

MUSCLE WALL®

Flood Defense — Engineer Resources

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FLOOD DEFENSE OVERVIEW

Muscle Wall is a low-density polyethylene (LDPE) portable flood barrier available in 2-ft, 3-ft, and 4-ft heights. Units interlock, are filled with water, and wrapped with a liner to form a continuous barrier system. The 4-ft Muscle Wall has been independently evaluated by the U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) under the FM 2510 Standard Testing Protocol and passed all hydrostatic, hydrodynamic, debris impact, and riverine current tests without damage. It is the first FM-approved 4-ft portable flood barrier.

| Specification | 2-FOOT WALL | 3-FOOT WALL | 4-FOOT WALL |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Material | Low Density Polyethylene (LDPE) | Low Density Polyethylene (LDPE) | Low Density Polyethylene (LDPE) |
| Dimensions (H x L x W) | 2' x 6' x 2' | 3' x 6' x 2' | 4' x 6' x 2.54' |
| Min. Wall Thickness | 0.25 in. | 0.25 in. | 0.25 in. |
| Ground Footprint | 11.5 sq ft | 11.5 sq ft | 14.5 sq ft |
| Empty Weight | 62 lbs | 72 lbs | 121 lbs |
| Filled Weight | 600 lbs | 766 lbs | 1,400 lbs |
| Ground Pressure (empty) | 0.0333 psi | 0.0333 psi | 0.0527 psi |
| Ground Pressure (filled) | 0.3939 psi | 0.4325 psi | 0.6705 psi |
| Impact Strength | 190 ft-lb | 190 ft-lb | 190 ft-lb |
| Tensile Strength | 2,600 PSI at yield | 2,600 PSI at yield | 2,600 PSI at yield |
| Elongation to Yield | 20% | 20% | 20% |
| Temperature Range | -40°F to 180°F | -40°F to 180°F | -40°F to 180°F |
| UV Rating | 10-Year UV Rated | 10-Year UV Rated | 10-Year UV Rated |
| Units per Trailer | 256 / 48-ft flatbed | 192 / 48-ft flatbed | 96 / 48-ft flatbed |
| Units per Bundle/Pallet | 16 walls per pallet | 12 walls per bundle | 12 walls per pallet |
| Sandbag Equivalent | ~235 sandbags | ~355 sandbags | ~470 sandbags |

