SANDBAGGING FOR STRUCTURE PROTECTION

The golden rule - You cannot save one house by sacrificing the neighbors. You are liable for their damage.

Sandbagging is a quick line of defense for structure protection from water and debris flows during flood events. Homeowners and volunteers can easily construct adequate sandbag walls prior to flooding.

GETTING STARTED

- Placement is critical. A sandbag wall cannot sustain a head-on hit. The purpose of a sandbag wall is to *deflect* water and debris.
- Build the wall in a pyramid shape. A sandbag wall for post-fire protection is different than a wall built for a slowly rising river like the Mississippi. A post-fire-wall will provide debris flow protection during a flash flood. Expect multiple floods full of rock, trees and other debris.
- Do not try to dam or stop debris flows, rather make a path for the debris to move through.
- Water seeps through sandbags. Placing sandbags against doors and window sills will not keep the water out!
- Do not build a wall against any structure, the pressure can cause the structure to collapse. Minimum set back from a structure is 8 feet.
- Place the bags *parallel* to the flow. If the structure that needs protection is going to take a head-on hit, the water should flow at an angle away from the structure. Place the sandbag wall far enough away to provide room for the flow to move past the structure.

Sandbag wall with a sharp turn/angle. A large rock and a drop off prevented a gentler turn.

- Confined flows speed up the velocity of water which in turn causes more damage. If an angle is not possible, alternative shapes for the sandbag wall are an arrow shape, big U, or a horse shoe shape. This will split the force of flow around the structure.
- Never try to sandbag on the bank next to a stream or intermittent stream. There will be too much force and it will fail. The same is true for a dirt berm.
- Sandbags will deteriorate. Several factors determine the speed at which the walls deteriorate. Before filling, consider the following questions:

- Where were the bags stored? (Inside or out)
- What type of material are the bags made out of? Burlap deteriorates quickly. Are they used as steps to get over the wall? Protect them.

- Protection methods include plastic, adding concrete mix to the fill material, outdoor carpeting, and cement cloth. Plan this in advance of building the wall. See the modification section for more details.

- Before you begin securing materials, estimate the length and height of the sandbag wall. The exact dimensions will be finalized in the field.

TIP

Around doors and windows use large socks filled with polymer beads instead of sandbags. The polymer can be purchased at craft or garden stores. Once a polymer sock gets wet, it will dry and shrink back down. Polymer beads are great absorbents and can swell in water up to 200 times their original size. Have an extra set of socks ready to deploy. There are companies who make specialized polymer entryway protection products. Just beware they often have a one-time use.

PHASE 1: Filling Sandbags

Use what you have: dirt, sediment deposits, small rocks, decomposed granite or road base. Try not to use clean sand – it will destabilize the bags and make them slide which you don't want.

WHAT YOU'LL NEED:

TOOLS

- Shovels
- McLeod
- Mallet
- Optional: sandbagging rack

SUPPLIES

- Sandbags
- Hardhats
- First aid kit & extra band aids
- Gloves
- Masks

Fill sandbags a little over half full, up to 2/3 full, maximum. If the sandbags are too full, they will set stiffly and create large gaps in the wall. Do not use clean sand. Rough fill material will help lock the bags together.

Tie or fold bags as close to the bag opening as possible. Ensure the fill material has room to spread out when turned on its side. This will allow for each bag to have the space to lock with the neighboring bags which is essential for stability.

PHASE 2: Building a Pyramid Shape Wall

Ideally the base of the wall is 3 times the height. In mountainous areas, do the best you can.

When filled and folded over, bags are about 18 to 20 inches long and 12 inches wide. There are larger bags on the market and those work well for the foundation layer. However, larger bags are much heavier and can be difficult to lift and move around. If you choose larger bags, place your fill dirt as close as possible to your final location for ease.

STEP 1

Mark the inside perimeter

Using a sharp tool, mark the ground where the wall will be built. Mark the side that is *closest to the building*. This will be the "do not cross line." (Minimum distance from a structure is 8 feet.)

STEP 2

Remove organic material

Remove ground level organic material from the area where the wall will be built. Scrape grass and other plants down to ground level. DO NOT DIG.

STEP 3

Sizing the length of the wall

Flag the ends of the wall.

Make sure the wall extends far enough past the structure to ensure the wall is not flanked during a flood event. It is very easy to underestimate the length of a sandbag wall, so take the time it takes to make sure it is the right length.

STEP 4

Sizing the height of the wall

To make sure your wall is high enough, plan on adding 2 extra layers of bags. The Army Corp of Engineers recommends building the wall one foot higher than flood crest levels.

STEP 5

Laying the foundation/footer row

If the project will take several days to build, only lay what you can finish that day. Leave a rough edge where you will continue the next work day.

Lay the bags perpendicular to the ground mark you made in step one. Lay the bags two deep at a minimum. Two bags deep will be approximately 38 inches. Three bags will be approximately 48 inches. Try not to disturb the packed dirt underneath the bags. Instead, place a partially filled bag either on the foundation level, or on the wall bags to keep level.

