Reuben Clarson CONSULTING

January 15, 2020

Richard E. Brylanski, P.E.
Hole Montes, Inc.
6200 Whiskey Creek Drive
Fort Myers, FL 33919
Email: RickBrylanski@hmeng.com

Re: Seawall Inspection for Little Harbor East Marina
3301 Sea Grape Drive, Ruskin, FL 33570

Dear Mr. Brylanski,

This letter provides a summary of the field inspection performed on October 16, 2019 of the marina basin seawall located at the above referenced address. The following is a summary of findings and recommendations.

Existing Conditions/Construction

- 2,800 LF +/- of seawall
- Cast-In-Place concrete cap (12"x 20", 18" x 24", 24" x 27", 25" x 44" & 19" x 25")
- Precast Concrete & Vinyl Sheet Pile Seawall Sections
- Seawall exposed height = 75-128 inches

Approximately 2,800 linear feet (LF) of a vinyl sheet pile seawall consisting of 12-22 ft long sheets with various concrete cap sizes and PVC encased tiebacks. The exposed height from the top of the cap to the berm (mudline) ranges from 6.25 ft at the southwest end of the marina to 10.7 ft at the eastern end of the marina basin.

The existing vinyl seawall system was replaced during redevelopment of the property around 2012. A vinyl sheet pile seawall and concrete cap was installed in front of the original concrete slab seawall. The marine contractor, Hecker Construction, advised us that the Developer requested the alignment of the new vinyl wall to be constructed more waterward of the existing concrete wall than the engineered plans called for in order to gain upland in areas of the project. Contrary to the design plans, the new vinyl wall was installed as much as 3 ft waterward of the existing wall in some areas. The void space between the vinyl sheets and the older concrete slabs was filled with sand.

Most of the vinyl sheets were observed to be kicking out at the bottom of the wall and the sheets are bowing in areas. The concrete cap is tilted backward in many areas. Significant loss of sediment was also evident in many areas behind the seawall. Since the seawall was installed waterward of the proposed design, the depth of the water and subsequent exposed height of the seawall is greater than was anticipated in the vinyl seawall replacement design.

Therefore, the penetration depth in the sediment of the vinyl sheets is less than the adequate and is causing movement of the wall. The sections of the seawall that have kicked out may not be stabilized. In addition, the old concrete wall may be pushing outward on the replaced vinyl wall as sand and not concrete was filled between the two walls.

The vinyl seawall installed during redevelopment has been replaced in some areas. Approximately 340 LF of the vinyl seawall was recently replaced by Waterline Construction, Inc. at the eastern end of the marina basin. The wall consists of 22' long vinyl sheets with a 25" x 44" precast concrete cap and Manta-Ray (MR-SR) anchors. The seawall in the eastern area was not backfilled to the top of the cap. Another 300 LF section was also replaced on the northern side of the marina basin by Waterline Construction. The vinyl sheets were pulled and were replaced with 16' vinyl sheets with an 18" x 24" concrete cap and Manta-Ray (MR-SR) anchors.

Wellpoint drains have been installed to relieve hydrostatic pressure or water from behind the seawall. However, the drains have tilted upward in areas where the wall has kicked out and may not be draining most efficiently. In some areas along the north side of the basin the wellpoint drains have become misaligned. Significant sediment loss behind the seawall was observed on both the north and south sides of the basin. Sediment is being lost through misaligned, damaged or improperly installed wellpoint drains.

Most of the southern portion of the seawall cap is in good condition. Although, structural defects (horizontal cracking) in the front face of the seawall cap was observed by the marina loading area indicating the rebars inside the concrete are rusting from salt intrusion. The rusting causes the rebars to expand and thus crack the concrete. Horizontal cracking and spalling of the cap were observed in several areas along seawall at the northern side of the marina basin with previous concrete repairs evident in some locations. Shear cracking of the concrete cap due to movement of the seawall was also observed along the northern edge of the basin.