FLOOD DEFENSE APPLICATIONS

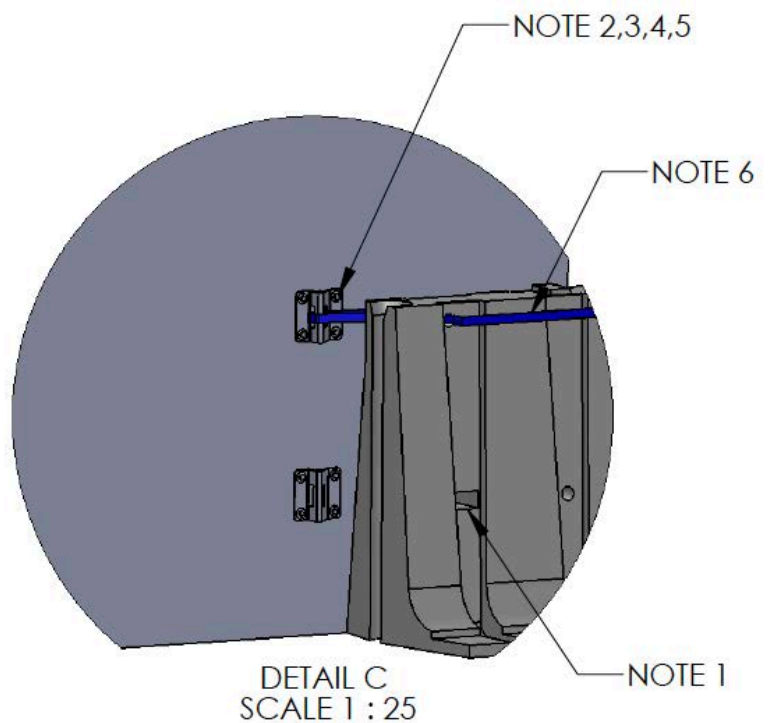
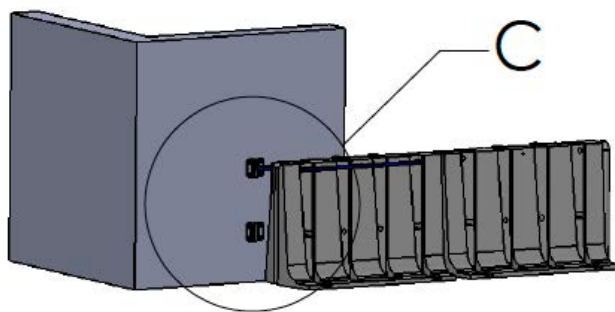
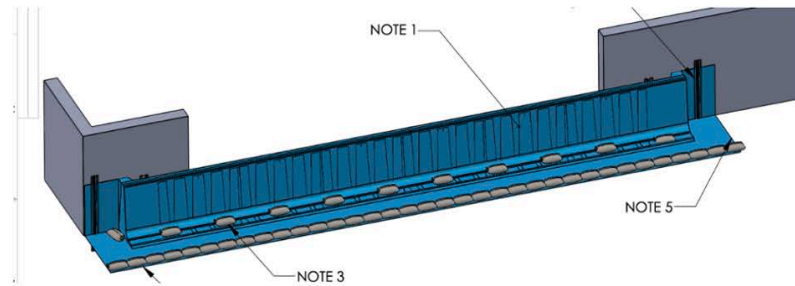
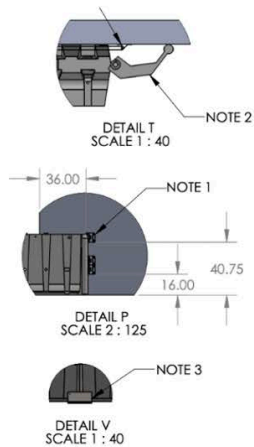
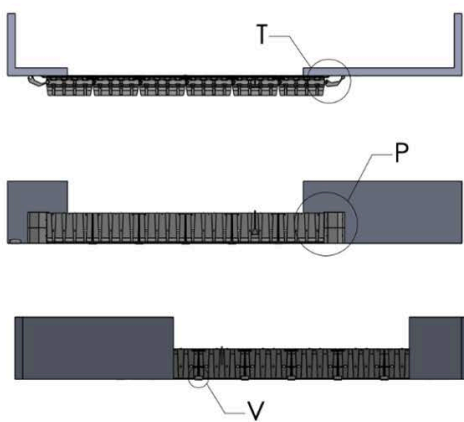
Muscle Wall is engineered for the full range of flood risk management scenarios. The following applications represent the primary sectors where rapid, reusable, engineered flood barriers provide the greatest advantage over traditional methods.

| | |
|--|---|
| <p>1. Data Centers & Mission-Critical Facilities</p> <p>Protect server campuses, substations, generators, and cooling systems from flash flooding or river rise. Downtime costs are enormous — rapid deployment before a storm event can prevent catastrophic loss.</p> | <p>2. Hospitals & Emergency Services</p> <p>Defend hospitals, fire stations, EMS hubs, and emergency operation centers so they remain functional during storm events when they are needed most.</p> |
| <p>3. Utilities & Power Infrastructure</p> <p>Protect electrical substations, water treatment plants, pump stations, telecom hubs, and gas facilities from flood intrusion that could trigger cascading infrastructure failures.</p> | <p>4. Levee Overtopping & Temporary Reinforcement</p> <p>Rapidly reinforce weak levee sections, create secondary containment lines, or protect against overtopping during major storm events without permanent construction.</p> |
| <p>5. Municipal Flood Fight Operations</p> <p>Used by cities and counties for street flooding, downtown districts, neighborhoods, and public works emergency response where speed and reusability matter.</p> | <p>6. Coastal Storm Surge Protection</p> <p>Temporary defense for ports, marinas, waterfront property, and low-lying coastal communities during hurricanes or king tides where advance deployment windows are short.</p> |
| <p>7. Construction Site Flood Protection</p> <p>Keep active job sites dry, protect excavations, foundations, cranes, materials, and maintain project schedules when seasonal flooding threatens site access or safety.</p> | <p>8. Transportation Infrastructure</p> <p>Protect highways, tunnels, rail corridors, airports, and bridges from floodwater intrusion or erosion damage that can close critical transportation corridors.</p> |
| <p>9. Industrial & Manufacturing Plants</p> <p>Protect warehouses, factories, chemical plants, refineries, and logistics centers from production shutdowns and asset loss during flood events.</p> | <p>10. Post-Fire Flood & Debris Flow Defense</p> <p>After wildfires, deploy to protect roads, homes, utilities, and streams from mudflow, ash runoff, and sudden flooding on fire-denuded slopes with minimal infiltration capacity.</p> |



