PREPARED FOR:
NEW BEDFORD PORT AUTHORITY

ROUTINE INSPECTION REPORT UPDATE
PORT OF NEW BEDFORD

POPE'S ISLAND MARINA

JULY 2020

PARE
CORPORATION

ROUTINE INSPECTION REPORT UPDATE
POPE'S ISLAND MARINA

NEW BEDFORD, MASSACHUSETTS

Table of Contents **Page No.**

FIGURES AND DRAWINGS:

TABLES

APPENDICES:

EXECUTIVE SUMMARY

The Pope's Island Marina Facility (the Marina) is comprised of a timber pile supported fixed pier and tee-head, and a series of six (6) main floating docks with finger floats providing slips for 198 vessels, not including the berths at the ends of the floats or along the tee-head. The facility was constructed in 1992 and has had repairs to the floating docks over the years, typically following storm events.

The purpose of this report is to provide the New Bedford Port Authority (NBPA) with an updated assessment of the Marina since the last inspection for the Marina which was completed in 2014. For this report update, the topside of the pier was inspected by Pare personnel, the underwater portion of the pier was inspected by Inner Tech Marine Services, and the electrical system was inspected by Buia Engineering.

Inspection of the main floats and finger floats indicated extensive deterioration of the concrete modules that make up the concrete floats. Many cracks and spalls were observed on the top of the deck. The concrete on the sides of the float was observed to be severely deteriorated. The deteriorated concrete leads to the weakening of the overall structure and listing of the floats. The mooring piles were noted to be in generally fair condition above and below water with some isolated piles in poor condition; however, many of the pile guides (hoops) and galvanized chain guides were observed to be in poor condition. Many of the pile hoops have been replaced with galvanized chain, which may allow for more movement of the float system and should not be considered a long-term solution. Several of the failing and deteriorated concrete finger floats have been replaced with timber and composite floats over the past several years. Along the fixed pier, the utility conduits are discontinuous, and the timber cross bracing was in poor condition with much of the lower hardware in critical condition. The timber wave fence along the tee-head was observed to be in poor condition with many rotted or broken members. The timber framing and decking of the pier was observed to be in fair condition.

The 2014 inspection report indicated that replacement of the floating docks would likely be required in approximately 3-5 years. Since then, several of the critical float modules have been replaced which has allowed the marina to extend the useful life of the system to keep the marina operation; however, the float system is in need of continuous repair and replacement of critical modules in order for the marina to be safe and useable. The weakened condition of the float system is such that significant storm events will likely cause increasing damage over the short term. More deficiencies were reported during this inspection report update than the previous inspection, indicating that the floating dock system is continuing to deteriorate even with regular repair and maintenance.

It is recommended that the entire marina float system be replaced with a new concrete wave attenuating float along the south side of the marina, and timber main and finger floats along the interior to allow for easier maintenance of floats as described in Alternative 4.

The approximate construction cost to replace the floating dock system with the recommended alternative is in the order of $5,500,000.

In the interim, it is recommended that repairs to critical deteriorated concrete float modules be completed to provide safe operation of the marina until full replacement is completed. The approximate cost to complete these repairs is $509,000; however, a significant cost savings may be realized if these repairs can be completed by marina staff.

1.0 INTRODUCTION

1.1 Background and Objectives

Pope's Island Marina is owned by the Massachusetts Department of Conservation and Recreation (MA DCR) and is leased to the New Bedford Port Authority (NBPA) who maintains and operates the site. The existing marina elements have been routinely inspected approximately every 3-5 years, and minor maintenance at the site is currently carried out on an as-needed basis by NBPA marina employees. The marina was last inspected by Pare in 2014, and previously by Apex Companies LLC in 2011.

Pare Corporation (Pare) was retained by the NBPA in March 2020 to provide an inspection and evaluation of the existing timber pile supported pier, concrete floating docks, finger floats, support piles, and utilities servicing the float system at the Pope's Island Marina. Pare visited the marina on April 6 and April 7, 2020. Engineers performed visual and tactile inspections of the floating docks noting specific locations of observable deficiencies to develop an overall existing conditions report. Pare visited the site again on May 20, 2020 to assess storm damage to the concrete floats on the west end of the site.

Inner Tech Marine Services (InnerTech) visited the site on April 6, 7, and 10 to complete an underwater inspection of the timber pile supported pier and concrete floats. Buia Engineering, Inc. (Buia) visited the site on May 20, 2020 with Pare personnel to investigate the existing electrical configurations, confirm existing drawings, and evaluate the condition of the system to estimate an anticipated remaining useful life.

The purpose of this Inspection Report update is to provide an overall assessment of the condition of the existing marina infrastructure and to provide recommended actions to address observed deficiencies in order to maintain and repair the facility.

1.2 Scope of Work

Pare performed visual and tactile inspections of the existing marina at low water by engineers familiar with the inspection and evaluation of existing deteriorated waterfront structures, and in accordance with the "ASCE Manual and Reports on Engineering Practice No. 130, Waterfront Facilities Inspection and Assessment."

The level of inspection at the marina included:

Level I Inspection

The inspection team completed a Level I inspection on 100 percent of the existing structures. The purpose of the Level I effort was to assess the overall structural condition and to identify, size, and locate significant and obvious signs of damage or deterioration (such as extensive corrosion, spalling or marine borer infestation). Fender elements were only inspected at the Level I effort.

Level II Inspection

A Level II inspection effort was completed on 10 percent of the marina elements and was performed by Innertech. Timber piles were cleaned of marine growth in intervals at mean low

water, mid-pile, and mudline to detect surface defects such as corrosion pitting, marine borer infestation, or mechanical/impact damage.

Level III Inspection

A Level III inspection effort was completed on 5 percent of the marina elements and was performed by Innertech. Timber piles and members were sounded with a hammer and spike. Pile diameter measurements were taken using a pile caliper or by measuring the circumference of the pile and determining the effective diameter.

Recommended repairs and associated cost estimates are included in within this report, along with a conceptual alternatives analysis for reconfiguration of the existing marina.

2.0 DESCRIPTION OF SITE

2.1 Site Location

Pope's Island Marina is a recreational boating facility located at 102 Pope's Island, New Bedford, MA off of Route 6. New Bedford, MA is located directly west of the island, and Fairhaven, MA is located directly east. The New Bedford Hurricane Barrier located to the south provides storm protection to the marina from Buzzard's Bay, with approximately 1-mile of fetch between the barrier and the marina.

2.2 Facility Description

The Marina is comprised of a 450' long timber pile supported main pier, an 810' long timber pile supported tee pier. Six Main floating docks - Dock A, B, C, D, E, and F – are approximately 6 feet wide and approximately 380 feet long, with 4 foot wide finger floats providing the Marina with 198 slips. The floats are held in place with timber piles. Typically the guide piles are driven at the ends of the finger floats, and are installed periodically along the sides of the main floats.

The existing concrete main and finger float modules are comprised of white polystyrene floatation units encased in an approximately 1 to 1.5 inches thick fiber reinforced concrete overlay. The concrete modules are connected with a timber wale on each side of the floats and are fastened with thru-rods. The concrete float modules are considered to be a light duty system, which is stressed during extreme events.

It is Pare's understanding that the existing main timber pier, main floats and finger floats were installed in 1992-1993, with repairs and improvements to the site completed in 2002 and 2006. Minor maintenance at the site is currently carried out on an as-needed basis by marina employees. Tropical Storm Irene caused damage and required additional repairs in 2012, and Pare revisited the site to observe damage from a seasonal storm on May 20, 2020.

3.0 INSPECTION FINDINGS

Based upon the observed conditions, the floats (specifically, the concrete float modules) are at or nearing the end of their useful life. Deterioration of the concrete was widespread along the deck and sides of the concrete mains and finger floats. Cracking and spalling of the deck are indicative of lateral wind and wave loads exceeding the capacity of the floating dock system. The deterioration

and relative displacement of the deck system has created trip hazards at the joints. The steel pile hoops which anchor the floats to the timber guide piles have broken or are seriously rusted and scaled.

Deterioration of the concrete modules along the waterline.

The concrete overlay on the float modules was observed to be significantly deteriorated, soft, and missing in numerous locations along the waterline. The weakening of the concrete leads to an overall reduction in strength, which causes listing of the floats and increased deflection and articulation under wave loads, which further exacerbates the weakened condition. The exact number of deteriorated float modules has not been determined to date; this will require additional underwater inspection. However, inspection of the sides of the modules indicate that the majority of the modules are compromised. The underwater inspection noted that many of the float modules were exposed and extremely fouled with marine growth throughout the marina.

According to marina staff, the NBPA has completed repairs to the original floats that had previously failed. Concrete floats have been replaced and deteriorated decking has been repaired throughout the years as required. Pare noted previously repaired spalls and cracks were observed to have additional deterioration and require further repair.

Pare was called back to the site on May 20, 2020 after marina staff observed damage to Dock D, Dock E, and Dock F after a seasonal storm. Pare noted additional cracks and spalls along the floats which were noted on the existing conditions plan. Some of the pre-existing spalls and cracks were observed to have worsened, causing new trip hazards and damage not originally identified in the initial inspection. Many of the timber triangles and thru rod connections became loose, requiring repair from marina staff. Several of the PVC rollers on the pile guides were observed to be cracked during the initial inspection. Pare noted that after the storm several of the PVC rollers were missing, including at the finger floats for slips 108-109, 110-111, and 116-117, and along the main floats between slips 111-112 on Dock D. It is recommended that three (3) of the concrete main docks between slips 115-117 be replaced due to significant deterioration and additional damage after the storm.

It appears that hardware on the hoop rings may be dissimilar metals than that of the hoop, potentially advancing deterioration of the steel hoop. Additionally, the connection for many pile guide hoops was observed to be loose, causing some of the guide piles to hang in the water. The hoops hanging in the water may deteriorate at a faster rate and these connections should be tightened. Several of the steel angles used for guide pile hoops are missing bolts along the top of the angle. These should be installed to restore the fully functioning capacity.

Details of the inspection findings, including specific locations of the observed deficiencies are presented on the site plans in Figures 1.0 through 4.0. The detailed deficiencies are presented in section 3.1 through 3.3 of this report.

Typically observed deficiencies include:

- Cracking and spalling of the concrete surface was typical across a majority of the floats. (Photo Nos. 3, 4, 5, 7, 8, 9, 10, 14, 17, 18, 25, 27, 28, 29, 31, 34, 35, 36, 37, 38)
- Twenty-two (22) of the concrete finger floats are failing and have started to list. (Photo Nos. 20, 28)
- Fifty-six (56) of the main float sections are failing and have started to list. (Photo No. 13, 17, 26)
- The sides of the concrete floats have failed exposing the polystyrene units. (Photo Nos. 8, 30)
- Twenty-nine (29) of the concrete finger floats have been replaced with timber finger floats. Some of these floats appear to be listing, however, additional underwater inspection is needed to determine if the listing is due to deterioration of the polystyrene float units. (Photo Nos. 10, 22)
- Nine (9) of the concrete main floats have been replaced with timber or composite decking floats. Listing of adjacent concrete floats has caused a trip hazard. (Photo Nos. 26, 31)
- Fifty two (52) of the pile hoops and rub blocks or galvanized chain guides were observed to be broken or heavily corroded. (Photos No. 12, 16, 19, 21, 39)
- Fifty (50) of the pile hoops have been replaced with galvanized chain guides and PVC pipe rollers. The galvanized chains may allow for more movement of the float system and lead to damage of the piles and should not be considered a long-term solution. the extent of deterioration of the chains was limited due to submersion in the water and significant marine growth. (Photos No. 8, 41)
- The connection for one of the timber finger floats failed during a seasonal storm and the float is no longer attached to the main float. (Photo No. 32)

Based upon the number of observed deficiencies along each of the docks, the existing floating docks are in an advanced state of deterioration and disrepair and are at or are nearing the end of their useful life. The listed floats not only present a usability concern, but also have developed into a safety issue. Although immediate repairs of the float system are necessary for safety and functionality, widespread deterioration of the concrete floats will continue to worsen and will likely be significantly affected by storm events even if remedial repairs are not completed. This was observed by Pare personnel after revisiting a site following a seasonal storm, where Pare noted several previous repairs and existing deficiencies had worsened.

The following table quantifies the observed deficiencies at the time of the inspection by presenting the inspection findings for each of the floating docks. This does not include the number of galvanized chain guides which appeared to be in fair condition based on observations above water.

Table 1: Floating Dock Deficiency Summary

		Listed Modules	Spalled Modules	Cracked Modules	Deteriorated Pile Hoops
A-DOCK	Finger Float (76 Total)	20 (26.3%)	40 (52.6%)	65 (85.5%)	7 (63.6%)
	Main Float (47 Total)	0 (0%)	13 (18.6%)	31 (44.3%)	2 (33.3%)
B-DOCK	Finger Float (76 Total)	11 (14.5%)	48 (63.2%)	43 (56.6%)	8 (40.0%)
	Main Float (47 Total)	0 (0%)	32 (68.1%)	14 (29.8%)	2 (40.0%)
C-DOCK	Finger Float (40 Total)	6 (15.0%)	6 (15.0%)	4 (10.0%)	1 (10.0%)
	Main Float (49 Total)	43 (87.8%)	44 (93.6%)	28 (59.6%)	2 (22.2%)
D-DOCK	Finger Float (40 Total)	3 (7.5%)	4 (10.0%)	2 (5.0%)	7 (63.6%)
	Main Float (49 Total)	16 (32.7%)	32 (65.3%)	32 (65.3%)	3 (33.3%)
E-DOCK	Finger Float (80 Total)	17 (21.3%)	35 (43.8%)	41 (51.3%)	13 (59.1%)
	Main Float (47 Total)	0 (0%)	30 (37.5%)	24 (30.0%)	0 (0.0%)
F-DOCK	Finger Float (80 Total)	11 (13.8%)	28 (35.0%)	45 (56.3%)	5 (25.0%)
	Main Float (47 Total)	0 (0%)	27 (57.4%)	27 (57.4%)	3 (42.9%)
TOTAL	Finger Float (392 Total)	68 (17.3%)	161 (41.1%)	200 (51.0%)	41 (43.6%)
	Main Float (286 Total)	59 (20.6%)	178 (62.2%)	156 (54.5%)	12 (28.6%)

3.1 Observed Conditions

The concrete floating docks were observed to be in overall fair to poor condition, including the pile hoops and chain guides for the timber guide piles. Underwater inspection of the timber piles completed by Innertech noted that some piles appeared to have minor superficial damage to the outer ¼" due to marine organisms, but overall appeared to be in fair condition and were sound when hit with a hammer. Circumferences of piles were measured approximately 1 – 2-feet above the mudline, and diameters ranged from 11.1-inches to 14.3-inches. The underwater inspection also indicated that the majority of float modules were deteriorated at the ends exposing the polystyrene units, and were typically covered in marine growth.

A-Dock

A-Dock is in overall poor condition. The concrete modules were observed to be deteriorated at the waterline. Nine (9) of the concrete finger floats and one (1) of the timber finger floats were observed to be listing.

Deteriorated concrete finger float

Spalling was noted on almost all of the finger floats (53% of modules). The main floats are in slightly better condition, with spalls on (19% of modules). Of these spalls, (22) of them were noted to be significant and should be repaired. Cracking was observed along each of the (22) finger floats, with cracks noted on 65 of the 76 concrete modules (86%). Cracks were also observed along the concrete main dock, with (44%) of modules cracked. Pare noted (10) cracks which should be repaired.

The timber wales are typically weathered but are mostly intact and functional. The triangles connecting the finger floats to main floats have all been replaced with timber aside from one, and they appear to be in generally fair condition. Six of the pile hoops anchoring the finger floats were observed to be in poor condition with corrosion and/or missing pile guide pieces, and two of the pile hoops appear to be in poor condition along the main floats. At locations of missing pile hoops, galvanized chain guides have typically been installed. Two (2) of the chain locations were observed to be in poor condition, however, the extent of deterioration of the chains was limited due to submersion in the water and significant marine growth.

B-Dock

Broken galvanized steel chain for timber guide pile.

B-Dock is in overall fair to poor condition. The concrete modules were typically observed to be deteriorated at the waterline. Five finger floats were observed to be listed. Surface spalls were observed across 68% of the main float modules, typically with several spalls per each module. Some of these spalls were noted to be significant and exposing the polystyrene float module beneath the concrete deck. Spalls were also observed on 48 of the 76 modules (63%) finger float modules. Of these spalls, (14) of them were noted to be significant and should be repaired. Cracking of the main float modules was noted at 14 of the 47 modules, and cracking along the finger floats was observed on 43 of the 76 modules (57%). Pare noted that (3) of these cracks should be repaired.

Three (3) finger floats were noted to have been replaced with timber/composite floats since the last inspection, and it appears that (10) of the pile hoops on the finger floats have been recently replaced. One (1) of the pile hoops anchoring a finger float and (2) anchoring the main floats were observed to be in poor condition with corrosion and/or

missing pile guide pieces. At locations of missing pile hoops, galvanized chain guides have typically been installed. One (1) of these chains was noted to be broken, however, the extent of deterioration of the chains was limited due to submersion in the water and significant marine growth.

The timber wales are typically weathered but are mostly intact and functional. The triangles connecting the finger floats to main floats have all been replaced with timber, and they appear to be in generally fair condition. A timber wale has fallen off near slip 72 of the triangle.

C-Dock

Listing of the concrete main floats

C-Dock is in overall fair poor condition. Approximately forty-three (43) of the main float modules were observed to be listed and failing. The concrete modules were typically observed to be deteriorated at the waterline along both the main float and finger floats.

Surface spalling was noted throughout the remaining concrete finger and main floats, with 6 of 40 finger float modules (15%) spalled, and 44 of 49 main float modules (94%) spalled. The finger floats that weren't observed to have any spalling had previously been replaced with timber floats. Of these spalls, (24) of them were noted to be significant and should be repaired. Cracking of the finger floats was observed at 4 of 40 modules (10%) and 28 of 49 main float modules (60%). Pare noted that (13) of these cracks should be repaired.

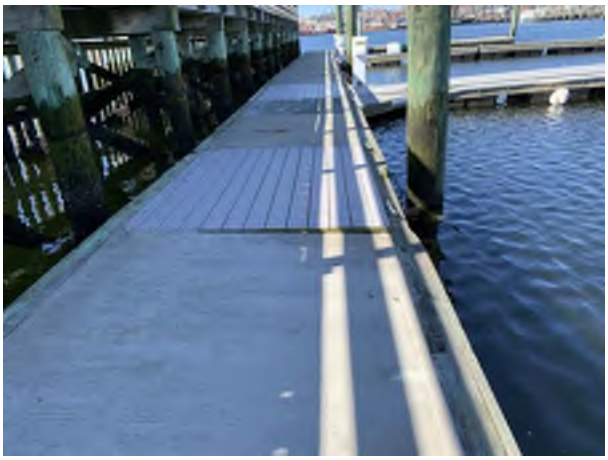
Eight (8) finger floats were noted to have been replaced with timber/composite floats since the last inspection, including the replacement of pile hoops. It appears that two (2) additional pile hoops were replaced on the remaining concrete finger dock and along the main float. It was noted that (4) of the recently replaced hoops had cracks in the PVC roller, but appeared to be functioning. The pile hoop at slip 81 was observed to be sitting in the water, potentially accelerating corrosion. At locations of missing pile hoops, galvanized chain guides have typically been installed. One (1) of these chains was noted to be broken, however, the extent of deterioration of the chains was limited due to submersion in the water and significant marine growth. A pile appears to be missing near the connection to the main float for finger 81.

The timber wales are typically in fair condition, with minor weathering typical. The triangles connecting the finger floats to main floats have all been replaced with timber, and they appear to be in generally fair condition. The triangle connections at slip 84, 85, 86, 87, 93 appear to be failing, causing a potential trip hazard.

D-Dock

D-Dock is in overall poor condition. Concrete modules were typically observed to be deteriorated at the waterline along both the finger floats and main floats. Finger floats 100/101

was observed to be listed and approximately 16 of the main float modules were observed to be listed as well.



Main float modules replaced with timber/composite floats with tripping hazard

Surface spalling was noted at 4 of 40 finger float modules (10%), and also along 32 of 49 main float modules (65%). Of these spalls, (27) of them were noted to be significant and should be repaired, some with exposed polystyrene floatation units and/or tripping hazards. Cracking of the concrete finger floats was observed at 2 of 40 modules (5%) and 32 of 49 main float modules (65%). Pare noted that (32) of these cracks should be repaired.

Four (4) finger floats were noted to have been replaced with timber/composite floats since the last inspection, totaling eight (8) finger floats that were replaced including the replacement of pile hoops. It appears that three (3) along the main float, and one (1) was replaced along the end finger float. It was noted that seven (7) of the pile hoops had missing PVC rollers, five of which were observed to be destroyed during a seasonal storm in May. At locations of missing pile hoops, galvanized chain guides have typically been installed. One (1) of these chains was noted to be broken, and two (2) of the chains had ineffective PVC rollers which has lead to section loss of the timber piles. Minor to moderate chafe of the timber guide piles at the ends of finger floats were noted due to ineffective PVC rollers, and the finger float at 100/101 was observed to have approximately 40% section loss. The extent of deterioration of the chains was limited due to submersion in the water and significant marine growth. Pare noted that many of the steel angles on floats were missing the bolts along the top of the angle. These should be installed to prevent loss or damage to the pile guide system.

Three (3) of the main float modules have been repaired with a timber or composite deck section, totaling nine (9) main float modules which have been replaced. The adjacent concrete float modules next to recently replaced floats are continuing to list, causing a potential trip hazard.

The timber wales are typically in fair condition, with minor weathering typical. The triangles connecting the finger floats to main floats have all been replaced with timber, and they appear to be in generally fair condition. The triangle connections at slip 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, and 117 appear to be displaced or failing, causing a potential trip hazard. The triangle at slip 107 was overturned during the time of inspection, causing a pedestal to fall over.

Pare visited the site on May 20, 2020 to observe damage to Dock D after a seasonal storm. The finger float for slip 137 appears to have become shifted, potentially from displaced polystyrene flotation units and several large pieces of polystyrene float modules have become dislodged from the concrete floats on Dock D, which appear to be from between slips 103/104 of the main floats. Several of the PVC rollers on the pile guides were observed to be cracked during the initial inspection, and Pare noted that after the storm several of the PVC rollers were missing, including at the finger floats for slips 108/109, 110/111, and 116/117, and along the main floats between slips 111-112.

Marina staff also noted that several floats and triangle connections became loose and require repair, including:

Displaced polystyrene float units after seasonal storm

- 100/101 – loose finger float and triangle connection. Pare noted that the finger float also appears to be listed more than previously observed during the initial inspection.
- 103/104 – polystyrene float unit broke away from main float between slips
- 106/107 – loose finger and (2) triangle connections
- 108/109 – loose finger and (2) triangle connections
- 110 – loose finger float and triangle connection
- 112/113 – loose finger float and triangle. Pare noted that the hoops, steel angle, and PVC roller were all missing from the float.
- 113/114 – loose finger float and triangle
- 113/114 – main dock loose rods
- 117/118 – main dock loose rods

Pare noted significant deterioration and additional damage to three (3) of the concrete main docks between slips 115-117 and should be replaced, or replace the concrete deck.

E-Dock

E-Dock is in overall poor condition. Concrete modules were typically observed to be deteriorated at the waterline along the finger floats and main floats. Six (6) concrete finger floats were observed to be listed, along with one (1) timber float listed.

Surface spalling was noted at 35 of 80 finger float modules (44%), and also along 30 of 47 main float modules (38%). Of these spalls, (34) of them were noted to be significant and should be repaired. Cracking of the concrete finger floats was observed at 41 of 80 modules (51%) and 24 of 49 main float modules (30%). Pare noted that (15) of these cracks should be repaired.

Six (6) pile hoops are located at the ends of finger floats, two (2) of which are broken and require repair. At locations of missing pile hoops, galvanized chain guides have typically been installed. There are two locations where there is no pile hoop or chain guide (146/147 and 121/122). Minor to moderate chafe of the timber guide piles and wales at the ends of finger floats was noted to be typical due to ineffective or missing PVC rollers or timber rub blocks at the ends of the floats. The extent of deterioration of the chains was limited due to submersion in the water and significant marine growth. Pare noted that two (2) of the steel angles on floats for the pile hoops were missing the bolts along the top of the angle. These should be installed to prevent loss or damage to the pile guide system.

Deteriorated concrete finger float with listing

Three (3) finger floats noted to be listing and failing during the previous inspection have been replaced with timber floats (127/128, 133/134, 135/136) and one additional finger float has been replaced with timber (154/155).

