will work closely with its Federal partners to support implementation of the Dams Sector priorities in direct support of National R&D Plan implementation.

3.5 Dams Sector National Preparedness Efforts

[Presidential Policy Directive 8: National Preparedness \(PPD-8\)](#) affirmed that preparation for major emergencies is a shared responsibility of all levels of government and the private and nonprofit sectors. It called for a National Preparedness System to help align the efforts of all partners for prevention, protection, mitigation, response, and recovery. The Dams Sector contributes to national preparedness by mitigating risks to Dams Sector facilities and downstream risks originating in the Dams Sector, and by supporting the rapid recovery of other critical sectors during emergencies.

When transitioning to incident response and recovery, Dams Sector partners may use emergency action plans (EAPs) that define facility response procedures, including notification and information sharing. The EAP, or the facility's security plan, may also address operational security procedures, such as threat and suspicious incident reporting and analysis; planned, scaled responses to varying threat levels; and coordination with law enforcement agencies. Owners and operators that have EAPs and security plans regularly test them to maintain response and recovery capabilities that enable owners and operators to restore critical services.

Dams Sector incident response operations often support rapid interagency and cross-sector disaster recovery. For example, in disasters with large amounts of power loss, hydroelectric dams may provide blackstart capabilities to the Energy and Nuclear Sectors to accelerate large-scale power restoration. Under PPD-8, FEMA set a National Preparedness Goal and revised or developed National Planning, Prevention, Protection, Mitigation, Response, and Disaster Recovery Frameworks. Dams Sector partners have key responsibilities under all frameworks and under the Mitigation, Response, and Recovery Federal Operational Plans. In particular, the Dams Sector supports two national Emergency Support Functions (ESFs), which are designed to organize and coordinate Federal, SLTT, and private sector incident response:

- USACE is the primary coordinator of **ESF #3 – Public Works and Engineering** in charge of coordinating Federal capabilities to provide emergency repair of damaged public infrastructure and critical facilities (including temporary power, emergency water, sanitation systems, etc.). USACE, the Bureau of Reclamation, and other Federal partners have specific responsibilities within this ESF, which include:
 - Supporting the restoration of critical navigation, flood control, and other water infrastructure systems, including drinking water distribution and wastewater collection systems.

- Providing coordination and technical assistance (to include vessel removal, significant marine debris removal, and hydrographic survey) to effect the rapid recovery and reconstitution of critical waterways, channels, and ports.
 - Providing engineering support to assist in evaluating damage to water control systems such as dams, levees, and water delivery facilities and structures.
 - Providing personnel to assist in damage assessment, structural inspections, debris clearance monitoring, and restoration of facilities in general.
 - Providing technical assistance in contract management, contracting, procurement, construction inspection, and environmental and archaeological assessments.
- The U.S. Department of Energy is the primary coordinator of **ESF #12 – Energy**, which is intended facilitate the restoration of damaged energy systems and components during incidents requiring a Federal response. Multiple Dams Sector partners have coordination responsibilities to support hydroelectric power continuity and restoration. In particular, the Bureau of Reclamation:
 - Provides technical assistance for the assessment of hydroelectric facilities and flood control actions as they affect energy production.
 - Uses Bureau of Reclamation personnel to assist in the repair of damaged hydropower generation facilities.
 - Modifies operations at Bureau of Reclamation facilities to increase electrical generation to supplement losses in areas affected by an incident.
 - Uses hydroelectric plant internal restart capabilities to assist in restoring the power system if blackouts occur.

The Dams Sector also supports interagency response under the Infrastructure Systems Recovery Support Function, for which USACE is the primary coordinator. Federal, State, and private sector asset owners provide capabilities to stabilize critical infrastructure functions, minimize health and safety threats, and efficiently restore and revitalize systems and services to support a viable, resilient community.

While the ESFs only provide specific responsibilities to Federal partners, SLTT and private sector dams owners and operators may provide similar services and capabilities to support incident response and recovery within their communities. Despite the potential national implications of a major disaster, critical infrastructure preparedness, response, and recovery takes place primarily at the community and regional level among the cross-sector owners and operators of regionally critical assets.

CHAPTER ENDNOTES

30. U.S. Department of Homeland Security, *DHS Risk Lexicon*, 2010 Edition, <https://www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf>, and referenced in the NIPP 2013.

31. Based on the FY 2013 NCIP data call of Dams Sector assets.

32. Based on the FY 2013 list of nationally critical assets identified through the DHS National Critical Infrastructure Prioritization Program (NCIPP).

4 VISION, GOALS, AND PRIORITIES (OBJECTIVES)

An effective partnership among all Dams Sector stakeholders is instrumental in achieving the sector vision for security and resilience shared by the representative Dams SCC and GCC partners in the public and private sectors.

DAMS SECTOR VISION

The Dams Sector will collaborate to develop and implement multi-faceted, multi-level, and flexible security programs and resilience-enhancing strategies that accommodate the diversity of the sector to effectively protect its assets from physical and cyber threats and enhance its capability to respond to and recover from attacks, natural disasters, or other emergencies. The Dams Sector will support continued economic benefits from the use of critical assets by fostering information sharing and multi-sector coordination, guiding technology research and development, advocating for sector needs, and promoting a risk-informed management framework addressing prevention, protection, response, mitigation, and recovery.

The Dams SCC and GCC collectively developed 5 joint goals for sector security and resilience and 11 priorities (also referred to as objectives) that sector partners will pursue over the next four years to focus their voluntary security and resilience efforts. While owners and operators continuously implement risk reduction measures as part of regulatory requirements and best practices, the SSP identifies the priorities (objectives) and activities that guide collaborative efforts under the voluntary sector partnership.

Dams Sector goals and priorities (objectives) provide strategic direction for the sector to conduct collaborative activities and implement resilience measures that directly contribute to the national critical infrastructure goals identified in the NIPP 2013 and the Joint National Priorities. (See [Appendix B](#) for the full alignment of Sector goals, priorities (objectives) and activities to national goals and priorities.)

Table 2. Dams Sector Goals and Priorities (Objectives)

Dams Sector Goals	Dams Sector Priorities (Objectives)
<p>1 Strengthen Dams Sector public-private partnerships to maintain and improve coordination and information sharing.</p>	<p>PRIORITY A Integrate and leverage the security and resilience efforts of individual partners and raise awareness of the value of participation in the Dams Sector partnership.</p>
	<p>PRIORITY B Increase knowledge and rapid exchange of actionable information and strategies among asset owners, operators, and regulators and improve access to sector-specific intelligence information.</p>
<p>2 Identify and assess sector-specific threats, vulnerabilities, and consequences to support risk-informed decisions.</p>	<p>PRIORITY C Identify, characterize, and communicate Dams Sector physical, cyber, and human threats and update critical asset identification as risks evolve.</p>
	<p>PRIORITY D Leverage partner expertise to develop or maintain analytical tools and capabilities to support facility-specific and sector-wide risk assessment and prioritization of risk mitigation activities.</p>
	<p>PRIORITY E Identify and address critical infrastructure interdependencies and associated cascading impacts that influence local and regional disruptions.</p>

Dams Sector Goals

Dams Sector Priorities (Objectives)

<p>3 Develop and incorporate sustainable approaches to effectively reduce and manage physical and cyber risk to critical assets and develop response and recovery plans.</p>	<p>PRIORITY F Develop best practices and promote implementation of sustainable, integrated cyber-physical risk management practices for critical Dams Sector assets.</p>
	<p>PRIORITY G Improve incident response and recovery strategies and business continuity plans to enable rapid restoration of essential services and support regional recovery efforts.</p>
	<p>PRIORITY H Improve and adopt sector-specific cybersecurity tools and practices and develop integrated cyber event response and recovery plans.</p>
<p>4 Enhance Dams Sector security and resilience by advancing research and development solutions that support advance planning and adaptation.</p>	<p>PRIORITY I Improve coordination of ongoing and planned relevant R&D efforts by Dams Sector partners and pursue complementary R&D efforts with interdependent sectors.</p>
	<p>PRIORITY J Evaluate the effects of climate change and extreme weather patterns on the Dams Sector and their implications for sector risks and mitigation priorities.</p>
<p>5 Promote continuous learning and adaptation through community-level, cross-sector collaboration to enhance regional resilience.</p>	<p>PRIORITY K Share information during pre-event planning and promote the incorporation of post-incident lessons learned into training and response planning to improve lifecycle risk management.</p>

4.1 Dams Sector Activities

Dams Sector partners collaboratively developed a set of 12 activities that they will collaboratively conduct to effectively implement the Dams SSP and meaningfully contribute to the sector goals and priorities (objectives). Table 3 presents collaborative, voluntary activities that Dams SCC and GCC representatives will pursue with support and guidance from the SSA over the next one to four years. While the SSPs are updated every four years, the Dams Sector partnership may update its activities more frequently to reflect evolving risk, changing resource allocations, and progress or completion.

Sector partners recognize that no individual entity has authority over resources and budgets for the entire Dams Sector. Federal, State, local, tribal, territorial, and private sector partners contribute funds, personnel, expertise, and other valuable resources to sector security and resilience activities. However, Dams Sector partners are operating in extremely limited resource environments, while security and resilience investments are becoming increasingly expensive. As a result, the ability to achieve each of the Dams Sector activities will depend largely on future resource availability, funding allocations, and sector-wide prioritization processes. Resource limitations may not allow for completion of all identified activities. Rather than develop priorities and activities based solely on currently available funding, the sector identified the top activities it believes will make a significant contribution to national security and resilience.

The Joint Council will meet annually to prioritize and build on the SSP activities. During the time, the Joint Council will develop a list of discrete, detailed tasks to pursue over the coming year, considering timing, available resources, and feasibility.

Table 3. Dams Sector Activities Mapped to Sector Priorities (Objectives)

Map to Priority (Objective)	Sector Activities
A	1 Consolidate and facilitate access to security and resilience programs, tools, technical products, best practices, and resources for owners and operators.
B	2 Promote effective processes to disseminate relevant and actionable intelligence information, including sector-specific threat briefings, and ensure Dams Sector owners and operators can obtain security clearances in a timely manner.
B J	3 Promote and facilitate information sharing among Dams Sector owners and operators and their public sector partners, particularly at the State level, and protect sensitive Dams Sector risk and asset information.
B C	4 Promote sector-specific and cross-sector suspicious activity reporting tools and programs.
B C	5 Conduct the Dams Sector Information Sharing Drill annually to provide Dams Sector owners and operators the opportunity to evaluate information-sharing mechanisms related to physical and cyber threats.
F J	6 Coordinate sector-level and cross-sector activities and jointly develop and execute security and resilience activities, products, and programs.
H	7 Update the Roadmap to Secure Control Systems in the Dams Sector to reflect the current risk environment.
D H	8 Develop the Dams Sector Cybersecurity Capability Maturity Model, the Dams Sector NIST Cybersecurity Framework Implementation Guide, and supporting products or materials for sector owners and operators.
H	9 Promote participation in the Critical Infrastructure Cyber Community (C ³) Voluntary Program.
H	10 Develop procurement language or coordinated requests that encourage control system vendors to rapidly address Dams Sector vulnerabilities and security issues.
I	11 Conduct periodic reviews of the R&D needs and requirements of the Dams Sector and update based on potential risks from infrastructure interdependencies.
E G K	12 Participate in national and multi-jurisdictional exercises and regional pilot programs to promote emergency response coordination across interdependent sectors, jurisdictions, and disciplines; identify and assess the impacts of interdependencies; define effective mitigation strategies; and enhance disaster resilience to all hazards and emerging risks.

