Product Guide

AquaFence Flood Protection Technology

www.aquafenceusa.com

AquaFence®

AquaFence Summary

The AquaFence is a US Army Corps of Engineers tested flood protection barrier that can be:

- Deployed 100 times faster than sandbags without special training or heavy machinery
- Easily disassembled and stored for future floods
- 100% reused without any waste creation
- Delivered in protection heights ranging from 2.5’ to 9’ (0.75 to 2.7 meters)
- Used nationwide as FEMA compliant dry floodproofing

Invented and patented in Norway in 1999, the mission at AquaFence has always been to offer state of the art flood barriers that are easy to install during emergency situations, yet out of sight at all other times.

Originally developed in cooperation with multiple international flood protection programs as well as global insurance companies, AquaFence is now protecting hospitals, municipalities, transportation hubs, industrial buildings and significant real estate worldwide.

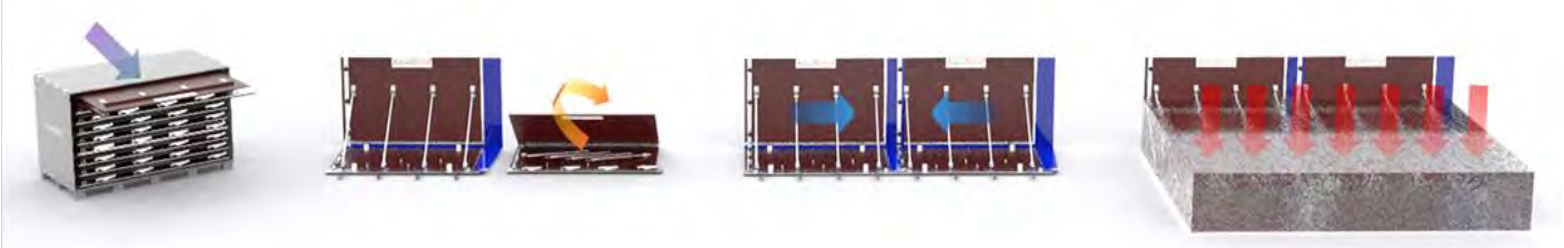
AquaFence Flood Barrier Technology

The **AquaFence Flood Barrier** is a modular system where multiple interconnected panels are used to form a flood wall around a structure or area. Each panel is individually self-stabilized by the weight of the water on the system, creating a barrier that is highly resistant to a variety of flood loads with minimal anchoring and preinstallation site work. The system can be reused dozens of times and only requires a fresh water rinse after each use.

The AquaFence patented Flood Barrier is designed with safety factors above industry standard and has been extensively tested in AquaFence as well as third party test facilities. All parts are made of durable materials, with examples of the system being used, in some cases fully submerged in water, for several years at a time. It has also been tested to withstand extreme temperatures. The system is compliant with building codes such as ASCE 7-16, ASCE 24-14, IBC 2015, and more.

Due to the ease of installation, AquaFence flood barriers can be installed even at low probability of flooding. The modularity of the system allows egress points to be created by leaving single modules out of the barrier. With egress in and out, the area at risk can stay open up until the last minute before flooding occurs, at which point the remaining modules are installed to complete the barrier.

When the AquaFence system is not in use, the panels are stored in custom, space efficient crates, which can be stacked up to four high.