The timber wales are typically in fair condition, with minor weathering typical. The timber wale at the T-head of the main and finger floats was observed to be falling off, and a small portion of the wale near slip 134 is missing. The triangles connecting the finger floats to main floats have all been replaced with timber, and they appear to be in generally fair condition. The plywood deck for the triangle connection at slip 136 has been disconnected, causing a potential trip hazard.

Pare visited the site on May 20, 2020 to observe damage to Dock D after a seasonal storm. A main float along Dock E near slip 134 has shifted causing a trip hazard and further damage to the deteriorated concrete.

Marina staff also noted several other areas damaged by the storm requiring repair:

- 132/133 – main dock loose and broken rods
- 150/151 – loose finger float and triangle. Pare noted that one of the float modules appears loose when stepped on.
- 137 – newly installed float shifted, T-bracket broke, loose rods, loose triangle, cracked inner wale. Pare noted that the pile hoop had broken off and it appears that float units may be displaced beneath the float. Pare noted that this float was listed during the initial inspection and the T-bracket was not connected to the finger float; however, the listing and damage appears to be worse after storm damage.

F-Dock

F-Dock is in overall fair poor condition. The concrete modules along the main float and finger floats were typically observed to be deteriorated at the waterline. Two (2) finger floats noted to be listed during the previous inspection are still in use and listed (165/166, 167/168), and two (2) additional concrete finger floats were noted to be listed (169/170, 175).

Surface spalling was noted at 28 of 80 finger float modules (35%), and also along 27 of 47 main float modules (57%). Of these spalls, (28) of them were noted to be significant and should be repaired. Cracking of the concrete finger floats was observed at 45of 80 modules (56%) and 27 of 47 main float modules (57%). Pare noted that (27) of these cracks should be repaired.

There are eight (8) pile hoops located at the ends of finger floats, one of which is missing the PVC roller and has caused moderate pile damage (198). One of these hoops is also covered in a rope, indicating the hoop may be significantly deteriorated and require replacement (157/158).

Replacement timber finger float

There are five (5) pile hoops located along the main docks, and three (3) of them have broken timber rub blocks which should be repaired. At locations of missing pile hoops, galvanized chain guides have typically been installed. There is one location where there is no pile hoop or chain guide (167/168). The extent of deterioration of the chains was limited due to submersion in the water and significant marine growth. Pare noted two (2) of the steel angles on floats for pile hoops were missing bolts along the top of the angle. These should be installed to prevent loss or damage to the pile guide system.

Two (2) finger floats noted to be listing and failing during the previous inspection have been replaced with timber floats (171/172, 196/197) and one additional finger float has been replaced with timber (163/164), totaling four (4) timber finger floats.

Pare visited the site on May 20, 2020 to observe damage to Dock D after a seasonal storm. Pare noted that between 196/197 on the main float there appeared to be more damage to deteriorated concrete.

Marina staff noted several other areas damaged by the storm requiring repair:

- 189/190 – main dock rods loose/detached.
- 190/191 – finger float on Dock F detached

Electrical and Utilities

Pare's electrical engineering subconsultant, Buia Engineering, Inc. (Buia), reviewed the existing electrical drawings and assessed existing conditions of the electrical system on site. A copy of Buia's inspection findings report is included in Appendix E of this report.

Buia met with the marina staff on site to review issues. The staff indicated that the power pedestals on the west side of the T-Head were being replaced because many of them were broken. They also indicated that replacing circuit breakers in the panelboards feeding the float power pedestals was a typical occurrence.

The Eversource electrical bills from July 2019 to December 2019 were reviewed which indicated that the peak electrical demand occurred in August at 172 KVA, which is 230 Amps at 480 Volts. Buia noted that the switchboard is rated for 800 Amps, noting that the actual peak demand is only 29% of the switchboard rating.

Buia noted that the Challenger Power Master PRL4 Panelboard is 29 years old and appears to be in good condition, and that marina staff did not indicate any problems with the switchboard. The five (5) substation panelboards rated at 400 Amps, 120/208 Volts were observed to be in fair condition. The power pedestals located on the floats were observed to be in fair condition,

however, marina staff indicated that replacement parts are difficult to order when repair is required. Buia noted that a temporary ground wire is in use until the power pedestal cable with a defective ground wire is replaced at Dock A.

Pare noted that the utility hangers along the underside of the fixed pier appeared to be in fair condition; however, steel straps connecting supply lines to the framing were observed to have minor to moderate corrosion. A blue PVC dry line was observed to be missing in several locations along the length of the main pier, and the steel fire line was observed to have moderate corrosion along the T-head between bent 21 to 62 from west to east. There is a conduit along the south side of the T-head which appears to be broken throughout the length. Pare also noted that several connections between light posts and conduits were disconnected.

Overall, the marina's electrical system appears to be functioning properly with consistent maintenance. However, the system is approximately 29 years old and replacement parts are becoming difficult to order. It is recommended that the marina begin planning for replacement of the electrical system with a new system.

Pile Supported Pier

The pile supported pier was observed to be in overall fair condition with the exception of the timber cross bracing and wave fence which were observed to be in poor to severe condition.

The underwater inspection completed by Innertech noted that minor deterioration in the outer ¼" of timber piles from marine borers was typical, but no section loss was observed. The piles were sound when hit with a hammer, and the majority of piles were relatively smooth to the touch and visibly green with CCA treatment after being cleaned. The circumference of the timber piles was measured and ranged from approximately 37-inches to 41-inches, indicating a pile diameter of 11.8-inches to 13.1 inches. A copy of the report is included in Appendix D of this report.

The timber cross bracing was observed to be in poor to severe condition, with the majority of bottom connection hardware rusted off or severely corroded. Several of the braces along the main pier and the majority of cross braces along the T-head were noted to be split or have up to 100% section loss at the bottom.

The timber wave fence is in poor to severe condition, with the majority of deterioration near mean low water. Deterioration of the bottom of the wave fence panels and severe corrosion of connection hardware was typical, and the lower wale was observed to be in critical condition or missing along the length.

Timber wave fence along T-head of pier

The timber fender piles along the length of the T-head were in overall fair condition; however, the hardware connecting the fender piles to the support piles was observed to have moderate to severe corrosion typical. The majority of the connections appear intact, but

consideration should be given to replacement of hardware with replacement of the marina floats. Isolated fender piles were observed to be in poor condition or broken at along the T-head at bent 2, 42, and 43 from the west to east. Damage to the rub blocks on the face of the fender piles was observed at bents 25, 40, 47, 59, 80, and 81. The majority of timber ladders were observed to not be long enough and should be replaced.

3.2 Comparison with Previous Inspection Report

The previous report completed in 2014 indicated that the floating docks would require replacement in approximately 3 – 5 years. Since then, some of the critical float modules have been replaced which has allowed the marina to extend the useful life of the system and continue to use the floats. However, the float system is in need of continuous repair and replacement in order for the marina to be safe and useable, therefore the entire float system should be replaced.

Pare noted the condition of the concrete floating docks appears to have gotten worse since the last inspection, with many of the previous concrete spall and crack repairs continuing to deteriorate and present a safety hazard. Twenty-nine (29) of the concrete finger floats and nine (9) of the concrete main floats have been replaced with timber and composite floats since the last inspection; however, more deficiencies were noted than in previous inspections indicating that the floating dock system is continuing to deteriorate even with regular repair and maintenance.

NBPA staff provided Pare with a 2019 Repair Plan for floating dock replacement and concrete float repair. The plan identifies floating docks that have been replaced with timber to date, and also indicates proposed concrete spall repairs and repairs that have been completed to date. Pare noted that (1) additional finger float on Dock D and (1) additional finger float on Dock F had been replaced with timber.

4.0 ALTERNATIVES ANALYSIS

The following marina replacement alternatives, with general scope of work, pros and cons, and opinion of probable cost (provided in Section 6.0) are provided in the following sections.

1.1 Alternative No. 1: Replace-In-Kind

This alternate considers full replacement of the floating docks and associated amenities and hardware using the same layout and configuration as the existing marina. Based upon the results of the inspection, this alternate would reuse the existing timber piles to support the new facility; however, during the course of construction some isolated pile replacements may be required. The existing wave fence will require replacement to protect the new floating docks.

Alternative No. 1A: Replace-In-Kind Hybrid

This variation of Alternative No. 1 considers replacement of the floating docks with a combination of concrete main docks and timber finger docks.

1.2 Alternative No. 2: Replace with New Configuration

This alternate considers reconfiguration of the existing marina. Given the current layout of the existing pile supported pier was observed to be in fair condition during inspection,

reconfiguration is somewhat limited. This option includes full replacement of all floating docks, including new timber guide piles. As shown, the marina would be provided with concrete floating docks around the perimeter of the layout, with timber main and finger floats along the interior of the site. The existing wave fence will require replacement to protect the new floating docks. It should be noted that this alternative does not optimize the number of slip spaces or the access to the new slips but provides full replacement of the elements.

1.3 Alternative No. 3: Replace with Expanded Configuration

This alternate expands the existing footprint of the marina to the west to increase berthing and revenue. The potential expansion would require coordination with neighboring properties, and will need to consider the existing mooring basin just beyond the southwest corner of the existing facility. Expansion to the east of the marina would impact the existing public access docks and encroach on the existing mooring field and was not included in this evaluation. It is anticipated that the existing floating docks will be replaced with new concrete docks, reusing the existing timber piles with the exception of the new piles required to support the expansion. However, during the course of construction some additional pile replacements may be required. The existing wave fence will require replacement to protect the new floating docks.

1.4 Alternative No. 4: Replace with Concrete Wave Attenuator System

This alternate considers full replacement of the floating docks and associated amenities and hardware. It uses the same layout and configuration of the existing marina; however, Dock C and Dock D will be replaced with concrete wave attenuating floating docks. The wave attenuating docks are provided with wave baffels to withstand wave action and dissipate energy to protect the interior of the marina, making the existing wave fence obsolete. The concrete wave attenuators can be supported with steel pipe piles and are considered to be a heavier duty system compared to the existing concrete floats. The wave attenuators will facilitate the use of timber main and timber finger floats on the interior of the marina where existing timber piles can be used. In addition, if timber floats are utilized along the inside of the marina, repair and full replacement of the float modules may be completed by marina staff depending on the float type instead of utilizing a Marina Contractor making it easier for long-term maintenance.

1.5 Alternative No. 5: Do Nothing and Continue Annual Repairs

Repairs of deteriorated concrete float modules will be required to provide safe operation of the marina for the upcoming season. This includes cracks greater than 1/16", cracks that pose a tripping hazard, or ones that are connected to a spall. Spall repairs should be completed on deteriorated areas greater than 4" in diameter, in areas that pose a tripping hazard, in areas that have exposed polystyrene float units, or in areas where the previous spall repair has failed. Repair of deteriorated concrete float module decking with composite decking, timber or concrete will provide a better walking surface, but does not contribute to the strength of the floats or address the deterioration and listing of the float modules.

This alternative does not address the long-term repairs that will continue to develop and worsen. This does not address the concrete modules that have cracked, or areas where the concrete matrix at the waterline has deteriorated and is missing in many locations. Minor repairs will not repair the floats that are listing. Repairs to deteriorated concrete spalls and cracks have been completed by marina staff in the past; however, many of these repairs were

noted to have continuing deterioration and damage, indicating that the light duty concrete floats continue to exceed their capacity.

5.0 SUMMARY OF RECOMMENDATIONS

As was highlighted several times above, the floating dock system at the Marina is in a weakened condition requiring continuous repair and is at or nearing the end of its useful life. The modules are continuously losing structural strength and can likely not be easily repaired.

The existing concrete floats are considered to be a light duty system. Typical industry standards for concrete floats exposed to a relatively high wind and wave climate, such as exists at the Pope's Island Marina, consist of 3-inch reinforced concrete decks and 2-inch to 3-inch thick sides and bottoms. As such, this light duty system is susceptible to damage and deterioration during storm events, and will require ever-increasing repair and maintenance until the system is replaced with a new system of floating docks.

The repair and replacement of the concrete float modules is above the capacity and capability of the NBPA staff, as the fabrication of the concrete float modules, and the installation of the concrete float modules, will require the services of a Marine Contractor utilizing a crane barge.

It is recommended that the float system be replaced with new concrete floating wave attenuators along the length of the timber pile supported pier with timber main and finger floats along the interior as outlined in **Alternative 4.** The concrete wave attenuators provide a more effective system for wave energy dissipation and can be designed to withstand a maximum wave height and length specific to the marina's wave climate within Buzzard's Bay.

Electrical System

At present, the electrical system is providing electrical service in accordance with the posted service on the Marina Slip Layout. Replacement of the electrical system should be considered with full replacement of the marina as the system is 29 years old.

Timber Pile Supported Pier

The existing pile supported pier was observed to be in overall fair condition with the exception of the timber cross bracing and wave fence, which were noted to be in poor to severe condition. It is recommended that the timber cross bracing be replaced with new 4x10 timbers along the length of the pier. The recommended replacement for the marina considers the demolition and removal of the existing timber wave fence; however, if a different alternate is selected the timber wave fence should be replaced in kind. Many of the timber ladders along the T-head of the pier were observed to not be long enough and should also be replaced. Several fender piles and rub blocks were noted to be damaged and should be replaced. Moderate to severe corrosion of the steel hardware was noted to be typical, and replacement should be considered with replacement of the marina system.

Permitting and Construction Considerations

Should the NBPA wish to move forward with the replacement of the marina, it is anticipated that design and permitting may last approximately 2-years, leading to a Winter 2022 construction time frame. In addition, the concrete float attenuators in the recommended alternative have a longer lead time due to the

extensive fabrication; however, purchase of the floats in advance could allow the bid phase to be completed within the lead time of the floats and facilitate other upgrades or demolition work.

6.0 COST ESTIMATES

The following provides opinions of probable construction costs for the intermediate repairs and alternative replacements for the marina. A 15% contingency has been included in the presented costs. A detailed cost breakdown for the intermediate repairs and each alternative are provided in Appendix B.

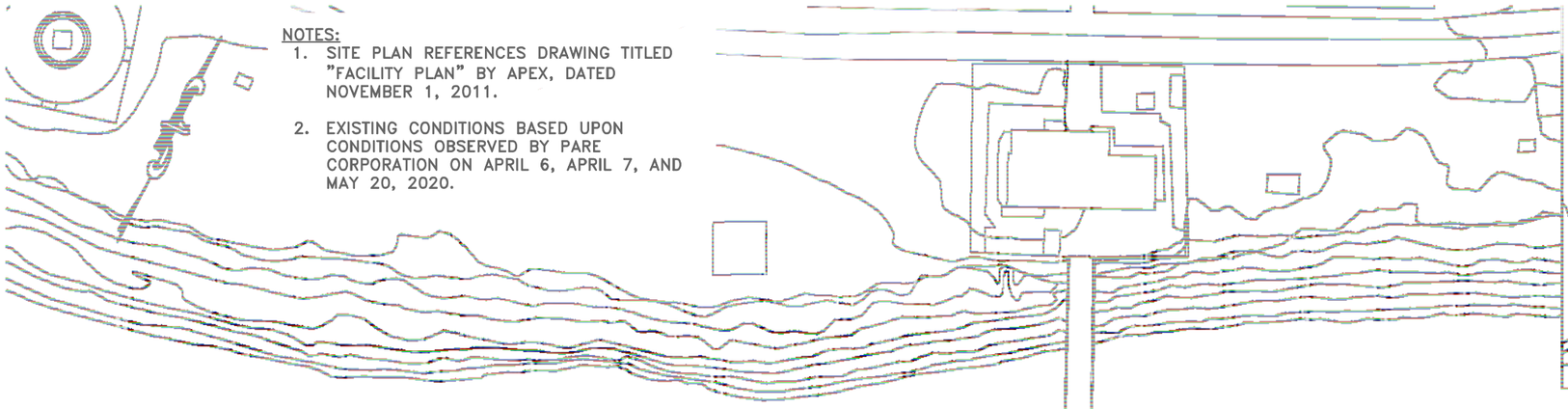
Table 2: Opinion of Probable Cost

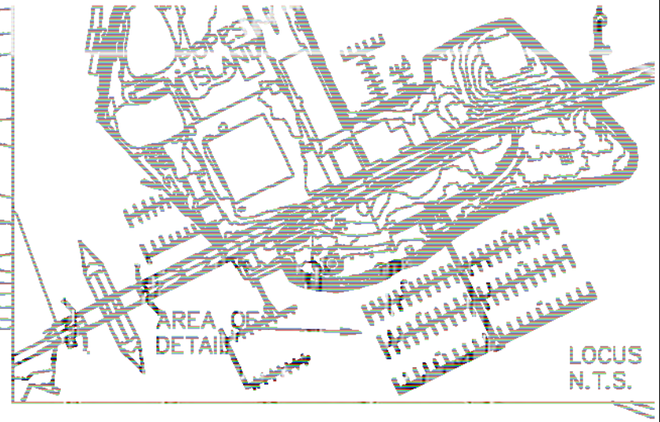
Alternative	Alternative Title	Description	Opinion of Probable Cost
Intermediate Repairs		Concrete spall repair, concrete crack repair, pile hoop repair, PVC/timber roller repair, timber triangle repair, concrete float replacement with timber, fender pile rub block replacement, ladder replacement	$509,000
Alternative 1	Replace-In-Kind	Full replacement of the floating docks and associated hardware and amenities in-kind with concrete, replacement of timber cross bracing, replacement of timber wave fence, replacement of timber ladders, replacement of select timber piles, timber fender piles	$6,049,000
Alternative 1A	Replace-In-Kind Hybrid (Concrete Mains and Timber Fingers)	Full replacement of the floating docks and associated hardware and amenities in-kind with concrete mains and timber fingers, replacement of timber cross bracing, replacement of timber wave fence, replacement of timber ladders, replacement of select timber piles, timber fender piles	$5,350,000
Alternative 2	Replace with New Configuration	Full replacement of the floating docks and associated hardware and amenities with reconfiguration of concrete and timber docks, replacement of timber cross bracing, replacement of timber wave fence, replacement of timber ladders, replacement of select timber piles, timber fender piles	$6,891,000
Alternative 3	Replace with Expanded Configuration	Full replacement of the floating docks and associated hardware and amenities with expanded configuration of concrete docks, replacement of timber cross bracing, replacement of timber wave fence, replacement of timber ladders, replacement of select timber piles, timber fender piles	$6,575,000
Alternative 4	Replace with Concrete Wave Attenuator System	Full replacement of the floating docks and associated hardware and amenities with new concrete wave attenuating floats along the south side of the marina and interior timber main and finger floats, replacement of timber cross bracing, replacement of timber wave fence, replacement of timber ladders, replacement of select timber piles, timber fender piles	$5,499,000

FIGURES AND DRAWINGS

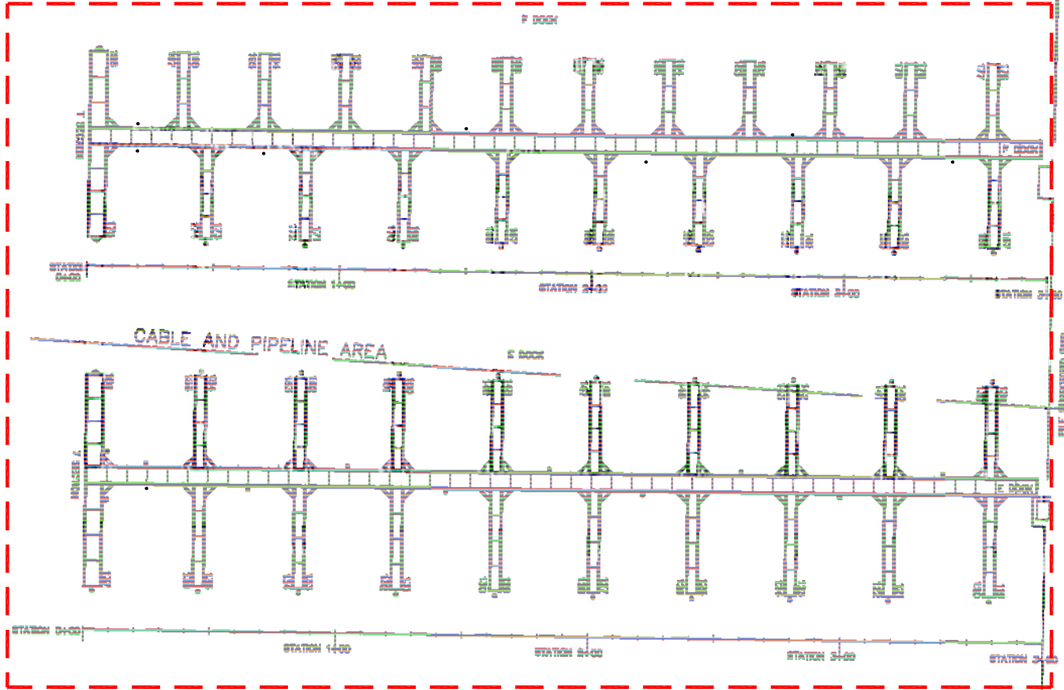
NOTES:

1. SITE PLAN REFERENCES DRAWING TITLED "FACILITY PLAN" BY APEX, DATED NOVEMBER 1, 2011.
2. EXISTING CONDITIONS BASED UPON CONDITIONS OBSERVED BY PARE CORPORATION ON APRIL 6, APRIL 7, AND MAY 20, 2020.