FLOOD DEFENSE DETAILS - FLOOD PROTECTION CLOSURES

WALL MOUNTS

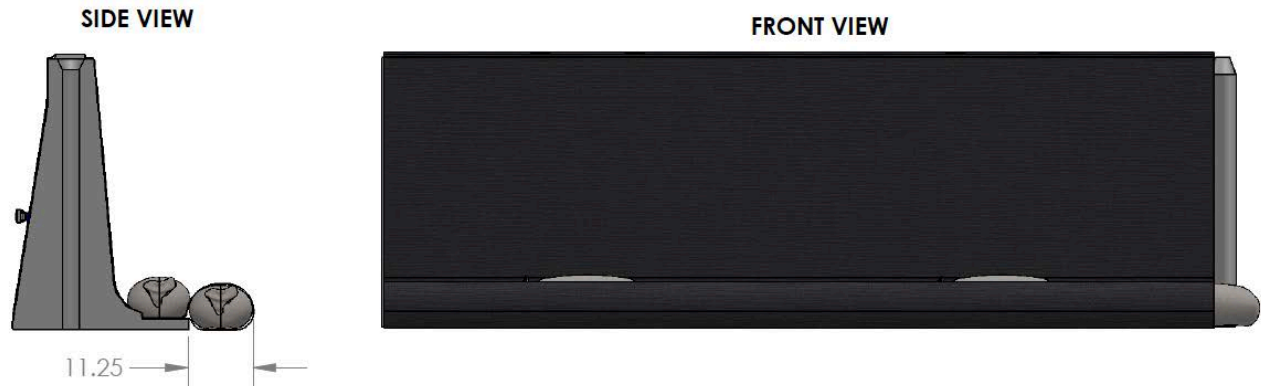


NOTES:

1. CENTER WALL MOUNT WITH STRAP HOLES ON WALL.
2. DRILL FOUR 5/8" X 4 1/8" DEEP HOLES INTO THE SURFACE OF THE WALL USING THE MOUNTS HOLES AS A GUIDE.
3. MAKE SURE THE HOLE IS CLEAN AND DRY, THEN FILL THE HOLE HALF FULL WITH MW-FC-502.07.
4. INSTALL EPOXY ANCHORS IN TO HOLES SO THEY ARE FLUSH OR SUB-FLUSH WITH THE SURFACE AND WAIT 45 MINUTES FOR THE EPOXY TO SET.
5. BOLT DOWN WALL MOUNTS WITH SUPPLIED BOLTS AND WASHERS.
6. WRAP STRAP AROUND WALL AND THROUGH MOUNT

FLOOD DEFENSE DETAILS CONTINUED - LINER DETAILS

SINGLE ROW OF SANDBAGS



BACK VIEW



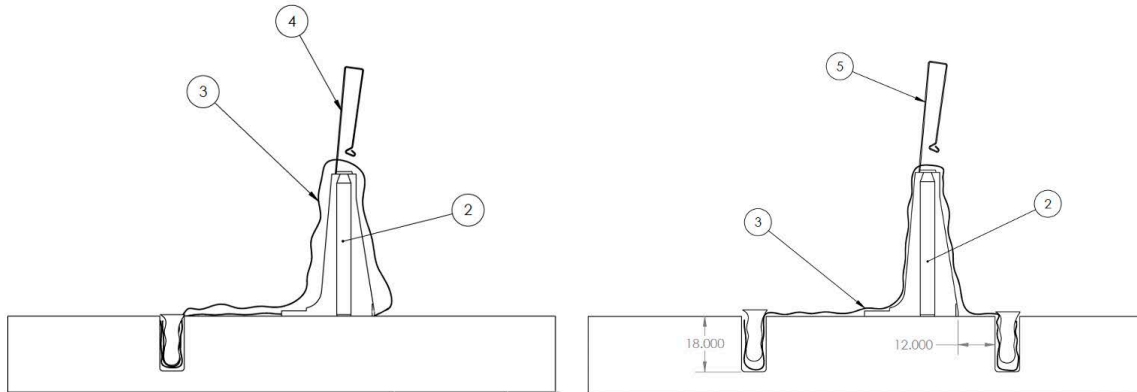
DOUBLE ROW OF SANDBAGS



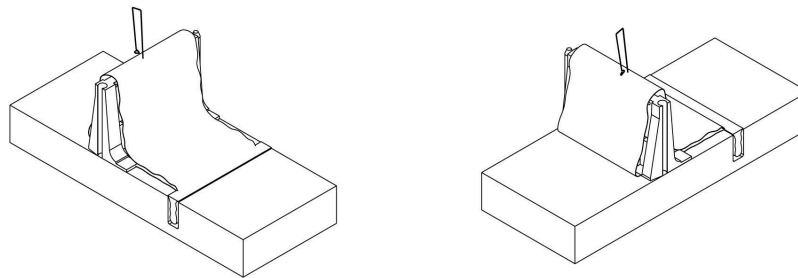
BACK VIEW



Wrap & Trench Liner Detail Examples:



| ITEM NO. | PART NUMBER | DESCRIPTION | QTY. |
|----------|-------------|-----------------------|------|
| 2 | MW-106 | FOUR FOOT MUSCLE WALL | 1 |
| 3 | LINER | LINER | 1 |
| 4 | MW-650 | 4FT LINER CLIP | 1 |