Provided in the table below is a summary of the field observations at measured stations starting at the southwestern end of the marina basin (0+00), moving toward the east and then back westward to the western limits (26+01) of the seawall in the marina basin.

Table 1: Seawall Inspection Observations

Note: Station 0+00 Starts at SW End of Marina Basin Moving to NW end of Marina Basin

Station	*Cap Size*	*Vertical Wall*	*Exposed Ht*	*Observation/Comment*
0+00	12" x 20"	Vinyl	75"	Vinyl Sheet Pile Seawall
0+17-0+30	12" x 20"	Vinyl	112"	Loss of sediment
0+23	12" x 20"	Vinyl	112"	Expansion Joint. Sheets bowing, cap tilted backward, sheet splitting with grass growing out of sheet joints.
0+59	12" x 20"	Vinyl	112"	Start of sidewalk
0+84	12" x 20"	Vinyl	112"	Expansion Joint. Sheets bowing, cap tilted backward, sheet splitting with grass growing out of sheet joints.
1+44	12" x 20"	Vinyl	112"	Expansion Joint. Sediment loss with tieback exposed. Tiebacks at 12' oc
1+79	12" x 20"	Vinyl	112"	End Sidewalk
2+05	12" x 20"	Vinyl	112"	Expansion Joint.
2+14	12" x 20"	Vinyl	112"	Sediment loss.
2+28-2+41	12" x 20"	Vinyl	112"	Sediment loss.
2+51	12" x 20"	Vinyl	112"	Sediment loss.
2+59	12" x 20"	Vinyl	112"	Sediment loss.
2+67	12" x 20"	Vinyl	112"	Expansion Joint.
2+68-2+89	12" x 20"	Vinyl	112"	Sediment loss and sheets bowing more in this area
2+91-2+95	12" x 20"	Vinyl	112"	Sediment loss.
3+05-3+15	12" x 20"	Vinyl	112"	Sediment loss.
3+27	12" x 20"	Vinyl	112"	Expansion Joint.
3+61	12" x 20"	Vinyl	112"	Sediment loss.
3+84	12" x 20"	Vinyl	112"	Damaged sheet, cracked at bottom
3+89	12" x 20"	Vinyl	112"	Expansion Joint.
4+30	12" x 20"	Vinyl	112"	Sediment loss and sheets bowing slightly
4+39-4+50	12" x 20"	Vinyl	112"	Sediment loss.
4+50	12" x 20"	Vinyl	112"	Expansion Joint.
4+56-4+64	12" x 20"	Vinyl	112"	Sediment loss at FDC connection. Tieback exposed
4+70-4+88	12" x 20"	Vinyl	112"	Sediment loss.
5+03-5+44	12" x 20"	Vinyl	112"	Sediment loss.
5+11	12" x 30"	Vinyl	112"	Cap alignment changes
5+35	12" x 30"	Vinyl	112"	Wall bowing
5+36	12" x 30"	Vinyl	112"	Mangrove in well point drain

