STRATEGIES FOR PROTECTING YOUR PROPERTY

A Homeowner's Guide

for

Flood, Debris, and Erosion Control after the High Park Fire

(Includes tips on how to properly use sandbags)

Larimer County Engineering Department
200 West Oak Street, Suite 3000
P.O. Box 1190
Fort Collins, CO 80522-1190

On the Web: www.larimer.org/highparkfire or www.larimer.org/engineering
Phone: 970-498-5700

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1. After the Fire

The post fire conditions of the High Park Fire recovery area present two primary community hazards: debris flows and flooding. Hillsides, once protected by vegetation, are compromised after fires and can produce stormwater debris flows that include soil, rocks, trees, shrubs, ash, and loose organic matter. Flooding risk can range from nuisance flooding to flash flooding due to steep slopes and the loss of organic material in the forest, which normally help to absorb runoff and stabilize the soil.

Geologists, hydrologists and experts in the field of post-fire hazards believe that these hazards will be present in the High Park Fire area for years to come. Therefore, it is important for homeowners to protect their property from debris flows and flooding and work to control further erosion. This guide provides general information on how to protect your home.

1.1 Precautions

Keep in mind that flooding may occur even during moderate storms as rain falls on areas where vegetation has been destroyed by fire. Debris flows are equally dangerous, especially in hillside or mountainous areas, and erosion often results in areas where there are steep banks of scoured soil or other ground materials.

Important facts to remember:

Flooding

- *Consist of large quantities of water and are often turbulent and murky due to fine sediment, ash and soil.*
- *Can quickly reach depths that would pose a threat to people and automobiles.*
- *Inundate large areas and can damage or destroy structures in their path.*

Debris Flows

- *Consist of large quantities of soil, rocks, boulders, trees, or brush moved by flood waters.*
- *Occur when flood waters flow over barren soils and burn areas.*
- *Are highly destructive and may leave large quantities of sediment and rocks in their paths.*
- *Contain sufficient strength to destroy objects in their path.*
- *Can be controlled or directed to reduce property damage.*

Erosion

- *Cannot be controlled while it is happening and is often not seen until flood waters have subsided.*
- *Can seriously undermine structures, often leading to major structural failures.*
- *Occurs most often when waters flow rapidly over loosely compacted soil or burn areas.*
- *Can be reduced by stabilizing slopes prior to storms.*

2. Getting Prepared

It is important to start planning early before the spring rainy season begins. Early action can help minimize damage during the storm season because once the debris flows start, it is too late to plan protection. Put your plans into action when the weather forecast predicts storms.

2.1 Property Evaluation

It is important to conduct a thorough evaluation of your property to develop a protection plan. First, start by determining where water and debris are likely to flow and collect. Once you have located potential routes where water and debris may flow, plan and implement diversions in those identified flow pathways. Pay particular attention to steep, barren slopes, low spots, and high flow areas when planning for structure and property protection.

Figure 1. – Sandbag barriers placed to protect home in Jones Valley, CA[9]

When devising a protection strategy for your property, pay special attention to the following general rules:

- *Never underestimate the power of stormwater and debris flows.*
- *Try to direct stormwater and debris flows away from any structures.*
- *Avoid altering natural or existing drainage patterns in a way that might worsen conditions for you or your neighbor.*
- *Work cooperatively with your neighbor to achieve the best results.*
- *Avoid trying to control or confine flows more than is absolutely necessary; remember that water and debris flows need to go somewhere.*
- *Place protection devices in such a way as to deflect debris; do not try to create a dam or stop the flows in any way; this may cause flooding.*
- *In extreme conditions, board up windows as necessary to prevent debris from entering structures.*
- *Protect your most valuable property first – your home. Then prioritize money and time available to protect other valuable parts of your property (landscaping, other structures).*
- *Don't let visual appearance dictate protection placement. Be prepared to sacrifice the use of portions of your property to achieve the greatest amount of protection.*
- *Don't take unnecessary risks; if your debris control problems appear to warrant solutions beyond the scope of this guide, consult a competent expert such as a civil or geotechnical engineer, or a landscape architect for additional advice.*

