April 23, 2012

Segmental Block Retaining Wall Repair

Location

First Baptist Church

291 118th Street
Orofino, Idaho

Report Prepared

For

Ecology and Environment, Inc.

EPA START

Introduction:

A segmental wall is located on property of the First Baptist Church at 219 118th Street, Orofino, Idaho. The segmental block wall and associated fill was part of the project for the removal of asbestos cement water lines in the area. The soil removed along with the crushed asbestos cement water lines were disposed of on the First Baptist Church's Property to provide fill for additional parking. Due to the grades of the site, a segmental block retaining wall was constructed to provide the additional parking on the property.

The segmental block gravity retaining wall ranged in height from 6 feet to 19.5 feet using Redi-Rock 60"x46"x18", 41"x46"x18" and 28"x46"x18" block and encompasses three sides of the fill area. A surcharge load for parking on a flat surface was used for the design of the segmental gravity wall by J M Engineering. The design consists of a gravity wall where the weight of the wall retains the loads from the soil fill and parking.

The soil backfill for the wall was material coming from the removal of existing asbestos cement water pipe from areas in Orofino, Idaho. This material as per the soil testing performed by Geotesting Express is a sandy silty clay (CL-ML) with a maximum dry density of 115 to 119 pcf at an optimum moisture of 14.5% to 13.0% (depending on the sample tested). The sandy silty clay soil has a very low permeability of 8.8×10^{-7} cm/sec (0.0032 cm/hr).

The construction of the segmental block wall provided a flat area behind the wall that has been paved with bituminous asphalt with the exception of a grassy area adjacent to the western end of the site adjacent to the segmented block wall. Talking with Steven Hall of E&E, ECSI has learned that over the winter, the grassy area adjacent to the segmental block wall was used for the stockpile of snow removed from the parking areas of the First Baptist Church.

From the Daily Project Field Reports prepared by Allwest Testing and Engineering the construction of the segmental block wall and the placement of the fill material occurred from 08/30/2011 to 10/12/2011. During the construction of the segmental wall and the placement of the sandy silty clay fill material, Allwest Testing and Engineering provided compaction and moisture content testing.

In review of Allwest Testing and Engineering's daily project field reports, the compaction and moisture content of the fill material met or exceeded the project specifications for placement of fill material.

Existing Situation:

The segmental block retaining wall and fill placement construction was completed on October 12, 2011. Since the completion of the construction, the wall has exhibited signs of failure. From the pictures provided, separation of the blocks and bulging of the wall is evident. Areas of settling are noticeable in the bituminous asphalt paved areas and in the grassy area supported by the wall. The grass area appears to be saturated and water standing in areas of the bituminous asphalt parking can be observed in the photographs.

Recommendation:

In reviewing the information provided to ECSI, LLC pertaining to the design, construction and the recommendation by the original designer for the repair of the segmental block retaining wall constructed on the property of First Baptist Church at 219 118th Street, Orofino, Idaho, several factors appear to have acted to cause the failure of the segmental block wall.

The stockpiling of snow removed from the parking lot on the grass area adjacent to the segmental block wall provided additional surcharge on the fill material, placing a greater load on the segmental block wall. Snow that has been compacted and stockpiled can weigh as much as 20 lb/cu.ft. A stockpile 5' deep can produce a load of 100 lb/sq.ft. in addition to the load from the parking lot. The storage of snow in the grassy area saturates the soil by constant melting over a long periods permitting infiltration of water into the soil. As the soil becomes saturated, reducing the soil's ability to resist the surface loads and the soil starts moving. It did not appear from the design information provided, that stock piling of snow on the grassy area was anticipated and included in the segmental block wall design.

The grass area adjacent to the segmental block wall does not seem to have positive drainage away from the area. JM Engineering's recommendation dated April 2012 to install a dry well and grade the grass area to drain to the dry well confirms this observation. The grass area not having positive drainage creates a situation where rainwater and snowmelt do not drain from the area via surface flow. The water pools on the grassy surface, saturating the soil and reducing its ability to support the surface loads.

ESCI, LLC recommends the following steps to repair the segmental block wall failure, based on the information provided. The following recommendations should be evaluated by the design engineer and incorporated as appropriate:

1. Remove the fill material in the grass area behind the wall to the original ground elevation.
2. Remove the segmental block wall to the base course.

3. Redesign the segmental block wall to use the existing block wall segments with Geogrid layers placed between every course of block and take in to account the additional surcharge for the stock piling of snow.
4. Provide clean free draining stone backfill behind the segmental block wall as per Redi-Rock wall design requirements. (do not reuse the existing stone backfill)
5. Provide non-woven geotextile fabric separation between the free draining stone backfill and the soil fill material.
6. Compact soil fill material in 18” lifts to 90% Modified Proctor behind the wall.
7. Obtain soil tests on the existing soil material under the fill to determine infiltration rates for determining the required depth and sizing of the wet well. The wet well should be able to accept the flow from a 25 yr – 24 hr (4% chance) storm event.
8. Install drywell as per J M Engineering’s recommendation dated April 2012. The seepage ports of the drywell should be below the elevation of the segmental block wall footing. If the site conditions permit, positive drainage from the drywell through a pipe would be preferred.
9. Grade the grassy area to have positive drainage to the drywell (2% minimum grade in grass areas) as per J M Engineering’s recommendation dated April 2012.
10. A system of 4” perforated pipe with free draining backfill bedding wrapped with filter fabric should be installed in the grassy area and connected to the drywell.