5+72	12" x 27"	Vinyl	112"	Expansion Joint. Rotation of cap lessens
5+78-6+23	12" x 27"	Vinyl	112"	Sediment loss.
6+33	12" x 30"	Vinyl	113"	Expansion Joint.
6+41	12" x 30"	Vinyl	113"	Cut sheet at top
6+50-6+81	12" x 30"	Vinyl	113"	Sediment loss.
6+94	18" x 24"	Vinyl	113"	Expansion Joint. Sediment loss.
6+98-7+80	18" x 24"	Vinyl	113"	Sediment loss. Hole in sheet and panels seem slightly twisted.
7+55	18" x 24"	Vinyl	113"	Expansion Joint.
7+75	18" x 24"	Vinyl	113"	Chip off back of cap.
7+94-8+04	18" x 24"	Vinyl	113"	Settling under sidewalk
8+18	18" x 24"	Vinyl	113"	Expansion Joint.
8+56	18" x 24"	Vinyl	113"	Sidewalk settling
8+77	18" x 24"	Vinyl	113"	Sediment loss.
8+79	18" x 24"	Vinyl	123"	Expansion Joint.
9+31	24" x 27"	Vinyl	99"	Change in cap height to marina loading area 31" below, Longitudinal cracking full length of cap face, 22" vinyl sheet peak to peak.
9+94-10+41	24" x 27"	Vinyl	99"	Loading area
11+15	25" x 44"	Vinyl	102"	End of lower wall. New wall sheets 33.5" peak to peak.
11+43	25" x 44"	Vinyl	102"	Expansion Joint.
11+76	25" x 44"	Vinyl	102"	Sediment loss. Replaced wall but no backfill.
11+98	25" x 44"	Vinyl	102"	Expansion Joint.
12+50	25" x 44"	Vinyl	128"	Expansion Joint.
13+03	25" x 44"	Vinyl	128"	Expansion Joint.
13+56	25" x 44"	Vinyl	128"	Expansion Joint.
14+06	25" x 44"	Vinyl	128"	Expansion Joint.
14+61	18" x 24"	Vinyl	114"	End of wall. Heading West w/ 24" RCP in corner
15+16	18" x 24"	Vinyl	114"	Spalling cap at Expansion Joint. Sheets 24" peak to peak, bowing along docks
16+58	18" x 24"	Vinyl	114"	Expansion Joint.
17+62	18" x 24"	Vinyl	114"	Expansion Joint.
17+90	18" x 24"	Vinyl	114"	Expansion joint.
18+73	18" x 24"	Vinyl	114"	Corner Horizontal cracking at top of cap
18+80	18" x 24"	Vinyl	114"	Repaired Expansion Joint.
18+91	18" x 24"	Vinyl	114"	Sediment loss.
19+10	18" x 24"	Vinyl	114"	Sediment loss.
19+20	18" x 24"	Vinyl	114"	Sediment loss.
19+42	14" x 20"	Vinyl	114"	Expansion Joint. Cap size change

19+35-19+63	14" x 20"	Vinyl	114"	Sediment loss.
20+02	14" x 20"	Vinyl	114"	Expansion Joint., cap in good condition from corner
20+26	14" x 20"	Vinyl	93"	Sediment loss.
20+26-21+78	14" x 20"	Vinyl	93"	Sediment loss.
20+64	14" x 20"	Vinyl	93"	Shear crack in cap and starting to tilt back.
20+99	14" x 20"	Vinyl	93"	Diagonal crack in cap
21+07	14" x 20"	Vinyl	93"	Diagonal crack in cap
21+19	14" x 20"	Vinyl	93"	Spalled/shearing at Expansion Joint., wellpoint drains missing or misaligned.
21+84	14" x 20"	Vinyl	93"	Expansion Joint.
21+93	14" x 20"	Vinyl	93"	Sediment loss.
22+37	19" x 25"	Vinyl	99"	Vinyl sheets 3' width peak to peak
22+97	19" x 25"	Vinyl	99"	Expansion Joint.
23+50	19" x 25"	Vinyl	99"	Expansion Joint.
23+94	19" x 25"	Vinyl	99"	Expansion Joint.
25+45	14" x 20"	Vinyl	93"	End of new wall
26+01	14" x 20"	Vinyl	93"	Seawall basin end.

Recommendations

Due to the design condition and structural defects found in the existing vinyl sheet pile seawall system, provided below are recommend options for both the commercial marina area (south seawall) and the residential area (north seawall) for repair and/or replacement.

Commercial Marina Area (Southern Seawall Section)

Option 1

Option 1 includes repairs and structural reinforcement of the existing vinyl seawall system. within 1 year. For additional structural support of the seawall, we recommend adding approximately 930 LF a double box beam composite waler approximately 6” above the mean highwater (MHW) line to be anchored with new 1” diameter x 16’ long HDG tieback rods to Manta Ray (MR-SR) anchors at 6’ on center. The tieback rods should extend past both the existing vinyl wall and the original concrete wall.