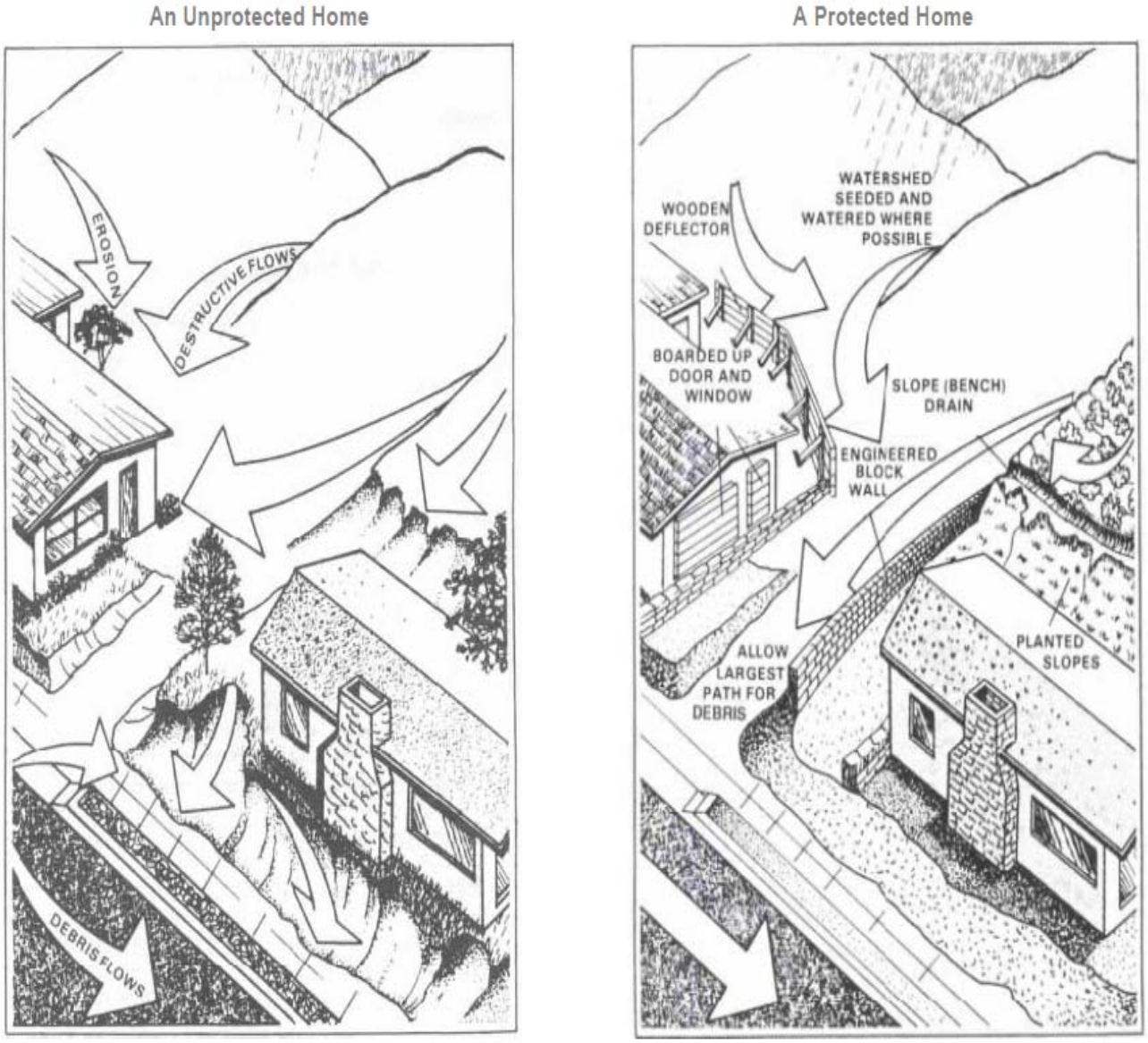

Figure 2. – Examples of Unprotected vs. Protected Homes[5]

2.2 Materials and Supplies

There are many effective and relatively inexpensive do-it-yourself ways to control flows. Most can be installed with normal household tools using materials available at your local lumber yard or hardware store. Materials that you may need to implement the specific methods described in this guide typically include sandbags, gravel bags, fiber rolls, lumber, plywood, plastic sheeting, rubber seals (similar to weather stripping), and concrete blocks.