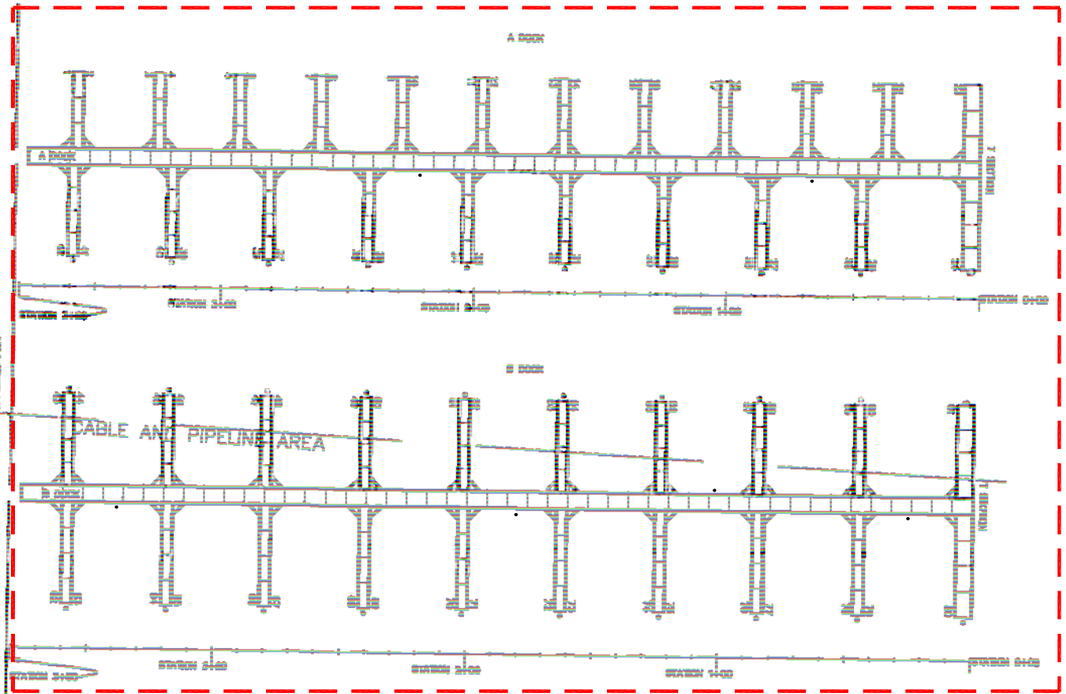




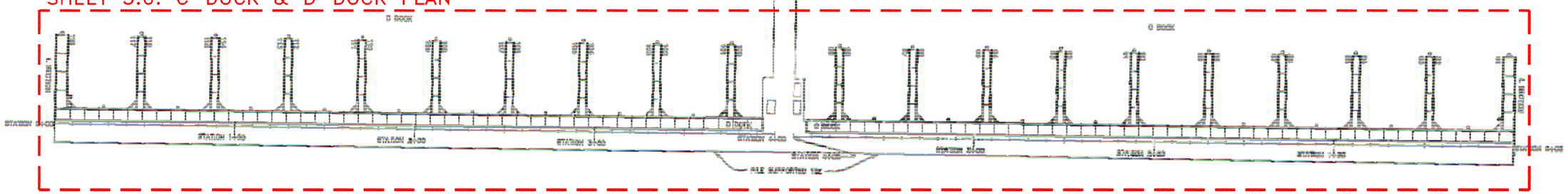
SHEET 4.0: E-DOCK & F-DOCK PLAN



SHEET 2.0: A-DOCK & B-DOCK PLAN



SHEET 3.0: C-DOCK & D-DOCK PLAN



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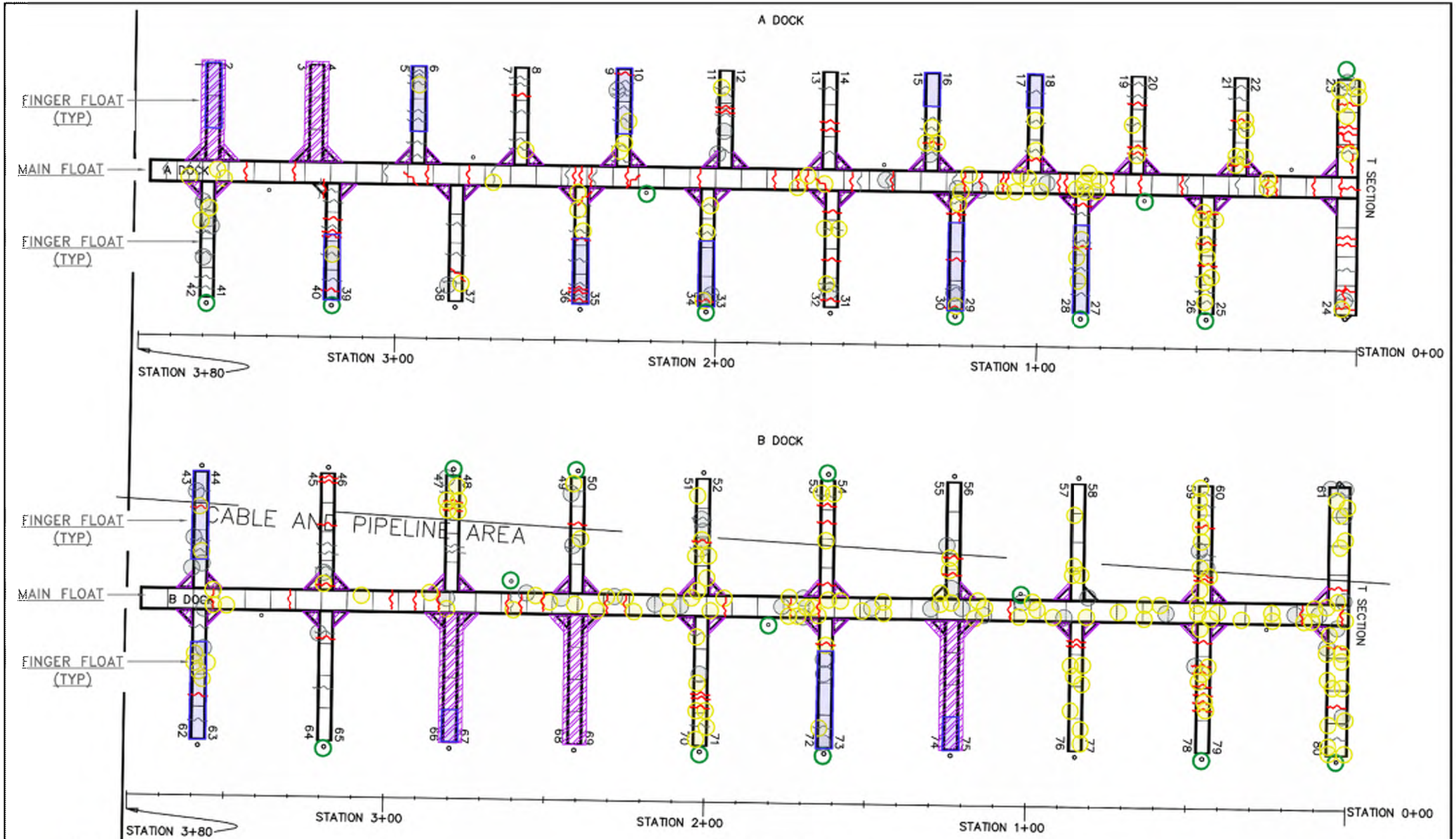
POPE'S ISLAND MARINA
INSPECTION UPDATE
NEW BEDFORD PORT AUTHORITY
NEW BEDFORD, MASSACHUSETTS

REVISIONS:

PROJECT NO.:	20058.00
DATE:	JUNE 2020
SCALE:	1"=60'
DESIGNED BY:	DJG
CHECKED BY:	RMM
DRAWN BY:	LMC/DJG
APPROVED BY:	JMB

DRAWING TITLE:
POPE'S ISLAND MARINA KEY PLAN

DRAWING NO.:
1.0
SHEET NO.: 1 OF 4



LEGEND:

- LISTED FLOAT
- CONCRETE CRACK
- CONCRETE SPALL
- POOR PILE HOOP
- TIMBER FLOATS
- PREVIOUS DEFICIENCY

EXISTING CONDITIONS PLAN

SCALE: 1"=30'-0"

CRITICAL MODULE DEFICIENCIES: A–DOCK		
FLOAT	Crack	Spall
MAIN	1	5
FINGER	9	17

CRITICAL MODULE DEFICIENCIES: B–DOCK		
FLOAT	Crack	Spall
MAIN	1	2
FINGER	2	12

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INSPECTION UPDATE

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REVISIONS:

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SCALE:	1"=30'
DESIGNED BY:	DJG
CHECKED BY:	BMM
DRAWN BY:	LMC/DJG
APPROVED BY:	JMB

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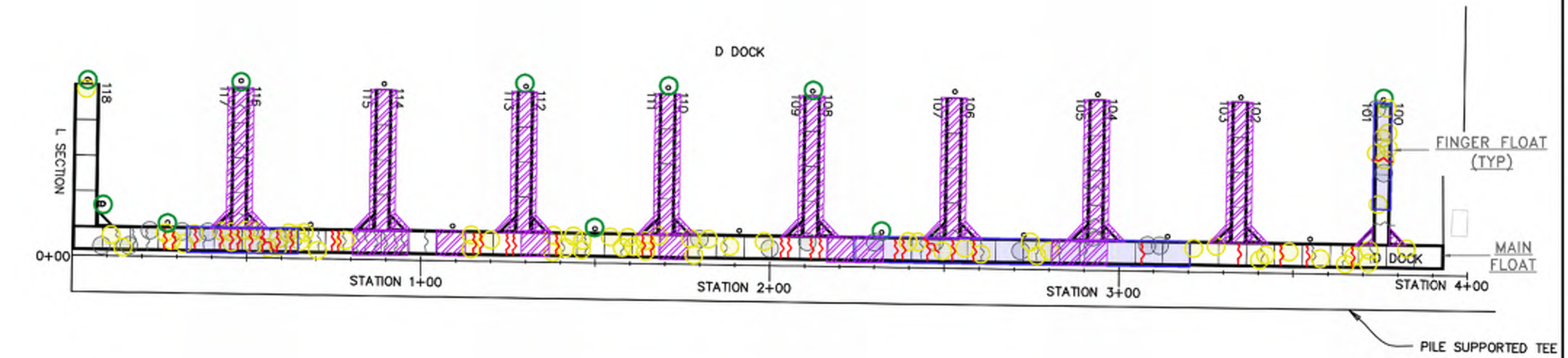
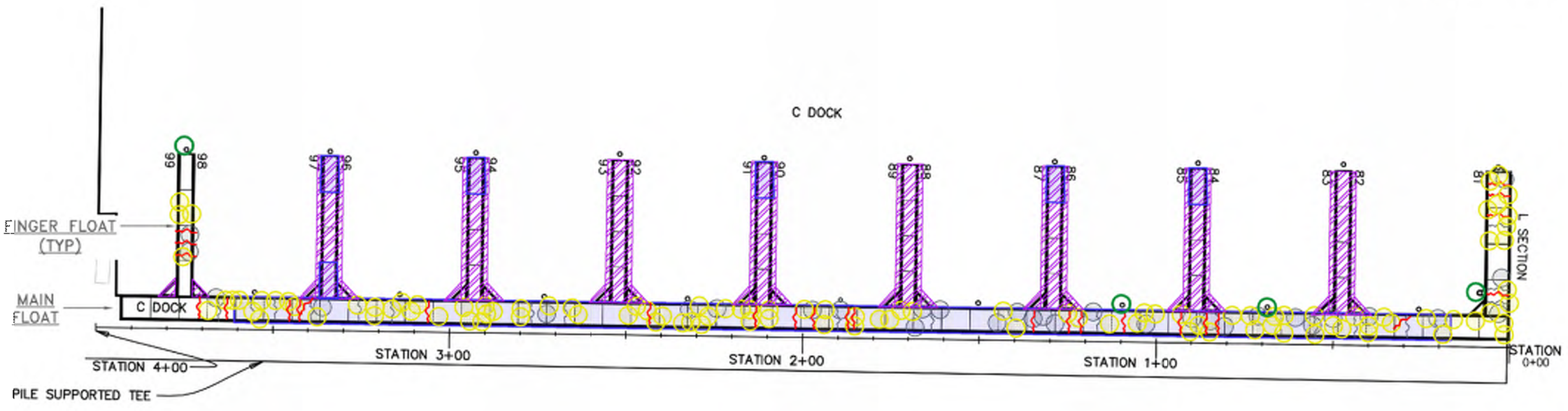
A–DOCK & B–DOCK PLAN

DRAWING NO.:
2.0

SHEET NO.: 2 OF 4





LEGEND:

- LISTED FLOAT
- CONCRETE CRACK
- CONCRETE SPALL
- POOR PILE HOOP
- TIMBER FLOATS
- PREVIOUS DEFICIENCY

EXISTING CONDITIONS PLAN

SCALE: 1"=30'-0

CRITICAL MODULE DEFICIENCIES: C-DOCK		
FLOAT	Crack	Spall
MAIN	10	6
FINGER	3	18

CRITICAL MODULE DEFICIENCIES: D-DOCK		
FLOAT	Crack	Spall
MAIN	31	27
FINGER	1	5

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INSPECTION UPDATE

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NEW BEDFORD, MASSACHUSETTS

REVISIONS:

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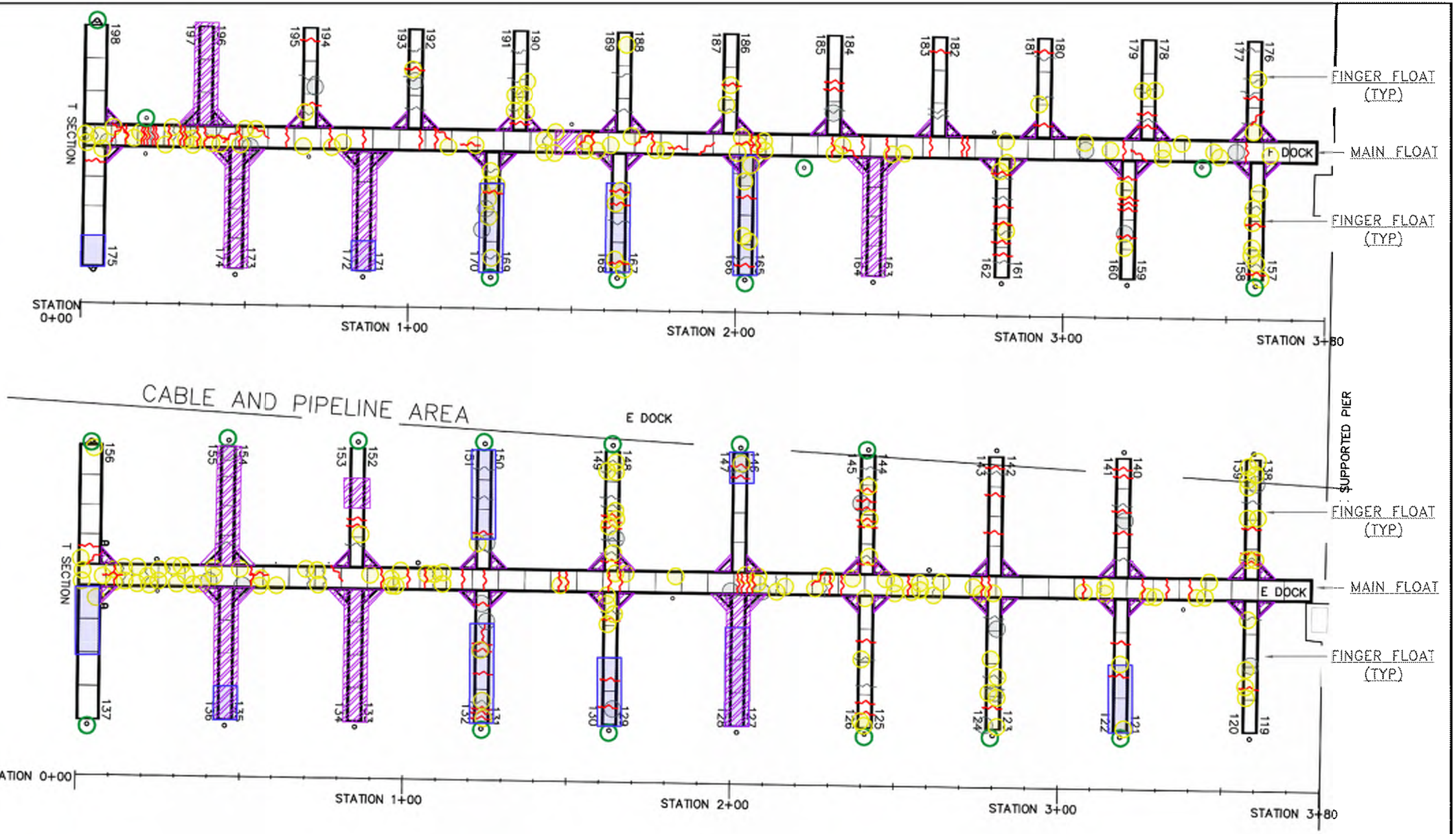
APPROVED BY:	JMB

DRAWING TITLE:
C-DOCK & D-DOCK PLAN

DRAWING NO.:
3.0
SHEET NO.: 3 OF 4



LEGEND:

- LISTED FLOAT
- CONCRETE CRACK
- CONCRETE SPALL
- POOR PILE HOOP
- TIMBER FLOATS
- PREVIOUS DEFICIENCY

EXISTING CONDITIONS PLAN

SCALE: 1"=30'-0"

CRITICAL MODULE DEFICIENCIES: E-DOCK		
FLOAT	Crack	Spall
MAIN	5	16
FINGER	10	18

CRITICAL MODULE DEFICIENCIES: F-DOCK		
FLOAT	Crack	Spall
MAIN	18	15
FINGER	9	13

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APPROVED BY:	JNB

DRAWING TITLE
E-DOCK & F-DOCK PLAN

DRAWING NO.:
4.0
SHEET NO.: 4 OF 4

NOTES:

1. SITE PLAN REFERENCES AVAILABLE AERIAL IMAGERY FROM MASSACHUSETTS GIS AND NOTES TAKEN DURING THE INSPECTION.

SLIP TOTALS

A	42
B	38
C	19
D	19
E	38
F	42
TOTAL:	198

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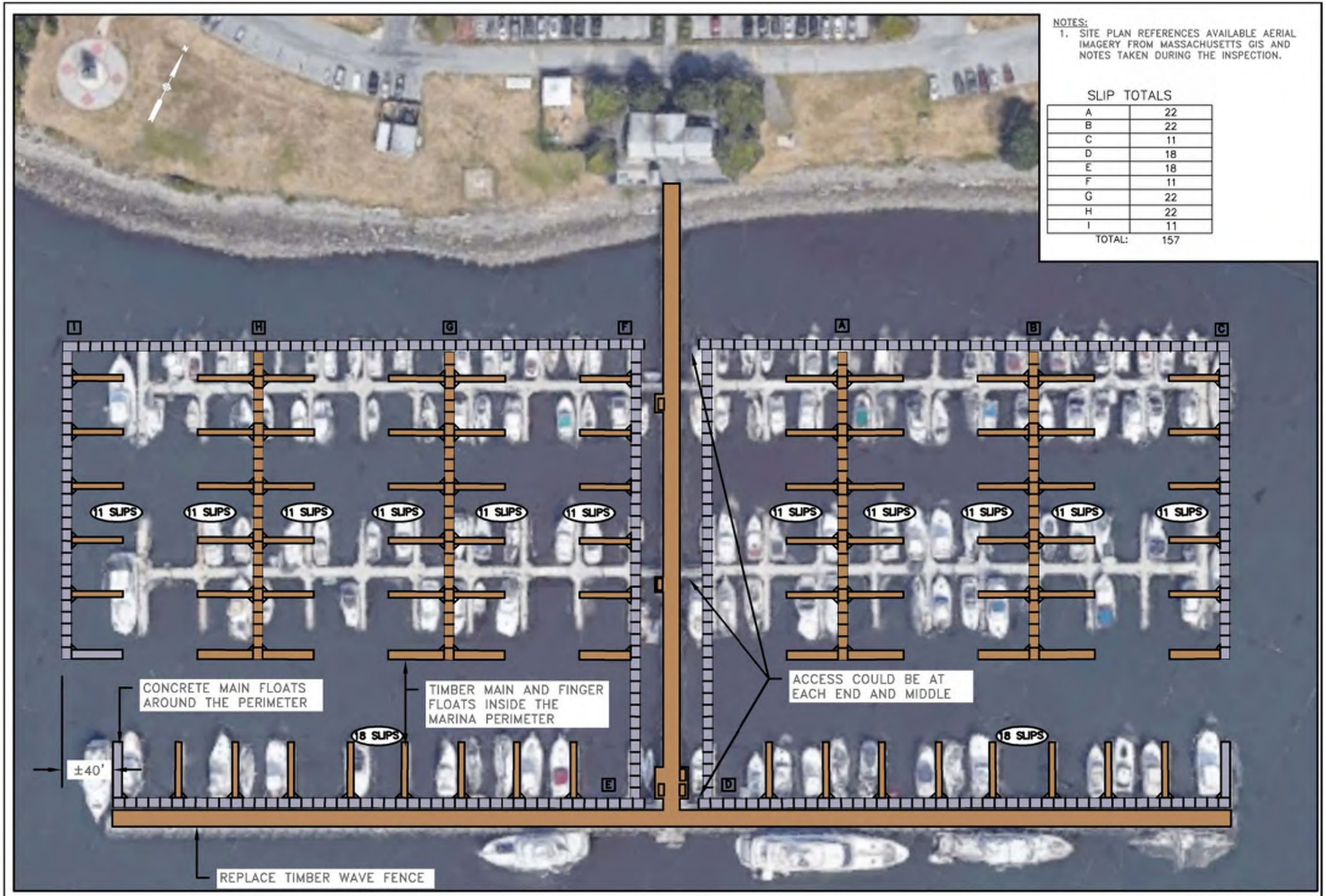
APPROVED BY:	JMB

DRAWING TITLE:
ALTERNATIVE 1 REPLACE IN-KIND

DRAWING NO.:
A-1
SHEET NO.: 1 OF 4



NOTES:

1. SITE PLAN REFERENCES AVAILABLE AERIAL IMAGERY FROM MASSACHUSETTS GIS AND NOTES TAKEN DURING THE INSPECTION.

SLIP TOTALS

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B	22
C	11
D	18
E	18
F	11
G	22
H	22
I	11
TOTAL:	157

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SCALE:	1"=30'±
DESIGNED BY:	DJG
CHECKED BY:	RMH
DRAWN BY:	LMC/DJG
APPROVED BY:	JMB

DRAWING TITLE:

ALTERNATIVE 2 RECONFIGURATION

DRAWING NO.:

A-2

SHEET NO.: 2 OF 4

NOTES:
1. SITE PLAN REFERENCES AVAILABLE AERIAL IMAGERY FROM MASSACHUSETTS GIS AND NOTES TAKEN DURING THE INSPECTION.

SLIP TOTALS

A	42
B	38
C	19
D	19
E	50
F	56
TOTAL:	224

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REVISIONS:

PROJECT NO.:	20058.00
DATE:	JUNE 2020
SCALE:	1"=30'
DESIGNED BY:	DJG
CHECKED BY:	RMM
DRAWN BY:	LMC/DBD
APPROVED BY:	JMB

DRAWING TITLE:
ALTERNATIVE 3 MARINA EXPANSION

DRAWING NO.:
A-3

SHEET NO.: 3 OF 4

NOTES:

1. SITE PLAN REFERENCES AVAILABLE AERIAL IMAGERY FROM MASSACHUSETTS GIS AND NOTES TAKEN DURING THE INSPECTION.

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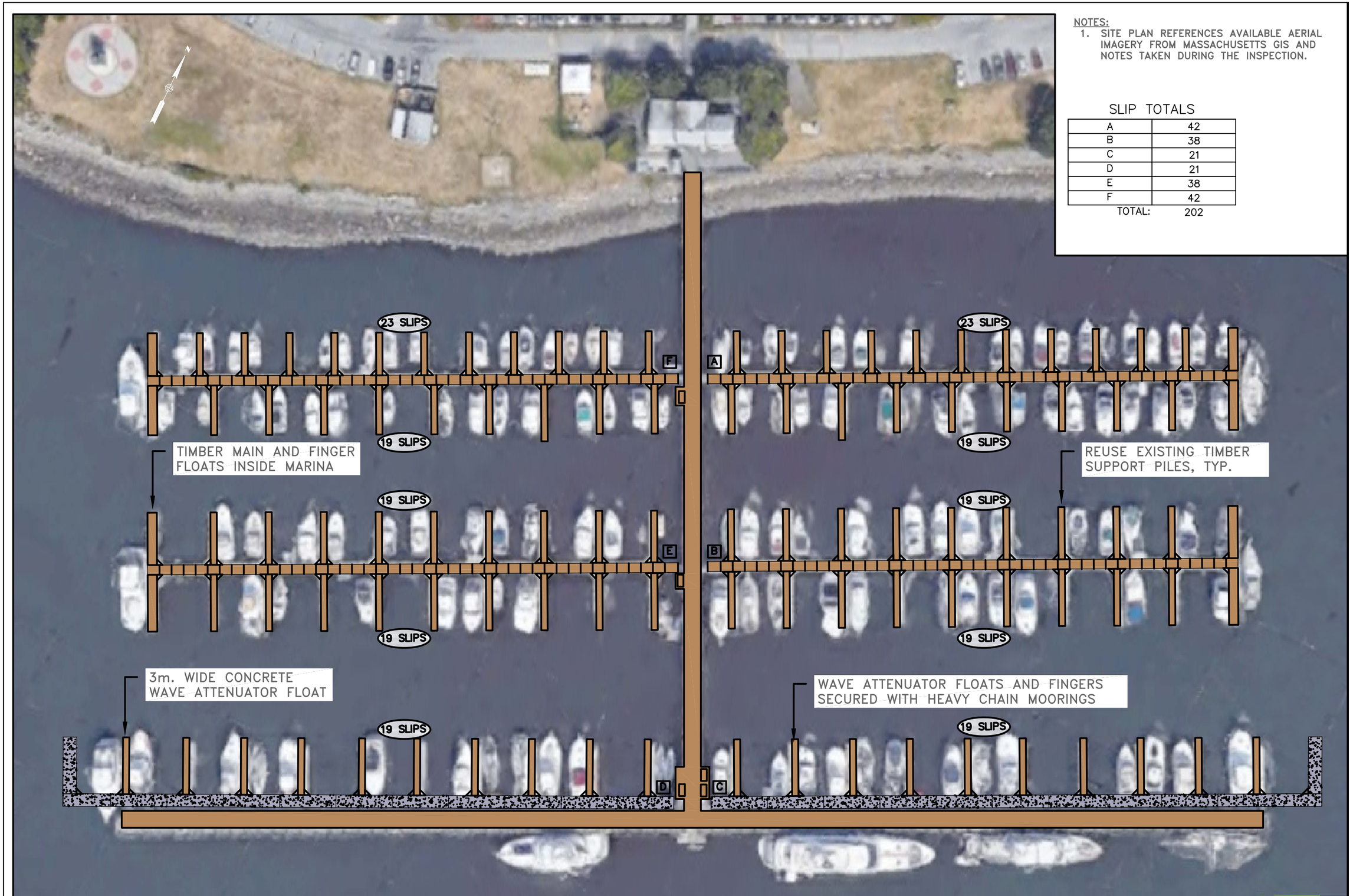
B	38
C	21
D	21
E	38
F	42
TOTAL:	202



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REVISIONS:

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SCALE:	1"=30'±
DESIGNED BY:	DJG
CHECKED BY:	RMM
DRAWN BY:	LMC/DJG
APPROVED BY:	JMB

DRAWING TITLE:
ALTERNATIVE 4 WAVE ATTENUATORS

DRAWING NO.:
A-4
SHEET NO.: 4 OF 4

APPENDIX A – KEY PERSONNEL

Ryan M. McCoy, P.E.
Managing Engineer

PARE CORPORATION

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer – Massachusetts, Rhode Island

OSHA Construction Safety 10-Hour Training

Municipal Vulnerability Preparedness (MVP) Provider

AFFILIATIONS AND MEMBERSHIPS

American Society of Civil Engineers

Boston Society of Civil Engineers

ASCE – Coasts, Oceans, Ports, and Rivers Institute, Boston Chapter (Chair, 06/2016 – 06/2018)

Pare's Climate Change Committee

EDUCATION

University of Massachusetts, Dartmouth - B.S., Civil Engineering, 2006

RELEVANT EXPERIENCE

Mr. McCoy has 15 years of experience during which he has gained knowledge of waterfront/marine, structural, and subsurface engineering. He has been involved in the performance of field surveys, preparation of site plans, design, cost estimates, construction specifications, site inspections, construction oversight, and permitting. His experience also includes presenting at a multitude of public meetings for development projects from the schematic design phase to permit applications. Relevant engineering experience includes:

- **Boston Redevelopment Authority – Pier 4 Culvert Repairs:** Project Manager for the investigation to subsidence along an abandoned drydock discharge culvert. The scope of the project included preparation of an Existing Conditions Report, design of repairs, permitting, preparation of bid documents, bid phase, and construction phase services. Boston, MA

- **Massport Waterfront Structures Inspection and Repair:** Project Engineer for the inspection, evaluation and repair of existing waterfront facilities in Boston Harbor. As a task order project, work included underwater and topside inspections, engineering analysis and evaluations, preparations of opinion of probable costs, and recommendations for remedial action. Sites include the Conley Terminal Berths 11-17, Logan Airport Light Piers 33L and 4R, Commonwealth Pier (World Trade Center), East Boston Piers Park Pier, and the inspection and evaluation of MBTA Ferry Terminal Facilities. Boston, MA.