Any broken or misaligned wellpoint drains should be replaced with new drains installed through both walls at 6’ on center and 5” above the barnacle line to relieve the hydrostatic pressure or aid in removing water from behind the wall. The annular area around the existing wellpoint drains and any holes should be filled with epoxy to limit sediment loss.

All voids behind the seawall should be filled with crushed shell or pea gravel as needed (perhaps more than once) to fill in the existing voids behind the seawall, allowing for drainage, but aid in

trapping the sand particles. All cracking in the seawall cap areas should be chipped, cleaned and filled with hydraulic cement or epoxy.

The ballpark cost for this option is approximately $215,000 with a useful life expectancy of approximately 20-30± years.

Option 2

Option 2 includes replacement of the existing vinyl seawall system (930 LF). Recommended specifications for a new seawall would include construction of a new vinyl corrugated seawall system with 14'-20' sheets and a new concrete cap and 1" diameter HDG PVC encased tieback rods to MR-SR manta ray anchors or deadmen. Wellpoint drains should be installed through both walls at 6' on center and 5" above the barnacle line to relieve the hydrostatic pressure or aid in removing water from behind the wall. The existing wall would remain. Concrete filler would be applied between the two walls. The ballpark cost for replacement of the seawall in today's prices is approximately $375,000 with a useful life expectancy of 50± years.

Residential Marina Area (Northern Seawall Section)

Due to the structural defects, residential use of the seawall and potential for structures to be constructed closer to the existing seawall we recommend replacement of the existing vinyl seawall systems that have not been recently replaced (Approximately 850 LF). Recommended specifications for a new seawall would include construction of a new vinyl corrugated seawall system with 16'-20' long sheets and a new concrete cap and 1" diameter HDG PVC encased tieback rods to MR-SR manta ray anchors or deadmen. Well point drains should be installed through both walls at 6' on center and 5" above the barnacle line to relieve the hydrostatic pressure or aid in removing water from behind the wall. The existing wall would remain. Concrete filler would be applied between the two walls. The ballpark cost for replacement of the seawall in today's prices is approximately $340,000 with a useful life expectancy of 50± years.

If you should have any questions or comments, please do not hesitate to contact me. We appreciate the opportunity to provide this report.

Sincerely,

REUBEN CLARSON CONSULTING, INC.

John B. Adams, Jr., PE
FL Professional Engineer No. 53963

JOHN B. ADAMS JR. CERTIFICATE No.53963 STATE OF FLORIDA PROFESSIONAL ENGINEER

Digitally signed by John B. Adams, Jr.
Date: 2020.01.17 12:10:01 -05'00'

Photo #1- View of Concrete Cap Tilting Backward Looking Northeast from Southwest End of property

