Temporary Slope Protection Method for Shallow or Surficial Failures

The following are general guidelines for minimizing additional movement of shallow or surficial slope failures during the winter months. These approaches should not be considered long term permanent solutions, but rather temporary measures used to reduce further failures before long term repairs can be performed during the drier months.

The main objective of these methods is to reduce the amount of water flowing onto the ground surface in the area of the slide by using a system of plastic sheets and sandbags. This is important because as the slope becomes saturated with water, its strength and stability will decrease.

Slope failures are the movement of material downslope in response to the pull of gravity. The failures are typically triggered by the loss of strength due to the slope’s saturation of water. The performance of the slope failure will depend on its geometry, along with its degree of saturation. The following guidelines deal with minimizing the amount of water absorbed by the slope, but geometric conditions also influence the stability. If at all possible, do not remove the toe or bottom of the slope failure which is located on the lower hillside (see figures). The toe helps stabilize the upslope section of the failure from the pull of gravity. Removing the toe of the slope reduces the amount of buttressing forces acting against the pull of gravity and will consequently induce more surficial failures upslope.

The potential sources of water causing saturation of the slope that can be minimized by these techniques include direct rainfall and/or water flowing into the failure area from an upslope source. The procedures described below will minimize both. It should be noted that these methods transfer water from the area of the slippage to an area downslope, so locating a suitable discharge point, such as a storm drain inlet or street gutter is very important.

Because the systems may be impacted by further inclement weather, regular maintenance will be required. If the system fails and collected water is discharged or overflows at an improper location, the repairs could actually CONTRIBUTE to additional surficial failures.

The materials used for the following method can be substituted as needed, but the general strategy to minimize the flow of water onto the slope failure should be kept the same.
General steps include (also refer to the attached sketches and photos for additional details):

1. Purchase a roll or rolls of plastic at a building supply company. The width comes in various sizes, typically from 6 to 20 feet and the thickness varies from 4 to 12 Mils. Purchase the largest width that is practical with a minimum of 10 Mil thickness.

2. Starting at the upslope limits of the slope failure, roll the plastic downslope. Extend the plastic 5 to 10 feet past the slide, depending on the size of the failure.

3. Secure the plastic at the top of the failure by wrapping it around a 2x4 wooden board several times in order to prevent tearing of the plastic. Then drill holes through the 2x4 and secure them with reinforcing steel.

4. Proceed to place plastic across the entire slide as described above with a minimum of 2 feet overlap between the plastic sheets.

5. The plastic sheets should extend 5 to 10 feet beyond the limits of the slide, depending on the size of the failure.

6. Secure the remaining portions of plastic by placing sandbags or old tires on top of the plastic every 5 to 20 feet on the edges and along the overlap areas. Connect the sandbags or old tires together with rope and anchor them to a NEW set of reinforcing steel or wooden stakes that should be placed just upslope of the plastic.

   Note: Do not penetrate the plastic to secure the sandbags or tires because this may cause tearing of the plastic in high winds or if additional ground movement occurs.

7. Look at any obvious sources of water upslope, like a downspout, and if possible divert the water BEFORE it reaches the top of the slide. Other sources of water include cracks in concrete or asphalt concrete (AC) used for streets, patios, or drainage ditches. Repeatedly seal the cracks in AC and concrete with asphalt and flexible grout, respectively.

8. Prevent surface water from flowing onto the plastic at the upper limits of the repair by placing a row of sandbags or hay bales at the top. The sandbags should overlap one another in the direction of water flow.

9. Collect the water generated from direct rainfall on top of the plastic with a row of sandbags located at the bottom. It is recommended that a notch be cut into the slope so that the sandbags are secure. The sandbags should overlap one another in the direction of water flow and be placed on top of the plastic.

10. The water collected along the upslope edge of the rows of sandbags on top and bottom should be collected if substantial. The size of the slide and the upslope characteristics of the failure will determine how much water will be generated. If the water is significant, then sandbag collection areas should be installed.

11. Create a collection area by using a circular row of sandbags stacked a couple of feet high.

   Note: The downslope collection area should be built on the plastic so that all the water generated on top of the plastic is diverted away from the failure, and not allowed to saturate the soil located just downslope.
12. Install a flexible plastic pipe through the sandbags and into the collection area so that all the water will be diverted into the pipe.

13. Extend the pipe downslope to a suitable discharge area, preferably a storm drain or a street gutter, in order to minimize erosion at the point of discharge. If the pipe(s) cannot be discharged into a storm drain or street gutter, be sure that the water is evenly discharged onto the slope downhill to minimize the potential of another failure downslope.

   Note: Put slack in the flexible line to accommodate more movement that may occur.

Maintenance will be required of the installation throughout the winter season due to strong winds and heavy rains. Be prepared, with extra plastic, to repair any tears that may develop.

For additional information, please visit the USGS “Landslide Recognition and Safety Guidelines” website shown on our links.

For more information, please contact us at:

   Alan Kropp & Associates  
   2140 Shattuck Avenue, Berkeley, CA 94704  
   510.841.5095 (TEL)  
   510.841.8357 (FAX)
TYPICAL TEMPORARY SLOPE PROTECTION METHOD FOR SHALLOW OR SURFICIAL FAILURES (CROSS-SECTION VIEW)

Upper Hillside
- Sandbags
- Reinforcing steel (or Wooden stake)
- Plastic sheet

Ground surface
- Sandbag (or Tire)
- Rope
- Toe
- Sandbags

Lower Hillside
- Notch

Limits of shallow or surficial slope failure

SANDBAG PLACEMENT DETAIL

Sandbagging tips

Reducing seepage
Drape plastic tarp over barrier. Hold it in place with sandbags.

Filling sandbags
Done best by two people:
One holds the bag open and the other shovels in sand.

Bags filled one-third to one-half full.
Weight: 35-40 lbs.

Heavy-bodied or sandy soil

Building a flood barrier with sandbags

1. Place untied bags lengthwise, parallel to water flow.
2. Fold the open end to form a triangle.
3. Place next bag on the fold and stamp into place to form a tight seal.
4. If more than one layer is needed, stagger the joint connections.

Sources: Army Corps of Engineers, Knight Rider Tribe

ALAN KROPP & ASSOCIATES
Geotechnical Consultants
EXAMPLE OF PLASTIC-COVERED SLOPE

Note sandbags tied together with ropes, collection pipe intercepting water source above, deflection wall at toe.

Note wrapped deflection wall at toe conveying water to low point – where sand bag catchment basin collects water that is discharged by above-ground pipe.
## CONTRACTOR REFERENCES

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<tr>
<th>Name</th>
<th>Address</th>
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| Ted Yeghoian     | Ted W. Yeghoian Grading, Inc.  
964 Scots Lane  
Walnut Creek, CA 94596 | 925-935-4875 |
| Al Williams      | Williams Grading  
P.O. Box 214  
Byron, CA 94514 | 925-516-0572 |
| Steve O’Connor   | Engineered Soil Repairs  
1267 Springbrook Road  
Walnut Creek, CA 94596 | 925-210-2150 |
| Bill Gibson      |                                             |              |
| Myron Hagen      | Ned Clyde Construction  
159 Mason Circle  
Concord, CA 94520 | 925-689-5411 |