2.3 Maintenance

Maintenance of all erosion control devices along with the routine removal of accumulated water and debris is *crucial* to avoid potential flooding problems and structural damage. When not routinely maintained, erosion control devices may become ineffective. In addition, all drainage

pathways should be kept clear of debris and overgrowth since blockage may cause flooding and structural failure. Typically, maintenance of hillside drains is the responsibility of the property owner.

3. Protecting Structures

Each property and structure is unique. Protective measure should always be selected to address your property and its surroundings. The following issues should be considered when developing a strategy:

- Protecting structures
- Protecting land from water and debris flows
- Protecting slopes and surfaces from erosion.

3.1 Sandbag Barriers

Properly filled, installed and maintained sandbags can be used very effectively to re-direct stormwater and debris flows away from buildings during a minor storm event. If you have burned areas on the slopes above your home, you should consider using sandbags or other barrier protection until the slopes are re-vegetated and stabilized.

3.1.1 Sandbag Placement

Ideally sandbag barriers should be placed a minimum of 3-ft from the toe of an erodible slope and a minimum of 8-ft away from buildings. To divert debris flows around your home, place bags on the uphill side of the building and provide a clear flow path that moves downhill and around the building as shown in Figure 3.

Sandbags cannot be used to protect from major debris flows. Do not use them if you have a contributing drainage area to your home greater than 5 acres. If the slope around your structure is steep, please see the guidelines in *Section 3.1.6.*