5 MEASURING EFFECTIVENESS

Owners and operators use a variety of indicators to measure the effectiveness and continuous improvement of their security and resilience risk management processes at the facility level. Measuring improvements in security and resilience at the sector level is far more difficult. Sector owners and operators conduct multiple activities, including asset inspections, assessments, and requirements implementation that can demonstrate collective sector progress. Where possible, sector partners also attempt to measure how their voluntary partnership activities contribute to risk reduction and enhanced resilience across the sector.

As the Dams SSA, DHS has the primary responsibility for measuring and reporting sector progress toward Dams Sector activities using relevant metrics. An established performance metrics system designed to track the progress of sector activities is used to ensure accurate and consistent measurement.

Table 4 aligns Dams Sector activities with a set of possible performance metrics that the SSA may use to measure and report progress, where possible. The metrics not only measure the completion of an activity—using output measures such as the number of products developed or partners engaged—but also aim to measure the outcomes of these activities—particularly how effective they are in achieving progress toward sector goals.

Within the voluntary sector partnership, often the best available outcome measure is to track intent to act based on the information, tools, or guidance received through sector activities. The SSA measures this intent to act using a survey—during or following each engagement or activity—that asks three things:

- Was the information received current and relevant?
- Will the information inform decision-making?
- Will participants further share the information within their organization?

Survey results indicate the effectiveness of each activity in equipping participants with the information, tools, guidance, and processes to take actions that ultimately reduce or better manage sector risk.

The SSA will report sector progress through the National Annual Report and the quadrennial SSP updates. The following list is not exhaustive of all possible ways to measure effectiveness, and sector asset owners may voluntarily measure and report additional information on sector progress during the National Annual Reporting process.

Table 4. Dams Sector Activities and Expected Metrics

Dams Sector Activities	Expected Metrics
<p>1 Consolidate and facilitate access to security and resilience programs, tools, technical products, best practices, and resources for owners and operators.</p>	<ul style="list-style-type: none"> • Products developed and their level of distribution (including the number of recipients and how stakeholders were reached) • How recipients intend to use the information they receive
<p>2 Promote effective processes to disseminate relevant and actionable intelligence information, including sector-specific threat briefings, and ensure Dams Sector owners and operators can obtain security clearances in a timely manner.</p>	<ul style="list-style-type: none"> • Number of classified and/or unclassified briefings and forums and the level of participation • Number of meetings and workshops organized or coordinated by the sector to share information • Number of clearances submitted and granted • Relevancy of the information partners receive and how they intend to use that information

Dams Sector Activities	Expected Metrics	
3	Promote and facilitate information sharing among Dams Sector owners and operators and their public sector partners, particularly at the State level, and protect sensitive Dams Sector risk and asset information.	<ul style="list-style-type: none"> Stakeholder use of current information-sharing platforms, such as HSIN-CI, and information products Relevancy of the information partners receive and how they intend to use that information
4	Promote sector-specific and cross-sector suspicious activity reporting tools and programs.	<ul style="list-style-type: none"> Level of stakeholder use of current suspicious activity reporting platforms
5	Conduct the Dams Sector Information Sharing Drill annually to provide Dams Sector owners and operators the opportunity to evaluate information-sharing mechanisms related to physical and cyber threats.	<ul style="list-style-type: none"> Level of participation in the Information Sharing Drills and the change over time Level of participation in planning meetings and workshops How recipients intend to use the information they receive by participating
6	Coordinate sector-level and cross-sector activities and jointly develop and execute security and resilience activities, products, and programs.	<ul style="list-style-type: none"> Number of conferences, industry meetings, and key events organized Level of participation in sector-specific and cross-sector events Products developed and their level of distribution (including the number of recipients and how stakeholders were reached) How recipients intend to use the information they receive
7	Update the Roadmap to Secure Control Systems in the Dams Sector to reflect the current risk environment.	<ul style="list-style-type: none"> Status of completion Level of distribution (including the number of recipients and how stakeholders were reached) How recipients intend to use the information they receive
8	Develop the Dams Sector Cybersecurity Capability Maturity Model, the Dams Sector NIST Cybersecurity Framework Implementation Guide, and supporting products or materials for sector owners and operators.	<ul style="list-style-type: none"> Status of completion Level of distribution (including the number of recipients and how stakeholders were reached) How recipients intend to use the information they receive
9	Promote participation in the Critical Infrastructure Cyber Community (C ³) Voluntary Program.	<ul style="list-style-type: none"> Number of industry meetings or key events organized or supported under the C³ Voluntary Program Level of Dams Sector participation in sector-specific and cross-sector C³ events
10	Develop procurement language or coordinated requests that encourage control system vendors to rapidly address Dams Sector vulnerabilities and security issues.	<ul style="list-style-type: none"> Products developed and their level of distribution (including the number of recipients and how stakeholders were reached) How recipients intend to use the procurement language or guidance developed

Dams Sector Activities	Expected Metrics	
11	<p>Conduct periodic reviews of the R&D needs and requirements of the Dams Sector and update based on potential risks from infrastructure interdependencies.</p>	<ul style="list-style-type: none"> • Status of completion • Level of participation in periodic reviews • How recipients intend to use the information developed
12	<p>Participate in national and multi-jurisdictional exercises and regional pilot programs to promote emergency response coordination across interdependent sectors, jurisdictions, and disciplines; identify and assess the impacts of interdependencies; define effective mitigation strategies; and enhance disaster resilience to all hazards and emerging risks.</p>	<ul style="list-style-type: none"> • Number of sector and cross-sector exercises organized or supported, including national, regional, and local exercises • Level of participation in sector and cross-sector exercises • Level of participation in planning meetings or workshops • How participants intend to use the information they receive

APPENDIX A

Acronyms and Abbreviations

ASDSO	Association of State Dam Safety Officials	FLETC	Federal Law Enforcement Training Center
ASFPM	Association of State Flood Plain Managers	FWS	U.S. Fish and Wildlife Service
BLM	Bureau of Land Management	GAO	U.S. Government Accountability Office
BPA	Bonneville Power Administration	GCC	Government Coordinating Council
C2M2	Cybersecurity Capability Maturity Model	GHG	greenhouse gas
C³	Critical Infrastructure Cyber Community	HSIN-CI	Homeland Security Information Network–Critical Infrastructure
CAPRA	Critical Asset and Portfolio Risk Analysis	HSPD-7	Homeland Security Presidential Directive 7
CARMA	Cybersecurity Assessment & Risk Management Approach	IBWC	International Boundary and Water Commission
CARVER	Criticality, Accessibility, Recuperability, Vulnerability, Effect, Recognizability	ICS	industrial control systems
CCTV	closed-circuit television	ICS-CERT	Industrial Control Systems Cyber Emergency Response Team
CDII	Cyber-Dependent Infrastructure Identification	IP	DHS Office of Infrastructure Protection
CFR	Comprehensive Facility Report	IT	information technology
CIP	Critical Infrastructure Protection	LGCC	Levee Government Coordinating Council
CIPAC	Critical Infrastructure Partnership Advisory Council	LSCC	Levee Subsector Coordinating Council
CRM-D	Common Risk Model for Dams	MSRAM	Maritime Security Risk Analysis Model
CRR	Cyber Resilience Review	NAFSMA	National Association of Flood and Stormwater Management Agencies
CS&C	DHS Office of Cybersecurity & Communications	NCCIC	National Cybersecurity and Communications Integration Center
CSET	Cybersecurity Evaluation Tool	NCIPP	National Critical Infrastructure Prioritization Program
CTS	Consequence-Based Top Screen	NERC	North American Electric Reliability Corporation
DAMSVR	Dam Assessment Matrix for Security and Vulnerability Risk	NICC	National Infrastructure Coordinating Center
DHS	U.S. Department of Homeland Security	NID	National Inventory of Dams
DOD	U.S. Department of Defense	NIPP 2013	<i>National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience</i>
DOE	U.S. Department of Energy	NPPD	DHS National Protection and Programs Directorate
DOI	U.S. Department of the Interior	NRCS	Natural Resources Conservation Service
DOL	U.S. Department of Labor	NWS	National Weather Service
EAPs	Emergency Action Plans	OCIA	DHS Office of Cyber and Infrastructure Analysis
ECIP	Enhanced Critical Infrastructure Protection	PCII	Protected Critical Infrastructure Information
EO	Executive Order	PPD	Presidential Policy Directive
EPA	U.S. Environmental Protection Agency	PPT	Portfolio Prioritization Tool
ES-ISAC	Electricity Sector Information Sharing and Analysis Center	PSA	Protective Security Advisor
ESF	Emergency Support Function	R&D	research and development
FBI	Federal Bureau of Investigation	RAM-D	Risk Assessment Methodology for Dams
FEMA	Federal Emergency Management Agency	Reclamation	Bureau of Reclamation
FERC	Federal Energy Regulatory Commission	SCC	Dams Sector Coordinating Council
FISMA	Federal Information Security Management Act		

SAVs	Site Assistance Visits
SCADA	supervisory control and data acquisition
SCC	Sector Coordinating Council
SLTT	State, local, tribal, and territorial
SLTTGCC	State, Local, Tribal, and Territorial Government Coordinating Council
SOPD	DHS IP Sector Outreach and Programs Division
SSA	Sector-Specific Agency
SSP	Sector-Specific Plan
TSA	Transportation Security Administration
TVA	Tennessee Valley Authority
US-CERT	United States Computer Emergency Readiness Team
USACE	U.S. Army Corps of Engineers
USCG	United States Coast Guard
USDA	U.S. Department of Agriculture
WRRDA	Water Resources Reform and Development Act of 2014

APPENDIX B

Alignment with the NIPP 2013

Table B-1. Dams Sector Priorities Aligned with Joint National Priorities and NIPP Goals

























Dams Sector Priorities	Joint National Priorities					NIPP Goals
	Strengthen Management of Cyber and Physical Risks to Critical Infrastructure	Build Capabilities and Coordination for Enhanced Incident Response and Recovery	Strengthen Collaboration Across Sectors, Jurisdictions, and Disciplines	Enhance Effectiveness in Resilience Decision-making	Share Information to Improve Prevention, Protection, Mitigation, Response, and Recovery Activities	
A Integrate security and resilience efforts of individual partners						Share information across the critical infrastructure community to build awareness and enable risk-informed decision-making.
B Increase knowledge and rapid exchange of actionable information						
C Identify threats and update critical asset identification						Assess and analyze risks to critical infrastructure (T, V, C) to inform risk management activities.
D Develop analytical tools and capabilities to support risk assessment and prioritization						
E Identify and address interdependencies and cascading impacts						
F Develop best practices and implement integrated cyber-physical risk management practices						Secure critical infrastructure against physical, cyber, and human threats through sustainable risk reduction efforts, while considering costs and benefits.
G Improve incident response and recovery strategies						
H Improve cybersecurity tools and practices and response plans						
I Improve coordination of R&D efforts						Enhance critical infrastructure resilience by minimizing consequences and employing effective response and recovery.
J Evaluate the effects of climate change and implications for sector risks						
K Share information during pre-event planning and incorporate post-incident lessons learned						Promote learning and adaptation during and after incidents and exercises.

