Landshore® Enterprises, LLC

Streambank & Shoreline protection/stabilization/reclamation
Environmental Engineering, Erosion Control, Construction Management
d/b/a Erosion Restoration, LLC

Griffin Lakes Community Development District
c/o: Mr. Angel Camacho, Alvarez Engineers
5385 N. Nob Hill Road,
Sunrise, FL 33351

April 4, 2022

Dear Mr. Camacho,

Please allow us to summarize the findings and proposed solutions as described in the Erosion and Sedimentation Control Plan for five (5) lakes located within the Griffin Lakes Community Development District, provided by Landshore Enterprises, LLC ("Landshore®", "Our", "We").

During the week of December 13, 2021, our engineering team collected field data and soil samples from all five lakes. We tested the soil samples and performed stability analysis to ASTM standards at our in-house laboratory. Our team performed a comprehensive model of existing conditions that was examined by staff engineers, certified stormwater inspectors, and construction manager to find a viable alternative. Our recommended solutions are presented on the set of drawings based on low-altitude high-resolution aerial photographs, geo-referenced in state plane coordinates with cross sections, details, specifications, and best management practices for storm water pollution prevention, attached under this cover letter.

The most common type of lake bank erosion is a stair step type of drop-off or linear erosion. This is the case in the lakes at Griffin Lake CDD, where the water level is normally close to or at control elevation.

Technical Findings:

Lake 1: Located on the western side of the community, it has two segments of the shoreline where bulkhead was used as a method of slope stabilization. This bulkhead is still in good condition other than the main span board. It is recommended that the top board is replaced with a new one, or it could be fastened down. Several areas around the bulkhead sections have ducks and other waterfowl activities. This wildlife has destroyed or eroded the existing sod in the area. The outfalls within the lake all appear to be open and free from blockages, along with proper support around the pipes.

The perimeter of the lake measured at 1,335LF, and the span distance across is an average of 50 feet wide. Overall, the slopes along the lake are steeper than ideal, measuring at 3.2-3.5H: 1V. For lakes with residential access a 4H:1V slope is ideal.

The embankment drop from the top of the escarpment to the underwater shelf is consistent around the lake with a measured drop of 1.5-2 feet. The lake depth averages 7-8 feet, where the deepest part of the lake is found in the upper center section.

The soil sample collected consisted of a poorly graded sand with a dry density of 103.81 lb/ft^3 and an angle of internal friction of 29.7 degrees.

Lake 2: Located on the western side of the community, it has two segments in the North and South of the lake where the slope is stabilized with a bulkhead. The bulkhead requires a minor cosmetic repair, it is recommended that the top board is replaced with a newly treated board and properly fastened. Similar to lake 1, lake 2 has duck activity around the ends of the bulkhead, and it is destroying the existing sod and expediting the erosion in the area. The outfalls pipes are all open and flowing unhindered, they are properly supported at the base and stabled.

The perimeter measured at 1,154LF, and the span distance across is between 48-50 feet wide. The average slope leading from the finish floor elevation to the water's edge was measured at 3.2-3.5H: 1V, similar to lake 1. The embankment appears consistent around the lake with a measured drop of 1.5-2 feet, in most cases. The lake depth averages 5-6 feet, where the deepest part of the lake is found in the southern section adjacent to the bulkhead at an elevation of -6.97' NGVD, or 8 feet deep.

The soil sample collected consisted of a poorly graded sand with silt with a dry density of 91.3 lb/ft^3 and an angle of internal friction of 30.3 degrees.

Technical Findings (cont.):

Lake 3: This lake is located in the center of the community. While reviewing the surface and the underwater conditions of the above and below water slopes, it was determined that this lake does not require any immediate means of shoreline protection. The existing bulkhead along with the offset of the shoreline is considered stable and no immediate action is needed.

It is recommended that the lake is monitored over the next few years for any changes in the condition of the shoreline.

Lake 4: Located north of the main gate, it is the smallest of the five (5) lakes within the community. The lake has a wooden bulkhead of approximately 250LF surrounding the shoreline. The bulkhead is in an overall good condition. There are two outfalls, both of which are deeper than the others found in the community. We were not able to confirm their condition because they are too deep, however it is believed they are operating properly due to the depth and void measured in front of the outfalls.

The lake perimeter measured at 551LF, and the span distance across is an average of 60 feet wide. The average depth of the lake is 6 feet, where the deepest part of the lake is found in the western section, adjacent to the boat ramp, at an elevation of -6.11' NGVD, or 6 feet deep.

Landshore® is proposing the repairs of the existing conditions of the shoreline to be divided into three (3) phases, with Phase 1 categorized as a serious erosion condition that will require immediate attention, Phase 2 categorized as a poor erosion condition that will require attention at some point, and Phase 3 categorized as a fair erosion condition that will require monitoring over time.

Phase 1 is located on the east section of the shoreline adjacent to the taller section of the bulkhead, denoted with a red line on the *Erosion Control Element Plan* (page 6 of the Erosion and Sedimentation Control Plan). At this area, a very steep slope of 2.5H:1V was measured from the top of slope to the top of bank. With the same slope continuing into the water down to the lake bottom.