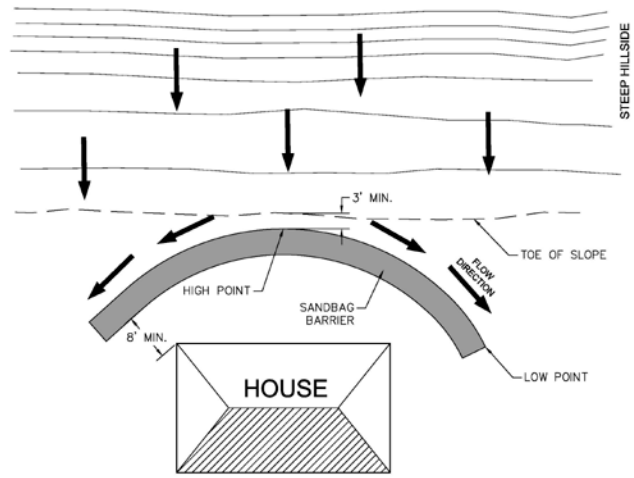

Figure 3. Sandbag placement around home

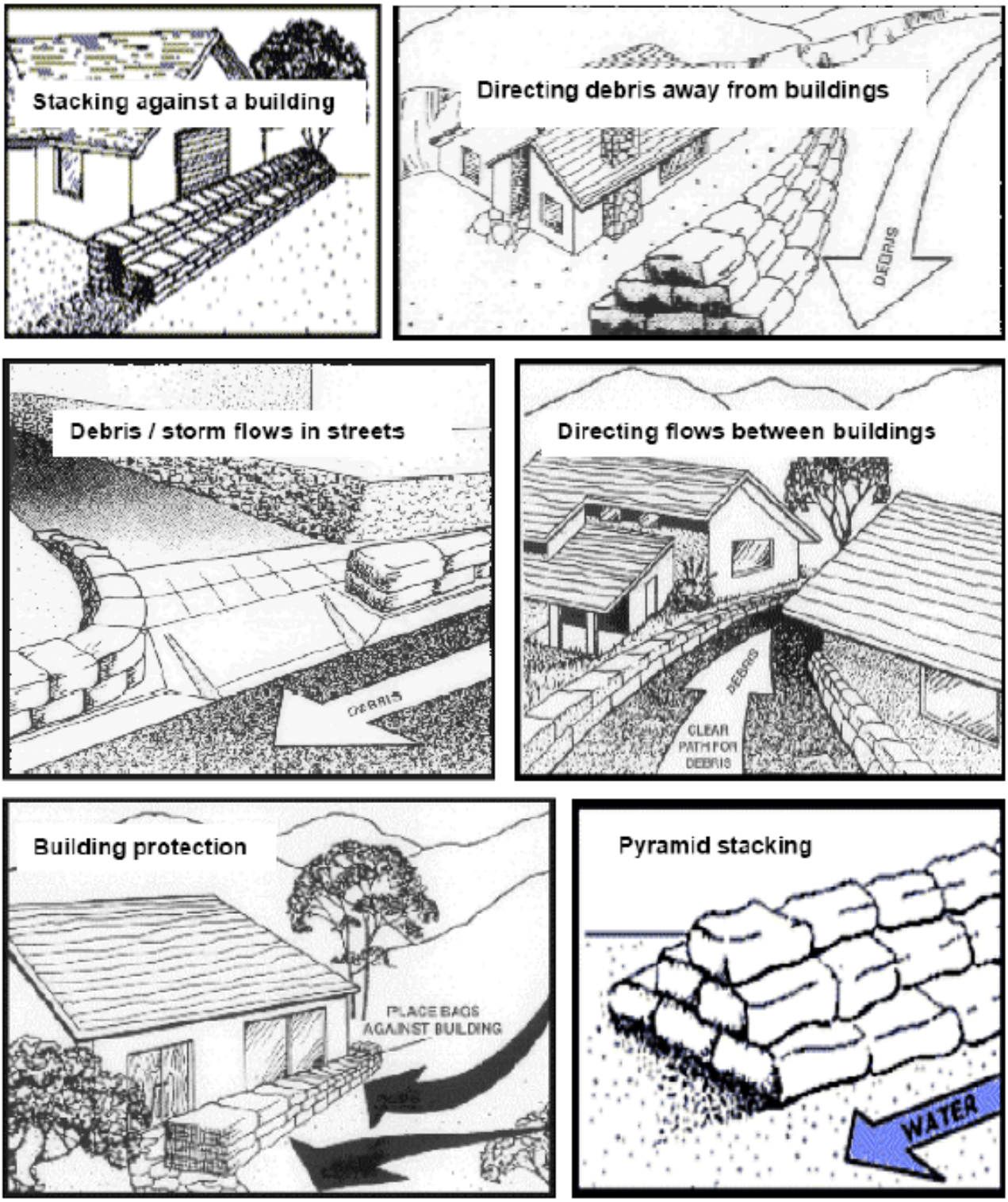

Figure 4. – Use and Proper Placement for Sandbags[5]

3.1.2 Getting Bags

Sandbags are available for purchase at most home supply stores. The number of bags you will need depends on the barrier length needed to divert the flow around your home. Guidelines to help you calculate the number of bags needed are included in Table 1.

3.1.3 Sandbag Placement

The following are guidelines for bag placement.

1. Remove any debris in the area where sandbags are to be placed. Remove snow and ice and anything else "slippery" in order to create a good bond between the ground and the sandbag barrier.
2. Place bags with the opening in the top in the direction of flow of water to prevent them from opening when water runs by. The bag you receive should be filled about half full and tied near the top of the bag. Place the bags by folding the empty portion of the bag under.

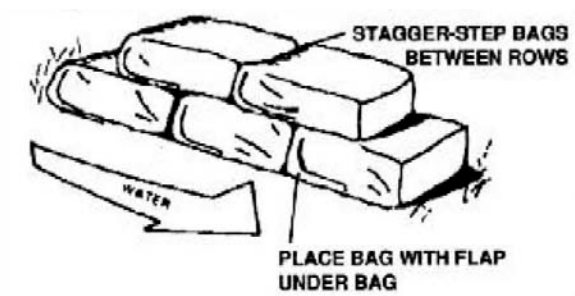

Figure 5. Open end of bag in direction of flow[5]

3. Place succeeding bags with the bottom of the bag tightly and partially overlapping the previous bag.
4. Place bags like bricks to avoid continuous joints. Offset adjacent rows and layers by one-half bag length.