Table B-2. Contribution of the Dams Sector Activities to the NIPP 2013 Calls to Action

Dams Sector Contribution or Aligned Activity		NIPP 2013 Calls to Action											
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
1	Consolidate and facilitate access to security and resilience programs, tools, technical products, best practices, and resources for owners and operators.		X	X		X			X	X			
2	Promote effective processes to disseminate relevant and actionable intelligence information, including sector-specific threat briefings, and ensure Dams Sector owners and operators can obtain security clearances in a timely manner.		X	X		X							
3	Promote and facilitate information sharing among Dams Sector owners and operators and their public sector partners, particularly at the State level, and protect sensitive Dams Sector risk and asset information.		X			X							
4	Promote sector-specific and cross-sector suspicious activity reporting tools and programs.		X			X	X						
5	Conduct the Dams Sector Information Sharing Drill annually to provide Dams Sector owners and operators the opportunity to evaluate information-sharing mechanisms related to physical and cyber threats.					X	X			X			
6	Coordinate sector-level and cross-sector activities and jointly develop and execute security and resilience activities, products, and programs.	X	X					X		X			
7	Update the Roadmap to Secure Control Systems in the Dams Sector to reflect the current risk environment.					X							X
8	Develop the Dams Sector Cybersecurity Capability Maturity Model, the Dams Sector NIST Cybersecurity Framework Implementation Guide, and supporting products or materials for sector owners and operators.					X				X			
9	Promote participation in the Critical Infrastructure Cyber Community (C ³) Voluntary Program.				X	X							
10	Develop procurement language or coordinated requests that encourage control system vendors to rapidly address Dams Sector vulnerabilities and security issues.		X						X				
11	Conduct periodic reviews of the R&D needs and requirements of the Dams Sector and update based on potential risks from infrastructure interdependencies.					X					X		
12	Participate in national and multi-jurisdictional exercises and regional pilot programs to promote emergency response coordination across interdependent sectors, jurisdictions, and disciplines; identify and assess the impacts of interdependencies; define effective mitigation strategies; and enhance disaster resilience to all hazards and emerging risks.		X	X		X	X	X	X				X
	Dams Sector goals and priorities were developed in alignment with the 2014 Joint National Priorities in support of Call to Action #1.	X											
	Development of the 2015 Dams Sector-Specific Plan meets Call to Action #2.		X										
	The Dams Sector supports Call to Action #10 by working with its Federal partners to implement the <i>National Critical Infrastructure Security and Resilience Research and Development Plan</i> .										X		
	The measurement approach outlined in Chapter 5: Measuring Effectiveness will enable the Dams Sector to evaluate and report on the progress of partnership efforts in support of Call to Action #11.												X

NIPP 2013 Calls to Action

Call to Action #1: Set National Focus through Jointly Developed Priorities

Call to Action #2: Determine Collective Actions through Joint Planning Efforts

Call to Action #3: Empower Local and Regional Partnerships to Build Capacity Nationally

Call to Action #4: Leverage Incentives to Advance Security and Resilience

Call to Action #5: Enable Risk-Informed Decision-making through Enhanced Situational Awareness

Call to Action #6: Analyze Infrastructure Dependencies, Interdependencies, and Associated Cascading Effects

Call to Action #7: Identify, Assess, and Respond to Unanticipated Infrastructure Cascading Effects During and Following Incidents

Call to Action #8: Promote Infrastructure, Community, and Regional Recovery Following Incidents

Call to Action #9: Strengthen Coordinated Development and Delivery of Technical Assistance, Training, and Education

Call to Action #10: Improve Critical Infrastructure Security and Resilience by Advancing Research and Development Solutions

Call to Action #11: Evaluate Progress Toward the Achievement of Goals

Call to Action #12: Learn and Adapt During and After Exercises and Incidents

APPENDIX C

Additional Sector Risk Management Guidelines

Sector-Specific Guidelines

In keeping with the Dams Sector's goal to provide guidance on managing risks, the Sector-Specific Agency (SSA), in conjunction with the Dams Sector Security Education Working Group, prepared a series of reference documents to assist owners and operators in implementing their protective programs:

- *Security Awareness Handbook*—Assists in identifying security concerns, coordinating proper response, and establishing effective partnerships with local law enforcement and first responder communities. A companion, non-sensitive guide was developed to allow for wider dissemination.
- *Protective Measures Handbook*—Assists in selecting protective measures to address the physical, cyber, and human elements, including recommendations for developing site security plans.
- *Crisis Management Handbook*—Provides information related to emergency response and preparedness issues, including recommendations for developing emergency action plans and recovery plans.
- *Security Awareness Guide for Levees*—Assists in identifying security concerns, surveillance indicators, and incident reporting.
- *Active and Passive Vehicle Barriers Guide*—Provides general information on active and passive vehicle barrier systems and their design and selection.
- *Waterside Barriers Guide*—Provides information on waterside barriers and their use, maintenance, and effectiveness.
- *Personnel Screening Guide*—Provides information that assists in developing and implementing personnel screening protocols.
- *Physical Security Measures for Levees Brochure*—Provides general information on physical security measures that are applicable to levees.
- *Security Awareness for Levee Owners Brochure*—Provides succinct information on security issues that are relevant to levee owners.

Sector-Specific Risk Assessment Tools

Dams Sector owners and operators use their extensive experience with infrastructure risks, lessons learned from new incidents, and sector best practices to assess and manage risk. To support in-depth risk assessment at the facility level, the Dams Sector has supported the creation of several technical risk assessment tools and methodologies specifically for use in the Dams Sector.

Risk Assessment Methodology for Dams (RAM-D)

RAM-D was developed by Sandia National Laboratories under the auspices of the former Interagency Forum on Infrastructure Protection, which included the U.S. Army Corps of Engineers (USACE), the Bureau of Reclamation, the Tennessee Valley Authority (TVA), the Bonneville Power Administration (BPA), the Western Area Power Administration, the Federal Bureau of Investigation (FBI), the U.S. Department of Energy (DOE), and Sandia National Laboratories. This methodology is an adaptation of the security principles and procedures developed to protect nuclear facilities. The approach provides procedures for completing threat and consequence assessments, a systematic process for determining the effectiveness of security systems, and mechanisms to evaluate the relative level of risk and the need for security upgrades or consequence mitigation measures for risk reduction.

Dam Assessment Matrix for Security and Vulnerability Risk (DAMSVR)

The DAMSVR was developed by the Federal Energy Regulatory Commission with expertise and technical assistance provided by the Bureau of Reclamation, USACE, and representatives of the Association of State Dam Safety Officials. The DAMSVR approach is an adaptation of the CARVER (Criticality, Accessibility, Recuperability, Vulnerability, Effect, Recognizability)

method and provides a systematic methodology to determine relative risk scores for assets or project features by considering identified vulnerabilities, threats, and mitigation measures. DAMSVR is distributed by the Federal Energy Regulatory Commission (FERC); a copy can be requested by visiting <https://www.ferc.gov/industries/hydropower/safety/guidelines/security/damsvr.asp>.

Critical Asset and Portfolio Risk Analysis (CAPRA)

Developed by the University of Maryland, this quantitative approach is suited for all-hazards risk analysis. The approach includes several phases: scenario identification, consequence and criticality assessment, security vulnerability assessment, hazard likelihood assessment, and cost-benefit analysis. CAPRA provides a systematic approach to evaluate relevant hazard scenarios and identify representative attack profiles considering alternative delivery systems and intrusion paths. The methodology considers physical (fragility, mitigation effectiveness, and response effectiveness) and security (probability of detection, delay time, response time, and probability of neutralization) vulnerabilities. The probability of attack for each attack profile is estimated based on relative attractiveness. The methodology produces actionable risk assessments and facilitates quantitative cost-benefit analysis. All values (risk, cost, and benefit) are expressed in dollars per year; thus, the cost-benefit ratio gives a measure of the number of dollars realized in benefit for each dollar spent on risk reduction.

Maritime Security Risk Analysis Model (MSRAM)

Developed by U.S. Coast Guard (USCG), MSRAM is a tool that provides decision-makers at various levels with actionable information regarding the risk to critical infrastructure in the maritime domain, including the Nation's navigable waterways. MSRAM allows decision-makers to understand the geographic density of risk across the Nation's ports, know the profile of risk within a port, and recognize asset-specific risks. The methodology considers the risk posed by different scenarios in terms of threat, vulnerability, and consequence. MSRAM considers area-wide security measures and response capabilities and is designed to capture the security risk facing different types of targets spanning every sector within the maritime domain, allowing comparison among different targets and geographic areas.

Cybersecurity Evaluation Tool (CSET)

The Cybersecurity Evaluation Tool (CSET) is a DHS product that assists organizations in protecting their key national cyber assets. It was developed under the direction of the DHS Industrial Control System Cyber Emergency Response Team (ICS-CERT) by cybersecurity experts. This tool provides users with a systematic and repeatable approach for assessing the security posture of their cyber systems and networks. It includes both high-level and detailed questions related to all industrial control and IT systems.

CSET is a desktop software tool that guides users through a step-by-step process to assess their control system and information technology network security practices against recognized industry standards. The output from CSET is a prioritized list of recommendations for improving the cybersecurity posture of the organization's enterprise and industrial control cyber systems. The tool derives the recommendations from a database of cybersecurity standards, guidelines, and practices. Each recommendation is linked to a set of actions that can be applied to enhance cybersecurity controls.