Photo #2 – View Looking Southwest from the Southwest End of property

Photo #3 – Settling in Seawall Causing Movement in Cap

Photo #4 – View of Vegetation Growth Through Seawall

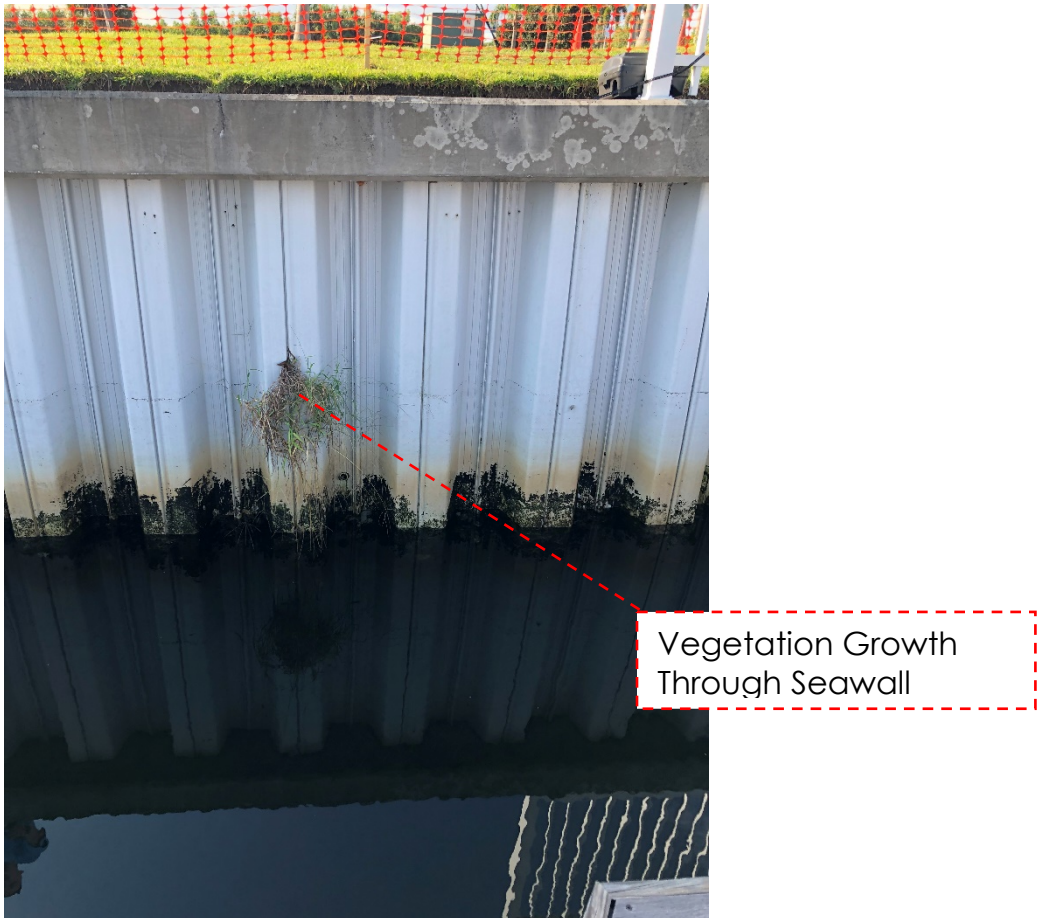