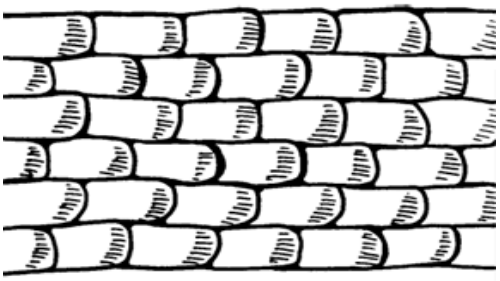

Figure 6. Plan of Bottom Layer[7]

5. Finish each layer before starting the next by tamping the bags into place by walking on them. Stamp down firmly to eliminate voids, form a tight seal, flatten the top of the bag and prevent slippage between succeeding layers.
6. Place sandbags in a pyramid fashion with the base equal to 3 times the height.
7. The maximum recommended height is 3-ft. The following table can be used to estimate the number of bags needed to construct a sandbag barrier in a pyramid fashion.

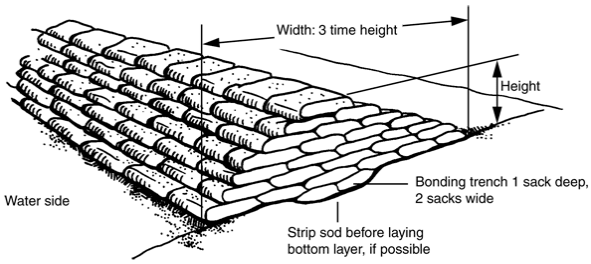

Figure 7. Pyramid Stacking[7]

Table 1. Number of Bags needed for 50 linear ft

Height above ground	Base width	# Bags per 50 linear feet of barrier
1 foot (3 layers)	3 feet	300
2 feet (6 layers)	6 feet	1050
3 feet (9 layers)	9 feet	2350

8. Plastic should be used to cover the sandbags in order to prevent them from deteriorating in 4 to 6 months due to UV exposure. The plastic used should be treated to resist UV light for up to 2 years. Place plastic at the toe of the sandbag pyramid and weigh down with more sandbags at the toe and top of the pyramid.

3.1.4 Safety

Safety should be a priority when placing sandbag barriers. Each bag will weigh between 40 to 50 lbs each and you may need to place hundreds of them. Therefore, it is important to use proper lifting techniques to avoid injury and fatigue. Lift with your legs and bend at the knees; do not use your back. Consider getting some helping hands and create a chain for passing bags from the truck to the location where they are being placed.

Some sandbags are treated with UV inhibitors to help prevent deterioration. Use work gloves and avoid contact with your eyes and mouth. Also remember to dress appropriately for the weather and stay hydrated by drinking lots of water.

3.1.5 Maintenance & Disposal

Maintenance of your sandbag barrier and removal of accumulated debris is important to prevent problems and structural damage. Remember to clean out debris and/or silt trapped behind the bags after each storm and weekly throughout the rainy season. Replace or reshape sandbags as needed and repair washouts or other damages. Remove sandbags when no longer needed. Recycle sand fill whenever possible and properly dispose of the bag material.

3.1.6 Steep Slopes

If there is not enough room to lay sandbags on a mildly sloped area around your home as shown in Figure 3, you can use your home as a deflector for debris flows. Board up windows and doors with minimum 3/8” thick plywood with a 2-3” overlap outside of the edges. Waterproof the window and door openings with plastic sheets a minimum 6 mils in thickness. Stack sandbags or use 2”x4” braces against the plywood to secure it. You should also stack sandbags around the perimeter of your house.

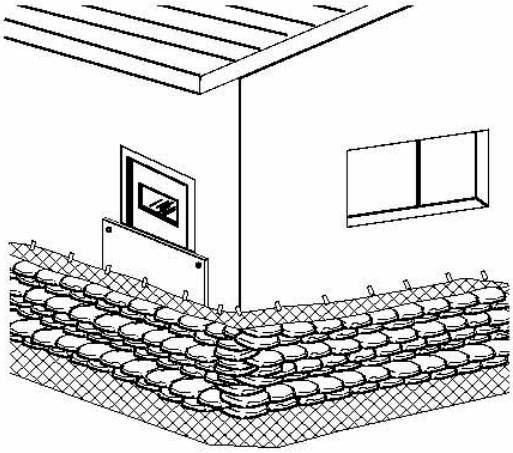

Figure 8. – Illustration of building boarded and protected with sandbags[9]

Figure 9. - Structure protection for building in Silverwood Lake[9]

3.2 Gravel Bags

Gravel bags are similar to sandbags except they are made of burlap and filled with small rocks (gravel). Gravel bags can be placed on slopes to minimize erosion. The burlap and gravel allow stormwater to pass through the bag while trapping sediment upstream. Gravel bags should be placed across the slope not more than two high as shown in Figure 5. After each storm, the silt trapped behind the bags should be cleaned out.