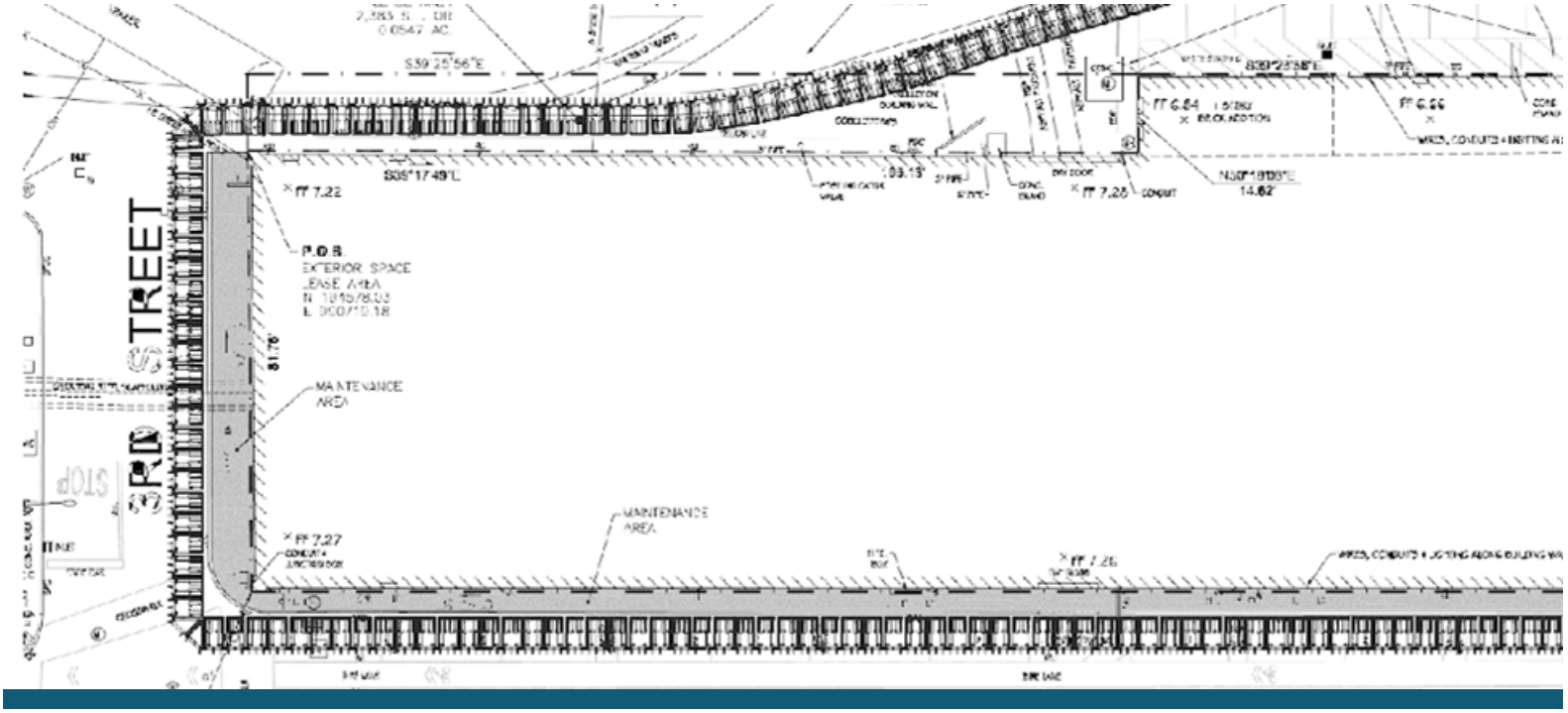


Remove panels from crate

Place panels in line and open them

Connect adjacent panels through flexible membrane

Allow floodwater buildup on horizontal panel to create a self-stabilizing system

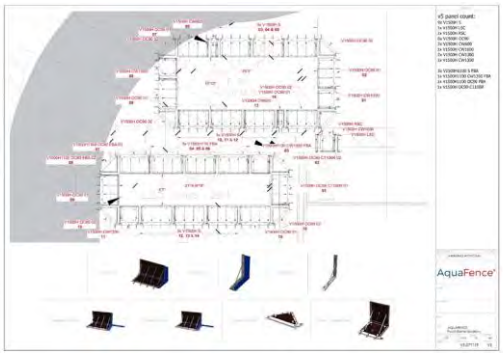


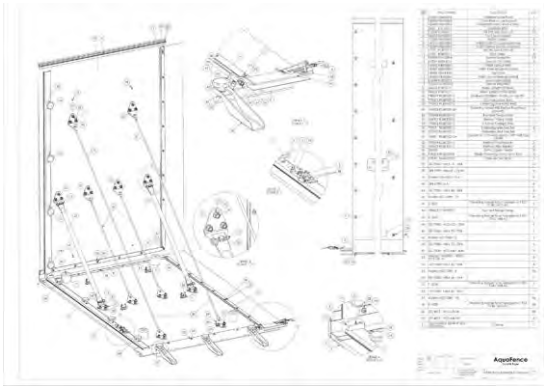
AquaFence Engineering Services

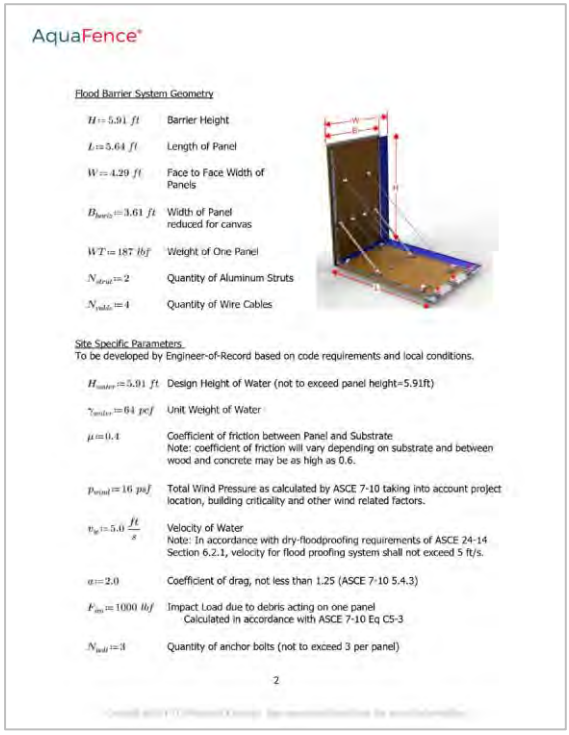
AquaFence Flood Barriers are highly engineered systems delivered with detailed documentation ranging from plan and shop drawings to stamped calculations. A site-specific flood barrier from AquaFence is typically designed based on a combination of building plans, elevation drawings and site visits by AquaFence engineers.

The AquaFence flood barriers can be highly customized to account for unique site parameters typical of urban environments such as sidewalks, drainage systems, alleyways, etc. All customized designs undergo detailed engineering analysis to ensure a high level of performance.