STEP 3

Tighten the bags

Use a McCloud tool, mallet, or your fist to pound the bags on the foundation level to make them tight.

STEP 7

Building the first wall row

1. Place a bag, long side on the very edge of the foundation row on the side facing the flow.
2. Tuck the flap of the bag under the bag on the downstream flow side.
3. Place another bag tightly behind the first bag and continue until the depth is filled with a row of bags.
4. Pound tight and level.
5. Repeat the process.

STEP 8

Building the second wall row

Build the second row just like the first, except off set the bags like bricks. The seams will be straddled by the next row.

Use a half bag to complete the end.

STEP 9 **Building the first pyramid row** (one bag deep)

1. Set the first long side bag on the flood side a ½ a bags width back from the front of the wall.
2. Tightly fit the bags together and lay the depth row.
3. Pound tight.
4. Repeat across until row is complete.

STEP 10 **Building the third wall row**

Repeat step eight.

STEP 11 **Continue**

Continue building the wall in the pattern of the two-pyramid row until the top row is two bags deep.

STEP 12 **Building the cap/header row**

The cap row is laid in the same direction as the foundation row. See step 5. It lays across the top of the wall and holds the layer in place. This row provides added protection from birds, squirrels, or other elements that will deteriorate the wall.

MODIFICATIONS

Adding cover to the wall for protection

Please note, this expense is generally not covered by emergency funding but does preserve the integrity of the wall for a longer period of time.

PLASTIC: This is best done while you build the wall. Heavy mill plastic can be placed under the front 6 inches or more of the foundation layer. With each pyramid row, place the plastic under the first layer same as the foundation. Plastic can be awkward to work around. However, if you place the plastic after you build the wall, the plastic will be susceptible to flapping in the wind. While rocks look nice to hold the plastic down on the flow side of the wall, they will be immediately moved during the first flood. Do not use rocks on the flow side of the wall. On the back-side of the wall, you can use rocks or anything heavy to hold the flap of plastic.

ASTRO TURF: Anchor the turf to the bags with long screws with washers. It is used mainly for businesses in remote locations to secure the shelter-in-place buildings. Disassembling after flood danger has passed is unknown.

CEMENT BLANKETS: Screw in to the front of the wall. Disaster funding will reimburse for cement blankets used in susceptible areas. The blankets must be watered after they are placed. This hardens the cement. Disassembling after the flood danger has past is done from the back side of the wall.

ADDING CEMENT TO FILL MATERIAL: This is a new technique that is labor intensive. PPE must be worn (dust mask etc.) The cement will not harden until it is wet in a storm. While these types of walls could last longer, they will be very hard to disassemble after flood danger has passed.

Video: How to build a wall
https://www.youtube.com/watch?v=fuX6iIttME0

SANDBAG WALL ALTERNATIVES

There are alternative products for building large sandbag walls that you might want to consider exploring.

Hesco Cages
Hesco cages are made of wire and fabric and last for a long time. They need to be filled with heavy machinery and can be filled with dirt and rocks. They are built to manage big flood and debris flows.

Polyurethane Bags
Available in 2, 4, and 8- foot tall sizes, the bags come in an accordion shape that unfold to 25 or 50- feet in length.

RIBS™ - *Rapid Installation Barrier System*
RIBS is a rapidly deployed, patented alternative to sandbags for flood control and de-watering applications. RIBS' trapezoidal design resists water flow while providing a stable barricade against severe weather events and the threat of encroaching waters. Woven, reinforced polypropylene fabric 2-foot bags can be filled by hand with sand, dirt or gravel. The one drawback is the bags require a cage to hold them up while filling. Manufacturers of the product are starting to recognize the drawbacks of this design and are starting to supply drawings which allow you to "build your own" cage, instead of having to rent one from the manufacturer.

Gabion Baskets
Gabion baskets are labor intensive in design and should be engineered before use. The suggested size for use in fire scars is a 3x3x6 foot basket. A set of baskets is built below grade and stacked. Each rock is hand laid and interlocked inside the baskets. The baskets prevent the rock from seeping out. The next row or two are clipped to the below grade baskets and then filled in the same manner. Baskets are delivered flat and need to be assembled. Hog nose rings are used to secure the baskets. A special tool is needed to close the lids. Many contractors have come up with methods of filling the baskets with skid steers and it might be best to partner with one. Check with the funder and engineer to guarantee reimbursement if you choose this method.

LESSONS LEARNED

- Don't use sandbags to protect landscaping. That will ensure the water flows nicely into your front door. Sorry!
- One layer of bags will do more harm than good. The bags will become floating projectiles so be sure to construct a well-built wall as described here.
- Walking or sitting on sandbags speeds up deterioration. If sandbags are going to be walked on or set on be sure to cover them with outdoor carpet or artificial turf. They will last for many years.
- Change your parking and walking patterns during flood season. When you sandbag around the house and leave driveways and walking paths open, water and debris will flow down these unprotected paths into the home or building. It's inconvenient but mucking out a home full of debris is far more inconvenient.
- Make the wall higher than what you think you will need! Postfire flooding is generally underestimated.