Engineering
UPDATE©

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LANDSLIDE DURING LAND DEVELOPMENT

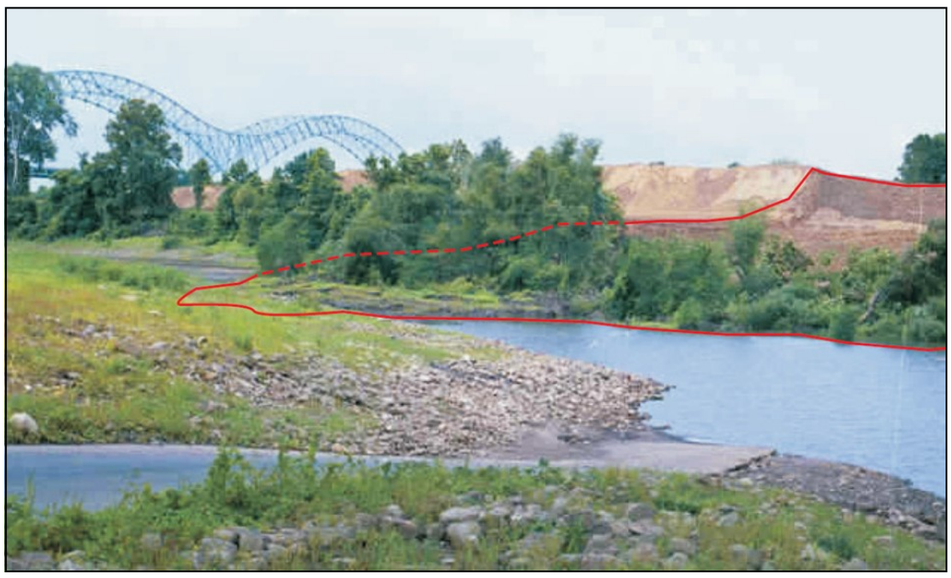

FIGURE 1 LANDSLIDE INTO A WATER CHANNEL DURING THE PLACEMENT OF FILL

An investigation of a landslide was undertaken by MEA to determine the cause of the failure (see Figure 1). The failure occurred during the placement of fill above soft clay soils. The site required up to about 20 ft. of fill to bring it above flood elevation. Most of the fill was required along an earth-sloped water channel.

Because the site had thick soft clay layers to depths greater than 90 ft., it was determined that vertical wick drains could be used to relieve porewater pressures in the clay soil which would develop during the placement of the structural fill. Moreover, the accompanying consolidation of the clay would be accelerated which in turn would result in added strength to resist a sliding failure into the channel.

As the site was being filled, borrow soil was being stockpiled at a rate of soil import that significantly exceeded that of fill placement. The balance of imported soil was stored farthest from the channel. With as much as 10 ft. of fill installed and a large resulting stockpile, failure occurred overnight without warning.

The pre-existing and estimated topography at the time of failure is shown in Figure 2.
Figure 2 also depicts the outline of the failed soil mass which accounted for 3.4 acres