The AquaFence system is compliant with International and American building codes such as IBC 2015, ASCE 7-16 and ASCE 24-14.






AquaFence

Flood Barrier System Geometry

$H := 5.91\ ft$	Barrier Height
$L := 5.64\ ft$	Length of Panel
$W := 4.29\ ft$	Face to Face Width of Panels
$B_{beris} := 3.61\ ft$	Width of Panel reduced for canvas
$WT := 187\ lbf$	Weight of One Panel
$N_{strut} := 2$	Quantity of Aluminum Struts
$N_{cable} := 4$	Quantity of Wire Cables

Site Specific Parameters
To be developed by Engineer-of-Record based on code requirements and local conditions.

$H_{water} := 5.91\ ft$	Design Height of Water (not to exceed panel height=5.91ft)
$\gamma_{water} := 64\ pcf$	Unit Weight of Water
$\mu := 0.4$	Coefficient of friction between Panel and Substrate Note: coefficient of friction will vary depending on substrate and between wood and concrete may be as high as 0.6.
$P_{wind} := 16\ psf$	Total Wind Pressure as calculated by ASCE 7-10 taking into account project location, building criticality and other wind related factors.
$v_w := 5.0\ \frac{ft}{s}$	Velocity of Water Note: In accordance with dry-floodproofing requirements of ASCE 24-14 Section 6.2.1, velocity for flood proofing system shall not exceed 5 ft/s.
$\alpha := 2.0$	Coefficient of drag, not less than 1.25 (ASCE 7-10 5.4.3)
$F_{im} := 1000\ lbf$	Impact Load due to debris acting on one panel Calculated in accordance with ASCE 7-10 Eq C5-3
$N_{bolt} := 3$	Quantity of anchor bolts (not to exceed 3 per panel)

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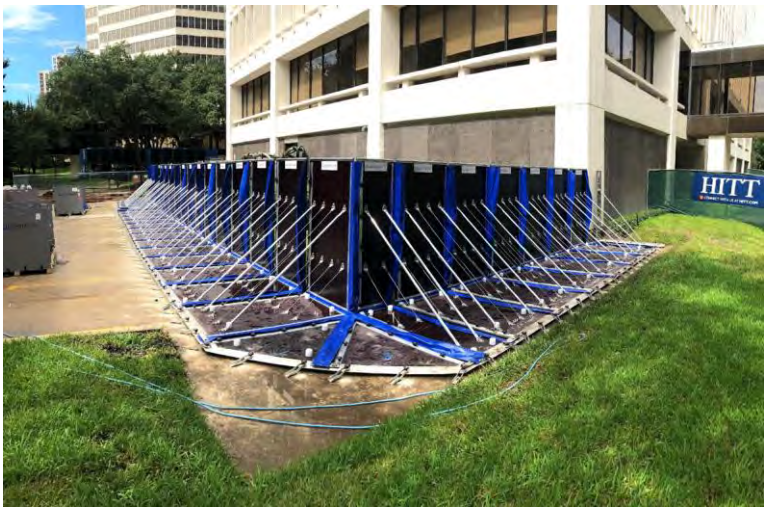
The AquaFence Integrated Flood Shield

The **Integrated Flood Shield** is a FEMA compliant customized solution designed to floodproof openings and exposures of buildings and other critical assets. These systems are designed for both new and existing buildings and are delivered with a FEMA compliant Emergency Response Plan created in cooperation with building management.

The self-stabilizing nature of AquaFence systems ensures that the loads on the flood barrier are not transferred back to the building itself, therefore having minimal impact on the building exterior. A handful of ½" (12 mm) drop-in anchors are typically used on either end of the barrier to ensure a tight seal between the AquaFence system and the protected building or structure. These anchors are capped when not in use and are the only trace of the system once it has been disassembled. In cases where the AquaFence concludes at a surface that can not be anchored into, e.g. flood proof glass, a customized method utilizing the reaction force from the ground can be used to create the necessary seal against the structure.

AquaFence Integrated Flood Shields can be used on the inside or outside of buildings to divert water away from critical assets.