CSET has been designed for easy installation and use on a stand-alone laptop or workstation. It incorporates a variety of available standards from organizations such as the National Institute of Standards and Technology (NIST), the North American Electric Reliability Corporation (NERC), the Transportation Security Administration (TSA), the U.S. Department of Defense (DOD), and others. When the tool user selects one or more of the standards, CSET will open a set of questions to be answered. The answers to these questions will be compared against a selected security assurance level, and a detailed report will be generated to show areas for potential improvement. CSET provides an excellent means to perform a self-assessment of the security posture of your control system environment.

APPENDIX D

Detailed Dams Sector Asset Descriptions

Dams Sector assets include dams, hydropower generation facilities, navigation locks, levees, dikes, hurricane barriers, mine tailings and other industrial waste impoundments, and other similar water retention and water control facilities.

The rapid growth of the American economy and population in the 20th century caused a corresponding increase in the demand for water infrastructure projects. Legislation such as the Reclamation Act of 1902; the Tennessee Valley Authority (TVA) Act of 1933; and the Flood Control Acts of 1928, 1936, and 1938 resulted in construction of a large number of dams and levees. Dam building in the United States peaked during the 30 years following World War II, when more than half of the Nation's more than 87,000 National Inventory of Dams (NID)-listed dams were built.

Prior to the 1930s, levees were constructed haphazardly, without the benefit of good engineering practices, to protect agricultural areas. Disastrous floods on the Mississippi and Ohio rivers spurred the U.S. Congress to pass the Flood Control Acts of 1928 and 1936, which established a direct Federal interest in the design and construction of levees. Although the total number is currently unknown, preliminary estimates indicate that there may be as many as 100,000 miles of levees in the Nation.^{D1} The aftermath of hurricanes Katrina and Rita turned the attention of Congress once more to levees and Congress passed the National Levee Safety Act of 2007.

In addition to the physical dams infrastructure in the United States, the Dams Sector includes the human employees and cyber-based systems that control physical Dams Sector processes and ensure their safe operation. This appendix provides an overview of the physical, human, and cyber elements. It also supplements "Sector Components and Assets" in [Chapter 1](#) by providing more detailed descriptions of dams, levees, hurricane barriers, navigation locks, and mine tailings.

D.1 Physical Element

Dams in the United States range in height from a few feet to more than 700 feet and in length from a few tens of feet to more than 1 mile. Normal reservoir storage (i.e., the volume of water stored in a reservoir for a majority of the time) behind U.S. dams can range from a few acre-feet to 30 million acre-feet. Dams in the U.S. territories range from 30 feet to 274 feet high with reservoir sizes that range from 100 acre-feet to 55,000 acre-feet. Dams are also located near or along the borders with Canada and Mexico.

In addition to the main impounding structure, one or several appurtenant structures may be associated with the multiple purposes of the facility. Examples of the types of structures that could be appurtenant to a dam include free overflow and gated spillway structures, outlet works, water supply features, penstocks, power generation features, navigation locks, embankments associated with the main structure (also known as saddle dams, dikes, and freeboard dams), and different types of control structures. Each dam type and each appurtenant structure has its own purpose and varying degrees of vulnerability. In general, each functional component may be associated with different protective configurations.

Levees (and flood risk reduction systems in general) may feature multiple components, including embankment sections, as well as floodwall sections, pumps and pumping stations, interior drainage works, flood damage reduction channels, closure structures, penetrations (e.g., utilities and pipes), and transitions (i.e., sections where the materials constituting the levee system change from, for example, a conventional floodwall section to an earthen section).

D.2 Human Element

The safe operation and security of the Nation's critical infrastructure depend heavily on human employees. Sector facilities can be either staffed or unstaffed. Many smaller or remote assets have minimal requirements for operation and can be operated without personnel onsite for fairly lengthy periods of time (e.g., a week). Some facilities are operated remotely from central operations centers and may or may not require onsite personnel on a daily basis. Some are staffed on a "business day schedule" (i.e., 8- or 10-hour schedules for 5 to 7 days a week). Some of the larger or more complex facilities require staff to be present on a 24/7 basis.

Because of the specialized nature of the work performed in the Dams Sector, the workforce for sector assets such as hydropower facilities or navigation locks has considerable stability compared to other industries, and each facility has a

relatively small workforce. As such, asset owners are well acquainted with their workers and schedules. As a result, the potential for criminal infiltration is very limited in that impostors, infiltrators, or insider threats may be easier to recognize than in other types of infrastructure. This makes the work environment significantly easier to monitor. Unusual activity—such as surveillance, terrorist attacks, and other criminal activities—is much easier to distinguish and respond to in the early stages of a potential situation. However, this workforce design may not be necessarily applicable to other types of facilities, such as levees, which are spatially distributed and require easy and open access for maintenance purposes.

The number of personnel required to operate and maintain a dam can vary significantly. The need for staff depends greatly on the complexity of the asset and the benefits derived from it. Larger hydropower dams may require adjustments in operations several times per hour to respond to generation needs and economics. They may require several operators for each shift; a crew of maintenance and monitoring personnel; specialized staff that respond to hourly, daily, or weekly adjustments to power demands; marketing specialists; transmission line crews; and security personnel and guards. Simple, less complex facilities may require only one person to operate the structure and perform monitoring and maintenance duties. For example, recreational dams and stock ponds have minimal staffing needs. Staffing at levees and flood control projects is somewhat similar to that at dams, but is more focused on operations and maintenance activities and will vary depending on water levels and weather conditions.

Many of these positions are highly technical and specialized in nature and require personnel with three or more years of apprentice work or advanced training. Operations at some dams may also require the use of either full-time or corporate sharing of management and information technology (IT) personnel. Furthermore, IT and/or operational cybersecurity personnel are required to implement cybersecurity measures that prevent and/or mitigate potential cyber risks.

It is often necessary for dam owners to prepare personnel succession plans and continuity-of-operations plans to ensure ongoing operation in the event of work stoppages and extended periods of illness, such as during pandemics. In addition, the schedule for noncritical operations can be modified to respond to situations that may be understaffed (e.g., establishing a deferred maintenance schedule).

D.3 Cyber Element

Industrial control systems assist in the efficiency and safety of dam operations and maintenance and play a key role in many sector facilities by monitoring and/or controlling physical processes. Security access control systems and intrusion detection systems may also be cyber-based systems. Across the sector, cyber-based systems vary widely on the basis of age and generation of the system; thus, they also vary with respect to complexity and sophistication. Some systems are closed systems and use isolated networks and proprietary communication protocols, while others use open architectures, common communication paths, and may rely on the Internet. In addition, control systems at dams may also be connected to the electric power grid. Dams Sector owners use a variety of cybersecurity processes, tools, and standards. More information can be found in the Dams Sector Cybersecurity Guidelines developed by the Cybersecurity Working Group.

Some legacy industrial control systems were designed for operability and reliability during an era when security received low priority. These systems operated in fairly isolated environments and typically relied on proprietary software, hardware, and/or communications technology. Infiltrating and compromising these systems often required specific knowledge of individual systems architecture and physical access to system components.

In contrast, modern control systems are highly network-based and use common and open standards for communication protocols. Asset owners and operators have gained benefits by extending the connectivity of their systems and have increasingly adopted commercial off-the-shelf technologies that provide the higher levels of interoperability required among today's modern infrastructure. Standard operating systems are increasingly used in central supervisory stations, which are now typically connected to remote controllers via public or private networks provided by telecommunications companies. Common telecommunications technologies, such as the Internet, public-switched telephone networks, or cable or wireless networks, may be used.

In general, levee operations are considerably less dependent on information technology than dams. They typically rely on basic telecommunications and information infrastructures that can be supplemented with manual operations.

D.4 Sector Assets

Table D-1 provides the full taxonomy of physical infrastructure assets that are included in the Dams Sector, as discussed in this Sector-Specific Plan.

Table D-1. Dams Sector Taxonomy

CATEGORY	SEGMENT	EXAMPLES OF COMPONENTS	
Dam Projects (“Dams”) As special cases, it includes the following: Navigation Projects Hydropower Projects	Water Retention Structures	Embankment Section Concrete Section	
	Water Control Structures	Spillway Outlet Works	
	Impoundments	Reservoir	
	Hydropower Facilities	Conventional Plant Run-of-the-River Plant Pumped Storage Plant	
	Navigation Structures	Navigation Lock	
	Water Transmission Structures	Canal	
	Operation and Control Facilities	Remote Operation Facility Control Center	
	Public Access Facilities	Visitor Center Parking	
	Flood Damage Reduction Systems (“Levees”)	Flood Protection Structures	Levee Flood Wall
		Dike	
Water Control Structures		Pumping Station River Control Structure	
Water Transmission Structures		Canal	
Hurricane and Storm Surge Protection Systems	Structural Protection Systems	Hurricane Barrier Dike Shoreline Protection Structure Levee	
	Non-Structural Protection Systems	Wetlands	
Mine Tailings and Industrial Waste Impoundments	Impoundment Retention Structures	Impounding Structure	
	Impoundment Control Structures	Spillway Outlet Works	
	Impoundments	Tailings Industrial Waste Residuals	

Dams

Dams are facilities that include some or all of the following components to perform their intended purposes:

- **A conventional dam or impounding structure**—Structural sections that hold back the water.
- **Reservoir**—A body of water impounded by the dam.
- **Spillways**—Structures that facilitate the discharge of normal and/or flood flows in a manner that protects the structural integrity of the project.
- **Outlet works**—A combination of structures and equipment required for safe operation and control of water released from a reservoir.
- **A powerhouse**—A structure that houses turbines, generators, and associated control equipment for the production of hydroelectricity.

- **Penstocks**—Pipelines or conduits used to convey water under pressure to turbines or pump units).
- **Canals/aqueducts**—Constructed channels, usually open, that convey water by gravity and also may be used for navigational purposes.

Figure D-1 depicts some of the multi-functional components that can be found at a project.

Figure D-1. Multi-Functional Components of a Dams Project



In general, canals convey water within an open channel from a source to a destination and can serve a variety of functions. Some canals, constructed as part of water supply or transportation projects, have an embankment section forming one of the sides of the water conveyance structure and acting as a water retention structure. Water is also conveyed through tunnels and pipelines. Water can be conveyed for a variety of uses (e.g., domestic, municipal, industrial, or agricultural water supply) or as a means of transportation for boats, barges, or other watercraft. In some cases, dams also include navigation locks.