- **Port of Galilee North Bulkhead Repairs:** Project Manager for the $6M waterfront infrastructure project including design and reconstruction of three commercial fishing piers and various bulkhead repairs. The scope also included the design, permitting and preparation of bid documents for the waterfront infrastructure project. Narragansett, RI.

- **Port of Galilee Bulkhead/Pier Inspection:** Lead Engineer for the visual, tactile, and underwater inspection of 1470 feet of deteriorated bulkhead and 16 timber piers, up to 200 feet in length. Responsibilities included existing data review, inspection from landside and on boat, and supervision of underwater inspection. Also responsible for completion of the inspection findings report including inventory of structures, discussion of current conditions, repair recommendations, cost estimate, Key Plan, and discussion of resilient alternatives. Narragansett, RI.

- **Langone Park Seawall Repairs:** Project Manager for the repairs to the existing steel sheet pile seawall at Langone Park in Boston, MA, including structural and geotechnical repairs, and incorporating resilience for future sea level rise. The scope of work included design, permitting, preparation of bid documents, bid phase services, construction administration and construction oversight. Boston, MA.

- **Inland Fuel Terminal:** Project Manager for the design and construction for the replacement of deteriorated berthing dolphins at the fuel terminal. The scope of work for the steel pile supported structures included inspection, subsurface exploration program, geotechnical and structural design of the new steel pipe pile supported structures, cost estimating, preparation of bid documents, and construction administration services. Tiverton, RI.

- **Boston Redevelopment Authority – Parcel V-1/Pier 5 Bulkhead Repairs:** Project Manager for the design and rehabilitation of the existing deteriorated steel cellular cofferdams at Pier 5 dry dock in the former South Boston Naval Annex. The scope of work included over-sheeting the structure and filling the annulus between the existing and new structures. Tasks included the design, cost estimates, preparation of bid documents, bid assistance, and construction administration services including construction oversight, submittal and pay requisition review, coordination of weekly progress meetings, response to Contractor questions, and preparation of as-built documentation. Boston, MA

- **MADCR – Hewitt's Cove State Pier Full Condition Study:** Project engineer for the inspection and evaluation of timber pile supported Pier 1 and adjacent steel bulkheads. Prepared reconstruction alternates considering MBTA use of the site during the imminent reconstruction of the Pier 2 ferry dock. The scope of work also included the design and review of improvement dredging at the site to accommodate high speed passenger ferries. Hingham, MA

- **Chatham Fish Pier Site Assessment of Facility Conditions:** Project Manager for the overall site assessment and facility conditions of the municipal pier to guide the Town in its evaluation of uses and options for the fish pier and amenities. Responsible for completion of assessment report including existing data review, inventory of structures, repair recommendations, cost estimates, and resilient alternatives discussion. Chatham, MA

- **Battleship Cove Marine Infrastructure Rehabilitation**: Project Engineer for the design and rehabilitation of existing waterfront infrastructure supporting the Battleship Cove Facility. The project includes the full replacement of a pile supported pier, cellular sheetpile mooring islands, timber pile mooring dolphins, handicap accessible improvements, utility upgrades, and other landside access improvements. Provided construction administration services including submittal and pay requisition review, coordination of weekly progress meetings, response to Contractor questions, and preparation of as-built documentation. Fall River, MA

- **New Bedford Commercial Fishing Piers:** Project Engineer for repairs to the steel sheetpile filled wharf and concrete pile-supported piers including completing design, cost estimate and bid documents. Also provided oversight during construction, reviewed submittal and pay requisition, coordinated and attended weekly progress meetings, responded to Contractor questions, and prepared of as-built documentation. New Bedford, MA.

- **Fall River State Pier - South Basin Improvements:** Engineer for the planning, design, permitting and preparation of bid documents for this $10M waterfront infrastructure project. Design included a 400-foot long fixed pier, 400-foot long bulkhead structure, and 180-foot long ADA compliant floating dock for support of this multi-use waterfront facility. Project included rehabilitation of the existing timber pile pier structure, design to accommodate Short Sea Shipping, and design of maintenance and improvement dredging. Fall River, MA.

Danielle J. Goudreau, P.E.
Engineer II

PARE CORPORATION

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer – Rhode Island

AFFILIATIONS AND MEMBERSHIPS

ASCE-COPRI Ports & Harbors Committee

ASCE-COPRI's Design Standards for Piers and Wharves Committee

ASCE-COPRI's Waterfront Facilities Rehabilitation Manual Committee

Treasurer of the Providence Engineering Society

Chair of Pare's Climate Change Committee

American Society of Civil Engineers

Boston Society of Civil Engineers

COPRI Boston Chapter

MERITS

COPRI's Top Honor for Best Student Paper Award, 2016

PUBLICATIONS

Ports '16 Conference Proceedings - Investigation of Combined Storm Surge Inundation and Sea Level Rise to the New Bedford Hurricane Barrier

Revitalizing the Providence, Rhode Island, Waterfront: The Smallest State's Showcase

EDUCATION

University of Rhode Island -
B.S., Civil Engineering, 2015
M.S., Civil Engineering, 2016

RELEVANT EXPERIENCE

Ms. Goudreau has five years of specialized waterfront experience, where she has gained significant knowledge of waterfront/marine, structural, and subsurface engineering. She has been involved in the completion of field surveys; condition evaluations; preparation of inspection findings reports; structural and geotechnical design for piers, wharves, bulkheads, seawalls, and shore protection structures; permitting support; construction oversight; cost estimates; and preparation of bid documents. Her experience also includes preparation of professional papers and presentation at conferences. Ms. Goudreau was given the top honor for student papers at the Ports 16 Conference in New Orleans for her research on combined storm surge inundation and sea level rise at the New Bedford Hurricane Barrier. Relevant project experience includes:

- **Church Street Marina Expansion Project:** Staff engineer for the on-going project including subsurface investigations, design, permitting, preparation of Bid Documents and Construction Administration for the expansion of an existing marina in Bristol Harbor. Responsible for timber and soil capacity analysis for design, cost estimates, permitting support and bid documents The scope of work also includes the installation of concrete floating breakwaters and floating docks. Bristol, RI.

- **Port of Galilee North Bulkhead Repairs:** Staff engineer for the $3M waterfront infrastructure project including design and reconstruction of three commercial fishing piers and various bulkhead repairs. Responsibilities include timber framing design, soil capacity analysis, cost estimates, permit application, and bid documents. Narragansett, RI

- **Port of Galilee Bulkhead/Pier Inspection:** Staff engineer for the visual, tactile, and underwater inspection of 1470 feet of deteriorated bulkhead and 16 timber piers, up to 200 feet in length. Responsibilities included existing data review, inspection from landside and jon boat, and supervision of underwater inspection. Also responsible for completion of the inspection findings report including inventory of structures, discussion of current conditions, repair recommendations, cost estimate, Key Plan, and discussion of resilient alternatives. Narragansett, RI

- **Rocky Point Fishing Pier:** Staff engineer for the design and reconstruction of the existing deteriorated timber fishing pier. Designs included consideration of additional floating docks for mooring use by small vessels. Responsible for timber and soil capacity analysis for design, cost estimates, and bid documents. Warwick, RI

- **Charleston Commerce Center Failure Inspection:** Staff engineer for the visual and tactile inspection of a 90-foot-long failed steel sheet pile bulkhead and inspection findings report. Responsibilities included existing data review, inspection from the landside and jon boat, structural and geotechnical analysis of the retaining structure to determine potential failure mechanisms, and repair recommendations. Boston, MA

- **Prudence Island Ferry Pier:** Staff engineer for pier rehabilitation project consisting of $2M in steel sheet pile bulkhead repair. The scope also includes repairs to a historical stone bulkhead at the ferry pier. Responsible for completing analysis of steel sheet piling and soil capacity for design, cost estimates, and preparation of bid documents. Bristol, RI

- **Lafarge North America – Boston Terminal Landside Structures Inspection:** Staff engineer for the visual and tactile inspection of structural components of cement storage silos, support buildings, and elevated platforms and walkways. Responsibilities also included preparation of a written findings report with observations, comments, repair recommend-dations, and load capacity calculations for structures. Charlestown, MA

- **Boston Redevelopment Authority – Parcel V-1/Pier 5 Bulkhead Repairs:** Staff engineer for the design and rehabilitation of an existing deteriorated steel sheet pile bulkhead and cofferdam. Completed tie-back and cantilever wall analyses for the design and prepared cost estimates and bid documents. Designs included the reuse of the existing tie-back system as a value engineering effort. Also provided construction administration services including construction observation and submittal and pay requisition review. Boston, MA

- **Lafarge North America – Ravena Plant Wharf Repairs:** Staff engineer for wharf repairs which included the design and construction of deteriorated berthing dolphins at the cement plant dock. Wharf repairs were carried out in such a manner to keep the dock operational during construction. Responsibilities included design of the steel pile-supported structure to resist large lateral loads, determining the capacity of soils on site, and the design of concrete encasements to protect and increase the capacity of existing deteriorated steel piles. Also responsible for the preparation of cost estimates and bid documents, and construction administration services including submittal and pay requisition review. Ravena, NY

- **Essroc Cement – Rochester Terminal Wharf Reconstruction:** Staff engineer for reconstruction of the terminal wharf which was destroyed by fire. Responsibilities included design of the steel pile supported structure to resist large lateral loads, determining the capacity of soils on site, and the design of steel gangways. Design considered keeping the facility operational during construction. Also responsible for the preparation of cost estimates and bid documents, and construction administration services including submittal and pay requisition review. Rochester, NY

- **Inland Fuel Terminals – Tiverton Dolphin Reconstruction:** Staff engineer for the design and construction of deteriorated berthing dolphins at the fuel terminal, including design of the steel pile supported structure and capacity of soils on site, cost estimate, and bid documents. Also provided construction administration services including full-time construction oversight and submittal and pay requisition review. Tiverton, RI

- **Town of Chatham – Site Assessment of Facility Conditions:** Staff engineer for the overall site assessment and facility conditions of the municipal pier to guide the Town in its evaluation of uses and options for the fish pier and amenities. Responsible for completion of assessment report including existing data review, inventory of structures, repair recommendations, cost estimates, and resilient alternatives discussion. Chatham, MA

APPENDIX B – OPINION OF PROBABLE COSTS

PARE CORPORATION

PROJECT : Pope's Island Marina Inspection Report — PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: DJG — DATE: June 4, 2020

CHECK BY: RMM — DATE: June 5, 2020

Opinion of Probable Cost - Intermediate Repairs

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
General							
1	Fender Pile Rub Blocks	6	EA	$250	$1,500		
2	Timber Ladder	10	EA	$600	$6,000		
				Subtotal:	**$8,000**	(Rounded to the nearest $1,000)	
Dock A							
1	Spall Repair	280	SF	$6	$1,680		
2	Crack Repair	10	EA	$100	$1,000		
3	Finger Float Replacement (Timber)	960	SF	$70	$67,200		7 finger floats total
4	Pile Guide Hoops	6	EA	$150	$900		Does not include galvanized chain guides not in critical condition
5	Rollers / Timber for Pile Guide	3	EA	$80	$240		
6	Timber Triangle	0	EA	$150	$0		
				Subtotal:	**$72,000**	(Rounded to the nearest $1,000)	
Dock B							
1	Spall Repair	75	SF	$6	$450		
2	Crack Repair	3	EA	$100	$300		
3	Finger Float Replacement (Timber)	480	SF	$70	$33,600		3 finger floats total
4	Pile Guide Hoops	10	EA	$150	$1,500		Does not include galvanized chain guides not in critical condition
5	Rollers / Timber for Pile Guide	1	EA	$80	$80		
6	Timber Triangle	1	EA	$150	$150		
				Subtotal:	**$37,000**	(Rounded to the nearest $1,000)	
Dock C							
1	Spall Repair	270	SF	$6	$1,620		
2	Crack Repair	13	EA	$100	$1,300		
3	Main Float Replacement (Timber)	2,070	SF	$70	$144,900		
4	Pile Guide Hoops	3	EA	$150	$450		
5	Rollers / Timber for Pile Guide	4	EA	$80	$320		
6	Timber Triangle	5	EA	$150	$750		
				Subtotal:	**$150,000**	(Rounded to the nearest $1,000)	
Dock D							
1	Spall Repair	380	SF	$6	$2,280		
2	Crack Repair	32	EA	$100	$3,200		
3	Finger Float Replacement (Timber)	160	SF	$70	$11,200		1 finger float total
4	Main Float Replacement (Timber)	720	SF	$70	$50,400		Does not include galvanized chain guides not in critical condition
5	Pile Guide Hoops	3	EA	$150	$450		
6	Rollers / Timber for Pile Guide	7	EA	$80	$560		
7	Timber Triangle	13	EA	$150	$1,950		
				Subtotal:	**$71,000**	(Rounded to the nearest $1,000)	
Dock E							
1	Spall Repair	170	SF	$6	$1,020		
2	Crack Repair	15	EA	$100	$1,500		
3	Finger Float Replacement (Timber)	784	SF	$70	$54,880		5 finger floats total
4	Pile Guide Hoops	5	EA	$150	$750		Does not include galvanized chain guides not in critical condition
5	Rollers / Timber for Pile Guide	8	EA	$80	$640		
6	Timber Wale	30	LF	$15	$450		
7	Timber Triangle	1	EA	$150	$150		
				Subtotal:	**$60,000**	(Rounded to the nearest $1,000)	

PROJECT : Pope's Island Marina Inspection Report PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: DJG DATE: June 4, 2020

CHECK BY: RMM DATE: June 5, 2020

Opinion of Probable Cost - Intermediate Repairs

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
Dock F							
1	Spall Repair	205	SF	$6	$1,230		
2	Crack Repair	27	EA	$100	$2,700		
3	Finger Float Replacement (Timber)	576	SF	$70	$40,320		4 finger floats total
4	Pile Guide Hoops	4	EA	$150	$600		Does not include galvanized chain guides not in critical condition
5	Rollers / Timber for Pile Guide	4	EA	$80	$320		
				Subtotal:	**$46,000**	(Rounded to the nearest $1,000)	
				Subtotal:	$441,520		
				15% Contingency	$67,000		
				TOTAL OPINION OF CONSTRUCTION COST	**$509,000**	(Rounded to the nearest $1,000)	

PARE CORPORATION

PROJECT : Pope's Island Marina Inspection Report PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: DJG DATE: June 4, 2020

CHECK BY: RMM DATE: June 5, 2020

Opinion of Probable Cost - Alternative 1: Replacement In-Kind

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
Base Bid							
1	Mob/Demob	1	LS	$100,000	$100,000	Pare Estimate	
2	Demo and Removal	29400	SF	$35	$1,029,000	Pare Estimate / Recent Project Costs	
3	Concrete Floating Docks	29400	SF	$115	$3,381,000	Pare Estimate / Recent Project Costs	
4	Utilities	1	LS	$288,000	$288,000	Pare Estimate / Recent Project Costs	
5	Timber Wave Fence	8100	SF	$28	$226,800	Pare Estimate / Recent Project Costs	
6	Replace Cross Bracing	252	EA	$750	$189,000	Pare Estimate / Recent Project Costs	
7	Replace Fender Pile	20	EA	$2,000	$40,000	Pare Estimate / Recent Project Costs	
8	Replace Ladder	10	EA	$600	$6,000	Pare Estimate / Recent Project Costs	
				Subtotal:	**$5,260,000**	(Rounded to the nearest $1,000)	
				15% Contingency	$789,000		
			TOTAL OPINION OF CONSTRUCTION COST		**$6,049,000**	(Rounded to the nearest $1,000)	

PARE CORPORATION

PROJECT : Pope's Island Marina Inspection Report | PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: KAD | DATE: July 27, 2020

CHECK BY: KWH | DATE: July 27, 2020

Opinion of Probable Cost - Alternative 1A: Replacement In-Kind Hybrid (Concrete Mains & Timber Fingers)

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
Base Bid							
1	Mob/Demob	1	LS	$100,000	$100,000	Pare Estimate	
2	Demo and Removal	29400	SF	$35	$1,029,000	Pare Estimate / Recent Project Costs	
3	Concrete Floating Docks (Mains)	15840	SF	$115	$1,821,600	Pare Estimate / Recent Project Costs	
4	Timber Floating Docks (Fingers)	13584	SF	$70	$950,880	Pare Estimate / Recent Project Costs	
5	Utilities	1	LS	$288,000	$288,000	Pare Estimate / Recent Project Costs	
6	Timber Wave Fence	8100	SF	$28	$226,800	Pare Estimate / Recent Project Costs	
7	Replace Cross Bracing	252	EA	$750	$189,000	Pare Estimate / Recent Project Costs	
8	Replace Fender Pile	20	EA	$2,000	$40,000	Pare Estimate / Recent Project Costs	
9	Replace Ladder	10	EA	$600	$6,000	Pare Estimate / Recent Project Costs	
				Subtotal:	**$4,652,000**	(Rounded to the nearest $1,000)	
				15% Contingency	$698,000		
			TOTAL OPINION OF CONSTRUCTION COST		**$5,350,000**	(Rounded to the nearest $1,000)	

PARE CORPORATION

PROJECT : Pope's Island Marina Inspection Report PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: DJG DATE: June 4, 2020

CHECK BY: RMM DATE: June 5, 2020

Opinion of Probable Cost - Alternative 2: Reconfiguration

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
Base Bid							
1	Mob/Demob	1	LS	$150,000	$150,000	Pare Estimate	
2	Demo and Removal	29400	SF	$40	$1,176,000	Pare Estimate / Recent Project Cost	Includes Pile removal
3	Concrete Floating Docks	19200	SF	$115	$2,208,000	Pare Estimate / Recent Project Cost	
4	Timber Floating Docks	21200	SF	$70	$1,484,000	Pare Estimate / Recent Project Cost	
5	New Timber Piles	120	EA	$2,000	$240,000	Pare Estimate / Recent Project Cost	
6	Utilities	1	LS	$271,800	$271,800	Pare Estimate / Recent Project Cost	
7	Timber Wave Fence	8100	SF	$28	$226,800	Pare Estimate / Recent Project Cost	
8	Replace Cross Bracing	252	EA	$750	$189,000	Pare Estimate / Recent Project Cost	
9	Replace Fender Pile	20	EA	$2,000	$40,000	Pare Estimate / Recent Project Cost	
10	Replace Ladder	10	EA	$600	$6,000	Pare Estimate / Recent Project Cost	
				Subtotal:	**$5,992,000**	(Rounded to the nearest $1,000)	
				15% Contingency	$899,000		
			TOTAL OPINION OF CONSTRUCTION COST		**$6,891,000**	(Rounded to the nearest $1,000)	

PARE CORPORATION

PROJECT : Pope's Island Marina Inspection Report | PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: DJG | DATE: June 4, 2020

CHECK BY: RMM | DATE: June 5, 2020

Opinion of Probable Cost - Alternative 3: Expansion

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
Base Bid							
1	Mob/Demob	1	LS	$150,000	$150,000	Pare Estimate	
2	Demo and Removal	29400	SF	$35	$1,029,000	Pare Estimate / Recent Project Costs	
3	Concrete Floating Docks	32500	SF	$115	$3,737,500	Pare Estimate / Recent Project Costs	
4	New Timber Piles	13	EA	$2,000	$26,000	Pare Estimate / Recent Project Costs	
5	Utilities	1	LS	$312,000	$312,000	Pare Estimate / Recent Project Costs	
6	Timber Wave Fence	8100	SF	$28	$226,800	Pare Estimate / Recent Project Costs	
7	Replace Cross Bracing	252	EA	$750	$189,000	Pare Estimate / Recent Project Costs	
8	Replace Fender Pile	20	EA	$2,000	$40,000	Pare Estimate / Recent Project Costs	
9	Replace Ladder	10	EA	$600	$6,000	Pare Estimate / Recent Project Costs	
				Subtotal:	**$5,717,000**	(Rounded to the nearest $1,000)	
				15% Contingency	$858,000		
			TOTAL OPINION OF CONSTRUCTION COST		**$6,575,000**	(Rounded to the nearest $1,000)	

PARE CORPORATION

PROJECT : Pope's Island Marina Inspection Report | PROJECT NUMBER: 20058.00

SUBJECT: Draft Opinion of Probable Construction Cost

COMPUTATIONS BY: DJG | DATE: June 4, 2020

CHECK BY: RMM | DATE: June 5, 2020

Opinion of Probable Cost - Alternative 4: Wave Attenuating Floats

Bid Item	Item	Quantity	Unit	Unit Price	Total	Source	Notes
Base Bid							
1	Mob/Demob	1	LS	$100,000	$100,000	Pare Estimate	
2	Demo and Removal	29400	SF	$35	$1,029,000	Pare Estimate / Recent Project Costs	
3	Timber Floating Docks	24480	SF	$70	$1,713,600	Pare Estimate / Recent Project Costs	
4	Concrete Wave Anttenuating Docks	9120	SF	$125	$1,140,000	Pare Estimate / Recent Project Costs	
5	New Steel Piles	22	EA	$12,500	$275,000	Pare Estimate / Recent Project Costs	
6	Utilities	1	LS	$288,000	$288,000	Pare Estimate / Recent Project Costs	
7	Replace Cross Bracing	252	EA	$750	$189,000	Pare Estimate / Recent Project Costs	
8	Replace Fender Pile	20	EA	$2,000	$40,000	Pare Estimate / Recent Project Costs	
9	Replace Ladder	10	EA	$600	$6,000	Pare Estimate / Recent Project Costs	
				Subtotal:	**$4,781,000**	(Rounded to the nearest $1,000)	
				15% Contingency	$718,000		
			TOTAL OPINION OF CONSTRUCTION COST		**$5,499,000**	(Rounded to the nearest $1,000)	

