# Dams Sector
## Waterside Barriers Guide

2017
(Originally Published 2009)

Homeland Security

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### Purpose

This guide was developed to assist dam owners and operators in understanding the possible need for waterside barriers as part of their overall security plan. It provides them and security personnel with a very cursory level of information on barriers and their use, maintenance, and effectiveness—elements that must be carefully taken into account when selecting waterside barriers.

The waterside barriers described here are systems or technologies designed to help protect critical assets from attack by swimmers or the water-borne vessels commonly found on rivers or reservoirs. Figure 1 depicts such a barrier.

Waterside markers put in place as part of a dam safety program to demarcate dangerous areas and warn swimmers and boaters of the dangers of proceeding farther are not the topic of this brochure.

Figure 1: Waterside Barrier
Source: DHS Photo

The threat scenarios evaluated in the site vulnerability assessment form the basis for determining if a surface or subsurface barrier technology or barrier system is necessary. The interdiction and use of force policies associated with the use of waterside barriers must also be assessed and resolved as part of the security plan. Barrier technology or barrier system selection should take into consideration: effectiveness, purchase, installation, maintenance, and replacement costs related to the site-specific environment and the training and staffing of site security forces.

### Security Plan

Most dams have a security plan that is based on site-specific risk management considerations. Among other information, this plan should contain a description of the types and severity of threats to which the dam or other critical assets could be exposed and an overall plan for controlling access to the site to lessen the threat exposure. Depending upon site-specific situations, access control could be applicable for waterside—surface and subsurface—approaches as well as landside approaches.

In recent years, comprehensive access control measures to stop or forestall attacks from pedestrian or motor vehicle traffic have been installed at many dams. The use of barriers to stop or significantly retard the approach of swimmers or watercraft intent on doing harm is less common.

### Waterside Threats

Water-based attacks from World War II to the present day have featured combat swimmers (unaided or with vehicle support), small boats, mini-submarines, and large vessels relying on kinetic energy or explosives or both. The October 2000 attack on the USS Cole, during a refueling stop in Yemen, was an obvious waterside attack. The US Navy, before and since the Cole incident depicted in Figure 2, developed capabilities for control of water-based access to its high-value assets.


Figure 2: Boat Attack on USS Cole
Source: DHS S & T Photo

Dams are not necessarily subject to the same types of threats as the US Navy, but water could be the route for an individual to gain access to a restricted area, either by swimming or using a boat. Another possible threat is an assault by a boat laden with explosives, similar to the USS Cole incident. A third type of threat is a floating or submerged container, filled with explosives and drawn into a water intake or placed in a sensitive area by a swimmer. The consequence of an unmitigated threat becomes whatever damage that threat is able to accomplish while being at the site.

## Waterside Barriers

Waterside barriers can be divided into two general categories based upon the amount of delay they cause attackers. The first are **barrier systems** that provide minimal delay and need to be paired with rapid detection and interdiction capabilities to stop the aggressor. The second are **barrier technologies** designed to stop or incapacitate an aggressor to such a degree that slow detection and interdiction is tolerable.

## Barrier Systems

Selecting a surface or subsurface waterside barrier system requires extensive consideration of the detection and response capabilities that are paired to the system, the appropriate detection point and standoff distances, security staffing and equipment requirements, and the procedures necessary to establish and maintain the standoff distance.

Detection systems can consist of remote radar, sonar, or imaging systems that integrate low-light, color, closed circuit television cameras and thermal imagers. The selected detection technology or detection system must be capable of significantly aiding in the identification and assessment of potential waterborne threats before they reach the minimum standoff distance—the closest point to the asset that provides enough remaining delay for response forces to reliably interdict the threat.

Because security relies on a combination of detection, assessment, delay, and interdiction, the adequacy of a barrier system is heavily dependent on trained staff that must monitor the detection components and make quick decisions about the intent of watercraft operators or swimmers approaching the dam. Security personnel must also be appropriately trained and equipped to effectively engage possible aggressor(s) once detected and before the barrier(s) and any remaining delay(s) are defeated. A key element of security staff training is complete understanding of and adherence to the standard operating procedures established in the site security plan for warnings, interdiction, and use of force.

The general design "zone" strategy outlined by the Department of Defense for waterfront attacks (see reference 1) could be adapted for selection and deployment of barrier systems. The four zones— assessment, warning, threat, and engagement—would be configured based upon the security system's detection capability and the security force's response capability.

## Barrier Technologies

Surface barrier technologies capable of stopping fast-moving boats are one option. These barriers are interconnected floating elements or anchored composites of netting such as that shown in Figures 3 and 4. The anti-submarine nets used by the US Navy during WWII are examples of subsurface barriers.

Although the use of these technologies minimizes the need for rapid detection equipment, security staff must still be appropriately trained and equipped to respond to situations in which the barrier technology has been breached or has successfully ensnared an aggressor.