3.3 Wooden Deflectors

Low-grade lumber can be used to create a timber deflector. This device should be limited to a height of three feet. When installing timber deflectors, drive stakes into the ground at least one-half their length to ensure proper anchorage. Place deflectors on solid, level soil, if possible, to reduce the risk of undercutting.

Sections of lumber barriers should be overlapped so that the protruding ends are facing downstream. If additional strength is needed, sandbags (Figure 10) or soil (Figure 11) can be firmly packed behind the deflector. If a taller barrier is required, an engineered wall should be considered.

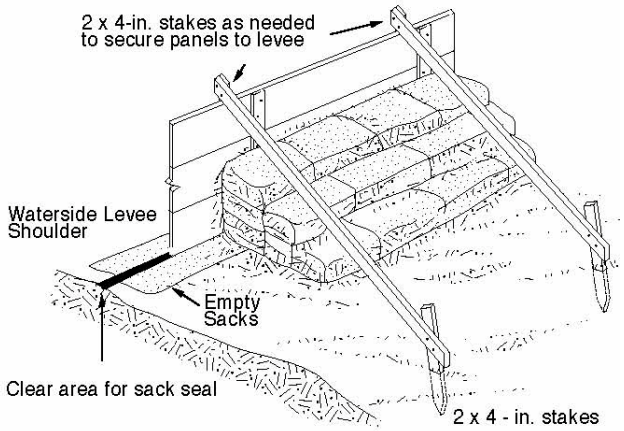

Figure 10. Wooden Deflector Barrier[9]

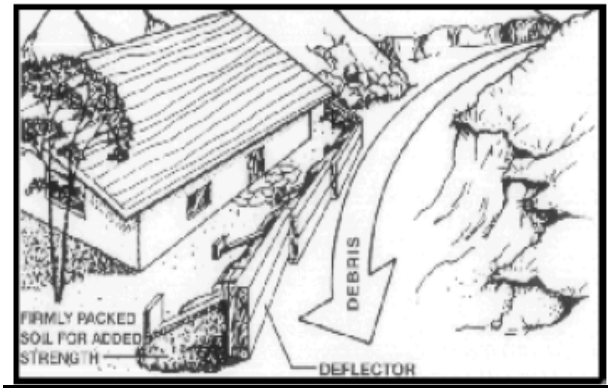

Figure 11. Home Protection using a Wooden Deflector Barrier[5]

3.3 Permanent Barriers

Permanent barriers might be required in situations with continued debris flow problems. Concrete block walls that are designed and built to withstand water and debris flows are excellent for protection and durability. In many cases, such walls can be adapted to become part of the landscaping. These walls generally are expensive and should be considered permanent installations. *Caution: Only engineered walls*

should be installed. Other permanent solutions include telephone poles or railroad tie barriers or removable driveway barriers (see Figure 12 & 13).

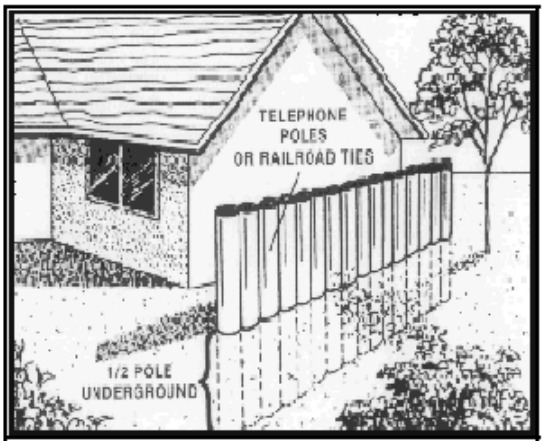

Figure 12. Telephone Pole Barrier[5]