APPENDIX C - REFERENCES

PREPARED FOR:
NEW BEDFORD HARBOR DEVELOPMENT COMMISSION

FLOATING DOCK CONDITION ASSESSMENT REPORT
PORT OF NEW BEDFORD

POPE'S ISLAND MARINA

APRIL 14, 2014

PARE
CORPORATION

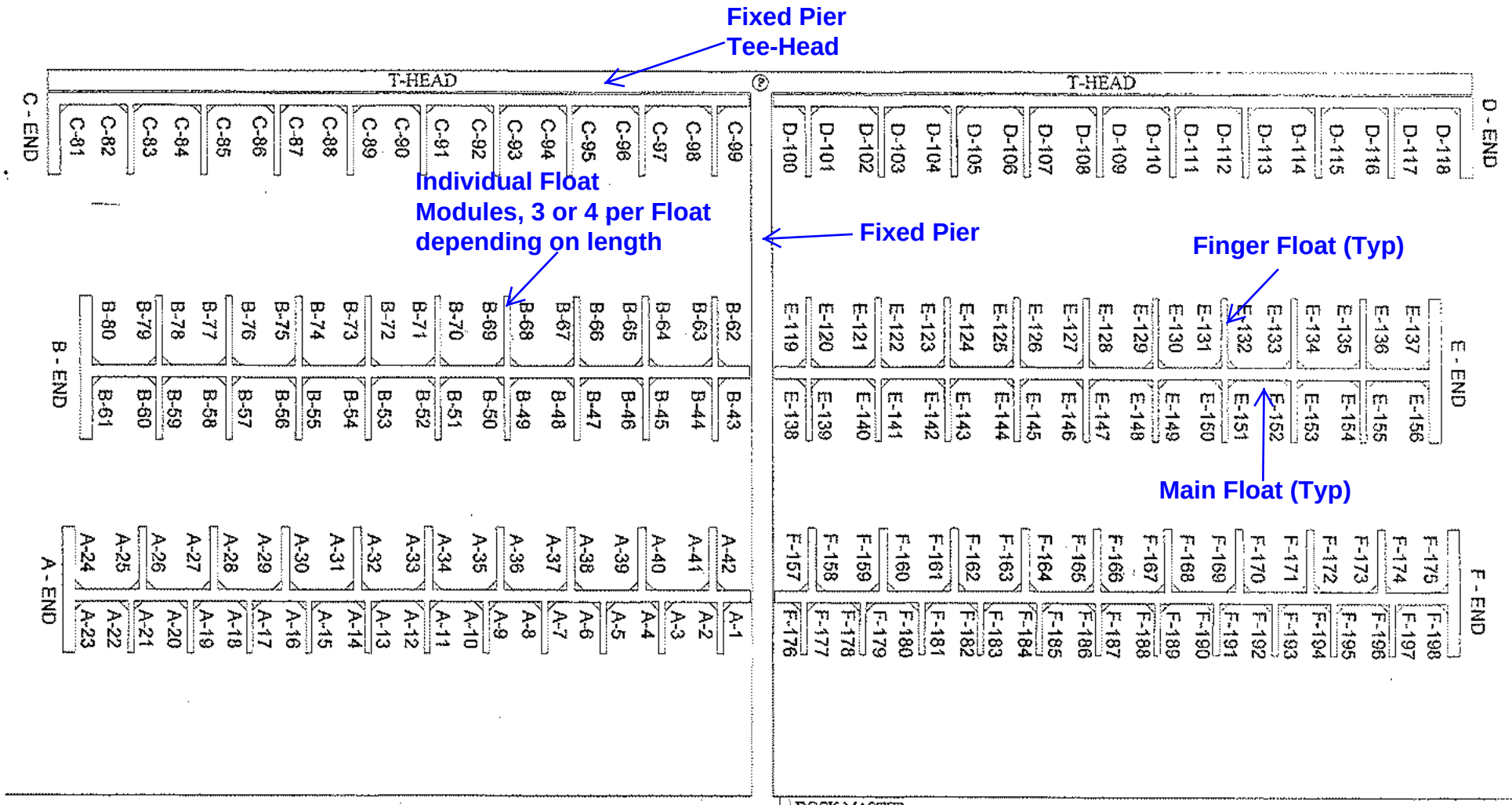
FLOATING DOCK CONDITION ASSESSMENT REPORT
POPE'S ISLAND MARINA

NEW BEDFORD, MASSACHUSETTS

Table of Contents **Page No.**

FIGURES:

APPENDICES:



POPE'S ISLAND MARINA

102 POPE'S ISLAND

NEW BEDFORD, MA 02740

PHONE: 508 - 979 - 1456 FAX: 508 - 979 - 1469

LONGITUDE: W 70° 54.8' LATITUDE: N 41° 38.4'

WE MONITOR V H F CHANNELS 9 and 74

MARINA OFFICE
MARINA FACILITIES

SLIPS	LENGTH	WIDTH	ELECTRIC
A 1 - 23	30'	15'	1 - 30 AMP
A 24 - 42	36'	18'	1 - 30 AMP
B 43 - 61	36'	18'	1 - 50 AMP
B 62 - 80	40'	18'	1 - 50 AMP
C 81 - 99	40'	19'	1 - 50 AMP
D 100 - 118	40'	19'	1 - 50 AMP
E 119 - 137	40'	18'	1 - 50 AMP
E 138 - 156	36'	18'	1 - 50 AMP
F 157 - 175	36'	18'	1 - 30 AMP
F 176 - 198	30'	15'	1 - 30 AMP

DOCK ENDS		
A	73'	1 - 30 AMP
B	83'	1 - 50 AMP
C	53'	1 - 50 AMP
D	53'	1 - 50 AMP
E	83'	1 - 50 AMP
F	73'	1 - 30 AMP
T-HD	810'	12 - 100 AMP

(P) PUMP-OUT FACILITY

BRADY : 05/12/95

POPE'S ISLAND MARINA SLIP LAYOUT PLAN

EXECUTIVE SUMMARY

The Pope's Island Marina Facility is comprised of a timber pile supported fixed pier and tee-head, and a series of six (6) "main floating docks" with "finger floats" providing berths for 198 vessels. The facility was constructed in 1992, and has had repairs to the floating docks over the years, typically following storm events.

The fixed pier and tee-head was inspected in March 2009, and was noted to be in generally good condition. A copy of the inspection report can be found at www.portofnewbedford.org/documents. Observed deficiencies included loose or missing wave fence boards, and corroded low wale hardware. The estimate of cost for repair was in the order of $200,000.

The main concrete floats are 6 feet wide, and are comprised of "modules" held together with timber wales and thru-rods. Similarly, the finger floats are 4 feet wide, with the float modules held together with timber wales and through rods. The float "modules" are comprised of white polystyrene insulation provided with an approximate 1 to 1.5 inch thick fiber-reinforced concrete overlay. The concrete float modules are considered to be a light duty system, which is stressed during extreme events.

Inspection of the main floats and finger floats indicated extensive deterioration of the concrete modules, which make up the concrete floats. Many cracks and spalls were observed on the top of the deck. The concrete on the sides of the float was observed to be severely deteriorated. The deteriorated concrete leads to the weakening of the overall structure, and listing of the floats. The mooring guide piles were noted to be in generally fair to good condition, however many of the pile guides (hoops) were in poor condition, or had been replaced or reinforced with chains.

The deteriorated condition of the concrete float modules is such that replacement of the floating docks will be required in approximately three (3) to five (5) years. The weakened condition of the float system is such that significant storm events may cause increasing damage over the short term. The HDC has commenced the replacement of deteriorated and listing concrete finger floats with timber framed finger floats, with three (3) floats completed in the spring of 2014.

The approximate cost to replace the floating dock system in its entirety is in the order of $4,500,000.

Critical repairs include replacement of listing floats and replacement of critically deteriorated main float modules at an approximate cost of $650,000.

1.0 INTRODUCTION

In June of 2013, Pare Corporation (PARE) was retained by the New Bedford Harbor Development Commission (HDC) to investigate reported issues with the electrical system at the Pope's Island Marina facility. Subsequent to this investigation, PARE was requested to provide an assessment of the floating docks at the facility. This report presents the findings of our inspections, and our assessment of the condition of the marina facility.

2.0 GENERAL

It is PARE's understanding that the existing main timber pier, main floats and finger floats were installed in 1992-1993, with repairs and improvements to the site completed in 2002 and 2006. Minor maintenance at the site is currently carried out on an as-needed basis by Marina employees. Tropical Storm Irene caused damage and required additional repairs in 2012.

The Marina is comprised of a 450' long timber pile supported main pier, an 810' long timber pile supported tee pier. Six "Main" floating docks - Dock A, B, C, D, E, and F – are approximately 6 feet wide and approximately 380 feet long, with 4 foot wide "finger floats" providing the Marina with 198 slips. The floats are held in place with timber guide piles. Typically the guide piles are driven at the ends of the finger floats, and are installed periodically along the sides of the main floats.

The existing concrete float modules are comprised of white polystyrene floatation units encased in an approximately 1 to 1.5 inches thick fiber reinforced concrete overlay. The concrete modules are connected with a timber wale on each side of the floats and are fastened with thru-rods.

PARE visited the marina on October 18, 2013 and again on March 11, 2014. Engineers performed a visual and tactile inspection of the floating docks noting specific locations of observable deficiencies in order to develop an overall existing conditions report. Inspection of the pile supported timber pier and appurtenances were not included in the scope of this inspection; these components of the structure were inspected by PARE in 2008. Noted repairs include timber wave fence and hardware, at an approximate cost of $200,000.

The undersides of the floating docks were not included in the scope of work to date, and have not been inspected.

3.0 INSPECTION FINDINGS

Based upon the observed conditions, the floats (specifically, the concrete float modules) are nearing the end of their useful life. Deterioration of the concrete was widespread along the deck and sides of the concrete mains and finger floats. Cracking and spalling of the deck are indicative of lateral wind and wave loads exceeding the capacity of the floating dock system. The deterioration and relative displacement of the deck system has created trip hazards at the joints. The steel pile hoops which anchor the floats to the timber guide piles have broken or are seriously rusted and scaled.

The concrete overlay on the float modules was observed to be significantly deteriorated, soft, and missing in numerous locations along the waterline. The weakening of the concrete leads to listing of the floats and overall reduction in strength. The reduction in strength leads to increased deflection and articulation under wave loads, which further exacerbates the weakened condition. The exact number of deteriorated float modules has not been determined to date; this will require additional underwater inspection. However, inspection of the sides of the modules indicate that approximately 50% of the modules are compromised.

Deterioration of the concrete modules along the waterline.

The Marina has provided repairs to the original floats that have previously failed. Concrete floats have been replaced and deteriorated decking has been repaired.

Details of the inspection findings, including specific locations of the observed deficiencies are presented on the site plans in Figures 1.0 through 4.0. The detailed deficiencies are presented in section 3.1 through 3.6 of this report, and are summarized in Section 3.7 of this report. Typically observed deficiencies include:

- Cracking and spalling of the concrete surface was typical across a majority of the floats. (Photo Nos. 2, 7, 8, 11, 12, 14, 15, 15, 17, 21)
- Sixteen (16) of the finger floats are failing and have started to list. (Photo Nos. 3, 5, 9, 10)
- Twenty Nine (29) of the main float sections are failing and have started to list. (Photo No. 6)
- The sides of the concrete floats have failed exposing the polystyrene units. (Photo No. 1)
- Five (5) floats have already been replaced with timber floats. (Photo No. 19)
- Eight (8) of the concrete deck modules have been replaced with timber or composite decking. (Photo Nos. 20, 21)
- Eighty Five (85) of the pile hoops and rub blocks were observed to be broken or heavily corroded, and have been replaced with chains with PVC pipe rollers. (Photo Nos. 23, 24)
- Three (3) of the connections between main floats and finger floats were noted to be broken and were observed to be repaired with steel plates bolted to the timber edge boards on the intersecting floats. (Photo No. 22)
- As part of their assessment, APEX indicated that a number of the float thru-rods need to be replaced.

3.1 A-Dock

A-Dock is in overall fair to poor condition. None of the floats were observed to be listing; however, the concrete modules were observed to be deteriorated at the waterline. Surface cracking was observed along each of the 22 finger floats, with cracks noted on 64 of the 76 concrete modules (85%). Significant spalling was noted

on 15 of the finger floats, along 20 of the 76 concrete modules. The main floats are in slightly better condition, with cracking noted on 15 of the 47 concrete modules, and spalling along 4 of the 47 modules.

The timber wales are typically weathered but are mostly intact and functional. Four of the pile hoops anchoring the finger floats were observed to be in poor condition, and four pile hoops are in poor condition along the main floats. At locations of missing pile hoops, galvanized chain guides have typically been installed. According to the 2011 report, none of the float thru-rods were deficient along the A-Dock, and indicated that they were in generally good condition.

3.2 B-Dock

B-Dock is in overall poor condition. The concrete modules were typically observed to be deteriorated at the waterline. Finger float 66/67 was observed to be listed, with significant surface spalling noted along the top of its four concrete modules.

Significant surface spalls were observed across 34% of the main float modules, typically with several spalls per each module. Cracking of the main float modules was less severe, with cracks noted at 2 of the 47 modules. Cracking along the finger floats was observed on 28 of the 76 modules (37%), with spalls observed on 36 of the 76 modules (47%).

Fifteen of the pile hoops anchoring the finger floats were observed to be in critical condition, and one pile hoops are in critical condition along the main floats. According to the 2011 report, nineteen thru-rods were rusted and scaled with limited wear noted at the point of contacts.

3.3 C-Dock

C-Dock is in overall poor condition. Finger floats 88/89, 92/93, 94/95, and 96/97 have begun to list and should be repaired or replaced. Approximately seventeen of the main float modules were observed to be listed. The concrete modules were typically observed to be deteriorated at the waterline along both the main float and finger floats.

Significant surface spalling was noted at 13 of 40 finger float modules (33%), and also along 22 of 49 main float modules (45%). Surface spalling along the main float modules was mostly concentrated between Station 0+00 and 2+00, as shown on Figure 3.0. Cracking of the concrete finger floats was observed at 13 of 40 modules (33%) and 17 of 49 main float modules (35%).

The timber wales were replaced as part of the 2006 repairs and are in sound condition. All 19 of the pile hoops supporting the main floats and finger floats are in poor condition. According to the 2011 report, the thru-rods were in various stages of deterioration, with ten thru-rods were in poor condition.

3.4 D-Dock

D-Dock is in overall fair to poor condition. Concrete modules were typically observed to be deteriorated at the waterline along both the finger floats and main floats. Finger floats 102/103 and 106/107 have begun to list and should be repaired or replaced. Approximately 12 of the main float modules were observed to be listed as well.

Finger floats 108/109, 110/111, 114/115, and 116/117 have been replaced with timber floats with composite decking. L-Section finger float 118 has been replaced with a steel frame float with HDPE float drums and a concrete deck. Six of the main float modules have been repaired with a timber or composite deck section (Photo 21).

Significant surface spalling was noted at 10 of 24 finger float modules (42%), and also along 12 of 49 main float modules (25%). Cracking of the concrete finger floats was observed at 8 of 24 modules (33%) and 17 of 49 main float modules (35%).

Cracking and displacement of the concrete modules.

The timber wales were replaced as part of the 2006 repairs and are in sound condition. Six of the pile hoops supporting the finger floats are in critical condition, include the two listed floats. Five of the pile hoops supporting the main floats are in poor condition.

The 2011 report indicated that the thru-rods for the D-Dock were in generally better conditions than most of the other rods at the marina, with eight thru-rods requiring maintenance. It should be noted that the eight thru-rods were observed along the two listed floats.

3.5 E-Dock

E-Dock is in overall poor condition. Concrete modules were typically observed to be deteriorated at the waterline along the finger floats and main floats. Five Finger floats (121/122, 127/128, 129/130, 133/134, and 135/136) have begun to list and should be repaired or replaced. T-Section finger float 137/156 was replaced with a steel frame float with HDPE float drums and a concrete deck during the 2010 repairs.

Significant surface spalling was noted at 13 of 80 finger float modules (16%), and also along 6 of 47 main float modules (13%). Serious spalling along the main float modules was concentrated near finger float 131/132 and 150/151, as shown on Figure 3.0. Cracking of the concrete finger floats was observed at 13 of 40 modules (33%) and 17 of 49 main float modules (35%)

Sixteen of the pile hoops supporting the finger floats are in critical condition (out of twenty total). Three of the pile hoops supporting the main floats are in critical condition.

The 2011 report noted that the thru-rods for E-Dock had surficial rust and limited wear. Thirty-two thru-rods were recommended for replacement or repair including four at the listed finger float 127/128, and six at listed float 135/136.

Listed float along E-Dock

3.6 F-Dock

F-Dock is in overall poor condition. The concrete modules along the main float and finger floats were typically observed to be deteriorated at the waterline. Finger floats 165/166, 167/168, 171/172, and 196/197 have begun to list and should be repaired or replaced. T-Section finger float 137/156 was replaced with a steel frame float with HDPE float drums and a concrete deck during the 2010 repairs.

New timber replacement float.

Finger float 173/174 has been replaced with a timber float with timber decking. This heavy duty float was recently constructed by the HDC and Marina personnel.

Significant surface spalling was noted at 5 of 76 finger float modules (7%), and also along 6 of 47 main float modules (13%). Cracking of the concrete finger floats was observed at 40 of 76 modules (53%) and 8 of 47 main float modules (17%)

According to the 2011 report thirty-nine thru-rods required replacement or repair. It should be noted that six of those were shown at finger float 173/174 which was replaced with a timber float. Another six of those thru-rods are noted at finger floats165/166 and 171/172 which were observed to be listed.

Seven of the pile hoops supporting the finger floats are in poor condition (out of ten total). Five of the pile hoops supporting the main floats are in poor condition.

3.7 Inspection Summary

Based upon the number of observed deficiencies along each of the docks, the existing floating docks are at or are nearing the end of their useful life. The listed floats not only present a usability concern, but also have developed into a safety issue. Widespread deterioration of the concrete floats will continue to worsen, and will likely be significantly affected by storm events.

The following table quantifies the observed deficiencies by presenting the inspection findings for each of the floating docks.

Table 1: Floating Dock Deficiency Summary

		Listed Modules	Spalled Modules	Cracked Modules	Deteriorated Pile Hoops	Deteriorated Thru-Rods
A-DOCK	Finger Float (76 Total)	0 (0%)	20 (42.6%)	64 (84.2%)	4 (5.3%)	0
	Main Float (47 Total)	0 (0%)	4 (5.3%)	15 (31.9%)	4 (8.5%)	
B-DOCK	Finger Float (76 Total)	4 (5.3%)	36 (47.4%)	28 (36.8%)	15 (19.7%)	19
	Main Float (47 Total)	0 (0%)	16 (34.0%)	2 (4.3%)	1 (2.1%)	
C-DOCK	Finger Float (40 Total)	11 (27.5%)	13 (32.5%)	13 (32.5%)	10 (25.0%)	10
	Main Float (49 Total)	17 (34.7%)	22 (44.9%)	17 (34.7%)	9 (18.4%)	
D-DOCK	Finger Float (24 Total)	8 (33.3%)	10 (41.7%)	8 (33.3%)	6 (25.0%)	8
	Main Float (49 Total)	12 (24.5%)	12 (24.5%)	26 (53.1%)	5 (10.2%)	
E-DOCK	Finger Float (80 Total)	16 (20.0%)	13 (16.3%)	28 (35.0%)	16 (20.0%)	32
	Main Float (47 Total)	0 (0%)	6 (12.8%)	9 (19.1%)	3 (6.4%)	
F-DOCK	Finger Float (76 Total)	12 (15.8%)	5 (6.6%)	40 (52.6%)	7 (9.2%)	34
	Main Float (47 Total)	0 (0%)	6 (12.8%)	8 (17.0%)	5 (10.6%)	
TOTAL	Finger Float (372 Total)	51 (13.7%)	96 (25.8%)	181 (48.7%)	59 (15.9%)	103
	Main Float (286 Total)	29 (10.1%)	66 (23.1%)	77 (26.9%)	27 (9.4%)	

4.0 ELECTRICAL SYSTEM

PARE and our electrical engineering subconsultant, Buia Engineering, Inc. (BUIA), reviewed the reported electrical concerns at the Marina. These electrical concerns included:

- Severe electrolysis of the vessel at Slip C-96;
- Electrical power supply issues at the end of C-Dock;
- Electrical issues at the end of F-Dock;
- Corrosion of electrical panel breakers and pedestal connections.

BUIA and PARE engineers met with the marina operators and vessel owners on site to review issues. Concern was voiced that the system electrical supply was not in keeping with the posted capacities, and that there may be possible breaks in the cable leading to corrosion.

BUIA engineers reviewed the existing electrical drawings, calculated voltage drops on the cable runs, and verified that the posted electrical capacities were indeed valid and in accordance with good engineering practice. The electrical capacities are consistent with the posted voltage and amperages provided in the – Pope's Island Marina Slip Layout Plan, located near the front of this report.

Inspection and testing of the pedestal at the end of C-Dock (Chaffeys Lock) indicated that proper voltage and current was available; however, one plug terminal showed burn marks and one phase wire had a portion of insulation burned off. The City Electrician replaced the burned wire. At our recommendation, the "Chaffeys Lock" vessel owner had the plug repaired and the issue was resolved.

The vessel owner of "Strike it Rich" at the end of F-Dock indicated that there were no issues with the electrical service, although the Marina Manager indicated that they had raised previous complaints.

Electrolysis at the Slip C-96 was monitored over the 2013 season. A zinc anode, visible at the stern of the vessel, did not indicate active electrolysis, and at the end of the season, electrolysis was not reported to be an issue as it was the previous year. It is recommended that if electrolysis conditions continue to be an issue, a Megger test be carried out to confirm the continuity of the cable and insulation. It does not appear to be required at this time.

It is understood that the marina electrical system is maintained by marina personnel, with assistance from the City Electrical Department as required. It is our recommendation that the marina maintenance personnel (Alex Downing) be provided with training such that minor maintenance and repairs, including the replacement of corroded breakers and plugs, be carried out in accordance with safe practice and tag-in, tag-out procedures. Training has since been provided to Mr. Downing. Any repairs outside of the capability of the maintenance personnel should be performed by a qualified electrician. It is recommended that the circuit breakers in the panels and pedestals be replaced, one section at a time, over a period of years.

5.0 EVALUATION AND RECOMMENDATIONS

<u>Concrete Float Modules</u>

The existing concrete float modules comprising the main floating docks and finger floats are

considered to be a "light duty system", as the fiber reinforced concrete encapsulating the polystyrene flotation is only 1-inch to 1.5 inches thick. Typical industry standards for concrete float modules exposed to a relatively high wind and wave climate, such as exists at the Pope's Island Marina, consist of 3-inch reinforced concrete decks and 2-inch to 3-inch thick sides and bottoms. As such, this light duty system is susceptible to damage and deterioration during extreme events.

The findings of this inspection indicate that the concrete modules comprising the main floating docks and finger floats are in an advanced state of deterioration and disrepair. The concrete modules have cracked, the concrete matrix at the waterline has deteriorated and is missing in many locations, such that the floats are listing. Many tie rods have "worked loose" by enlarging the penetration holes in the concrete, leading to articulation between floats.

The floating dock system is in a weakened condition and is nearing the end of its useful life. The modules are losing structural strength that cannot be repaired. Storm events will continue to cause damage to the float system, with increasing repairs required, until the system is replaced with a new system of floating docks. It is likely that full replacement of the floating docks will be required in approximately three (3) to five (5) years.

The estimate of cost to replace the existing deteriorated floating dock system with new concrete floats is in the order of $4,500,000.

In the interim, repairs of deteriorated concrete float modules will be required to provide safe operation of the marina. In the winter of 2014, the HDC has fabricated three (3) timber framed finger floats and is in the process of replacing damaged and listed concrete finger floats with these timber floats.

The repair and replacement of the concrete float modules is above the capacity and capability of the HDC staff, as the fabrication of the concrete float modules, and the installation of the concrete float modules (with tie rods and timber wales), will require the services of a Marine Contractor, utilizing a crane barge.

Replacement concrete float modules will need to match the existing module dimensions and freeboard, and be able to be utilized in the reconstructed facility. The replacement or reconstructed float modules will likely be of more robust construction, in keeping with industry standards for the level of exposure and wave climate at the facility.

Repair of deteriorated concrete float module decking with composite decking, timber or concrete will provide a better walking surface, but does not contribute to the strength of the floats or address the deterioration and listing of the float modules.

<u>High Priority Repairs</u>

- **Replace Listed Floats:**
  - 16 Finger Floats @ $120/sf = $305,000

- **Replace Critical Main Float Modules**
  - 60 Concrete Modules @ $120/sf = $345,000

<u>Total: $650,000</u>

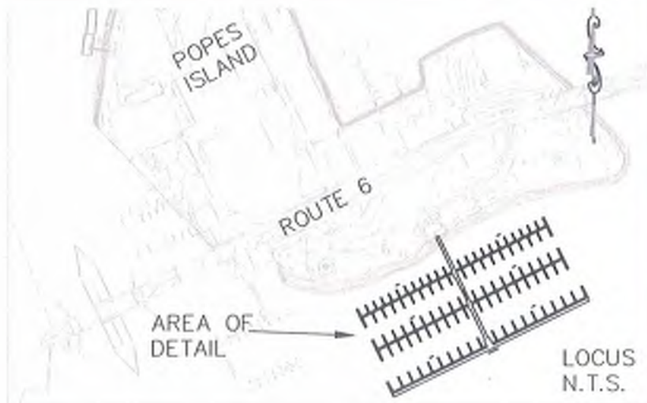
Electrical System

At present, the electrical system is providing electrical service in accordance with the posted service on the Marina Slip Layout. Replacement of corroded panel breakers and power pedestal breakers will be required over a period of years.