Photo #5 – View of Vertical Cracking at Top of Vinyl Sheet

Photo #6 – View of Vegetation Growth Through Seawall

Photo #7 – WellPoint Drain Misaligned in Vinyl Sheet

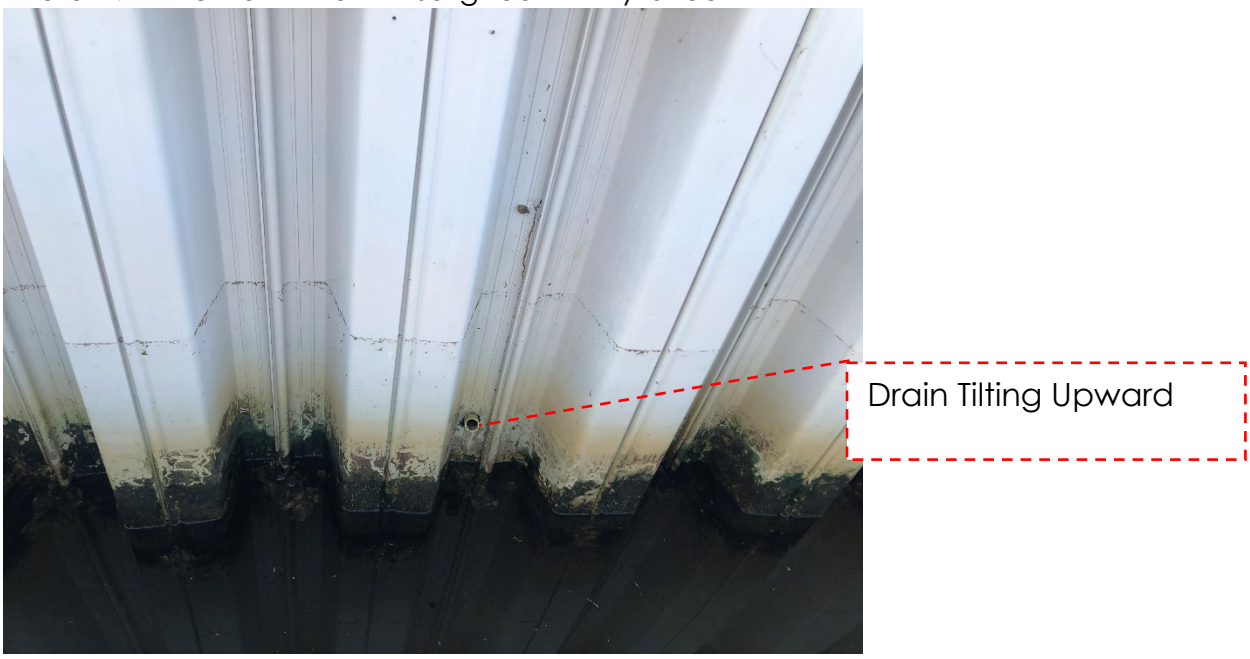

Photo #8 – Sediment Loss at FDC Connection and Tieback Exposed