The decision to implement a barrier technology requires full consideration of the organization's use of force policies. A system of warning signs should also alert boaters to the presence of the barrier technology.

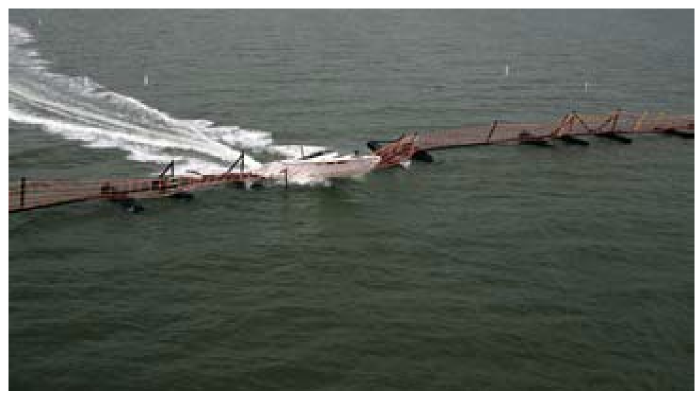

Figure 3: Net Boat Barrier
Source: Existing Barrier and Less Than Lethal Technologies, University of Kentucky, March 2012.

Figure 4: Net Boat Barrier
Source: Bureau of Reclamation

## Barrier Maintenance

Maintaining a barrier to ensure its maximum effectiveness may make the life cycle cost of waterside barriers much higher than the initial cost of procurement and installation. Climatic and other environmental factors can lead to repetitive maintenance and/or maintenance problems.

Surface and subsurface barriers are subject to constant forces from wind, waves, currents and possibly ice and ice flows. They will also intercept and possibly become entangled in floating debris such as that resulting from upstream floods. Debris accumulations can add additional stress to barrier components and may marginalize the barrier's effectiveness.

Barriers usually consist of a line of individual floating elements connected by cables or other devices. These connections are subject to continuous movement, possibly resulting in fatigue damage and failure of the connections. Metal components of a barrier system are subject to corrosion. The detection technologies that comprise the waterside barrier system are also subject to the harshness of weather which can affect performance.

In addition to maintaining the barrier, consideration must be given to providing approved entry through or around the barrier while maintaining the integrity and security of the system. This entry may be required during normal maintenance such as accessing an intake tower or during emergencies.

## Barrier Likelihood of Effectiveness

The effectiveness of a barrier system is dependent on the amount of delay time needed for the detection and interdiction capabilities to stop a threat. The security system is effective if a swimming or boating aggressor can be detected in sufficient time and at a sufficient distance to marshal the required security forces and allow them to act in a timely manner to avert the attack or minimize its impacts. The detection point or points must be at a sufficient distance from the standoff point to ensure that security forces can be alerted and mobilized.

The effectiveness of a barrier technology designed to stop a speeding boat is measured by its ability to stop a boat of a certain size at a certain speed. For example, the Bureau of Reclamation of the US Department of the Interior has developed contract language for certification of boat barriers (see reference 2). This standard requires that an 8,500-pound boat, traveling at 40 knots, be stopped within 10 meters of the original position of the barrier. Because vessel exclusion barriers are costly, the decision to install a vessel barrier should be based on a site-specific risk assessment.

The US Navy developed a five-level rating system for barriers based on the ability to stop a specific combination of vessel size and speed. In 2015, ASTM International developed a similar multi-level standard for waterside barriers (Standard Test Method for Boat Barriers, ASTM F2766-11 (2015)); and is available for purchase (see reference 3). Since ASTM standards are widely used for products within the United States, this waterside barrier standard will probably become the most common measure for certifying waterside barrier effectiveness.

## Technical Resources (Open Source)


1. Department of Defense Security Engineering Facilities Planning Manual, United Facilities Criteria (UFC) 4-020-01, September 2008. [http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-4-020-01](http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-4-020-01)
2. US Bureau of Reclamation, Directive and Standard SLE 03-02, Facility Security. [https://www.usbr.gov/recman/sle/sle03-02.pdf](https://www.usbr.gov/recman/sle/sle03-02.pdf)
3. ASTM Standard Test Method for Boat Barriers, F2766-11 (2015). [https://www.astm.org/Standards/F2766.htm](https://www.astm.org/Standards/F2766.htm)



*This guide is published under the auspices of the U.S. Department of Homeland Security (DHS).The need for the guide was identified by the Dams Sector Security Education Workgroup, which is composed of members from the Dams Sector Coordinating Council (SCC) and the Dams Sector Government Coordinating Council (GCC).*

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*The SCC and the GCC were established as a partnership mechanism to collaborate with the DHS Dams Sector-Specific Agency in sector-wide security and protection activities focused on the Dams Sector. For more information, contact: dams@hq.dhs.gov.*