Dams may be classified according to the type of construction materials used, the methods of construction, the slope or cross-section, the way that the structure resists the forces of the water pressure behind it, the means used for controlling seepage, the purpose, and the hazard potential. Materials used for construction include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, miscellaneous materials such as plastic or rubber, or any combination of these materials. The two most common types of dams in use today are embankment dams and concrete dams.^{D2}

Embankment dams are the most common type of dam in use today. An embankment dam is termed an “earthfill” or “rockfill” dam, depending on whether it is composed of compacted earth or mostly compacted or dumped rock. The ability to control water seepage through and under the dam is important, and increased seepage can cause piping or slope failure.

Concrete dams may be categorized as gravity, arch, or gravity arch dams. In concrete gravity dams, the most common form of concrete dam, the weight of the concrete and the friction force along the foundation are used to resist the reservoir water pressure. Gravity dams are constructed of vertical blocks of concrete—typically called monoliths—with flexible seals in the joints between the blocks. A slab-and-buttress dam is a specific type of gravity dam that uses significantly less concrete and diverts the forces to the dam foundation through vertical or sloping buttresses. Concrete arch dams are characterized by thinner cross-sections in which the reservoir water pressure is carried laterally into the abutments. The shape of the arch may resemble a segment of a circle or an ellipse, and the arch may be curved in the vertical plane as well. Such dams are usually constructed of a series of thin vertical blocks that are keyed together; barriers to stop water from flowing are provided

between the blocks. Variations of arch dams include multi-arch dams in which more than one curved section is used and arch-gravity dams that combine some features of the two types of dams.

Levees

The term “levee” is used to denote a manmade structure, usually an earthen embankment or concrete floodwall, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide reasonable assurance of excluding temporary flooding from the leveed area. Flooding may result from seasonal high water, storm surges, precipitation, and other weather events.

Most levees are therefore subject to water loading for periods of only a few days or weeks per year. Levees are built near or along rivers and coastlines that may be environmentally or hydrologically sensitive areas, which may complicate their design, construction, and access for routine maintenance and emergency response. Typically, a levee will parallel a watercourse rather than be perpendicular to it, as in the case of conventional dams.

Levees, as opposed to dams, are geospatially extended systems that can run for multiple miles; however, the levee system may consist of several segments under different governance units. This creates opportunities for multiple failure modes and points throughout the system. Proper levee maintenance is often overlooked because it appears to be fairly basic—repair erosion damage, protect against unwanted vegetation growth or animal burrowing, and so forth—so it may be given low priority in terms of timing or funding.

Levees are intended to reduce flood damage and are built to specific levels of design (e.g., 100-year flood event plus 3 feet of freeboard). The level of design will vary from project to project. However, the 100-year standard associated with the National Flood Insurance Program has had an unintended consequence of being the target design level because of the economic incentive related to flood insurance.

However, to minimize risk and maximize public safety, levee owners are beginning to design levees to afford levels of protection commensurate with the risk that they are protecting against. This makes accurate risk-based assessments important for levee improvements.

Hurricane Barriers

Hurricane barriers restrict the inflow of storm surges from hurricanes and extratropical storms into bays, estuaries, rivers, streams, and/or onto the adjacent lowlands. These barriers normally consist of gates that are closed during storms from a fully open position or partially open position, depending on the degree of routine use that they also serve.

Hurricane barriers in the Northeast that protect against flooding in large bays are normally left fully open and are closed only during a storm. Barriers in southern Florida serve a routine water control purpose and are completely closed during a hurricane event.

Hurricane barriers are typically large steel structures. For example, each of the movable gates that span the Providence River in Providence, Rhode Island, is 40 feet wide and weighs 53 tons. Hurricane barriers are usually composed of at least two gates—one on each bank of the channel—but more complex configurations may include multiple gates that can be independently raised or closed depending on the surge volume.

Navigation Locks

The term “navigation lock” is used to denote navigation projects that include the locks themselves (single or multiple chambers), as well as the associated dam (unless located in a canal), and a number of appurtenant structures such as approach walls, control rooms, and administration and maintenance buildings. The U.S. waterway system includes 236 lock chambers at 192 lock sites owned and/or operated by the U.S. Army Corps of Engineers (USACE). Many navigation projects may serve multiple purposes in addition to the primary navigation function. For example, 46 lock-associated dams currently produce hydropower.

These facilities make many inland waterways viable, year-round transportation corridors. Natural river beds are often long, uneven downhill slopes with shallow areas and deep pools. Water depths can vary with seasonal rainfall and snow melt; dry periods can significantly affect navigation. Locks on navigable rivers enable commercial and recreational river traffic to move safely from one pool level to the next. The lift of the locks—the difference between raising or lowering from one pool to the next—can range from just a few feet to 110 feet (e.g., John Day Lock and Dam on the Columbia River in Oregon and Washington).

Multiple locks may be part of one navigable river system. The Tennessee River system is managed through a series of dams and navigation locks owned by the United States and operated by TVA and USACE. The system's nine main and five auxiliary locks allow smooth movement on the river as it drops 513 feet in elevation from its beginning to the point at which it joins the Ohio River. The Mississippi River is made navigable through a total of 30 main and four auxiliary locks.

A principal value of the inland and intracoastal navigation system is the ability to efficiently convey large volumes of bulk commodities moving long distances. Towboats push barges lashed together to form a "tow." A 15-barge tow is common on larger rivers with locks, such as the Ohio, Upper Mississippi, Illinois, and Tennessee rivers. Such tows are an extremely efficient mode of transportation, moving about 22,500 tons of cargo as a single unit. A single 15-barge tow is the equivalent of about 225 rail cars or 870 tractor-trailer trucks. If the cargo transported on the inland waterways each year had to be moved by another mode, it would take an additional 6.3 million rail cars or 25.2 million trucks to carry the load.

The ability to move more cargo per shipment makes barge transport both fuel-efficient and environmentally advantageous. On average, a gallon of fuel allows 1 ton of cargo to be shipped 155 miles by truck, 413 miles by railway, and 576 miles by barge. As a result, cargo transported by barge results in an average transportation savings of about \$11 per ton over the cost of shipping by alternative modes. Environmental advantage can also be measured by comparing the greenhouse gas (GHG) emissions produced during fuel consumption. On average, the tons of GHG emissions produced per million ton-miles are 71.61 by truck, 26.88 by railway, and 19.27 by barge.

Coal is the largest commodity by volume moving on the inland waterways, and petroleum is the next largest group, including crude oil, gasoline, diesel fuel, jet fuel, heavy fuel oils, and asphalt. Another large group includes grain and other farm products, most of which move by waterway to ports on the Lower Mississippi or Columbia Rivers for export overseas. Sixty percent of the country's farm exports travel through inland waterways. Other major commodities include aggregates, such as stone, sand, and gravel used in construction; chemicals, including fertilizers; metal ores, minerals, and products, such as steel; and many other manufactured products.

Mine Tailings and Other Industrial Waste Impoundments

The mining industry, electric power generation, and manufacturing industries often use impoundment structures to store and dewater waste. In the coal industry, embankment structures used for the disposal of fine coal waste are referred to as slurry impoundments; in other extractive industries, the structures used for the disposal of fine mine waste are referred to as tailings ponds. In other industries, they may be referred to as surface or industrial waste impoundments. The primary goal of these impoundments is the storage of tailings or mine waste, which are transported, suspended in water, and settle out in the impoundment.

These impoundments typically have features similar to dams, including key trenches, internal drains, filters, spillways, and outlet works. Some industrial impoundments, particularly large diked structures in arid regions, are constructed without spillways or outlet works and are designed instead to store the design storm quantity above the maximum normal pool and draw the pool back down using floating-pump systems. Stormwater diversions may also be used to divert water around the pond to preserve its integrity during heavy rainfall.

Impoundments pose possible health and safety risks to the surrounding population and property if breached. The typical size of impoundments has grown over the years, with some measuring more than 20,000 acre-feet and hundreds of feet high. Unlike traditional dam structures, waste material may be released with any breach, causing environmental damage to downstream or down-valley ecosystems. In addition to aboveground risk of failure, impoundments at mine sites, such as those located above coal mines in the Appalachian region, may break through to underground active or inactive mines if not constructed with regard to the underlying workings. Past spills at mine sites, processing facilities, and coal ash locations illustrate the hazards inherent in these waste containment structures.

Impoundments can be subject to Federal and/or State regulations. For example, as authorized by the Federal Mine Safety and Health Act, the Mine Safety and Health Administration regulations require approved plans for dams at coal mines if the dam impounds water, sediment, or slurry to an elevation of 5 feet or more above the upstream toe with a storage volume of 20 acre-feet or more; impounds water, sediment, or slurry 20 feet or more above the upstream toe; or presents a hazard to miners as determined by the local district manager.

In general, the construction and operation of these impoundment sites may be regulated by various entities, with the States playing a key role in oversight. Depending on its type, an impoundment could be subject to regulation by the Mine Safety and Health Administration, the Office of Surface Mining Dam Safety Program within the DOI, the Office of Water and the Office of Solid Waste and Emergency Response within the EPA, and/or State and local authorities.

CHAPTER ENDNOTES

- D1. National Committee on Levee Safety, *Recommendations for a National Levee Safety Program* (2009), draft report, http://www.leveesafety.org/docs/NCLS-Recommendation-Report_012009_DRAFT.pdf.
- D2. Association of State Dam Safety Officials, "Introduction to Dams," accessed January 2015, <http://www.damsafety.org/news/?p=e4cda171-b510-4a91-aa30-067140346bb2>.

APPENDIX E

Detailed Dams Sector Partner Descriptions

E.1 Federal Agencies

U.S. Department of Defense, Army Corps of Engineers

An element of the U.S. Department of the Army within the U.S. Department of Defense (DOD), the U.S. Army Corps of Engineers (USACE) has responsibility or jurisdiction for:

- Dams that it planned, designed, constructed, and operates.
- Dams that it designed and constructed, but are operated and maintained by others.
- Non-USACE dams and reservoir projects subject to Section 7 of the Flood Control Act of 1944, the Federal Power Act of 1920, as amended, and other laws for which it is responsible for prescribing regulations for the use of storage allocated to flood control and/or navigation.

In addition, USACE has been involved with the dams for which it issues permits under its regulatory authority, as well as dams that USACE inventoried and inspected under the National Dam Inspection Act of 1972, the Dam Safety Act of 1986, and the National Dam Safety Program Act of 1996. However, USACE has no continuing responsibility or jurisdiction for those dams. USACE:

- Owns and/or operates 236 lock chambers at 192 sites.
- Operates and maintains 12,000 miles of inland and intracoastal waterways and 13,000 miles of deep draft navigation channels.
- Owns and operates 706 dams and 75 hydropower projects with 350 generating units.
- Has authority for more than 2,500 Federal levee systems, totaling more than 14,500 miles of levees.