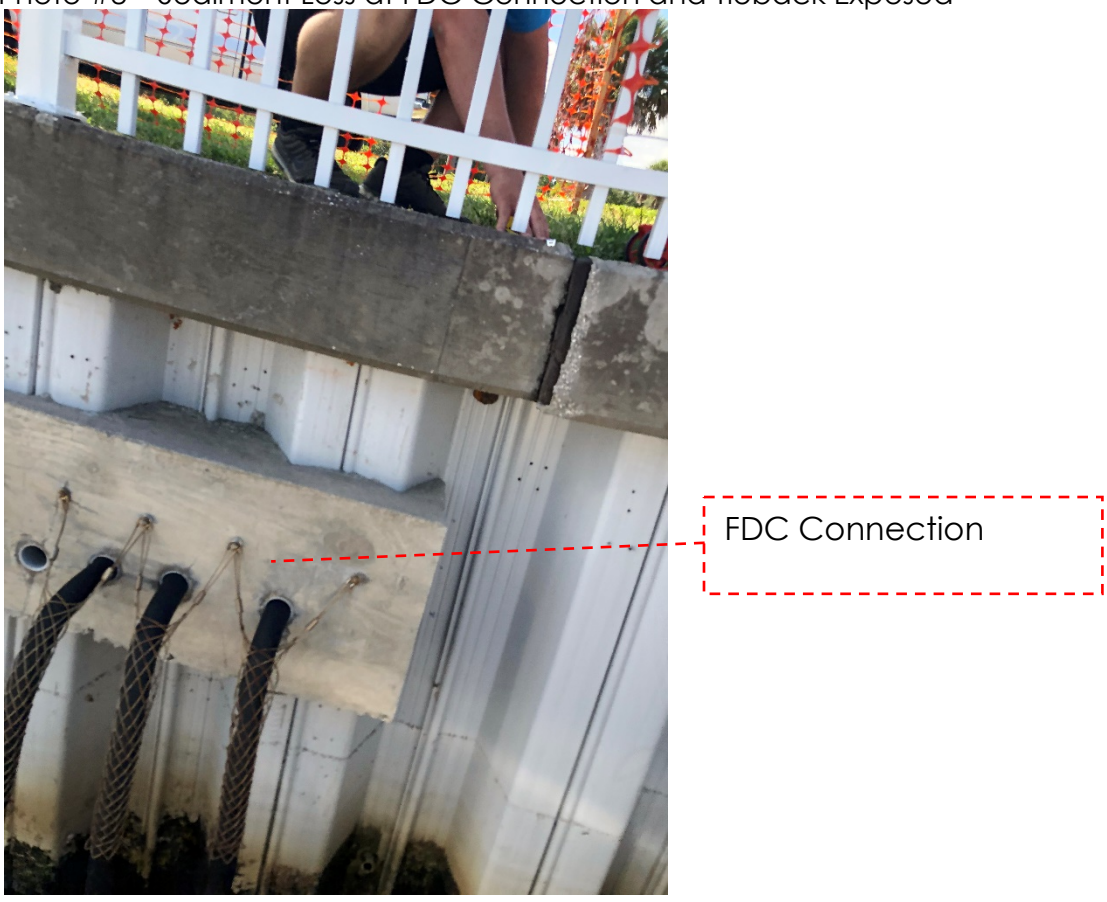

Photo #9 – Vinyl Sheet Cut at Top of Sheet

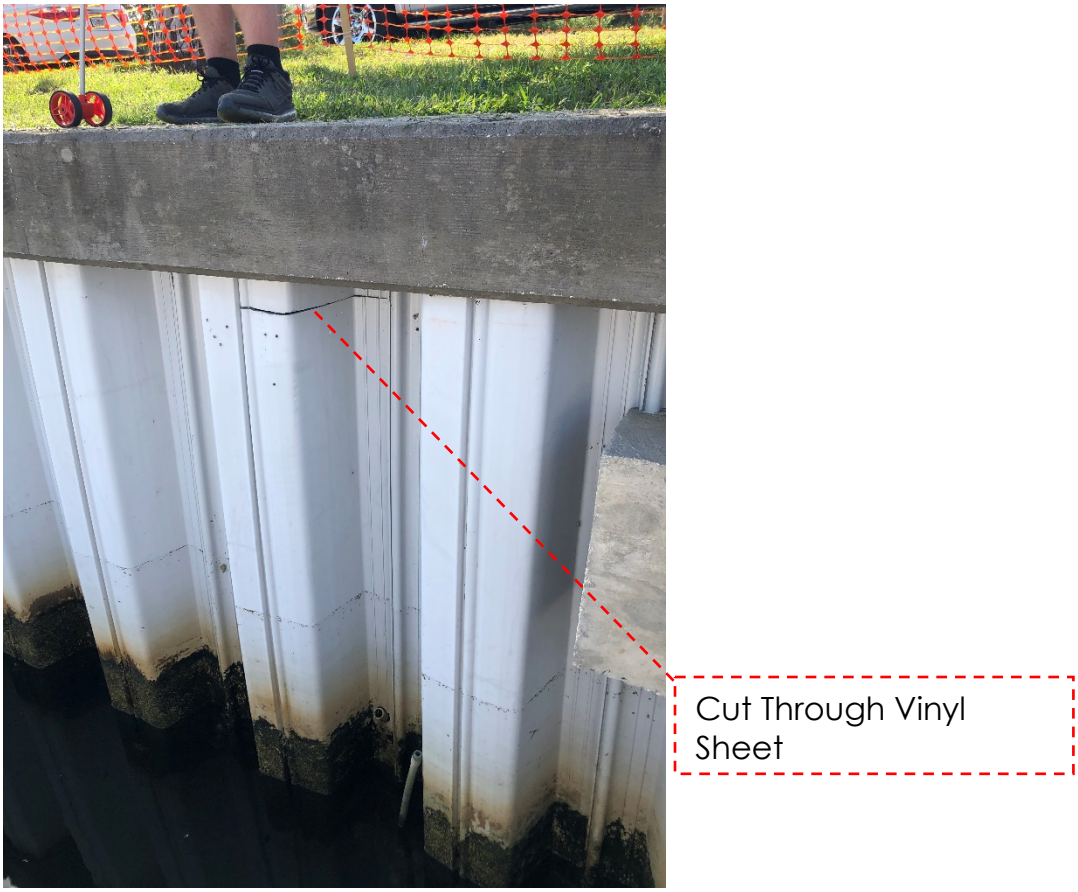

Photo #10 – View of Seawall Cap Change and Cap (Right Cap in Photo) Alignment Out 4 Inches