333 GRAND
OVER
4 TONS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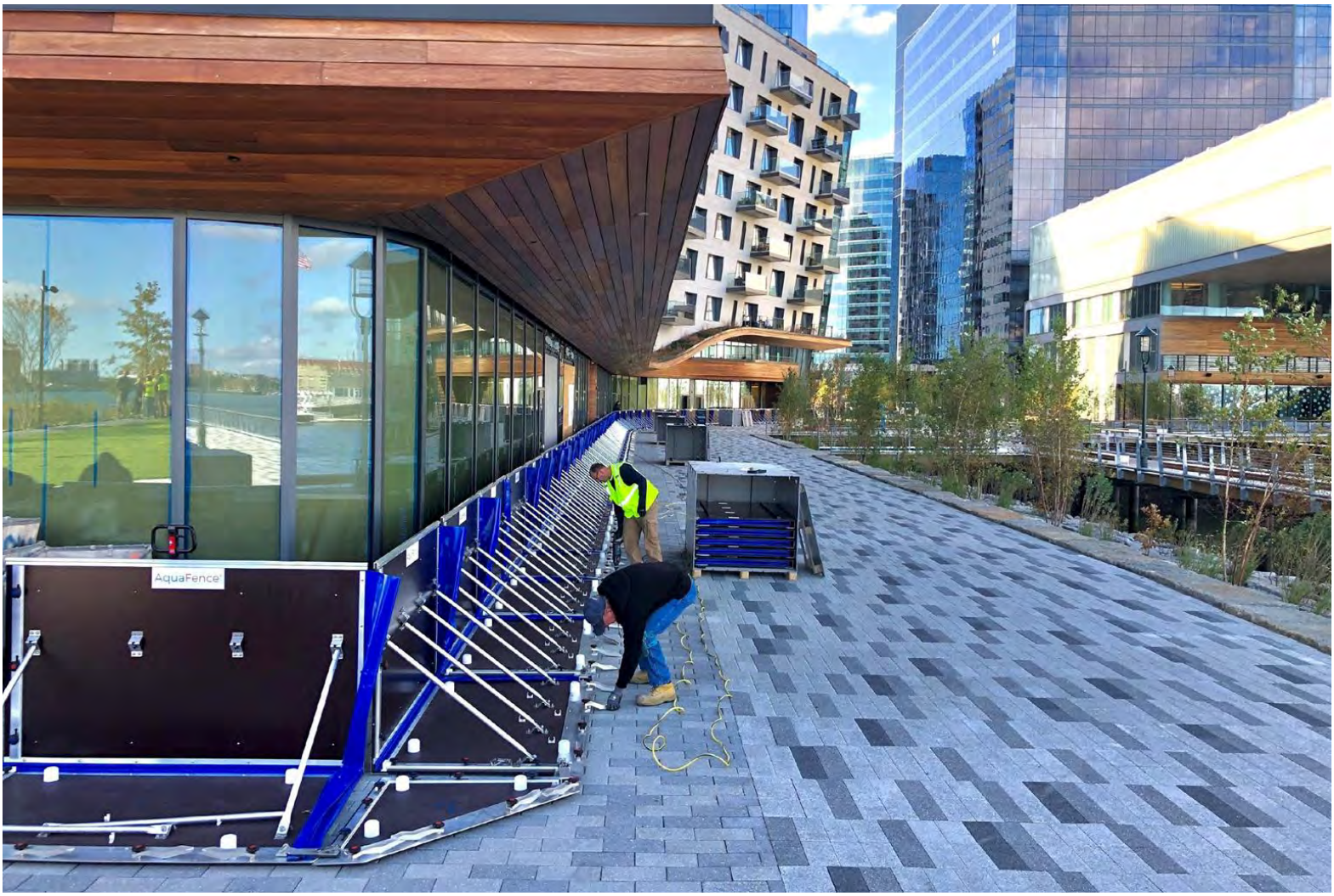
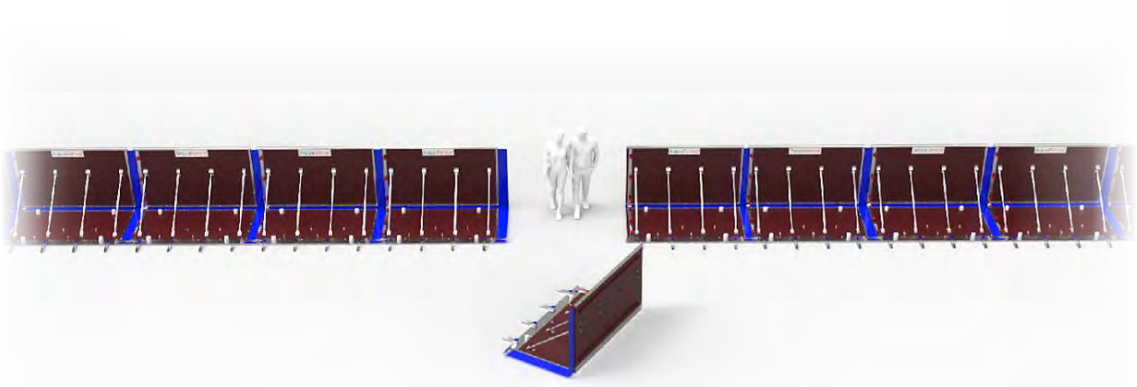
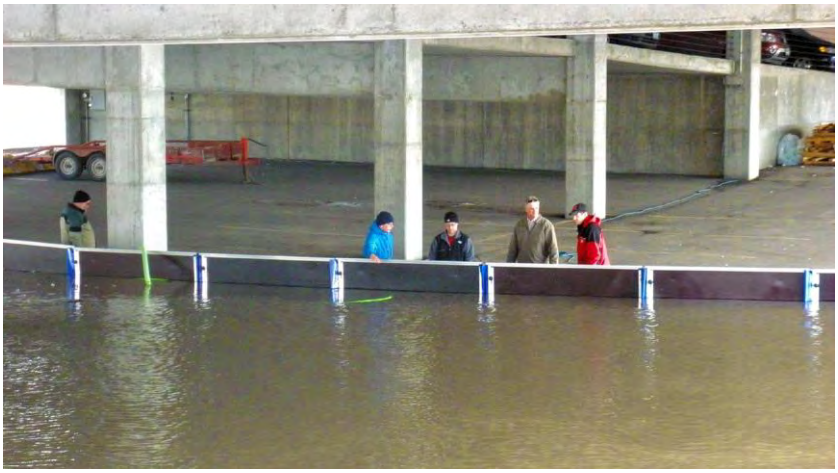


The AquaFence Perimeter Flood Barrier

The **AquaFence Perimeter Flood Barrier** is designed to circle properties ranging in size from single plots of land, to entire cities. In most urban environments, this flood barrier can be used without any advanced site work.

