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May 15, 2018

Holiday Island District Administration Office
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Holiday Island, Arkansas 72631

ATTN: Lawrence Blood
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RE: Geotechnical Engineering Recommendations Letter
Slope Failure Observation and Temporary Mitigation Alternatives
Stateline Drive
Holiday Island, Arkansas
GTS Proposal No. GTS118093

Mr. Blood:

This letter addresses our observations of the current slope failure and provides recommendations for temporary mitigation alternatives for the property south of Stateline Drive in Holiday Island, Arkansas. These recommendations are based on the on-site meeting on May 2, 2018 with you and Mr. Jeff Dehnhardt, P.E., of Engineering Services, Inc. (ESI).

We understand that Stateline Drive is closed to traffic at this time. Because we observed signs of historic slope failures at this site and due to the recent slope instability, Stateline Drive should remain closed in the vicinity of the slope failure until the slope can be stabilized. Temporary slope stability mitigation measures using rip rap reinforcement is explained later in this report. A proposal for further slope stability evaluation and geotechnical engineering recommendations for long-term slope stabilization was issued separately.

PROJECT INFORMATION

The project site is located on the south side of Stateline Drive in Holiday Island, Arkansas. The site consists of an approximate 1-acre area that slopes downhill to the north. Based on Google Earth aerial images, approximately 140 feet of elevation change occurs between Holiday Island Drive at the top of the bluff and Stateline Drive. A site location map showing the approximate area of the slope failure is shown on the following page.



Figure 1: Site Location Map – approximate location of the unstable slope (blue outline) and recent slide (blue shading)

We understand that the toe of the slope recently failed in late April 2018 and the soils covered Stateline Drive (area shown in Photograph 1). The soils were removed from the road and additional soils were removed from the area adjacent to the north of the road to prevent additional material from covering the road later.

We also understand that other slope movement has occurred previously in this area. A slide occurred during March/April 2017 to the east of the recent slide after the heavy seasonal rains.

Based on aerial images and our observations during the site visit, the topography shows signs of repeated slope failure occurring in a natural drainage valley, also shown in Figure 1.

OBSERVATIONS

We collected photographs of the slope and evaluated surface soil conditions during the site visit. A Log of Photographs showing some of our observations of slope movement and soil and water conditions during the site visit is attached to the end of this letter.

Toe of Slope – Photographs 1 through 4

We observed the exposed soils at the toe of the slope, where the soils had been excavated and removed as part of the recent slope repairs adjacent to Stateline Road. The area where the slope failure occurred and was excavated adjacent to the roadway was approximately 50 feet wide and extended up the hill about 20 feet. The soils were removed and disposed of downhill of the road and away from the site. We observed predominantly wet, silty clayey chert gravel soils exposed in the excavation north of the road. Water was observed flowing from the base of the gravel soils and collecting in the ditch adjacent to the road. Small outcrops of limestone bedrock were exposed underneath the clayey gravel in a few areas. We understand that the earthwork contractor scraped the limestone and could not penetrate it as they were removing the soils.

Upper Slope – Photographs 5 through 7

We accessed the upper portion of the slope from a residence located on Holiday Island Drive and adjacent to the west of the site. An exposed limestone bluff is present at the top of the slope. It appears that Holiday Island Drive is constructed at the top of the ridge above the limestone bluff. The limestone outcrops near the top of the slope are approximately 10 to 15 feet high where exposed.

We did not observe water seepage at the base of the limestone. However, we noticed several areas where water scoured the surface of the slope, beginning at the base of the limestone bluff and in scattered areas downslope of the bluff.

Middle Portion of the Slope (Main Slide Area) – Photographs 8 through 10

We observed at least three scarps in the middle portion of the slope. Most of the soils in the middle portion of the slope were too wet and soft to support foot traffic. As shown in Photographs 9 and 10, we observed water flowing over the ground surface and draining into the main slide area. The scarp exposed brown silty clayey chert gravel soils underneath an approximate 1-foot thick layer of dark gray, organic-rich silty gravel. Most of the trees and brush in the middle portion of the slope were undermined and toppled.