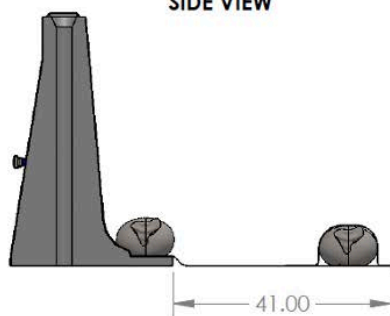


GRASS LAYOUT WITH SANDBAGS AND STAPLES

TOP VIEW



SIDE VIEW



- NOTES:**
1. USE LANDSCAPE STAPLES SPACED 16" APART ON FRONT EDGE OF LINER.
 2. USE LANDSCAPE STAPLES SPACED 16" APART BETWEEN BAGS AND MUSCLEWALL.

PROJECT GALLERY



MUSCLE WALL VS. SANDBAGS — PERFORMANCE COMPARISON

USACE ERDC testing directly compared the 4-ft Muscle Wall against a sandbag baseline tested under the same protocol in 2004. Results are drawn from Table 10 of the ERDC Report to Sponsor (May 2020).

| Factor | Muscle Wall | Sandbags |
|--------------------------------------|------------------------|----------------------------------|
| Construction time (74.5 ft. barrier) | 7.5 man-hrs | 205 man-hrs |
| Seepage at 1 ft. depth | 0.026 gpm/ft. | 0.050 gpm/ft. |
| Seepage at 2 ft. depth | 0.058 gpm/ft. | 0.230 gpm/ft. |
| Seepage at full depth (3.94 ft.) | 0.135 gpm/ft. | 0.530 gpm/ft. |
| Damage from waves | None | Sand washed out; required repair |
| Overtopping performance | No damage | Failed — bags washed off crest |
| Debris impact | No damage | Not tested |
| Reusability | Yes — multi-year | No — single use |
| Equivalent units | 1 wall = ~470 sandbags | — |

WHY MUSCLE WALL WINS — HEAD-TO-HEAD COMPARISON

Head-to-head against the alternatives a data center operator — or any critical facility manager — considers today.

| CRITERION | MUSCLE WALL | Sandbags | Concrete Jersey Barriers | Water Bladders | Earthen Berms |
|--------------------------------|--------------------------------|---------------|--------------------------|----------------|---------------------|
| FM Approved | Yes (only 4-ft wall in market) | No | No | No | No |
| USACE Tested | Yes | Yes (limited) | No | Mixed | No |
| Deploy 100 ft (small crew) | 30 minutes | Hours – days | Hours + crane | Hours | Days + heavy equip. |
| Reusable | Yes — 30+ year life | Single use | Yes (heavy) | Limited | Single use |
| Containment-rated (with liner) | Yes (oil & gas proven) | No | No | Limited | No |
| Heavy machinery required | No | No | Yes (crane) | No | Yes (excavator) |

Muscle Wall is the only solution that satisfies insurer, regulator, AND construction-economics requirements — in a single SKU.

WHY MUSCLE WALL — KEY ADVANTAGES

| | |
|--|---|
| Rapid Deployment | A 74.5 ft. barrier erected by 4 men in 7.5 hours — no heavy equipment required. |
| Reusable System | LDPE construction withstands multi-year redeployment. No waste after each event. |
| Minimal Site Disturbance | No excavation, no fill, no grading. Placed on existing grade — paved or unpaved. |
| Scalable Heights & Lengths | Available in 2-ft, 3-ft, and 4-ft heights. Interlock unlimited lengths. Stack for greater height. |
| Fast Removal After Event | Drain via bung-plug cap. Disconnect ratchet straps. Remove same day. |
| Engineered Credibility | USACE ERDC tested, FM 2510 approved, and backed by peer-reviewed ENGEO case studies. |
| Lower Labor Demand | 27x fewer man-hours than sandbags. Reduces risk to personnel during emergency deployment. |
| 90-degree & Irregular Turns | 22-degree hinge range per joint + reversible corner units allow adaptation to any site geometry. |