Perimeter Flood Barriers from AquaFence can be designed to change height as the elevation changes along the line of protection. They can also be designed to be deployed with several different starting points, allowing multiple teams to work simultaneously and speed up deployment times. This flexibility allows certain sections of the barrier to be left out in the hours leading up to a flood, permitting egress in and out of the area until the last minute.



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AdventHealth Tampa General Hospital


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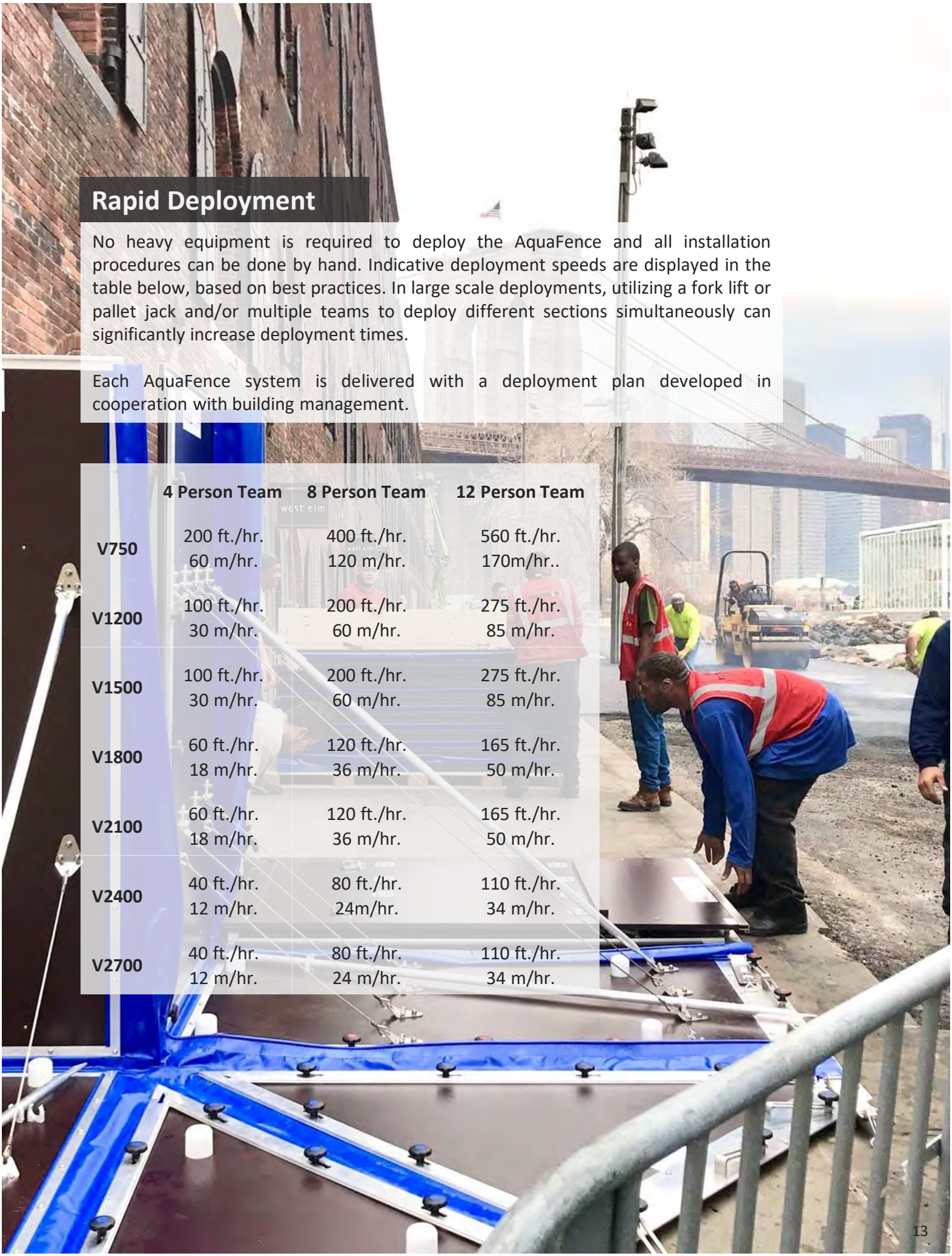