INTERPRETATION

The recent rain events appear to have saturated the soils in the slope, leading to the slope failure last month (April 2018). Based on the shallow depth to limestone, as exposed at the slope toe, and the massive limestone bluff outcrop at the slope crest, we anticipate that shallow bedrock is prominent in this area. During wet periods of the year (Winter and Spring), we expect that perched water develops in the clayey gravel soils overlying nearly impermeable limestone, so saturated soil conditions develop. We believe that the saturated soils lose shear strength under these conditions and the slopes become unstable, resulting in localized slope failure/slides. Signs of localized slope failures were noted in the observed scarps and bowl-shaped depressions in the ground surface.

RECOMMENDATIONS FOR TEMPORARY SLOPE STABILIZATION

We understand that the soils that slid into Stateline Drive were excavated and moved away from the site. Additional toe soil materials were removed to prevent them from continuing to slide into the road. To stabilize the soils upslope of the toe, we recommend replacing the excavated soils with heavier rock (rip rap). Rip rap placed at the toe should provide a mass to resist the soils sliding above the limestone and provide a drainage layer to alleviate the water flowing from the soils at the base of the toe.

We recommend removing the soils remaining in the area that has already been excavated to the top of the limestone so the rip rap can be placed directly on limestone. The soils that are presently remaining in the slope should not be removed any farther upslope. Additionally, a ditch should be excavated adjacent to the road and extending downhill to the east to promote draining water away from the slope failure area. A natural valley/creek bed appeared to be located to the east and would be an effective area to discharge the water.

Rip rap should be placed starting adjacent to the pavement and pushed/placed upslope. The rip rap should be stacked approximately two layers in thickness for interlocking and confinement.

Where the ditch is excavated downhill away from the slope failure area, the ditch can be left open without backfilling with rip rap.

Additional recommendations for slope stabilization can be provided after field exploration, laboratory testing and slope stability analyses are performed, as outlined in GTS, Inc. Proposal No. 118093, dated May 11, 2018, issued separately.



CLOSING

We appreciate the opportunity to be of assistance to you on this project. Please contact us if further explanation or clarification is required for this letter and if we can be of continued assistance.

Sincerely,



Shaun P. Baker, P.E.
Arkansas No. 11817

SPB:ANB



Andrew Beekman, P.E.
Project Engineer

Copies: Client (pdf - email)
ESI, Inc. (pdf - email) – Mr. Jeff Dehnhardt, P.E.

Holiday Island District Administration Office

Geotechnical Recommendations Letter

Slope Stability Evaluation and Slope Failure Mitigation

Stateline Drive

Holiday Island, Arkansas

GTS Proposal No. 118093

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LOG OF PHOTOGRAPHS



Photograph 1: Slope toe of the recent slide adjacent to Stateline Road. The soils that moved into the road during the slide were excavated and removed prior to our site visit. Note that water is collecting at the base of the slope toe adjacent to the pavement.



Photograph 2: The soils exposed in the slope toe after recent repairs consisted of silty clayey chert gravel. Water seeped from the soils near the bottom of the toe.



Photograph 3: Limestone bedrock exposed at the base of the slope toe excavation (shown by blue outline).



Photograph 4: Previous slope failure (slide) that occurred during April 2017, located just east of the current slide.



Photograph 5: Limestone bluff exposed near the crest of the slope, downhill of Holiday Island Drive.



Photograph 6: Scouring in the slope downhill of the limestone bluff.



Photograph 7: Scarp located mid-slope and downhill of the limestone bluff. This scarp appeared to indicate the uphill extent of the areas subject to historic slope failures/slides.



Photograph 8: The mid-slope soils are apparently prone to repetitive slides and instability. The scarp shown in the background is also shown closer in Photographs 9 and 10.



Photograph 9: Eastern scarp located approximately mid-slope. Water was flowing on the ground surface (in the lower right-hand corner of photograph) and drained into the area of the unstable soils above the slope toe failure.



Photograph 10: Closer view of the saturated soils in the scarp. The soils predominantly consisted of dark gray, organic-rich silty gravel overlying brown silty clayey chert gravel.