In addition to civil works facilities, USACE provides dam safety support and technical assistance to the U.S. Army, U.S. Navy, and U.S. Air Force. DOD has more than 250 dams located on military facilities within the United States and its territories.

USACE also provides technical and direct assistance to communities at risk from or affected by floods through the provisions of Public Law 84-99, Flood Control and Coastal Emergencies. Under these provisions, USACE is authorized to undertake activities such as disaster preparedness, emergency operations (flood response and post-flood response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provision of emergency water due to drought or contaminated sources. Public Law 84-99 also allows for “advance measures” assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.

In addition, USACE is the lead agency for executing Emergency Support Function (ESF) 3 – Public Works and Engineering. This function includes conducting pre-incident and post-incident assessments of public works and infrastructure; executing emergency contract support for life-saving and life-sustaining services; providing technical assistance to include engineering expertise, construction management, and contracting and real estate services; providing emergency repair of damaged public infrastructure and critical facilities; and implementing and managing the Federal Emergency Management Agency Public Assistance Program and other recovery programs.

U.S. Department of Agriculture

The U.S. Department of Agriculture (USDA) is a major planner, designer, financier, constructor, owner, and/or regulator of more than one-third of all the dams in the United States that are included in the NID. USDA dams provide livestock water, municipal water, wastewater management, electric power, flood protection, irrigation, fish and wildlife habitat, recreation, sediment retention, and manure storage and treatment.

As a major component within USDA, the **Natural Resources Conservation Service (NRCS)** designs, finances, and constructs systems under its technical and financial assistance programs for individuals, groups, organizations, and governmental units for the purposes of water storage, sediment retention, and flood protection. Although the NRCS does not own, operate, maintain, or regulate any dams, it provides technical and financial assistance for almost 27,000 NID-listed dams and financial assistance for more than 11,000 more. The total number of levees constructed with NRCS support is presently unknown; most are designed to provide 4-percent (25-year) protection to support agricultural land use. The **Forest Service** within USDA owns approximately 1,000 NID dams and administers permits for approximately 2,000 privately owned NID dams.

U.S. Department of Homeland Security

The U.S. Department of Homeland Security (DHS) is responsible for leading, integrating, and coordinating the overall national effort to enhance critical infrastructure protection; developing and implementing comprehensive, multi-tiered risk management programs and methodologies; generating cross-sector and cross-jurisdictional protection guidance, guidelines, and protocols; and recommending risk management and performance criteria and metrics within and across sectors.

Several components within DHS have multiple responsibilities that contribute substantially to the security and resilience of the Dams Sector.

The Office of Infrastructure Protection (IP) serves as the Sector-Specific Agency (SSA) for the Dams Sector. The Assistant Secretary of Infrastructure Protection has designated the Director of the DHS IP Sector Outreach and Programs Division (SOPD) to chair the Government Coordinating Council.

The Federal Emergency Management Agency (FEMA) is the lead agency for the National Dam Safety Program and has worked for years with Federal and State agencies and private owners on implementing dam safety requirements and supporting initiatives. FEMA facilitates improvements to State dam safety programs by providing grants, supporting training and research initiatives, and coordinating better communication and public awareness. FEMA also conducts flood mapping for the Nation in its role as the administrator of the National Flood Insurance Program. Its maps establish appropriate risk zone determinations behind levees for flood insurance purposes.

The United States Coast Guard (USCG) mission to provide maritime transportation safety, security, and mobility aligns with the navigation aspects of the Dams Sector. Many of the protective systems that USCG developed in its national defense role are transferable to some of the sector's most critical assets.

U.S. Department of the Interior

As the Nation's principal conservation agency, the U.S. Department of the Interior (DOI) is responsible for most of the federally owned public lands and natural resources. DOI is responsible, through its bureaus, for the planning, design, construction, operation, oversight, and maintenance of nearly 3,000 dams. DOI's Working Group for Dam Safety and Security addresses dam-specific issues for the various DOI bureaus described below:

- **The Bureau of Reclamation** is a Federal water resource management and development bureau authorized to operate in 17 Western States. Reclamation has constructed more than 600 dams and reservoirs that bring water to 31 million people and provide one out of five Western farmers with irrigation water for 10 million acres of farmland that produce 60 percent of the Nation's vegetables. Some of the largest and most iconic dams in the country are operated by Reclamation, including the Hoover Dam and Grand Coulee Dam. Reclamation maintains 479 dams and 348 reservoirs, including 53 power plants that provide more than 40 billion kilowatt hours annually. Reclamation also maintains several levees, such as the Colorado River channel, the Colorado River Front Work and Levee Project, and levees from Parker Dam to the U.S.-Mexico border. Reclamation also has a programmatic oversight role of the dam safety and security programs throughout DOI.
- **The Bureau of Indian Affairs** works with American Indian tribes and tribal nations to operate and maintain 859 dams on Indian reservations, 126 of which are classified as having high or significant hazard potential.
- **The Bureau of Land Management (BLM)** is responsible for agency-owned dams on public lands in 11 Western States, including Alaska. The BLM inventory consists of 590 dams, 8 of which are classified as having high hazard potential.
- **The U.S. Fish and Wildlife Service (FWS)** operates facilities associated with fish and wildlife conservation on National Wildlife Refuges, waterfowl production areas, and national fish hatcheries. FWS has an inventory of 193 dams.

- **The National Park Service** has stewardship of 79 million acres of national parks and maintains 505 dams.
- **The Office of Surface Mining** oversees dams under its authority as Federal regulators under the Surface Mining Control and Reclamation Act of 1977, but does not own any dams. It oversees 73 dams, 8 of which are classified as having high hazard potential and 12 of which are classified as having significant hazard potential.

U.S. Department of Labor

The U.S. Department of Labor (DOL) has Dams Sector responsibilities under the Federal Mine Safety and Health Act of 1977 for dams constructed by the mining industry. The act specifically includes “impoundments, retention dams, and tailing ponds as part of a coal or other mine.” The mining industry constructs dams for waste disposal, water supply, water treatment, and sediment control.

The DOL’s **Mine Safety and Health Administration** is responsible for regulating the safety of mining industry dams. Mining-related dams are inspected as part of a full mine inspection that occurs four times per year for underground mines and twice per year for surface mines. It regulates 626 dams through its 11 Coal Mine Safety and Health Districts, and 1,903 dams through its 6 Metal and Nonmetal Mine Safety and Health Districts.

U.S. Department of State, International Boundary and Water Commission

The U.S. Department of State has a role in the Dams Sector through the International Boundary and Water Commission (IBWC). Composed of a U.S. Section and a Mexican Section, the IBWC has jurisdiction over two large international dams, four small diversion dams on the Rio Grande, and one small diversion dam on the Colorado River.

The U.S. Section is also responsible for the maintenance of several other dams and river control structures that are not fully international in nature. The International Boundary and Water Commission owns, operates, and maintains more than 500 miles of levees and associated floodways along the lower portion of the Rio Grande.

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is authorized by the Federal Power Act to issue licenses to individuals, corporations, States, and municipalities to construct, operate, and maintain dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works that are necessary for the development of non-Federal hydroelectric projects on navigable streams, public lands of the United States, and streams over which Congress has jurisdiction under the Commerce Clause of the U.S. Constitution, or that use surplus water or power from any Federal dam. FERC has jurisdiction over approximately 2,600 dams.

Tennessee Valley Authority

Tennessee Valley Authority (TVA) is authorized by the Tennessee Valley Authority Act of 1933 to approve plans for the construction, operation, and maintenance of all structures affecting navigation, flood control, or public lands or reservations in the Tennessee River System. TVA is responsible for the planning, design, construction, operation, and maintenance of its 49 dams.

U.S. Department of Energy

The U.S. Department of Energy (DOE) is the designated Sector-Specific Agency for the Energy Sector and is responsible for coordinating the security and resilience of critical energy assets. It also assists Federal, State, and local governments with disruption preparation, response, and mitigation activities. It is the lead coordinator for ESF-12 – Energy, which is an integral part of the larger DOE responsibility of maintaining continuous and reliable energy supplies for the Nation through preventive measures and restoration and recovery actions. The agency therefore has a natural affinity with the hydroelectric component of the Dams Sector. In addition, DOE owns and has jurisdiction over 15 dams at three sites.

Bonneville Power Administration

The Bonneville Power Administration (BPA) is a Federal nonprofit agency that serves the Pacific Northwest by operating an extensive electricity transmission system. Although BPA is part of DOE, it is self-funding and covers its costs by selling its products and services. BPA markets wholesale electrical power from 31 Federal hydro projects in the Columbia River Basin, one non-Federal nuclear plant, and several other small non-Federal power plants. The dams are operated by USACE and the Bureau of Reclamation. About one-third of the electric power used in the Northwest comes from BPA.

National Weather Service

The National Weather Service (NWS), a component of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, is the Federal agency authorized to issue hydrologic forecast and flash flood/flood

warnings. During normal operations, NWS provides dam and levee operators with information that they can factor into their operations and planned discharges. During flood emergencies, NWS disseminates warnings to the public and local authorities for the purpose of saving lives and property. The agency also issues forecasts and warnings for hurricane landfall, flooding, flash-flooding, and river levels, all of which are of vital importance to dam, levee, and lock owners and operators, as well as downstream communities.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) is responsible for protecting the water systems that depend on the water stored by dams or conveyed by canals. The agency is also the SSA for the Water Sector.

E.2 State Agencies

State governments have primary responsibility for protecting their populations from dam failure. State dam safety offices have regulatory responsibility for about 80 percent of the more than 87,000 dams in the 2013 NID.^{E1} State agencies with jurisdiction over dams and levees are represented on the Dams Government Coordinating Council (GCC). Although programs vary in the scope of their authority from State to State, program activities typically provide for:

1. Safety evaluations of existing dams.
2. Reviews of plans and specifications for dam construction and major repairs.
3. Periodic inspections of construction of new dams or at existing dams.
4. Review and approval of emergency action plans (EAPs).

State efforts to regulate dams to ensure public safety began after the failure of the St. Francis Dam in California in 1928, the second worst U.S. dam failure after the Johnstown, Pennsylvania, failure of 1889. The failure of the St. Francis Dam led to the enactment of legislation in California that became the model for laws in other States. By the mid-1970s, about half of the States had systems for protecting the public from the potential hazards of dams. Today, all States except Alabama have adopted dam safety regulatory laws.^{E2}

The National Dam Safety Program, reauthorized in the Water Resources Reform and Development Act of 2014, provides assistance to enhance State programs through grants and technical research and training. This program allows States to identify their own priorities and take appropriate action within the constraints of available resources. Funds provided annually through grants to State dam safety programs can be used by States to develop dam security vulnerability screening tools and threat response plans for dams with high hazard potential.