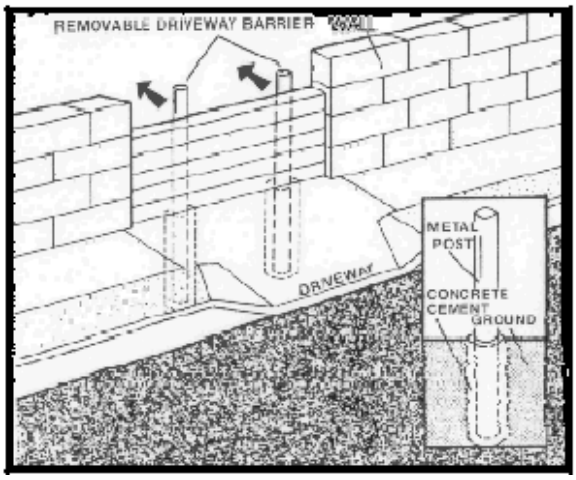

Figure 13. Driveway Barrier[5]

3.4 Window & Door Protection

One way to protect doors and windows is to completely cover them with plywood. Low-grade plywood can be placed over windows, vents and doors and should overlap three to four inches on all sides. Each sheet of plywood should be secured with four or more nails, screws, or bolts; stakes and board may also be used to wedge barriers in place. When the plywood is no longer needed, it can be dismantled and stored for years to come. As an alternative, standing pipes on both sides of a door may be used to secure a removable barrier (see Figure 14).

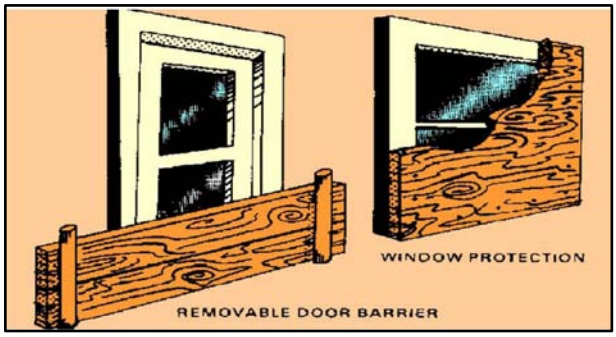

Figure 14. Using plywood to protect doors and windows[4]

Figure 15. Using plywood to protect doors and windows[5]

To prevent water from seeping around a door, a rubber seal (similar to weather stripping) can be affixed to the door frame. When the door is closed, a watertight seal should result. To prevent water from seeping around a sliding glass door, a plastic sheet (two to three millimeters thick) should be placed between the door and the sandbags or between the door and the plywood barrier

(see Figure 17). This is not recommended if the water levels are anticipated to rise above two feet.

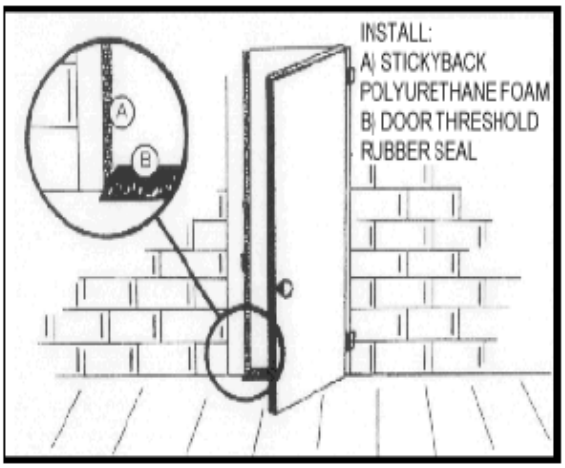

Figure 16. Sealing conventional doors[5]

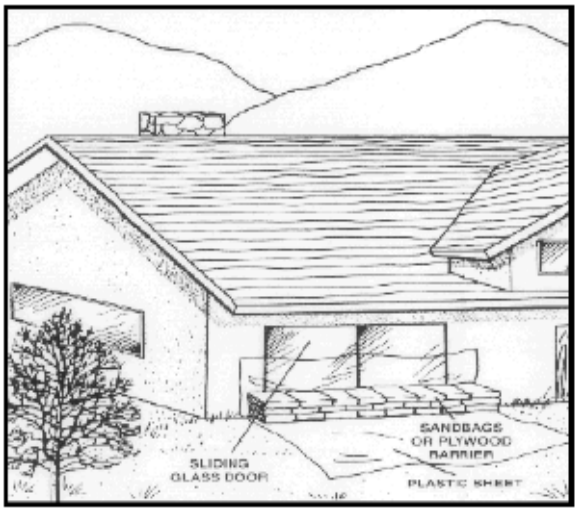

Figure 17. Sealing sliding glass doors[5]