The soil sample collected consisted of a poorly graded sand with a dry density of 99.43 lb/ft^3 and an angle of internal friction of 29.5 degrees.

Technical Findings (cont.):

Lake 5: Located south of the main gate, the lake has a wooden bulkhead of approximately 280 LF surrounding the shoreline. The bulkhead has a portion where it increases in height on the Northeast side of the lake. The overall condition of the bulkhead is good with a few minor items to address. There is a minor washout behind the bulkhead where it drops from a 6–7-foot wall to a 3–4-foot wall. At this drop, an area of the backfill has eroded away resulting in a tie back being exposed. The western outfall pipe was found to be blocked and only a small opening in the top of the pipe was visible. Along the South section of the shoreline adjacent to the residential buildings, Landshore® observed a significant amount of duck activity. This area has lost almost all the sod. In addition, adjacent to a covered patio area, a drop of approximately 1 foot of material has washed away.

The overall perimeter of the lake is measured at 767 LF, with the widest area across measured at 147 feet. This lake has an average depth of 6 feet where the deepest part of the lake is found in the southern section adjacent to the bulkhead at an elevation of -10.96' NGVD or 11-12 feet deep. The slopes recorded around the lake ranged from flat on the west and north bank to very steep 2.5H:1V on the east. A 1-1.5-foot drop was measured from the top of the bank into the water.

Landshore® is proposing the repairs of the existing conditions of the shoreline to be divided into three (3) phases, with Phase 1 categorized as a serious erosion condition that will require immediate attention, Phase 2 categorized as a poor erosion condition that will require attention at some point, and Phase 3 categorized as a fair erosion condition that will require monitoring over time.

The soil sample collected consisted of a poorly graded sand with silt with a dry density of 99.62 lb/ft^3 and an angle of internal friction of 30.0 degrees.

Recommended Solution:

After careful consideration of nonstructural erosion control solutions, it is our professional opinion, to the best of our knowledge and belief that present slope condition may be remedied by utilizing Eco-Filter Tubes (EFT®) or approved by Engineer equal construction product.

Reinforcing Slopes with Geotextile:

The use of geo-synthetics in reinforced soil slopes is an economical method of steeping up ground to increase available land for private and commercial use. They are more flexible than retaining walls and provide softer facing incorporating vegetation to blend in naturally with the surrounding area.

While effectively reducing seepage induced erosion by preventing transport of fine particles (suffusion) they have overall good percolation rate aiding filtration and preventing build-up of hydrostatic or uplift pressure. Applications may include reinforcement of fill in new construction and/or reconstruction of failed slopes.

The recommended solutions, as provided in the Erosion and Sedimentation Control Plans for Griffin Lakes Community Development District are presented as follows:

- Lake 1: Approximately 1,315LF of shoreline to be remediated by utilizing three (3) layers of eco-filter tubes.
- Lake 2: Approximately 942LF of shoreline to be remediated by utilizing three (3) layers of eco-filter tubes, and approximately 41LF of shoreline to be remediated by utilizing four (4) layers of eco-filter tubes.
- Lake 3: Monitor over the next few years for any changes in the condition of the shoreline.
- Lake 4: Phase 1, approximately 85LF of shoreline to be remediated by utilizing three (3) layers of eco-filter tubes. Phase 2, approximately 200LF of shoreline to be monitored with the option to remediate this area with two (2) layers of eco-filter tubes. Phase 3, approximately 252LF of shoreline to be monitored over time.
- Lake 5: Phase 1, approximately 428LF of shoreline to be remediated by utilizing three (3) layers of eco-filter tubes. Phase 2, approximately 83LF of shoreline to be monitored with the option to remediate this area with two (2) layers of eco-filter tubes, and approximately 72LF of shoreline to be remediated by utilizing three (3) layers of eco-filter tubes. Phase 3, approximately 169LF of shoreline to be monitored over time.

Additional recommendations:

Lake 1: The existing boat ramp consisting of a sloped GeoWeb® and drainage stone need to be backfilled with additional stone.
Lake 2: The existing boat ramp consisting of a sloped GeoWeb® and drainage stone need to be backfilled with additional stone.
Lake 4: The existing boat ramp consisting of a sloped GeoWeb® and drainage stone need to be backfilled with additional stone.
Lake 5: Clear blocked outfall pipe to the west of the lake. A spot repair at the bulkhead to the northeast, where there is an exposed tieback.

Additional notes:

We are recommending that the material to be used to fill in the eco-filter tubes is an imported material and not material dredged from the lakes. With the exception of lake 5, all lakes are narrow, and dredging the material needed for the eco-filter tubes from the lakes will deepen the lake bottom and increase the underwater slopes making it unstable and creating further erosion in the future.

Construction Cost:

Landshore® has expertise in design and installation of different remediation applications for slope stabilization and erosion control. Construction cost proposals are provided as part of the Erosion and Sedimentation Control Plans.

If you have any additional questions, or require further information, do not hesitate to contact us on (954) 327-3300 or via email at info@landshore.com.

We look forward to having the pleasure of continuing doing business with you.

Sincerely,
Miguel Reto
Design Engineer

Landshore Enterprises, LLC