State assistance under the National Dam Safety Program is intended to help States bring the necessary resources to bear on inspection and emergency planning for dam safety. For a State to qualify for assistance under the National Dam Safety Program, State appropriations must be budgeted to carry out the State's legislation, and the State dam safety program must be working toward meeting the criteria in the Dam Safety Act. With the exception of Alabama, States are meeting all or most of the act's criteria:

- Review and approve plans and specifications to construct, enlarge, modify, remove, and abandon dams.
- Perform periodic inspections during dam construction to ensure compliance with approved plans and specifications.
- Give State approval upon completion of dam construction and before operation of the dam.
- Require or perform an inspection at least once every five years of all dams and reservoirs that would pose a significant threat to human life and property in case of failure in order to determine the continued safety of the dams and reservoirs, and require a procedure for more detailed and frequent safety inspections.
- Require that all inspections be performed under the supervision of a State-registered professional engineer with experience in dam design and construction.
- Issue notices, when appropriate, to require owners of dams to perform the necessary maintenance or remedial work, revise operating procedures, or take other actions, including breaching dams when necessary.

- Establish regulations for carrying out the State’s legislation.
- Provide funds to ensure timely repairs or other changes to or removal of a dam to protect human life and property, and, if the owner of the dam does not take the action described above, take appropriate action as expeditiously as possible.
- Institute a system of emergency procedures to be used if a dam fails or if the failure of a dam is imminent.
- Identify each dam whose failure could be reasonably expected to endanger human life, the maximum area that could be flooded if the dam failed, and public facilities that would be affected by the flooding.

Relationship with the National Dam Safety Program

As the lead agency for the National Dam Safety Program, FEMA worked for years with other Federal and State agencies and private industry on implementing requirements and initiatives for dam safety. FEMA was established in 1979, by [Executive Order 12148: Federal Emergency Management \(EO 12148\)](#), in response to the need for unified and coordinated efforts for Federal assistance in national disasters. EO 12148 also provided that the Director of FEMA would coordinate all Federal efforts in dam safety. In 1986, Title XII of the Water Resources Development Act was enacted to establish and maintain dam safety programs, including training for dam safety inspectors. Ten years later, the Water Resources and Development Act of 1996 codified a program that had been successfully promoting dam safety and mitigating the effects of dam failures for more than 20 years. Section 215 of the 1996 act formally established the National Dam Safety Program and named the Director of FEMA as its coordinator. The passage of the 1996 act represented the culmination of years of collaborative efforts by the dam safety community to statutorily create the National Dam Safety Program.

The National Dam Safety Review Board and the Interagency Committee on Dam Safety play an important role in guiding the National Dam Safety Program and coordinating efforts across the dam safety community. Both organizations are chaired by FEMA and were reauthorized in subsequent laws and most recently under the Water Resources Reform and Development Act of 2014.

National Dam Safety Review Board

The National Dam Safety Review Board provides the Administrator of FEMA with advice in setting national dam safety priorities, considers the implications of national policy issues affecting dam safety, and assists FEMA in the review of State dam safety programs. The Board is composed of 11 voting members representing the Departments of Agriculture, Defense, and the Interior; FEMA; FERC; five members from State dam safety offices; a member representing the private sector; and a nonvoting representative from the DOE national laboratories.

Interagency Committee on Dam Safety

The Interagency Committee on Dam Safety encourages the establishment and maintenance of effective Federal programs, policies, and guidelines to enhance dam safety, and serves as the permanent forum for the coordination of Federal activities in dam safety. The Committee is composed of representatives from Federal agencies that build, own, operate, or regulate dams, and currently includes members representing the departments of Agriculture, Defense, Energy, Interior, and Labor, as well as FEMA, FERC, the Nuclear Regulatory Commission, TVA, and the International Boundary and Water Commission U.S. Section.

Relationships with Local, Tribal, and Territorial Governments

Local governments, public utilities, levee districts, and water management districts own and operate dams and levees. The interests of these owners and operators are represented on the Dams Sector Coordinating Council (SCC) and Levee Subsector Coordinating Council (LSCC) by their fellow owners and operators and by professional organizations such as the Association of State Dam Safety Officials (ASDSO), the National Hydropower Association, the Association of State Floodplain Managers (ASFPM), and the National Association of Flood and Stormwater Management Agencies (NAFSMA). The [complete list of Dams SCC and LSCC members](#) is provided in Chapter 2.

Non-Federal governments are also represented in the Dams Sector through liaison with the State, Local, Tribal, and Territorial Government Coordinating Council (SLTTGCC). Members of the council are invited to participate in all quarterly meetings of the Dams Sector partnership councils. The SSA also conducts periodic conference calls with SLTTGCC representatives to ensure maximum exchange of information.

In addition to the inclusion of tribal government interests in the sector through the SLTTGCC liaison, the Bureau of Reclamation, a GCC member, represents the Bureau of Indian Affairs, which operates 859 dams on American Indian lands, operates its dam safety program, and works with American Indian tribes and tribal nations to operate and maintain those dams. Working with the tribes to protect and develop natural resources on their reservations is an important Federal trust responsibility.

Relationships with Private Sector Organizations

Private national and international dam safety organizations have significant connections with and influence on the Dams Sector and play important roles in coordinating and contributing to sector safety, security, and resilience. In particular, industry associations perform valuable education, training, and outreach to smaller dams and levee owners and help them facilitate coordination with local governments, which are often the impetus for obtaining financial and technical assistance from State and Federal agencies. Though they are private organizations, some associations may represent both private and public sector asset owners and operators.

Association of State Dam Safety Officials

ASDSO is a national, nonprofit organization serving State dam safety programs and the broader dam safety community, which includes State and Federal dam safety professionals, dam owners and operators, engineering consultants, emergency managers, manufacturers, suppliers, academia, contractors, and others interested in improving dam safety. ASDSO is dedicated to improving dam safety through networking, education, research and awareness. Many of the State dam safety officials who are members have regulatory authority over dam safety and also have some degree of regulatory authority for levee safety in their State.

Association of State Floodplain Managers

ASFPM is an organization of professionals involved in floodplain management; flood hazard mitigation; the National Flood Insurance Program; and flood preparedness, warning, and recovery. ASFPM represents the flood hazard specialists of Federal, State, and local governments; the research community; the insurance industry; and the fields of engineering, hydrologic forecasting, emergency response, water resources, and others. The mission of ASFPM is to promote education, policies, and activities that mitigate current and future losses, costs, and human suffering caused by flooding and to protect the natural and beneficial functions of floodplains—all without causing adverse impacts. The safety and resilience of levees and dams are of great interest to floodplain managers.

National Association of Flood and Stormwater Management Agencies

NAFSMA is an organization of State and local public agencies that function to protect lives, property, and economic activity from the adverse impacts of storm and flood waters. The association advocates public policy, encourages the use of technologies, and conducts educational programs that facilitate and enhance the achievement of the public service function of its members.

National Hydropower Association

The National Hydropower Association is a national, nonprofit association committed exclusively to representing the interests of the hydroelectric power industry. Its members include more than 200 companies in the North American hydropower industry, from Fortune 500 companies to small businesses. Members include public utilities, investor-owned utilities, independent power producers, equipment manufacturers, environmental and engineering consultants, and attorneys.

National Mining Association

The National Mining Association is a nonprofit trade association that provides a forum in which the diverse segments of the mining industry come together to advocate public policies designed to protect and expand opportunities for domestic mining. Association members include more than 325 corporations involved in all aspects of the mining industry, including coal, metal, and industrial mineral producers and processors. The association's connections to the Dams Sector are the mine tailings and other industrial waste impoundment constituencies.

National Water Resources Association

The National Water Resources Association is a nonprofit federation of State organizations with a membership that includes rural water districts, municipal water entities, commercial companies, and individuals. The association's concerns with the appropriate management, conservation, and use of water are directly related to the interests of the Dams Sector.

United States Society on Dams

The United States Society on Dams (USSD), formerly the U.S. Committee on Large Dams, was established in the early 1930s, and is the nationwide professional organization focusing on dam and water resources development. USSD represents the United States as one of the 83 member countries of the International Commission on Large Dams and has served as the private sector member of the National Dam Safety Review Board since its establishment in 1998.

Other Relevant Organizations

Many other national and international groups also have potential interests in Dams Sector issues:

American Consulting Engineers Council

American Public Works Association

American Society of Civil Engineers

Associated General Contractors of America, Inc.

Earthquake Engineering Research Institute

Edison Electric Institute

Electric Power Research Institute

Floodplain Management Association

International Association of Emergency Managers

National Emergency Management Association

National Governors Association

National Society of Professional Engineers

National Watershed Coalition

Natural Hazards Research and Applications Information Center

North American Electric Reliability Council

Portland Cement Association

The Infrastructure Security Partnership

E.3 International Relationships

In the aftermath of the September 11, 2001, attacks, the Canadian, Mexican, and U.S. governments focused attention on their shared borders. Several frameworks exist to address international dams projects.

United States and Mexico

The Critical Infrastructure Protection Framework Agreement between Mexico and the United States provides the basis for the safe, efficient, and secure operation of the international dams on the countries' borders. Consistent with the agreement, the countries conduct joint inspections of the international dams on a five-year schedule. Corrective actions for deficiencies identified during these inspections are addressed in a risk-based priority order.

In addition to the five-year inspections, the countries conduct joint annual security assessments of their shared critical infrastructure. They also work cooperatively to develop strategies to secure the international diversion and storage dams. The countries alternate conducting silt surveys to determine the reservoir capacities at the Amistad and Falcon International Storage Dams on the Rio Grande River in Texas. These studies are done on a 10-year basis.

United States and Canada

Many rivers and some of the largest lakes in the world lie along or flow across the border between the United States and Canada. These lakes and rivers are used for many purposes in both nations, which at times results in conflict.

The International Joint Commission was established by the 1909 Boundary Waters Treaty. The commission has six members—three appointed by the President of the United States, with the advice and approval of the Senate, and three appointed by the Governor General in the Council of Canada, on the advice of the Prime Minister. The commissioners adhere to the treaty as they prevent or resolve disputes. More than 20 boards, made up of experts from the United States and Canada, help the commission carry out its responsibilities. The commission rules on applications for the approval of projects affecting boundary or transboundary waters and may regulate the operation of these projects. It also assists the two countries in protecting the transboundary environment, including the implementation of the Great Lakes Water Quality Agreement. The commission alerts the governments on emerging issues along the border that may give rise to bilateral disputes.