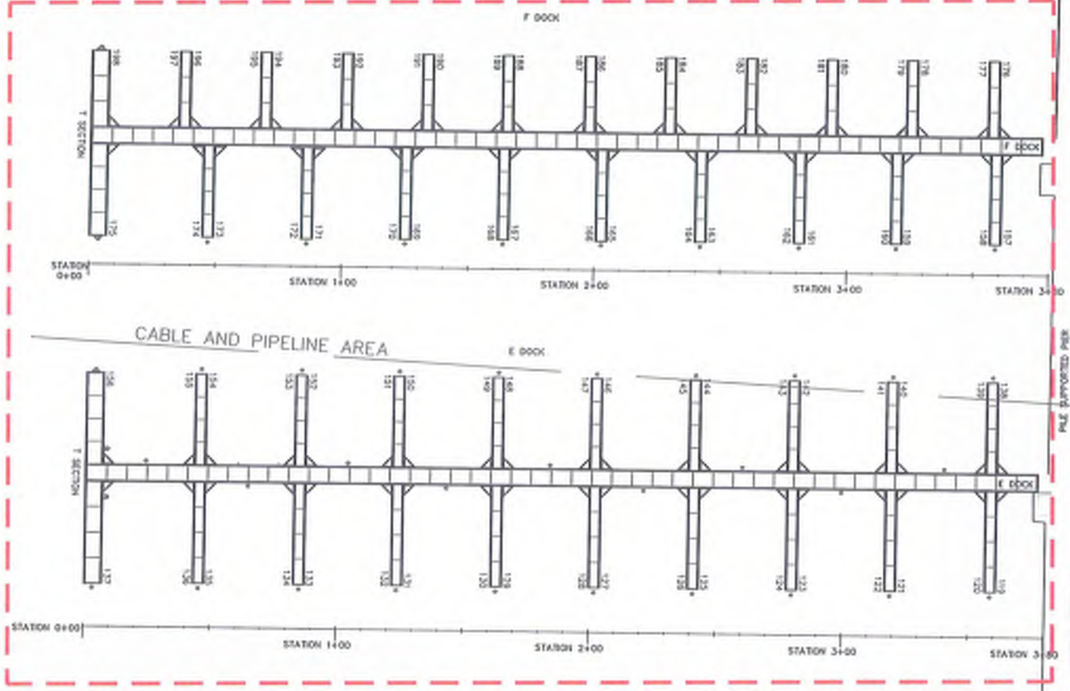
FIGURES

NOTES:

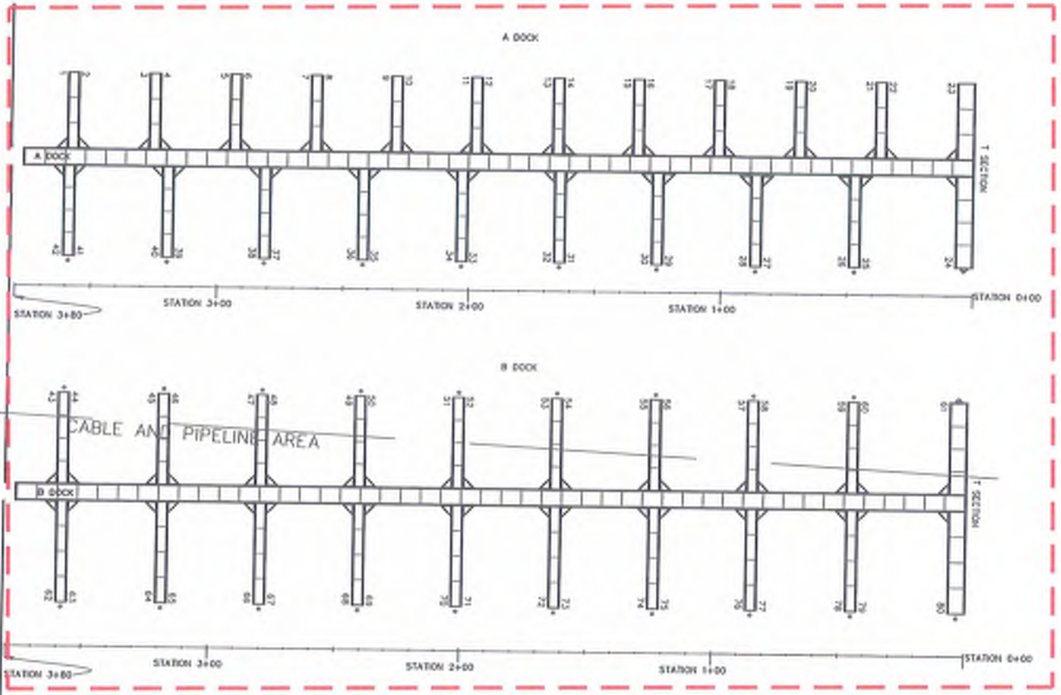
1. SITE PLAN REFERENCES DRAWING TITLED "FACILITY PLAN" BY APEX, DATED NOVEMBER 1, 2011.
2. EXISTING CONDITIONS BASED UPON NOTES PROVIDED BY ALEX DOWNING OF POPE'S ISLAND MARINA, AND OBSERVED BY PARE CORPORATION ON OCTOBER 18, 2013 AND MARCH 12, 2014.



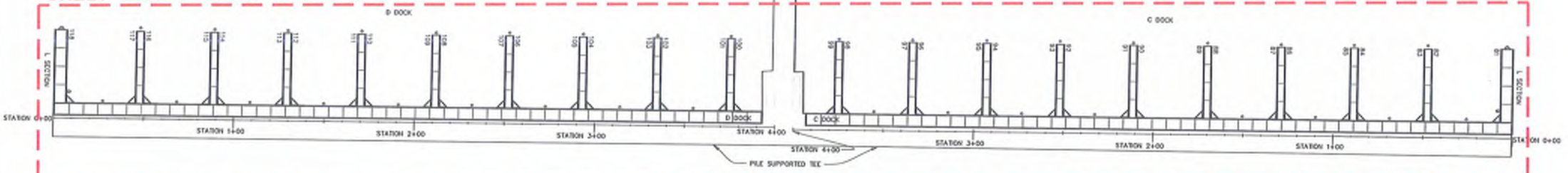
SHEET 4.0: E-DOCK & F-DOCK PLAN



SHEET 2.0: A-DOCK & B-DOCK PLAN



SHEET 3.0: C-DOCK & D-DOCK PLAN



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508-543-1701

SCALE ADJUSTMENT GUIDE
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BAR IS ONE INCH ON ORIGINAL DRAWING.

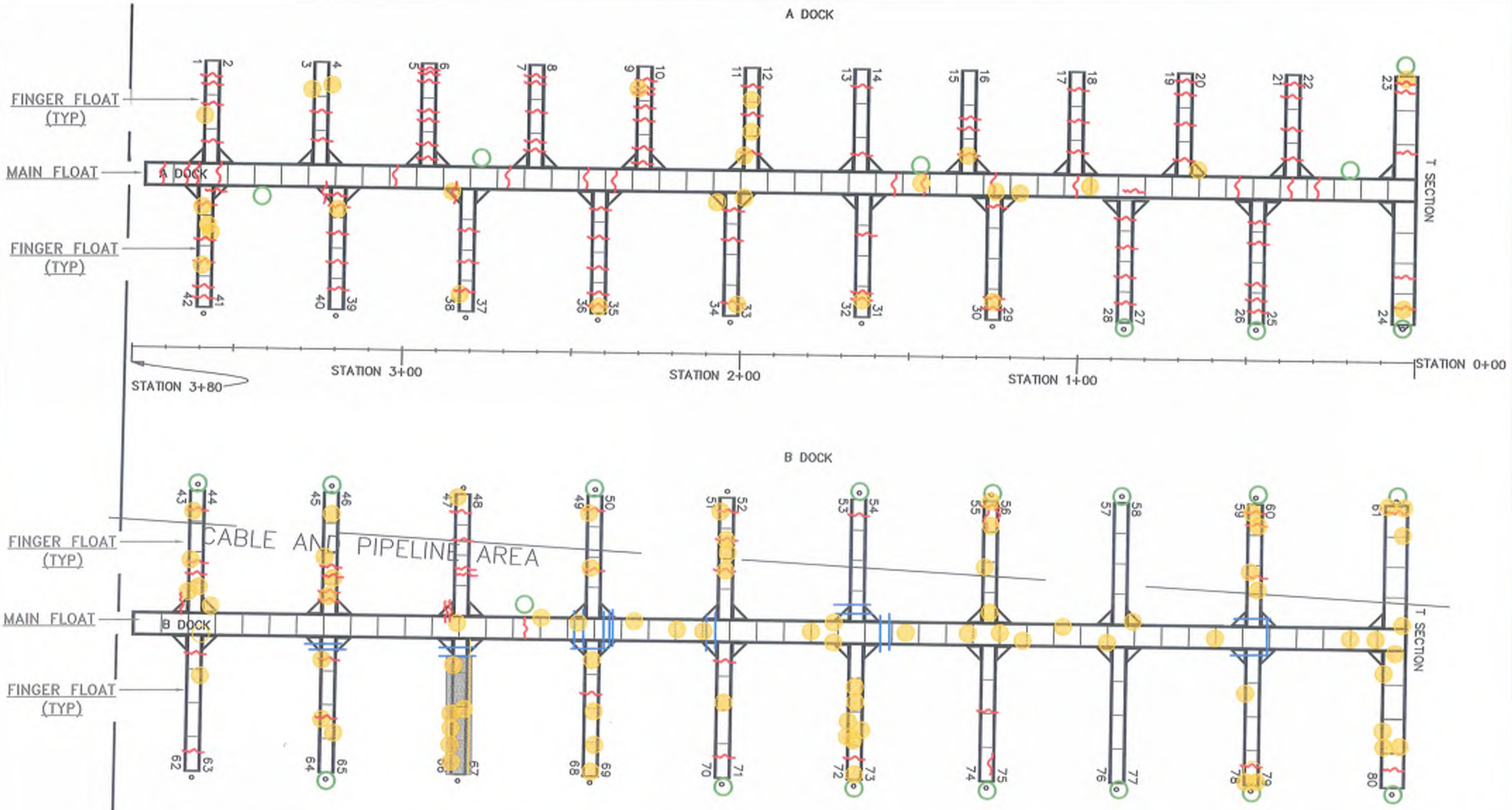
POPE'S ISLAND MARINA
FLOATING DOCK CONDITION ASSESSMENT
NEW BEDFORD HARBOR DEVELOPMENT CORPORATION
NEW BEDFORD, MASSACHUSETTS

REVISIONS:

PROJECT NO.:	09036.60/002
DATE:	FEBRUARY 2014
SCALE:	1"=60'
DESIGNED BY:	RH
CHECKED BY:	KH
DRAWN BY:	LMC
APPROVED BY:	JMB

DRAWING TITLE:
POPE'S ISLAND MARINA KEY PLAN

DRAWING NO.:
1.0
SHEET NO.: 1 OF 4



LEGEND:

- LISTED FLOAT
- CONCRETE CRACK
- CONCRETE SPALL
- POOR PILE HOOP
- POOR THRU-RODS
- TIMBER FLOATS

A-DOCK TOTALS		
Rating	Crack	Spall
A	40	10
B	32	10
C	31	13

B-DOCK TOTALS		
Rating	Crack	Spall
A	15	13
B	18	18
C	10	53

CRITICAL MODULE DEFICIENCIES: A-DOCK		
FLOAT	Crack	Spall
MAIN	2	1
FINGER	19	11

CRITICAL MODULE DEFICIENCIES: B-DOCK		
FLOAT	Crack	Spall
MAIN	1	8
FINGER	7	19

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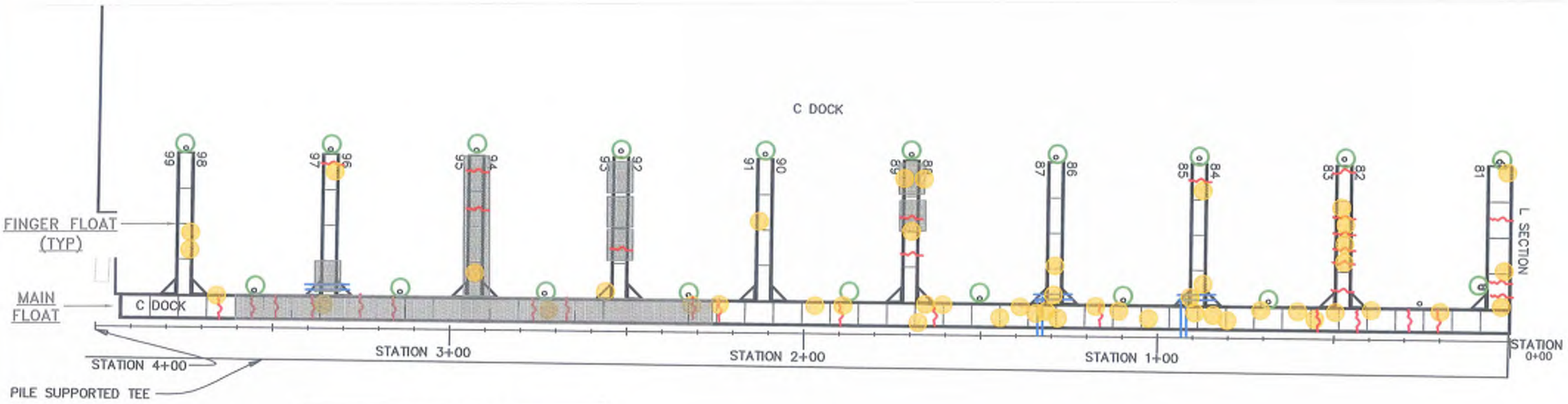
POPE'S ISLAND MARINA
FLOATING DOCK CONDITION ASSESSMENT
NEW BEDFORD HARBOR DEVELOPMENT CORPORATION
NEW BEDFORD, MASSACHUSETTS

REVISIONS:

PROJECT NO.:	0936.01/012
DATE:	FEBRUARY 2014
SCALE:	1"=30'
DESIGNED BY:	BM
CHECKED BY:	KH
DRAWN BY:	LMC
APPROVED BY:	JMB

DRAWING TITLE:
A-DOCK & B-DOCK PLAN

DRAWING NO.:
2.0
SHEET NO.: 2 OF 4



LEGEND:

- LISTED FLOAT
- CONCRETE CRACK
- CONCRETE SPALL
- POOR PILE HOOP
- POOR THRU-RODS
- TIMBER FLOATS

C-DOCK TOTALS		
Rating	Crack	Spall
A	10	0
B	9	11
C	11	37

D-DOCK TOTALS		
Rating	Crack	Spall
A	9	0
B	8	10
C	16	37

CRITICAL MODULE DEFICIENCIES: C-DOCK		
FLOAT	Crack	Spall
MAIN	5	11
FINGER	4	13

CRITICAL MODULE DEFICIENCIES: D-DOCK		
FLOAT	Crack	Spall
MAIN	12	6
FINGER	2	8

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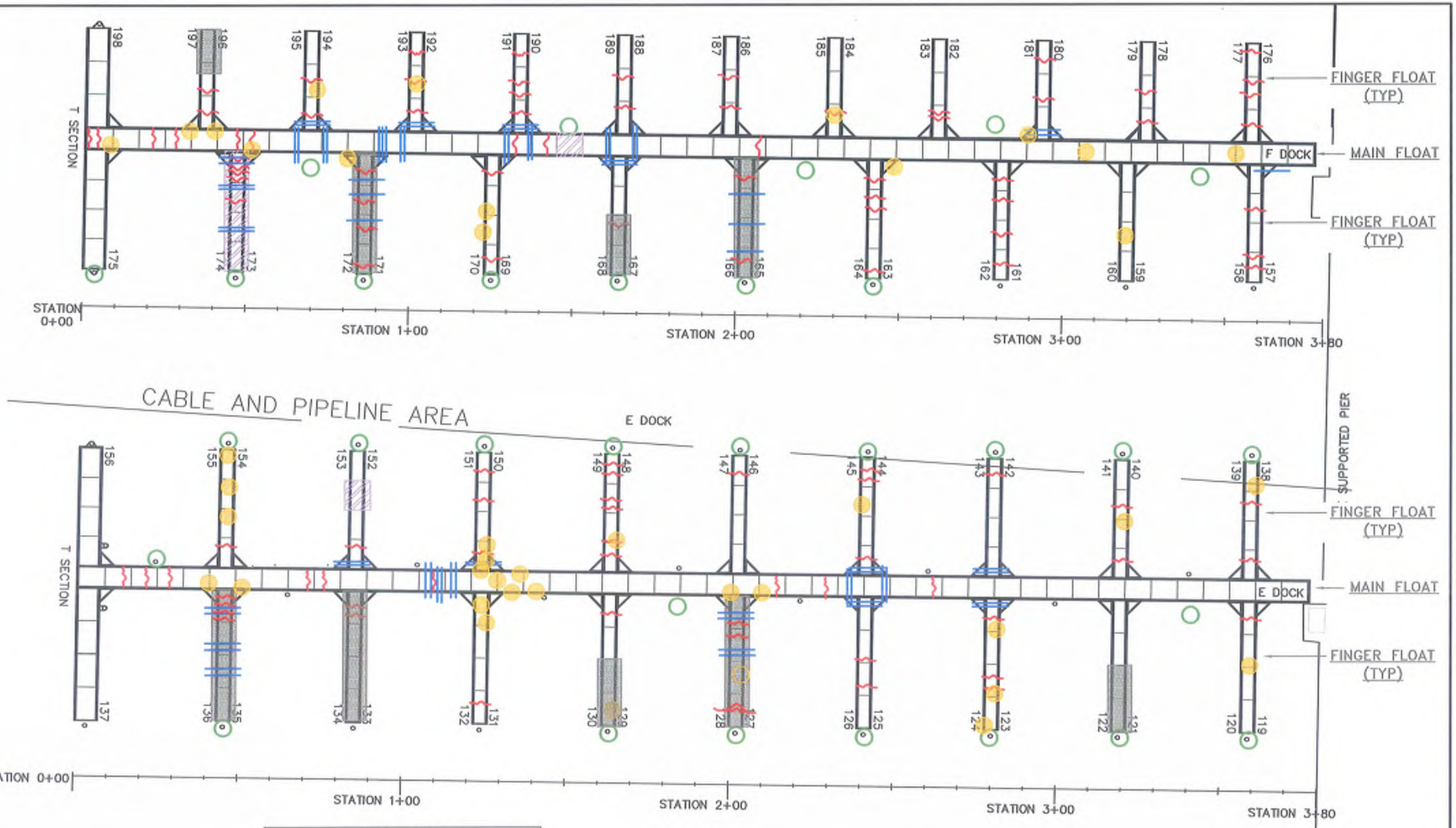
NEW BEDFORD, MASSACHUSETTS

REVISIONS:

PROJECT NO.:	09036.01/012
DATE:	FEBRUARY 2014
SCALE:	1"=30'
DESIGNED BY:	RH
CHECKED BY:	KH
DRAWN BY:	LHC
APPROVED BY:	JHB

DRAWING TITLE:
C-DOCK & D-DOCK PLAN

DRAWING NO.:
3.0
SHEET NO.: 3 OF 4



LEGEND:

- LISTED FLOAT
- CONCRETE CRACK
- CONCRETE SPALL
- POOR PILE HOOP
- POOR THRU-RODS
- TIMBER FLOATS

E-DOCK TOTALS		
Rating	Crack	Spall
A	16	3
B	10	7
C	18	14

F-DOCK TOTALS		
Rating	Crack	Spall
A	20	2
B	21	6
C	6	5

CRITICAL MODULE DEFICIENCIES: E-DOCK		
FLOAT	Crack	Spall
MAIN	6	5
FINGER	3	9

CRITICAL MODULE DEFICIENCIES: F-DOCK		
FLOAT	Crack	Spall
MAIN	2	1
FINGER	6	2

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POPE'S ISLAND MARINA
FLOATING DOCK CONDITION ASSESSMENT
NEW BEDFORD HARBOR DEVELOPMENT CORPORATION
NEW BEDFORD, MASSACHUSETTS

REVISIONS:

PROJECT NO.:	09036.01/012
DATE:	FEBRUARY 2014
SCALE:	1"=30'
DESIGNED BY:	RH
CHECKED BY:	KH
DRAWN BY:	LHC
APPROVED BY:	JHB

DRAWING TITLE:
E-DOCK & F-DOCK PLAN

DRAWING NO.:
4.0
SHEET NO.: 4 OF 4

APPENDIX A – PHOTOGRAPHS

Photo No. 1: Deteriorated concrete encapsulation with exposed polystyrene floatation units.

Photo No. 2: Typical spalling, cracking, and deterioration of the fiber reinforced concrete modules.

Photo No. 3: View of listed float along D-dock.

Photo No. 4: New concrete float at the end of F-dock.

Photo No. 5: Listed concrete float along E-dock.

Photo No. 6: Listed concrete main floats along D-dock

Photo No. 7: Cracking and deterioration of the concrete deck with a trip hazard.

Photo No. 8: Cracking and deterioration of the concrete deck.

Photo No. 9: Listed finger float with displaced concrete panel creating a trip hazard.

Photo No. 10: Typical view of displaced concrete panels with trip hazards.

Photo No. 11: Concrete deck deterioration.

Photo No. 12: Deterioration at the edge of a concrete deck panel with a trip hazard.

Photo No. 13: Typical trip hazard at the joints between adjacent concrete modules along the main floats.

Photo No. 14: Typical concrete deck deterioration.

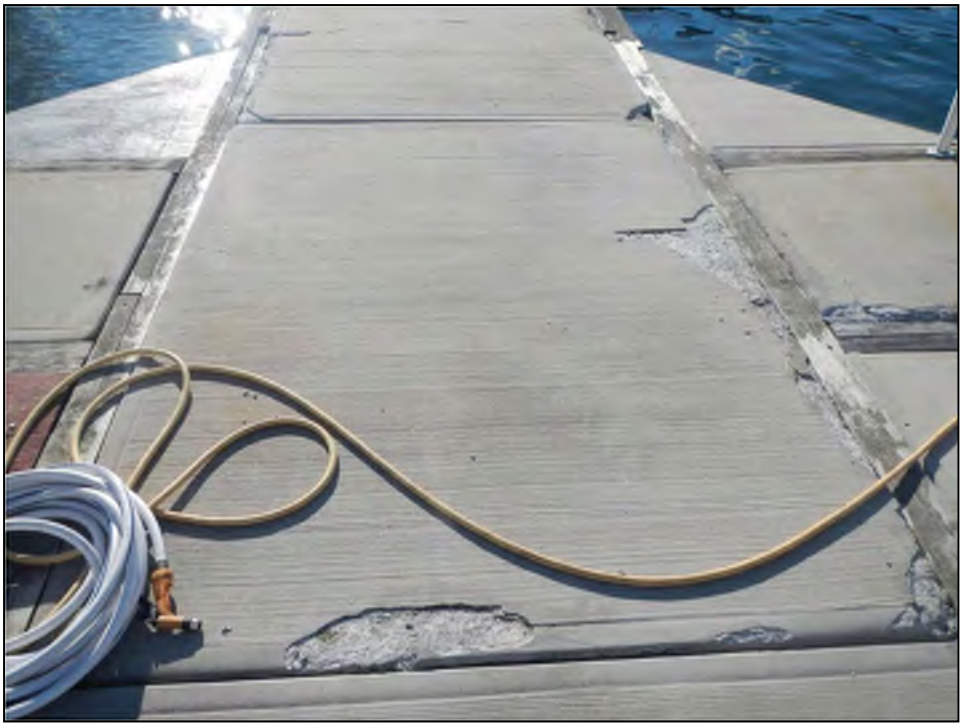


Photo No. 15: Deterioration of the edges of the concrete deck panels creating trip hazards.

Photo No. 16: Cracking and trip hazards along the concrete deck panels.

Photo No. 17: Cracking and trip hazards along the concrete deck panels.

Photo No. 18: Cracking and trip hazards along the concrete deck panels.

Photo No. 19: Deterioration of the concrete modules with exposed polystyrene at a finger float.

Photo No. 20: Deterioration of the concrete modules with exposed polystyrene at a finger float.

Photo No. 21: Deterioration of the concrete modules with exposed polystyrene at a finger float.