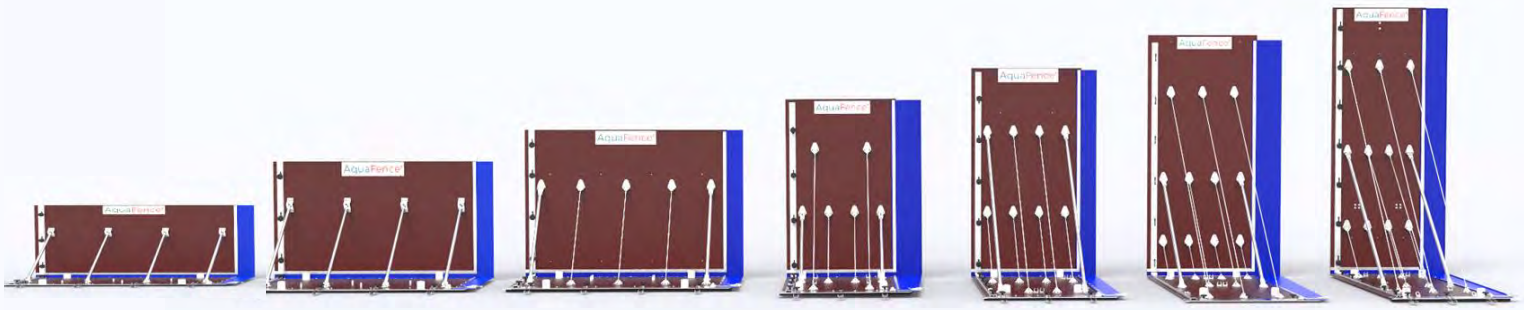
Rapid Deployment

No heavy equipment is required to deploy the AquaFence and all installation procedures can be done by hand. Indicative deployment speeds are displayed in the table below, based on best practices. In large scale deployments, utilizing a fork lift or pallet jack and/or multiple teams to deploy different sections simultaneously can significantly increase deployment times.

Each AquaFence system is delivered with a deployment plan developed in cooperation with building management.

	4 Person Team	8 Person Team	12 Person Team
V750	200 ft./hr. 60 m/hr.	400 ft./hr. 120 m/hr.	560 ft./hr. 170m/hr..
V1200	100 ft./hr. 30 m/hr.	200 ft./hr. 60 m/hr.	275 ft./hr. 85 m/hr.
V1500	100 ft./hr. 30 m/hr.	200 ft./hr. 60 m/hr.	275 ft./hr. 85 m/hr.
V1800	60 ft./hr. 18 m/hr.	120 ft./hr. 36 m/hr.	165 ft./hr. 50 m/hr.
V2100	60 ft./hr. 18 m/hr.	120 ft./hr. 36 m/hr.	165 ft./hr. 50 m/hr.
V2400	40 ft./hr. 12 m/hr.	80 ft./hr. 24m/hr.	110 ft./hr. 34 m/hr.
V2700	40 ft./hr. 12 m/hr.	80 ft./hr. 24 m/hr.	110 ft./hr. 34 m/hr.

AquaFence Flood Barrier Models



Model	V750	V1200	V1500	V1800	V2100	V2400	V2700
Height	29.5 in. 0.75 m	47.2 in. 1.20 m	59 in. 1.50 m	70.9 in. 1.80 m	82.7 in. 2.10 m	94.5 in. 2.40 m	106.3 in. 2.70 m
Depth	29.5 in. 0.75 m	47.2 in. 1.20 m	59 in. 1.50 m	70.9 in. 1.80 m	82.7 in. 2.10 m	94.5 in. 2.40 m	106.3 in. 2.70 m
Width	82.7 in. 2.10 m	82.7 in. 2.10 m	82.7 in. 2.10 m	47.2 in. 1.20 m	47.2 in. 1.20 m	41.3 in. 1.05 m	41.3 in. 1.05 m
Weight	116 lbs. 52 kg.	181 lbs. 82 kg.	190 lbs. 86 kg.	148 lbs. 67 kg.	201 lbs. 91 kg.	240 lbs. 109 kg.	258 lbs. 117 kg.

All AquaFence models are built with durable materials designed to be used in water over long periods of time. These materials include:

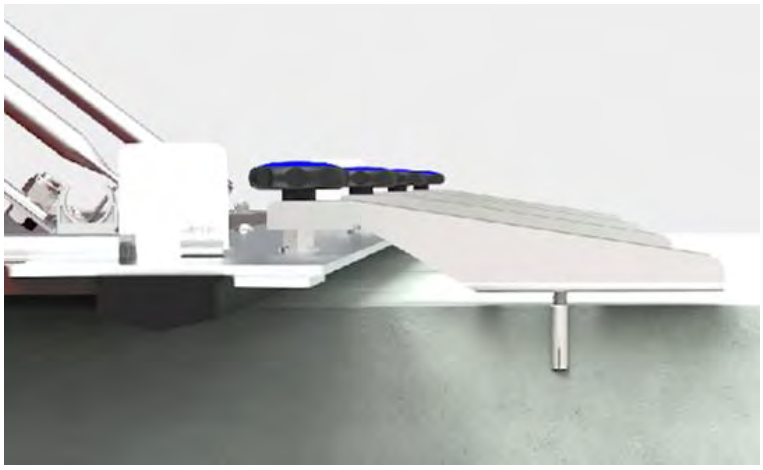
- Marine Grade Plywood
- 316 Stainless Steel
- PVC Canvas
- 6060 T6 and 6063 T6 Aluminum
- Polyethylene Closed Cell Gaskets

Additional, model specific, details can be found in the table above.