Photo #11 – View of Vertical Cracking at Top of Vinyl Sheet

Photo #12 – View of Horizontal Cracking in Seawall Cap

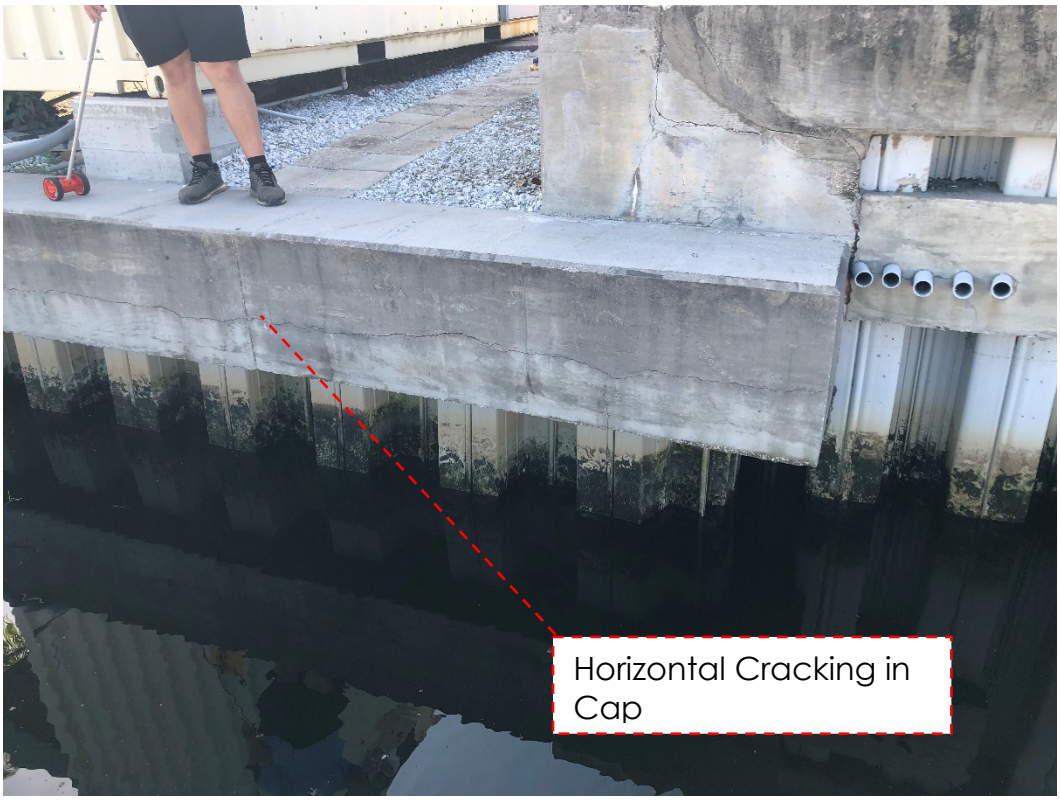

Photo #13 – View of Horizontal Cracking in Seawall Cap

Photo #14 – View of Horizontal Cracking in Seawall Cap

Photo #15 – Spalling Section of Seawall Cap

Photo #16 – View of Bowing Vinyl Sheets Underneath Docks

Photo #17 – Vertical Cracking at Top of Vinyl Sheet

Photo #18 – Repaired Section of Spalling in Cap

Photo #19 – Spalling Section of Seawall Cap at Expansion Joint