Photo No. 22: Deterioration of the concrete modules near the waterline.

Photo No. 23: Deterioration of the concrete modules near the waterline. Note fiber reinforcement.

Photo No. 24: Deterioration of the concrete modules near the waterline.

Photo No. 25: New timber float with composite decking.

Photo No. 26: Composite decking replacing a concrete deck panel.

Photo No. 27: Composite decking replacing a concrete deck panel.

Photo No. 28: Steel plate float connection bolted to timber edge boards.

Photo No. 29: Typical existing pile hoop. Note corroded connection hardware.

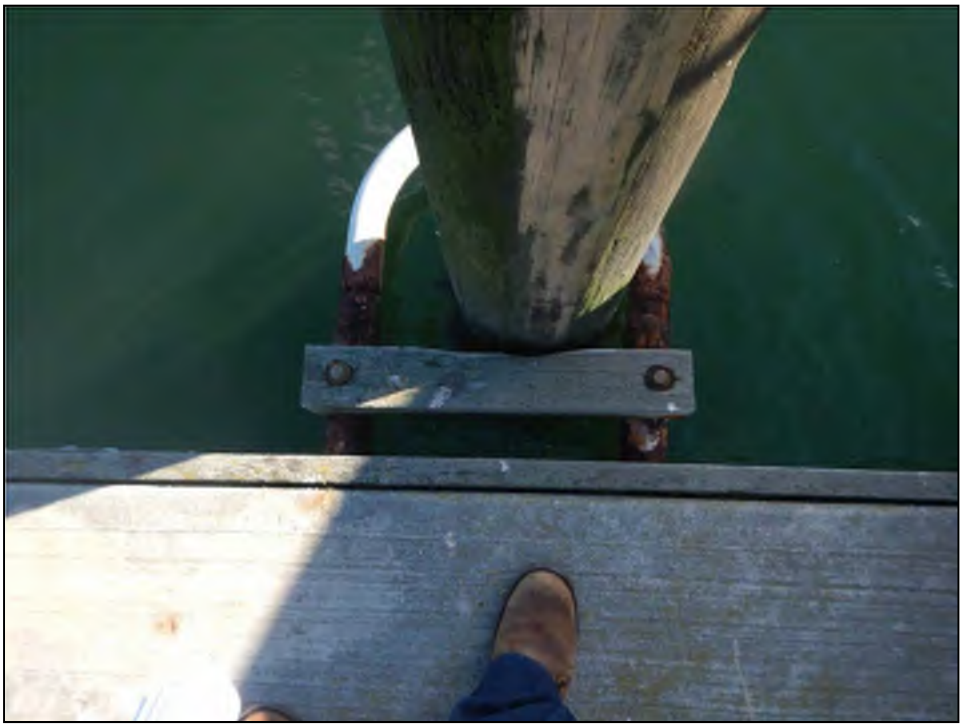


Photo No. 30: Significantly deteriorated steel pile hoop.

APPENDIX B – 2011 APEX COMPANIES' INSPECTION REPORT

NEW BEDFORD HARBOR
POPES ISLAND MARINA

AUGUST 2011 INSPECTION REPORT: FLOATING DOCK AND FINGER FLOAT INSPECTION

November 1, 2011

Prepared for:

City of New Bedford
Harbor Development Commission
Popes Island Marina - 102 Popes Island
New Bedford, MA 02745

Prepared by:

Apex Companies LLC
184 High Street
Boston, MA 02110

New Bedford Harbor
Popes Island Marina

August 2011 Inspection Report:
Floating Dock and
Finger Float Inspection

TABLE OF CONTENTS

INTRODUCTION

The New Bedford Harbor Development Commission (NBHDC) retained Apex Companies LLC (Apex) to perform topside visual inspections of the Floating Docks and Finger Floats at the municipal marina facilities on Popes Island at 102 Popes Island, on the south side of Route 6, in New Bedford, Massachusetts, and develop a report of existing conditions. Permitted in 1988 and built by the Massachusetts Department of Environmental Management in 1993, the 198-slip marina consists of a 450' long main pile-supported pier, an 810' long pile-supported "tee" pier, and six concrete Floating Docks with attached Finger Floats. The Floating Docks and Finger Floats are held in place by timber Guide Piles. The topside inspections were conducted in two phases, the first during March 2011 on D-Dock, and then a second phase covering the remainder of the marina completed on August 15th. The inspections were used to establish a record of existing conditions and to develop recommendations for focused maintenance and improvement activities. Prior to the completion of the written report, when Tropical Storm Irene caused significant damage to the marina, subsequent post-storm inspections and damage estimates postponed its assembly. This report has been prepared based on the field notes and inspection photos taken prior to the Tropical Storm event, and describes the conditions of the marina as they existed on the dates of inspection.

SCOPE OF WORK

This topside inspection focused on the concrete Floating Docks and Finger Floats. The pile supported main pier and tee (reviewed by Pare Corporation in 2009[1]), and the utilities servicing the Floating Docks and Finger Floats (see electrical work reference below), were completed separately by others and were outside the scope of this inspection. The inspections were conducted by Apex personnel, and consisted of a visual inspection coupled with photographs and field notes. The Docks were divided into sections based on stationing and by relative location based on the slip numbers of the Finger Floats. The First Phase (D-Dock) was followed by repairs to four Finger Floats, three Floating Dock Floatation Units, and a Floatation Unit located in the "L" section at the western end of the Floating Dock. The Second Phase built on the prior phase and expanded to the remaining portions of the Floating Dock and Finger Float system.

Separate from this inspection, annual inspections of the Pope's Island Marina owned moorings were performed by Pioneer Mooring Service, of South Dartmouth Massachusetts. The individual mooring inspection reports have been included in this report as Appendix 1.

Also separate from this inspection, recent electrical repairs by Souza & Branco Electric, Inc. have been performed at the marina to ensure a safe and uninterrupted power supply to the docks. The invoices documenting the completion of these projects are attached as Appendix 2.

[1] Pare Corporation, (March 2009), entitled "Inspection Report, Popes Island Marina, New Bedford Waterfront Facilities Inspections, New Bedford, Massachusetts.

EXISTING CONDITIONS:

Facility Construction:

The Docks and Finger Floats at the marina are constructed of concrete encased polystyrene Floatation Units, held together by overlapping lengths of lumber wales (or Walers). The Floatation Units are penetrated by sleeved channels (sleeved penetrations) spaced at one foot intervals starting six inches (nominal) from the ends of each Floatation Unit. Thru-Rods run through these sleeved penetrations, and through the Walers, and are fastened tightly to the outer Waler with washers and nuts. The Walers act to "sandwich" the Floatation Units holding them tightly in place, allowing the full dock to act as a single semi-rigid structure. Thru-Rods are not always present in every available sleeved penetration.

Finger Floats are affixed to a dock length using the same Thru-Rods, which hold the Floatation Units in place between the Walers. The Finger Floats have welded angle-iron triangular brackets (Angle-Iron Triangles), which are affixed to both sides of the dock side edge, and extend approximately five feet out to either side of the Finger Float. The Angle-Iron Triangles have drilled or punched holes spaced at one foot intervals allowing the connection of the Finger Float to the dock using the same Thru-Rods that hold the Floatation Units between the Walers. At these connection locations, the Thru-Rods pass through the outer and inner Walers on the opposite side of the Dock, through the Floatation Unit, through the inner and outer Waler on the Finger Float side of the Dock, then through the Angle-Iron Triangle, and are secured with a nut and washer. Finger Floats are constructed of narrower Floatation Units than are used in the main Floating Dock sections. The Finger Floats at the ends of A-, B-, E- and F-Docks form a T-section, and are constructed using Floatation Units of the same width as the Floating Dock section. The Finger Floats at the end of C- and D-Docks form an L-section, and are also constructed using Floatation Units of the same width as the Floating Dock sections.

All of the finger piers on B-, C-, D- and E-Docks, and all of the southern Finger Floats on A- and F-Docks, have a single wooden pile (Guide Pile) driven at the end furthest from the Dock. Guide Piles are also driven periodically along the length of the Docks. The Guide Piles serve to hold the Floating Dock and Finger Float system in horizontal position, while allowing it to rise and fall vertically with the tide. The Docks and Finger Floats have a steel u-shaped hoop (Guide Hoop) which wraps loosely around the Guide Pile. The original Guide Hoops appear to have included a rub block affixed to the hoop, situated between the Guide Pile and the Dock or Float to which the hoop is attached.

INSPECTION FINDINGS:

General:

The inspection found that although the marina is in generally good condition the Floating Docks and Finger Floats throughout the marina are in varying states of deterioration due to regular wear and tear. Photographs and field sketches documenting the condition of the Floating Docks and Finger Floats at the time of inspection are enclosed in the data CD accompanying this report. Much of the minor wear is typified by cracks in the concrete Floatation Units, many of which are

surficial and some of which have progressed to the point of being structural. In addition to exhibiting surficial cracks, some of the Floatation Units are losing buoyancy causing the Finger Floats or the portions of the docks to list or float lower in the water than adjacent units. In several locations the Guide Hoops, which have broken over time, have been replaced by Guide Chains. Original Guide Hoops, in place since the marina was constructed, show evidence of weakening, most noticeably in the appearance of scale rust. Additionally, many of the Guide Hoops are missing the rub blocks, which presumably were incorporated into all of them originally. The following sections describe the findings separated into sections by Dock, and documentation of the conditions found during the inspections can be seen in the attached photographs.

A-Dock

A-Dock appears to be in relatively good condition overall. The Walers and Coverboards are grey with age, but appear sound. Many of the Floatation Units exhibit surficial cracking and chipping, but none of them appear to have severe structural problems that require immediate attention. In general, Thru-Rods at the Angle-Iron Triangles show signs of surficial rust and limited wear at the point of contact with the triangle. Wear and rusting are not consistent along the length of A-Dock, and some of the Thru-Rods are more affected than others. The Angle-Iron Triangles themselves exhibit similar signs of ageing as the Thru-Rods which are attached to them, but are generally in good condition. Pile Guides are in generally fair condition, many of the original Guide Hoops have been replaced with Guide Chains, and the remaining hoops all show some signs of deterioration.

B-Dock

B-Dock appears to be in relatively good condition overall. The Walers and Coverboards are grey with age, but appear sound. Many of the Floatation Units exhibit surficial cracking and chipping, but none of them appear to have severe structural problems needing immediate attention. In general, Thru-Rods at the Angle-Iron Triangles show signs of surficial rust and limited wear at the point of contact with the triangle. Wear and rusting are not consistent along the length of B-Dock, and some of the Thru-Rods are more affected than others. The angle-iron triangles themselves exhibit similar signs of ageing as the Thru-Rods which are attached to them, but are generally in good condition. Pile Guides are in generally fair condition, many of the original Guide Hoops have been replaced with Guide Chains, and the remaining hoops all show some signs of deterioration.

The Thru-Rods and Angle-Iron Triangles at the T-section of B-Dock show signs of greater than average deterioration. The Thru-Rods have loosened, allowing the Floatation Units to move independently of the Walers and Angle-Iron Triangles. The Triangles have oversized oval bolt holes, and show greater than average oxidation and deterioration. The T-section is currently being stabilized with galvanized chain tensioned with turn-buckles.

C-Dock

C-Dock appears to be in relatively good condition overall. The Walers and Coverboards appear to have been replaced as part of the 2006 repairs and appear sound. Many of the Floatation Units exhibit surficial cracking and chipping, but none of them appear to have severe structural problems needing immediate attention. In general, Thru-Rods at the Angle-Iron Triangles show signs of surficial rust and limited wear at the point of contact with the triangle. Wear and rusting are not consistent along the length of C-Dock, and some of the Thru-Rods are more affected than others. The Angle-Iron Triangles themselves exhibit similar signs of ageing as the Thru-Rods which are attached to them, but are generally in good condition. Pile Guides are in generally fair condition, many of the original Guide Hoops have been replaced with Guide Chains, and the remaining hoops all show signs of deterioration.

D-Dock

D-Dock appears to be in relatively fair condition overall. The Walers and Coverboards appear to have been replaced as part of the 2006 repairs and appear sound. Many of the Floatation Units exhibit surficial cracking and chipping, but none of them appear to have severe structural problems needing immediate attention. Three Floatation Units on the Floating Dock, and one unit on the L-section, were replaced in April of this year, including the immediately adjacent inner and outer walers. In general, the Thru-Rods along D-dock show relatively less rusting and deterioration than the Thru-Rods on the other docks in the Marina. Thru-Rods at the Angle-Iron Triangles show signs of surficial rust and limited wear at the point of contact with the triangle. Wear and rusting are not consistent along the length of D-Dock, and some of the Thru-Rods are more affected than others. The Angle-Iron Triangles themselves exhibit similar signs of ageing as the Thru-Rods which are attached to them, but are generally in good condition. Pile Guides are in generally fair condition, most of the original Guide Hoops have been replaced with Guide Chains, and the remaining hoops all show signs of deterioration. Four D-Dock Finger Floats were replaced in April of this year. The old floats were removed and disposed of off-site, and new Finger Floats were constructed using plastic Floatation Units, wooden framing, and a composite deck surface.

E-Dock

E-Dock appears to be in relatively good condition overall. The Walers and Coverboards, on the majority of the dock and Finger Floats, are grey with age, but appear sound. The Walers and Coverboards on the western end are in very new condition, and were replaced in early 2010. Many of the Floatation Units exhibit surficial cracking and chipping. Finger Floats 135&136 and 133&134 have a significant list and the Angle-Iron Triangles show significant deterioration. In general, the remainder of the E-Dock Thru-Rods and Angle-Iron Triangles show signs of surficial rust and limited wear at the point of contact with the triangle. Wear and rusting are not consistent along the length of E-Dock, and some of the Thru-Rods are more affected than others. The Angle-Iron Triangles themselves exhibit similar signs of ageing as the Thru-Rods which are attached to them, but are generally in good condition. Pile Guides are in generally fair condition, most of the original Guide Hoops have been replaced with Guide Chains, and the remaining hoops all show signs of deterioration.

F-Dock

F-Dock appears to be in relatively good condition overall. The Walers and Coverboards on the majority of the dock are grey with age, but appear sound. The Walers and Coverboards on the western end are in very good condition having been replaced in early 2010. Many of the Floatation Units exhibit surficial cracking and chipping. Finger Floats 173&174, and 196&197 have a significant list especially at the ends away from the Floating Dock. In general, Thru-Rods at the Angle-Iron Triangles show signs of surficial rust and limited wear at the point of contact with the triangle. Wear and rusting are not consistent along the length of F-Dock, and some of the Thru-Rods are more affected than others. The Angle-Iron Triangles themselves exhibit similar signs of ageing as the Thru-Rods which are attached to them, but are generally in good condition. Pile Guides are in generally fair condition, many of the original Guide Hoops have been replaced with Guide Chains, and the remaining hoops all show signs of deterioration. One Floatation Unit on the Floating Dock itself has been previously removed, and replaced with a bridged section of wooden framing, and wooden decking, which does not include a Floatation Unit.

RECOMMENDATIONS:

General

Based on the conditions found during the inspections, Apex recommends that the following be performed to optimize the life and utility of the existing Floating Docks and Finger Floats at the Marina.

High Priority:

The Finger Floats which are exhibiting the most reduced or unbalanced buoyancy should be removed and replaced. Finger Floats 133&134, 135&136, 173&174 and 196&197 should be replaced as soon as funding is made available. The replacement of the Finger Floats in these locations should include the Angle-Iron Triangles and Thru-Rods which are used to attach the Finger Floats to the Floating Docks.

The T-section at the end of B-Dock should be reconstructed with new Inner and Outer Walers, new Thru-Rods, and new Angle-Iron Triangles. When the B-Dock T-section is disassembled for reconstruction, the Floatation Units should be carefully inspected for signs of structural damage. If structural damage to the Floatation Units is revealed, then they should be replaced at that time.

Lower Priority:

Finger Floats which are exhibiting reduced or unbalanced buoyancy should be replaced as funding becomes available. Many of the Finger Floats throughout the marina are exhibiting some varying degree of listing, or lost buoyancy, and as funding becomes available these Finger Floats should be

replaced. Since some buoyancy loss is expected as the marina facilities age, and the degree of buoyancy loss is dependent on several factors, an assessment should be made at the end of the fall and early in the spring as to which, if any, Finger Floats should be replaced at that time.

Thru-Rods and Angle-Iron Triangles

The Thru-Rods and Angle-Iron Triangles at the following Finger Floats should be replaced when funding is available:

A-Dock	B-Dock	C-Dock	D-Dock	E-Dock	F-Dock
T-Section	T-Section	86&87	103&102	155&154	194&195
21&22	68&69	85&84		150&151	192&193
13&14	64&65			148&149	190&191
10&9	59&60			142&143	171&172
	53&54			135&136	
	51&52			127&128	
				125&126	

The Thru-Rods and Angle-Iron Triangles should continue to be monitored and inspected after each storm event, and twice each year to ensure that they are in good condition, and applying adequate pressure to the outer walers through which they pass.

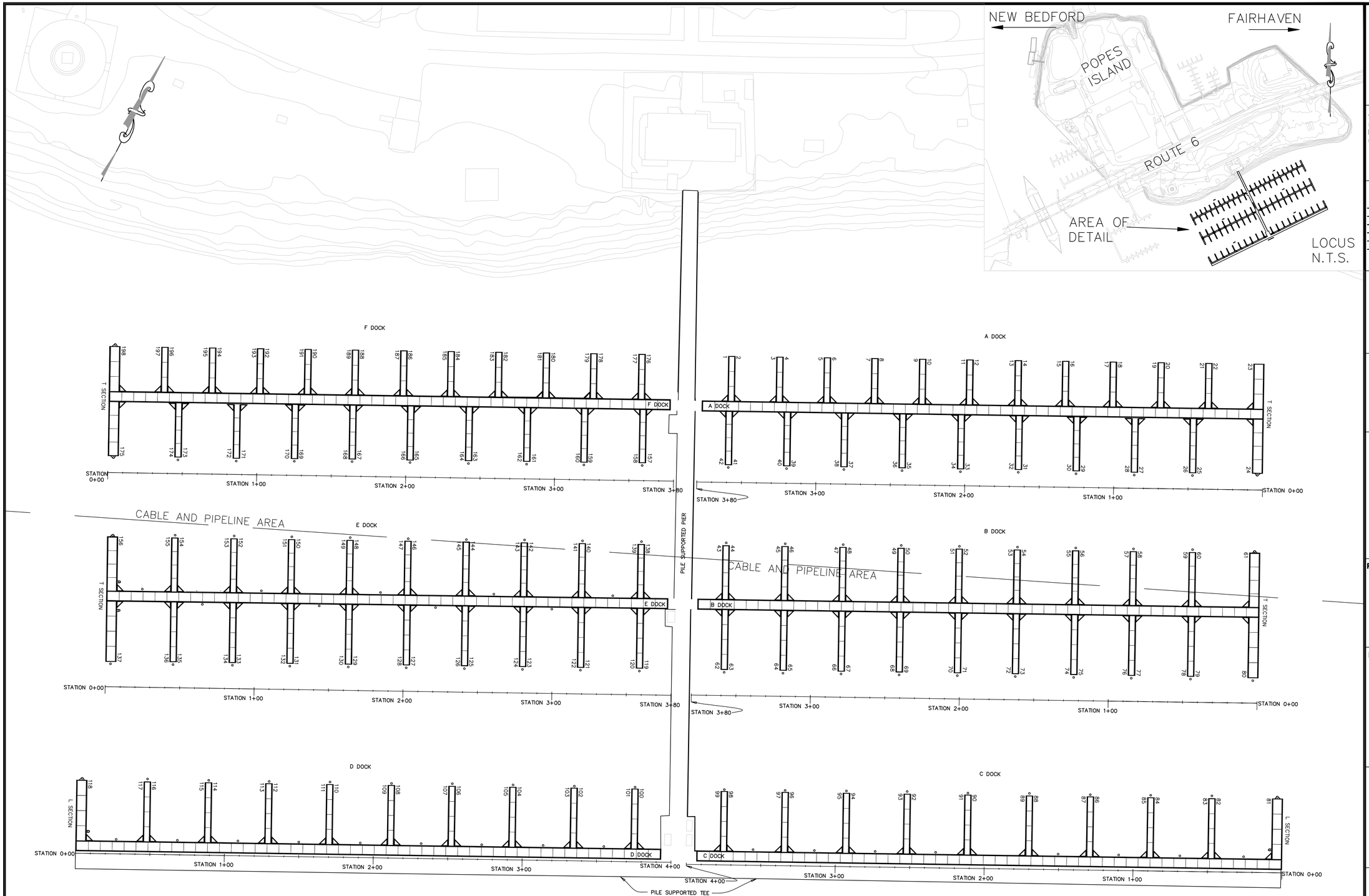
Pile Guides

The original hoop Pile Guides still in service at the marina, should be replaced with Hoop and Roller type pile guides as they come to the end of their service life. As funding is made available, the Chain Pile Guides should all be replaced with Hoop and Roller type pile guides, to provide more horizontal control over the movements of the Finger Floats and Floating Docks.

Attachments:

CD-ROM Containing Inspection Photographs
General Facility Plan Showing Dock Configuration and Slip Numbers

APPENDIX 1 – Pioneer Mooring Service Mooring Inspection Reports
APPENDIX 2 – Recent Electrical Service Invoices



APEX

1 WAMSUTTA STREET
SUITE 8
NEW BEDFORD, MA 2740
(617) 728-0070

184 HIGH STREET
SUITE 502
BOSTON MA 02110
(617) 728-0070

REVISIONS

NO.	DATE	DESCRIPTION

PROJECT TITLE:

POPES ISLAND MARINA EXISTING CONDITIONS SURVEY AUGUST 15, 2011

PREPARED FOR:

THE NEW BEDFORD HARBOR DEVELOPMENT COMMISSION

DRAWING TITLE:

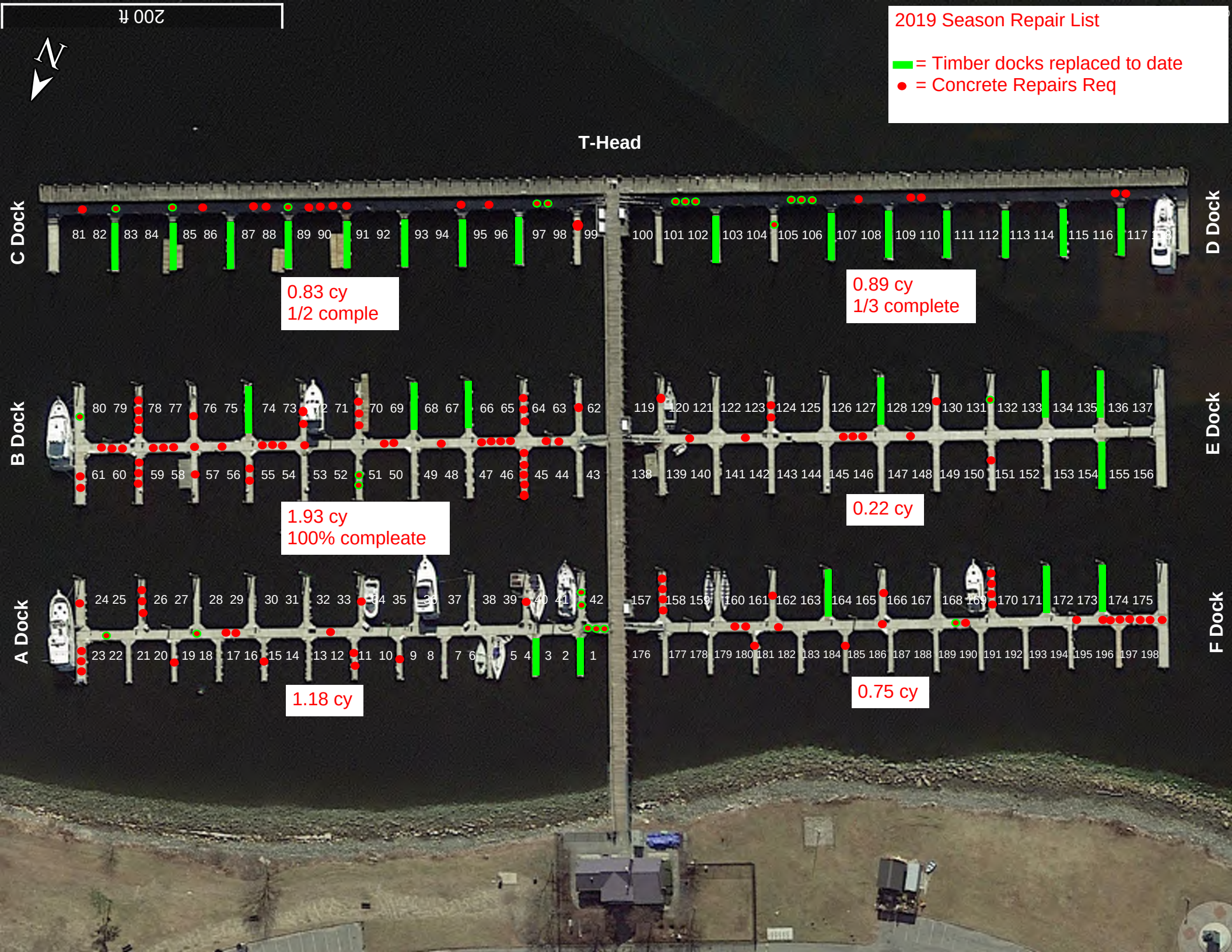
FACILITY PLAN

Scale: 1"=30'

0 15 30 60 75 FEET

Date 11/01/11	Drawing No.
Proj. Mgr. JAB	
Design GCD	
Check GCD	
Drawn GCD	
Job. No. 6714	
Last Rev. 11/01/11	

P:\Jobs\6714 Popes Island Marina\001 - Repairs\PANS\POPESIS AND_AUG_2011_FC.dwg


200 ft
N
2019 Season Repair List
= Timber docks replaced to date
= Concrete Repairs Req
T-Head
C Dock
D Dock
B Dock
E Dock
A Dock
F Dock
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99
100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
0.83 cy
1/2 comple
0.89 cy
1/3 complete
80 79 78 77 76 75 74 73 72 71 70 69 68 67 66 65 64 63 62
61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43
119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137
138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156
1.93 cy
100% compleate
0.22 cy
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198
1.18 cy
0.75 cy

APPENDIX D – UNDERWATER INSPECTION REPORT

FIELD SUMMERY REPORT
UNDERWATER INSPECTION
Of the
POPE'S ISLAND MARINA
PILINGS and WAVE BARRIER

NEW BEDFORD MASSACHUSETTS

APRIL 6-10, 2020

INSPECTION BY
INNER TECH MARINE SERVICES
25 TRIPPS LANE
RIVERSIDE, RI 02915

INSPECTION FOR
PARE CORPORATION
10 LINCOLN STREET, SUITE 210
FOXBORO, MA 02035

DATE OF INSPECTION: 4/6/2020, 4/7/2020, 4/10/2020

LOCATION: On Pope's Island, Rt. 6, New Bedford, MA.