Anchoring

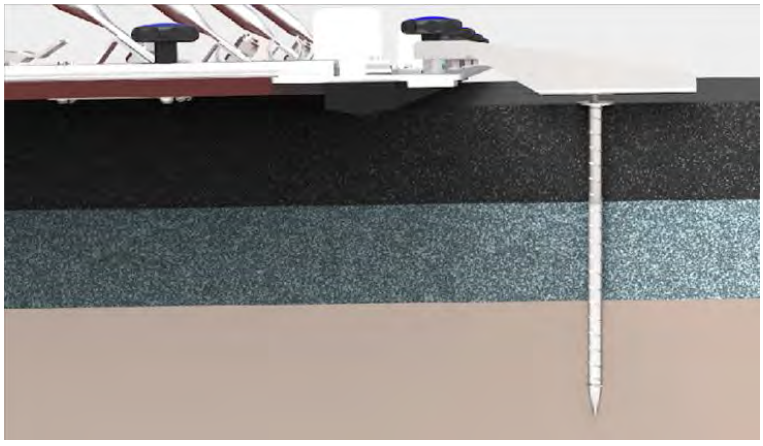
AquaFence requires tie-down anchors to secure the toe of the AquaFence panels to asphalt or concrete pavements. Anchor bolts can be stored with the panels for quick deployment.

Shown here are several anchors frequently used for the AquaFence system.

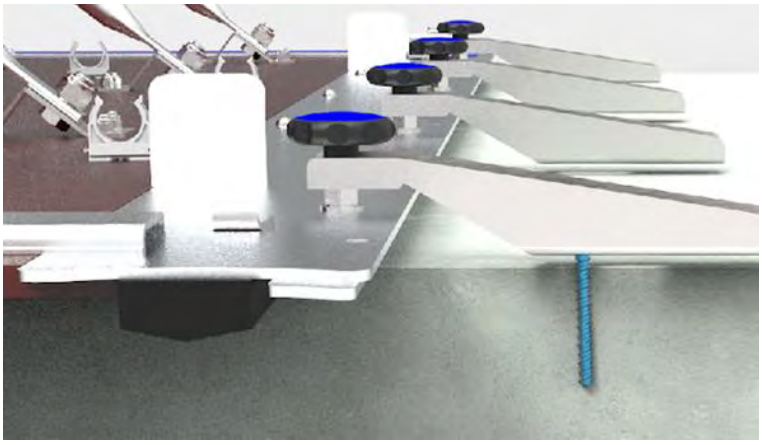


Concrete drop-in Anchors

Anchor Cap

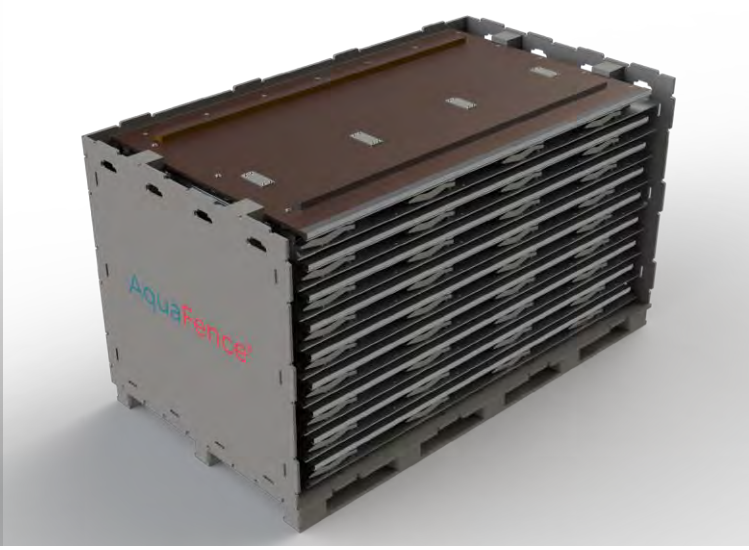


Asphalt Anchors



Tapcon Screws

Storage and Packing



AquaFence Flood Barriers are delivered in stackable, reusable, and weather resistant crates. Where height allows, crates can be stacked up to four high. General dimensions are 4’ 4” wide x 7’4” deep x 4’ 4” high (1,3m x 2,25m x 1,3m) allowing ten crates to fit in an average 9’ x 20’ (2,7m x6m) parking spot when stacked two high. The weight of an empty crate is approximately 250 lbs. (115 kg.)