4. Disclaimer

This document is provided for guidance only and the actual placement of sandbags on specific properties should be determined by the property owner. Should your flood, debris, and erosion control problems appear to warrant facilities in excess of the measures described in these Guidelines, it is recommended that you consult an experienced professional for additional advice.

Larimer County assumes no liability for the placement or effectiveness of the sand bags or other methods of protection described in this guide. Do not underestimate the power of debris flows.

5. Flood Insurance

Flood insurance under the National Flood Insurance Program is available throughout the unincorporated areas of Larimer County. Flooding is not covered as part of your regular homeowner's policy. If you have concerns that flooding may cause damage to your home, you should contact your insurance broker regarding flood insurance.

Please note that when purchasing insurance, there is a 30-day waiting period after the policy is issued, before the coverage becomes effective.

For more information about flood insurance, visit floodsmart.gov, or contact Norm Ashford at 303-235-4912 or Erin May at 303-299-7873. You may also contact the Federal Emergency Management Agency (FEMA) at the following toll free number: 1-800-638-6620.

6. Acknowledgements & References

Larimer County gratefully acknowledges Boulder County and their allowance of the use of their Guidelines created in response to the Fourmile Canyon Fire. Those guidelines were prepared with the use of the following publications:

1. "California Stormwater BMP Handbook – Construction". November 2009
2. "Emergency Watershed Protection", Natural Resource Conservation Service, Volume 1, March 2005
3. "Flood Fighting: How to Use Sandbags" published by U.S. Army Corps of Engineers – Emergency Management Branch.
4. "Homeowners' Guide for Flood, Debris, Flow and Erosion Control" published by the City of Los Angles.
5. "Homeowners' Guide for Flood, Debris, and Erosion Control after Fires" published by San Diego County.
6. "Memorandum to Michael A. Thomas, PE RE: Summary of Findings – Fourmile Canyon Post-Fire Hydrology and Discussion of Conceptual Mitigation Measures", Wright Water Engineers, Inc., January 20, 2011
7. "Sandbagging for Flood Protection", NDSU Extension Service, North Dakota State University, March 2010
8. "Sandbagging Techniques", US Army Corps of Engineers Northwestern Division. 2004
9. "State of California Emergency Flood Fighting Methods", Department of Water Resources Division of Flood Management Flood Operations Branch. August 2010.

7. Glossary of Terms

Debris - Any combination of ash, soil, rock, mud, trees, or vegetation usually transported by debris flow.

Debris Flow - Consists of any ash, soil, rocks, boulders, trees, or brush being moved along the landscape by storm waters. Depending on the intensity of the storm, debris flows may contain sufficient strength to destroy or move objects such as cars and buildings in their path.

Drainage Patterns - The drainage paths storm water runoff usually or historically takes through a given area.

Engineered Concrete Block Walls - Walls engineered to hold back water and debris flows. These walls are considered to be permanent, and generally do not require replacement or maintenance.

Flood - (1) typically a temporary condition of partial or complete inundation of land areas due to the overflow of inland or tidal waters; or (2) a large amount of storm runoff inundating an area of land that would, under normal conditions, be dry.

Flood Insurance - This type of **i**nsurance provides monetary compensation for flood damages to your home or belongings in your home. Flood insurance must be purchased separately from a homeowner's policy. Flood insurance is coordinated by the federal government, but can be purchased through your local insurance agent.

Natural Watercourse - An unimproved natural stream of any size; includes rivers, creeks, branches, canyons, arroyos, gullies, washes, etc.

Flood Season - That portion of the year, typically between the April 1st and September 1st when Larimer County receives its largest amount of rain, and the flood risk is greatest.

Sandbags - A plastic or vinyl type bag that can be filled with sand or native soil. These bags can be stacked or placed in such a fashion to redirect storm and debris flows away from homes or property improvements.