FORMALLY APPROVED & CERTIFIED BY THE FOLLOWING AND MANY MORE:

ASSOCIATION OF STATE FLOODPLAIN MANAGERS

STATE OF NEW JERSEY
PASSAIC VALLEY SEWERAGE COMMISSION

Cal OES
GOVERNOR'S OFFICE OF EMERGENCY SERVICES

FM Approvals
Member of the FM Global Group

COLORADO
Department of Transportation

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

CALIFORNIA DEPARTMENT OF WATER RESOURCES

GOVERNOR'S OFFICE OF HOMELAND SECURITY
GOHSEP
& EMERGENCY PREPAREDNESS

FDEM
DIVISION OF EMERGENCY MANAGEMENT
OFFICE OF THE GOVERNOR

| | |
|------------|---|
| 27x | Faster to construct than a comparable sandbag barrier (7.5 man-hrs vs. 205 man-hrs) |
| 4x | Less seepage than sandbags at full hydrostatic depth (3.94 ft.) |
| 0 | Damage from waves, overtopping, debris impact, or riverine current |
| FM | First FM 2510-approved 4-ft portable flood barrier — meets Factory Mutual standards |

Source: Ramos-Santiago, Blades & Gutshall — USACE ERDC Report to Sponsor, May 2020.

USACE ERDC TEST RESULTS SUMMARY

Testing was conducted at the ERDC Coastal and Hydraulics Laboratory on a 74.5-ft. barrier section constructed by a 4-man crew. Tests followed the FM 2510 Standard Testing Protocol under conditions emulating a levee overtopping scenario along a riverbank with moderate flow.

| Test | Result | Notes |
|---|--------|--|
| Hydrostatic — 1 ft. | PASS | 0.026 gpm/ft. seepage; no movement |
| Hydrostatic — 2 ft. | PASS | 0.058 gpm/ft. seepage; no movement |
| Hydrostatic — 100% (3.94 ft.) | PASS | 0.135 gpm/ft. seepage; barrier retained structural integrity |
| Waves (small/medium/large) | PASS | No damage; minor controlled movement under large waves |
| Overtopping | PASS | Sustained 1-inch average overtopping with no structural damage |
| Debris Impact (12" & 16" logs @ 7 ft/sec) | PASS | No noticeable damage to liner or structure |
| Riverine Current (7 ft/sec) | PASS | No significant seepage increase; no damage observed |
| Post Hydrostatic | PASS | Seepage 0.085 gpm/ft.; permanent deflection < 6 in. max |

Assembly time: 7.5 man-hours for 74.5 ft. of barrier — no heavy equipment required beyond a skid-steer for pallet offloading. Barrier remained undamaged through all tests and was designed for full recovery and reuse.

PROJECT GALLERY



FLOOD DEPLOYMENT QUICK-REFERENCE

| | | |
|---|-------------------------------|--|
| 1 | Site Assessment | Identify flood threat level, inflow direction, and barrier line. Note surface type (concrete, asphalt, or soil) to determine liner anchoring method. |
| 2 | Wall Placement | Interlock 6-ft. segments via male-to-female connectors. Use reversible corner units for 90-degree turns. No heavy equipment required for placement. |
| 3 | Strap & Secure | Install safety ratchet straps at each joint through kiss-through holes. Tighten top straps first, then lower straps under load. |
| 4 | Fill with Water | Fill each wall segment through the top fill hole. Water-filled weight provides hydrostatic resistance. One 4-ft. wall = ~1,400 lbs filled. |
| 5 | Liner Wrap | Wrap continuous liner from flood side, over top, and down to dry side. Anchor liner to ground — trench into soil or use sandbags on pavement. |
| 6 | End Anchoring | Key both ends into existing structures, wingwalls, or grade. Use perpendicular anchor walls on slopes greater than 10%. |
| 7 | Monitor & Maintain | Inspect strap tension and liner integrity during event. Remove debris buildup at barrier face. Pump behind barrier if seepage accumulates. |
| 8 | Rapid Removal | Drain via bung-plug cap at base. Release ratchet straps. Lift and restack for transport. Units nest for efficient shipping — 96 per 48-ft. trailer. |

CONTACT & ONLINE RESOURCES

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|---|---|
| Engineering Drawings & Specs | musclewall.com/engineering |
| USACE ERDC Evaluation Report | musclewall.com/engineering |
| Secondary Containment Calculator | musclewall.com/secondary-containment-calculator |
| Muscle Wall vs. Sandbag Calculator | musclewall.com/sandbag-calculator |
| Request a Quote | musclewall.com/get-a-quote |

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