In cases such as approving applications for dams or canals, the commission authorizes uses while protecting competing interests in accordance with the rules established by the two governments. If it approves a project, the commission can set conditions limiting water levels and flows (e.g., to protect shore properties and wetlands along with the interests of farmers, shipping companies, and others). After a structure is built, the commission may continue to play a role in how it is operated. There are 15 dams under the jurisdiction of the commission.

International Commission on Large Dams

The International Commission on Large Dams is an international organization that includes representatives from the National Committees on Dams from 86 different participating countries. The commission provides a forum for the exchange of knowledge and experience in all aspects related to dams, leading the profession in ensuring that dams worldwide are built and operated safely, efficiently, economically, and without detrimental effects on the environment. The commission hosts annual meetings and congresses (every three years) that continuously build on the experiences gained at previous commission meetings to actively advance the state of the practice in all aspects of dam operations and water management.

CHAPTER ENDNOTES

- E1. U.S. Army Corps of Engineers, “National Inventory of Dams,” fact sheet, accessed March 2015, <http://www.agc.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11913/Article/480923/national-inventory-of-dams.aspx>.
- E2. The Alabama Department of Economic and Community Affairs, Office of Water Resources, is supporting the establishment of an Alabama Dam Security and Safety Program. The legislation to establish this program has been under development for several years.

APPENDIX F

Dams Sector Authorities

F.1 Dams Sector Asset Management and Regulation Authorities

Key authorities that govern and/or have a general influence on the Dams Sector:

Federal Power Act of 1920

This act authorizes the Federal Energy Regulatory Commission (FERC) to regulate hydroelectric projects, including dams, reservoirs, and other projects to enhance navigation and power generation. The act authorizes FERC to regulate and license the construction, operation, and maintenance of dams, reservoirs, power terminals, and other structures designed to improve navigation and transmission of power by way of navigable waterways.

Flood Control Act of 1936

This act placed watersheds, water flow retardation, and soil erosion prevention under the U.S. Department of Agriculture and authorized the U.S. Army Corps of Engineers (USACE) to undertake civil engineering projects such as dams, levees, dikes, and other flood control measures for the improvement of rivers and other waterways for flood control and allied purposes. Those authorities were not to interfere with reclamation projects by the U.S. Department of the Interior's Bureau of Reclamation. The Flood Control Act of 1928, authorized USACE to design and construct projects for the control of floods on the Mississippi River and its tributaries, as well as the Sacramento River in California.

Federal Mine Safety and Health Act of 1977

This act amended the Federal Coal Mine Health and Safety Act of 1969, to encompass all mines under a single legislation—surface and underground—regardless of size, commodity mined, or method of extraction. The act requires that the Mine Safety and Health Administration inspect all mines each year. Underground mines are to receive at least four inspections annually; all surface operations are to be inspected at least twice annually. Advance notice of inspections is prohibited. The act requires or authorizes additional inspections and investigations to ensure safe and healthy work environments for miners. Violations found during inspections and investigations must be cited and are subject to civil penalties. Mine operators must notify the Mine Safety and Health Administration when they open or close a mine.

Dam Safety Act of 2006

This act reauthorized the National Dam Safety Program through Fiscal Year 2011, and continues all of the programs established by the 1996 act and the 2002 reauthorization that increase the safety of the Nation's dams. These programs include grants to the States for the improvement of State dam safety programs, training for State dam safety staff and inspectors, a program of technical and archival research, and funding to USACE for maintaining and updating the National Inventory of Dams. The 2006 act also continued the role of the National Dam Safety Review Board, which provides the Administrator of the Federal Emergency Management Agency (FEMA) with advice on national policy issues affecting dam safety. The National Dam Safety Program Act of 2014 was reauthorized in May 2014 as part of the Water Resources Reform and Redevelopment Act of 2014.

Water Resources Development Act of 2007 (Title IX, also known as the National Levee Safety Act of 2007): Subtitle C, National Levee Safety Program

This act directs the Secretary of the Army to establish a National Levee Safety Committee to (1) advise the Secretary in implementing a national levee safety program; (2) support programs, policies, and guidelines to enhance levee safety for the protection of human life and property throughout the United States; and (3) support coordination and information exchange between Federal and State agencies that share common problems and responsibilities related to levee safety. The Secretary is also directed to establish and maintain a national levee safety program, which shall include (1) periodically publishing an inventory of levees in the United States, including assessment and inspection results; (2) determining the potential for a failure or overtopping of each levee in the United States that would pose a risk to human life or public safety, with priority going to levees that constitute the highest risk; and (3) taking into consideration the potential of a levee to fail or overtop because of hydrologic or hydraulic conditions; storm surges; geotechnical conditions; inadequate operating

procedures; structural, mechanical, or design deficiencies; or other conditions in the vicinity of the levee. The act sets forth provisions regarding State participation, reporting requirements, and subsequent assessments. The National Levee Safety Committee issued its Recommendations for a National Levee Safety Program in 2009.

Water Resources Reform and Development Act (WRRDA) of 2014

This act promotes the Nation's competitiveness, prosperity, and economic growth by upholding the seminal Federal responsibility to maintain a strong transportation infrastructure and ensure the efficient flow of domestic and international commerce. Through WRRDA, Congress authorizes the key missions of the USACE, including developing, maintaining, and supporting the Nation's economically vital waterway infrastructure and supporting effective and targeted flood protection and environmental restoration needs. The WRRDA reauthorizes the National Dam Safety Act of 2006 and creates a requirement to develop and implement a comprehensive dam safety hazard education and public awareness initiative to assist the public in preparing for, mitigating, responding to, and recovering from dam incidents.

F.2 Dams Sector Infrastructure Protection and Resilience Authorities

Key authorities that govern and/or have an influence on the Dams Sector's approach to infrastructure protection:

Critical Infrastructure Information Act of 2002

Enacted as part of the Homeland Security Act, this act creates a framework that enables members of the private sector and others to voluntarily submit sensitive information regarding the Nation's critical infrastructure to DHS with the assurance that the information, if it satisfies certain requirements, will be protected from public disclosure. The Protected Critical Infrastructure Information (PCII) Program, created under the authority of this act, is central to the NIPP's information-sharing and protection strategy. By protecting sensitive information submitted through the program, the private sector is assured that the information will remain secure and will be used only to further critical infrastructure protection efforts.

Federal Information Security Management Act of 2002 (FISMA)

Enacted as Title III of the E-Government Act, FISMA requires each Federal agency to develop, document, and implement an agency-wide program to provide information security for the information and information systems that support the operations and assets of the agency, including those provided or managed by another agency, contractor, or other source.

Homeland Security Act of 2002

This act establishes a Cabinet-level department headed by a Secretary of Homeland Security with the mandate and legal authority to protect the American people from the continuing threat of terrorism. The mission of DHS is to prevent terrorist attacks within the United States, reduce the vulnerability of the United States to terrorism at home, minimize the damage and assist in the recovery from terrorist attacks that occur, and ensure that the overall economic security of the United States is not diminished by the efforts, activities, and programs aimed at securing the homeland. To fulfill another mission—protection of the Nation's critical infrastructure—DHS is to complete comprehensive assessments of critical infrastructure vulnerabilities, including the performance of risk assessments to determine the risks posed by particular types of terrorist attacks; develop a comprehensive national plan for securing critical infrastructure and the physical and technological assets that support such systems; and recommend, in coordination with other agencies of the Federal Government and in cooperation with State and local government agencies and authorities, the private sector, and other entities, the measures necessary to protect critical infrastructure. These requirements, combined with the President's direction in HSPD-7, mandate the unified approach to critical infrastructure protection taken in the NIPP.

Homeland Security Presidential Directive 7 (HSPD-7), Critical Infrastructure Identification, Prioritization, and Protection, 2003 (superseded by Presidential Policy Directive 21)

HSPD-7 establishes a framework for Federal departments and agencies to identify, prioritize, and protect critical infrastructure from terrorist attacks, with an emphasis on protecting against catastrophic health effects and mass casualties. This directive establishes a national policy for Federal departments and agencies to identify and prioritize the Nation's critical infrastructure and to protect it from terrorist attacks. HSPD-7 mandates the creation and implementation of the NIPP and sets forth roles and responsibilities for DHS; the SSAs; other Federal departments and agencies; and State, local, tribal, private sector, and other sector partners.

Public Law 84-99

USACE has authority under Public Law 84-99 to undertake emergency management activities, including disaster preparedness and advance measures (for the imminent threat of unusual flooding), emergency operations including flood response and post-flood response, provision of emergency water, certain hazard mitigation activities, and the rehabilitation

of flood risk management projects damaged or destroyed by floods. Public Law 84-99 authorities also include the protection or repair of federally-authorized coastal storm damage reduction projects.

Presidential Policy Directive 8 (PPD-8), National Preparedness, 2011

PPD-8 involves the whole community—not just the government—in a systematic effort to keep the nation safe from harm and resilient when struck by hazards, such as natural disasters, acts of terrorism, and pandemics. This directive calls on Federal departments and agencies to work with the whole community to develop a National Preparedness Goal, a National Preparedness System, and a series of frameworks and plans related to reaching the goal.

Presidential Policy Directive 21 (PPD-21), Critical Infrastructure Security and Resilience, 2013

PPD-21 replaces HSPD-7 and directs the Executive Branch to develop a situational awareness capability that addresses both physical and cyber aspects of how infrastructure is functioning in near-real time, understand the cascading consequences of infrastructure failures, evaluate and mature the public-private partnership, update the National Infrastructure Protection Plan, and develop a comprehensive research and development plan.

Executive Order 13636 (EO 13636), Improving Critical Infrastructure Cybersecurity, 2013

EO 13636 directs the Executive Branch to develop a technology-neutral voluntary cybersecurity framework (published in 2014 as the *NIST Framework for Improving Critical Infrastructure Cybersecurity*); promote and incentivize the adoption of cybersecurity practices; increase the volume, timeliness, and quality of cyber threat information sharing; incorporate strong privacy and civil liberties protections into every initiative to secure critical infrastructure; and explore the use of existing regulation to promote cybersecurity.

Executive Order 13690 (EO 13690), Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 2015

EO 13690 requires all future Federal investments in and affecting floodplains to meet a higher level of resilience. This includes where Federal funds are used to build new structures and facilities or to rebuild those that have been damaged. It builds off of the recommendations from the Hurricane Sandy Rebuilding Task Force, which required all federally-funded Sandy-related rebuilding projects to meet a consistent and higher flood risk reduction standard. It supports President Obama's 2013 Climate Action Plan by directing Federal agencies to take appropriate action to reduce risks to Federal investments and to revise their flood risk standard specifically.



Homeland
Security