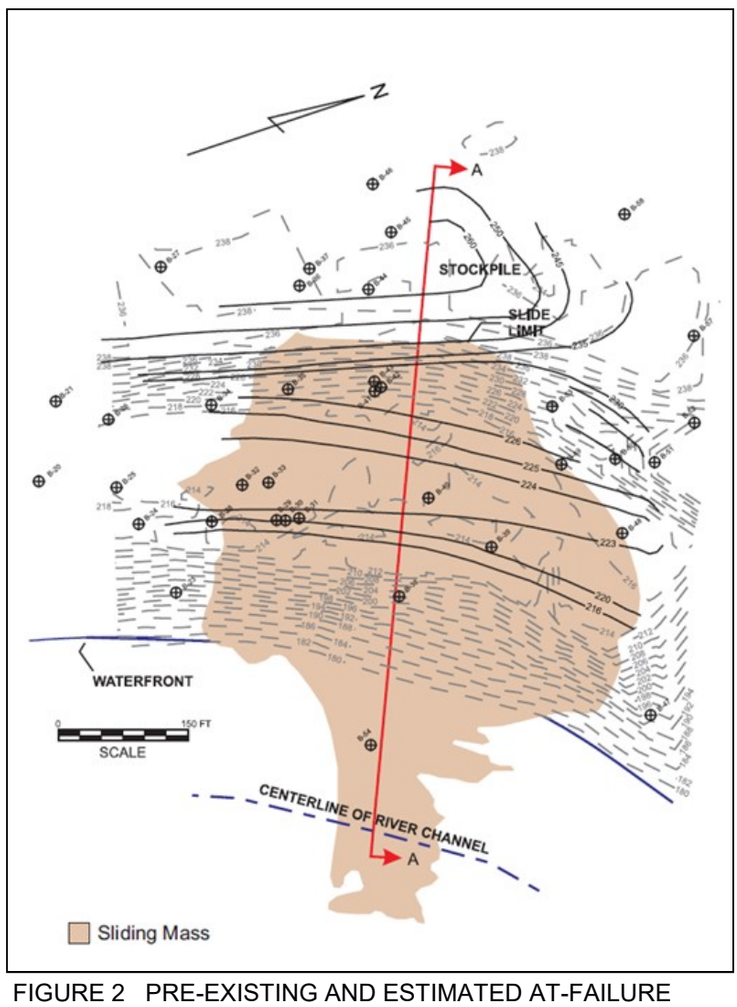

FIGURE 2 PRE-EXISTING AND ESTIMATED AT-FAILURE TOPOGRAPHY AS WELL AS AN OUTLINE OF THE SLIDE

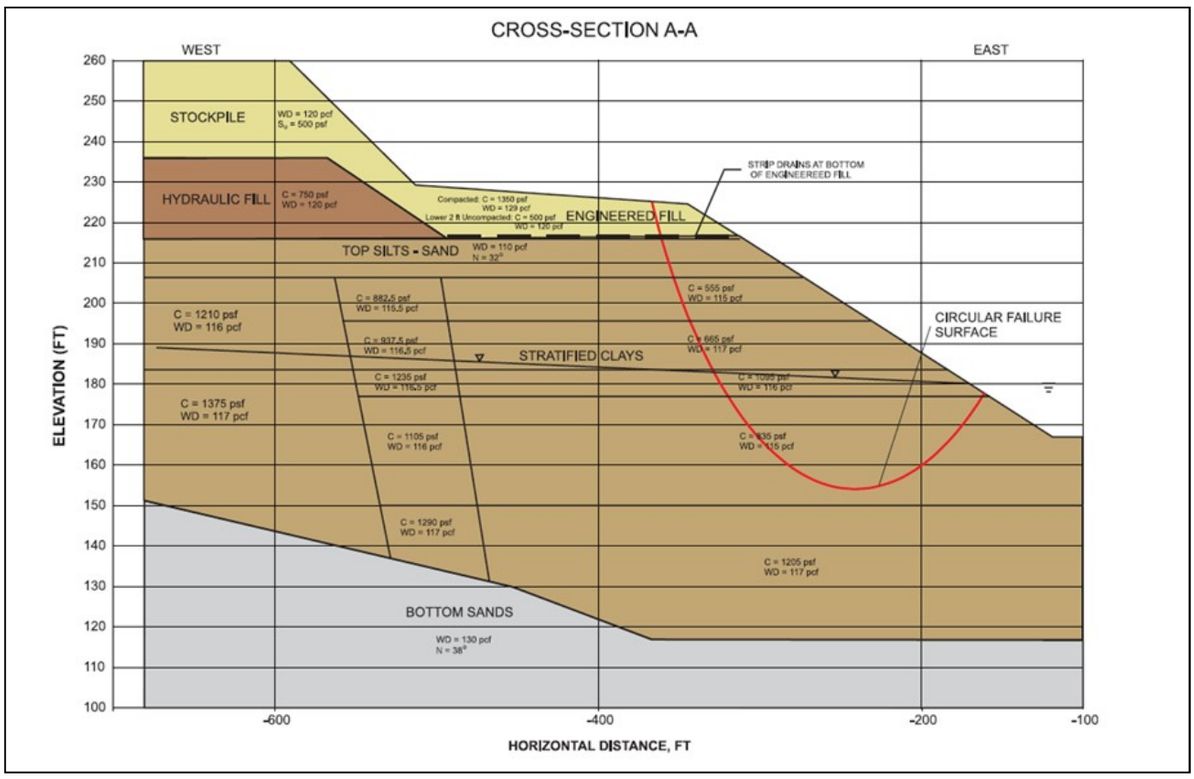

FIGURE 3 BASIC SOIL PROFILE CONDITIONS WITH THE CRITICAL FAILURE

above water level. As can be seen in Figure 2, the sliding mass extended into the stockpile area.
The landslide was investigated from a number of soil borings and laboratory test data. The basic soil profile used in the evaluation of the failure is shown in Figure 3. It is interesting to note that after about 45 days of fill placement, which is the time of failure, no noticeable increase in soil strength could be discerned as a result of the wick drains. Based on the groundwater and soil conditions at failure, the critical failure surface was obtained and is shown in Figure 3.

As can be seen in Figure 3, the sliding failure initiated at the channel bank and extended to a depth of 70 ft. This bank failure resulted in an inland progressive failure encompassing a limited section of the stockpile. Based on stability analyses, one massive failure was found to be much less likely.

In summary, a significant landslide was investigated. The landslide occurred during the soil fill operations and displaced 3.4 acres towards and into a water channel. Analysis of the failure determined that the sliding initiated near the channel bank and progressed further into the site. No noticeable improvement in soil strength was gained from the installed wick drains.

Other Engineering UPDATES of Interest:

UPDATE 23: Anatomy of Canal Geo-Construction Difficulties

UPDATE 26: Construction Slide Causes Significant Delay and Added Costs

UPDATE 7: Soil Provides Poor Road Construction Support

ABOUT MEA: Marino Engineering Associates, Inc. focuses on engineering research, practice and expert evaluations and is licensed in 25 states in the U.S. Our projects primarily have an emphasis on Geotechnical Engineering, however, we also have significant experience in projects involving transportation, subsidence engineering, laboratory testing, training, and geophysical exploration. Gennaro G. Marino, Ph.D., P.E., D.GE is president and principal engineer of Marino Engineering Associates, Inc., and has been a licensed professional engineer since 1984. To obtain additional information on MEA, one can also visit our website at www.meacorporation.com.

FOR MORE INFORMATION: There is a significant amount of additional information that is available on the above subject. For more information, please contact MEA at the address listed below.

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