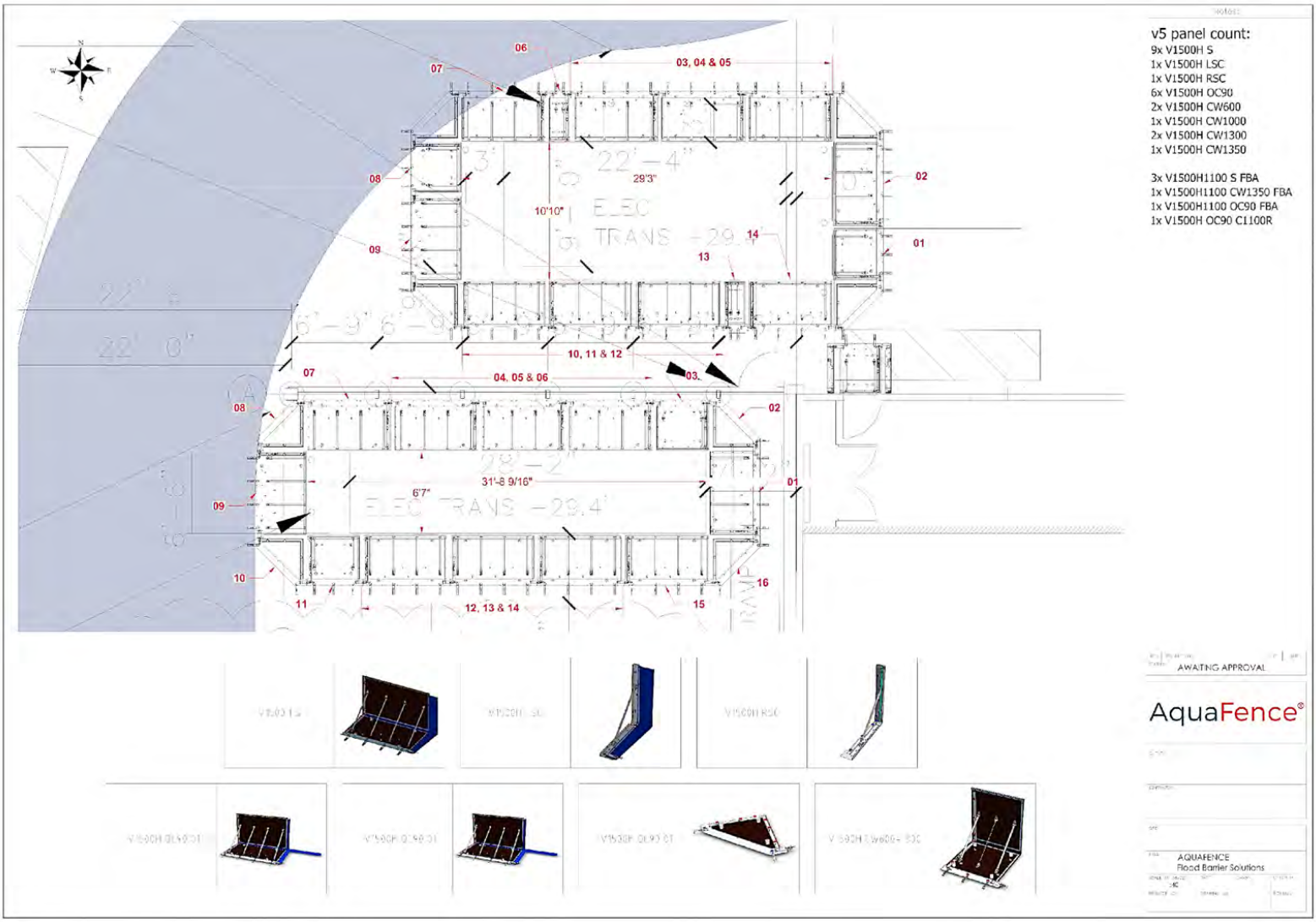
In cases where space dictates it favorable to store the AquaFence panels outside of the crates, they can be stood up on their side and efficiently stored as shown in the image below.

Storage crates per protected distance:

	100 linear ft. (30 linear m)	300 linear ft. (90 linear m)
V750, V1200, V1500	2	5
V1800, V2100	3	9
V2400, V2700	4	11

FEMA Emergency Response Plan

The AquaFence team will work with building management to create detailed deployment and response plans. Each property owner will be trained annually on installation, and AquaFence will issue a certificate for employees or contractors who participate. The AquaFence team will also create a detailed deployment plan with itemized panels and components that will include setting expectations on the timing to deploy based on flood warning areas.



Certifications

A globally recognized testing system whose approval is backed by scientific research and testing, the FM approval platinum shield certifies AquaFence products to the highest flood protection standards.

The **United States Army Corps of Engineers** is a U.S. federal agency under the Department of Defense and a major Army command made up of some 37,000 civilian and military personnel, making it one of the world's largest public engineering, design, and construction management agencies. Generally associated with dams, canals and flood protection in the United States, USACE is involved in a wide range of public works throughout the world. The corps' mission is to "Deliver vital public and military engineering services; partnering in peace and war to strengthen our Nation's security, energize the economy and reduce risks from disasters." Please contact AquaFence to request a full copy of the Army Corp test booklet.

Association of State Flood Plain Managers (ASFPM). 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 **Hamburg University of Technology** (TUHH) conducted a performance review of the AquaFence flood barrier, testing it for hydrostatic, hydrodynamic and impact loading. The performance of the system under these loads was characterized as excellent. TUHH also approved the AquaFence flood barrier for a minimum lifecycle of 60 separate deployments.

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