WORK SCOPE: Swim-by of all piers, Level 1
Clean off and inspection of 10% of the piles, Level 11
Sounding and measurement of 5% of the Piles, Level 111
Swim-by of X braces and the wave barrier

PERSONEL PRESENT
INNER TECH
Inspector: Stephen Antoniou
Standby diver: Michael Bradshaw
Dive tender: John Marmaris

PARE CORPORATION
Resident engineer: Danielle Geoudreau P.E.

DIVE STATION AND EXISTING CONDITIONS: All inspection diving was staged aboard the ITMS 28ft. Dive boat "Diane and Sarah. Air supply was provided to the diver via HP tanks and umbilical. Communications was established at all times. Cold water support was provided by water heated dive suits. Approximate water temperature was 41 degrees, visibility was typically 5-10 feet, water depth was 5-14 ft.

BRIEF HISTORY OF THE SITE: The Marina structures were previously inspected approximately 2008. Deficiencies noted were some evidence of marine borer activity, cross brace fasteners were poor.

DIVING INSPECTION PROCEDURE: There were approximately 505 piles to be inspected. A level 1 swim-by was conducted of all piles to look for obvious deterioration; loss of cross section, splintering, broken piles. A Level 11 inspection including cleaning off the marine growth on the piles was conducted on approximately 25% of the piles during the swim-by level 1 inspection. After cleaning the piles were hit with a chipping hammer to look for delamination, hollowing, extensive marine borer damage. A Level 111 inspection was conducted; after cleaning the circumference of the pile was measured, typically near the mud line, the pile was sounded, and random photographs were taken. 35 out of 505 piles, or approximately 14% of the piles were measured.

OBSERVATIONS
MAIN PIER SECTION

The main pier section consisted of Bents 1-45, with three piles per bent. The piles are connected by cross braces. The fasteners connecting the cross braces at low water are poor. Most of the nuts are rusted off the bolts. Some of the brace ends at low water were fractured and split, likely caused by pile movement, weathering and weakness around the fastener counterbore. The piles that were cleaned and inspected showed some superficial damage from marine organisms. This damage seemed to be located in the outer ¼ inch layer of wood. The piles which were sounded seemed to be hard and without internal damage. The circumference of the piles was measured, typically, the measured area appeared smooth, green from CCA treatment and without gross deterioration.

CIRCUMFRENCE OF RANDOM MEASURED PILES

BENT	MEASUREMENT
7	37.5”
15	39”
24	36.5”
26	37.5”
38	37”
40	38”

PHOTO #1, This is a typical fastener at low water holding a cross brace.

PHOTO #2, This is a photograph of a cleaned pile under the Main Pier. The pile was relatively smooth and undamaged, the green pile treatment can be seen, some barnacle scaring is present.

PHOTO #3 Photo of a fractured brace end and deteriorated fastener.

OBSERVATIONS
West Finger Piers, "F" "E" and "D" Dock

This section consists of approximately 62 piles. Most of the piles were sounded during the swim-by inspection, all piles sounded and felt hard when hit with a brick hammer. After cleaning, the outer layer of wood appeared relatively smooth and the green wood treatment (CCA) could be seen. Some pilings appeared to have some superficial damage to the outer ¼ inch from marine organisms. Measured piles were cleaned, the circumference of the measured piles is detailed below. The piles were numbered using the nearest "slip" number.

CIRCUMFERENCE of MEASURED PILES

SLIP NUMBER	MEASUREMENT
F Dock, 163	45"
F Dock, 168	39"
F Dock, 174	39
E Dock, 153	37.5"
E Dock, 148	36"
E Dock, 139	37"
E Dock, 10	36.5"
D Dock, 118	44"
D Dock, 110	41"

PHOTO #4, Typical pile in the West section. Piles were relatively smooth with some barnacle scars. The vertical scrapes in the picture are from the cleaning tool, the green wood treatment can be seen.

PHOTO #5, Another picture of a pile in the West section of the Marina, the camera gives a close-up view. The wood was hard and smooth to the touch, there is some superficial marine organism damage on the surface of the pile. The circular area mid photo is a “knot” in the wood, which was intact.

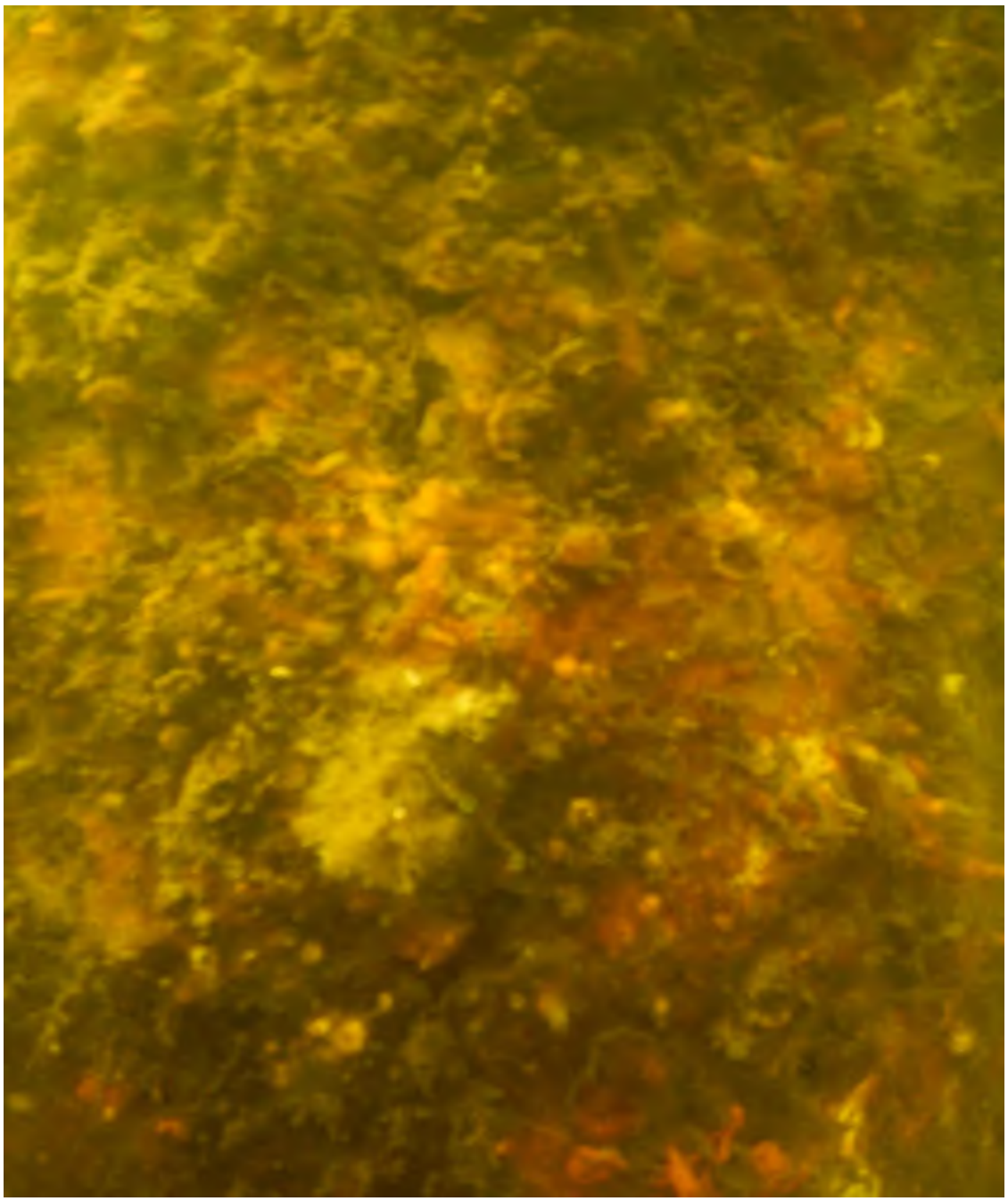


PHOTO #6, Pile surface before cleaning.

OBSERVATIONS
T-HEAD PIER AND WAVE FENCE

This section consists of 80 bents with 3 associated piles and cross braces. There is a wave fence on the outside of the T-Head pier and Fender piles. No broken or severely damage piles were seen. Almost all of the piles were sounded using a brick hammer, during the swim-by inspection. All sounded and felt hard. Random areas of the piles surfaces were scraped clean of marine growth to facilitate the inspection. All appeared relatively smooth with some barnacle scaring and superficial damage from marine organisms. The green wood treatment (CCA) could be seen on the pile surface. Additional piles were cleaned and the circumference measured. The measurements are detailed below. Many of the cross braces, at or below low water, were typically split and damaged and the associated fasteners in poor condition. The splitting likely caused by pier movement, ice, weathering or marine organisms. The wave fence sections at or below low water were in poor condition with the low water support-whaler loose and falling off because of the deteriorated fasteners. Most of the wave fence planks were disconnected from the low water support because of deteriorated fasteners. Many of the planks were hollow and deteriorated.

CIRCUMFERENCE of MEASURED PILES

BENT NUMBER	MEASUREMENT
72	41”
67	37”
60	40”
50	41”
37	37”
25	37.5”
18	37”
2	37”

PHOTO #7, showing the surface of a random cleaned pile. The green CCA treatment can be seen, there are barnacle scars on the surface. The pile was hard to a hammer blow and smooth to the touch. The circular area top of photo is a knot in the wooden pile. The knot was not deteriorated and the wood sound. The different colored lines are from the scraping-cleaning process.

PHOTO #8, typical X brace fastener at low water.

PHOTO #9, taken at low tide. Note the splintered braces at low water and splintered wave barrier blanks

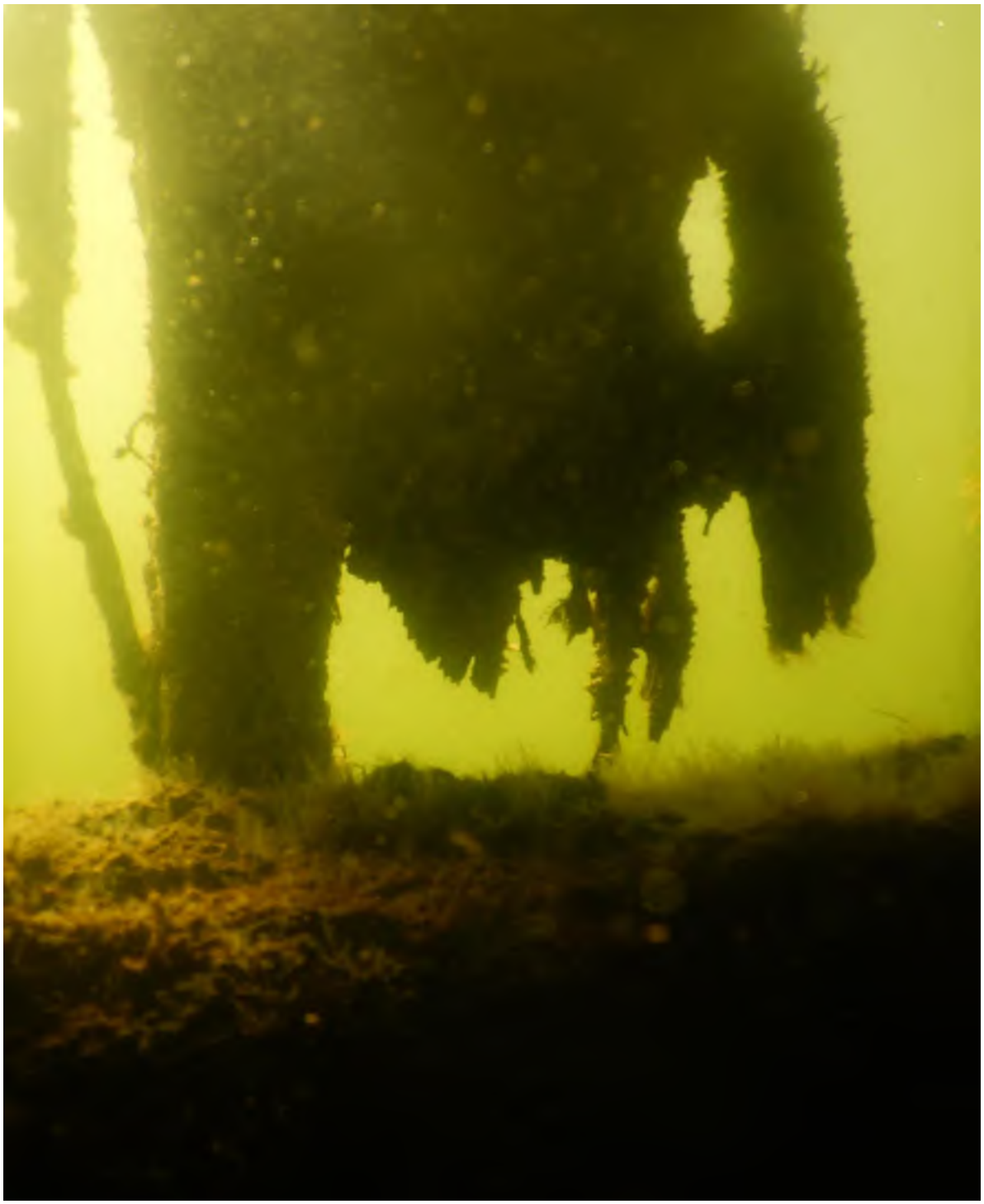


PHOTO #10, showing a wave plank underwater. Many of the planks were in this condition and the whaler-support timber below was rotted and falling down. Low water fasteners holding the planks were poor, fasteners holding the timbers to the piles were poor

OBSERVATIONS

EAST SIDE OF THE MARINA, FINGER DOCKS “A”, “B” and C”

There are approximately 60 piles in this area. A level 1 inspection was conducted of all the piles, all piles appeared intact and without obvious damage. During the level 11 inspection almost all of the piles were sounded and over 25% of the piles were cleaned in random areas to look for splintering, borer damage, hollowing or other deterioration. Typically, most piles appeared CCA treated, felt smooth to the touch and sounded hard. Most piles had some superficial marine organism damage to the outter ¼ inch of wood. During the level 111 inspection random piles were cleaned, the wood sounded and a circumfrence reading taken approximately 1-2ft off the mud line. The circumfrence reading is charted below, the location of the piles is reference to their proximity to the nearest numbered “slip”. It was noted that many of the floats in this area had the ends deteriorated and the inside of the float could be seen

CIRCUMFERENCE of MEASURED PILES

SLIP NUMBER	MEASUREMENT
C Dock, 97	44”
C Dock, 91	38”
B Dock, 63	35”
B Dock, 51	43”
B Dock, 70	40’
B Dock, 80	36”
A Dock, 25	40”
A Dock, 40-41	38”
A Dock, 35	38”

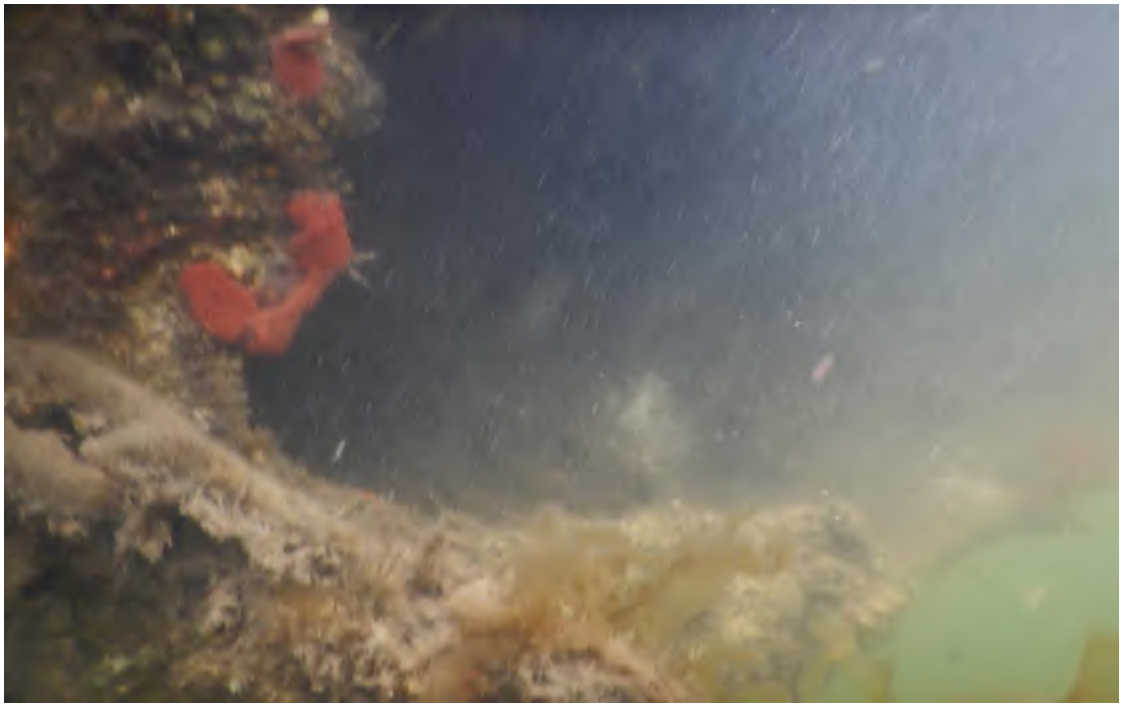


PHOTO #11, showing the deteriorated end of a float with the interior visible, many of the floats in this area were like this.

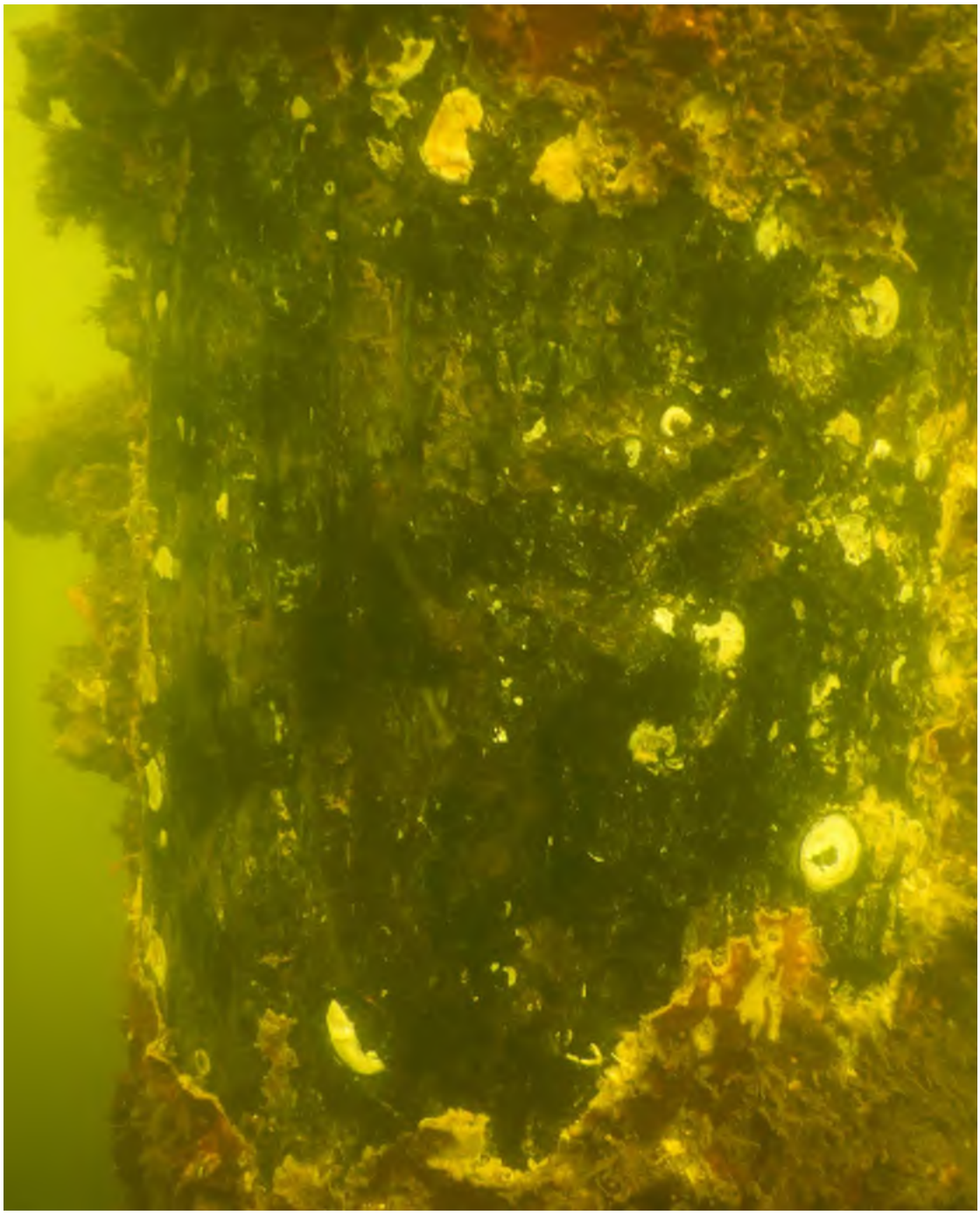


PHOTO # 12, showing a typical pile in this area. This pile looks rough in the photo due to the incomplete cleaning, however, it was hard and relatively smooth to the touch. The green CCA treatment could be seen on the outside of the pile, there was superficial marine organism damage to the outside layer of wood. The pile sounded hard to a hammer blow.

SUMMERY OF OBSERVATIONS

All piles cleaned and inspected were relatively smooth to the touch and green colored from CCA treatment. All piles showed some superficial damage from marine organisms, to the outside approximately ¼" layer of wood although no delamination was present. The piles cleaned and inspected are considered to be in good condition with no loss of X section from borers observed. The measurements taken of the lower portions of the piles were similar and only varied depending on the actual girth of the pile and how deep it was driven. The low water fasteners holding X braces and wave fence planks are poor and deteriorated. A few of the X braces on the Main Pier are poor. Most of the braces on the T-Head Pier are poor. Many are splintered and hollow. The low water portion of the Wave Fence is poor. The planks are rotted and their fasteners missing, causing the planks to swing in wave and wake serge. The lower whaler-support has fallen in many locations and the remaining fasteners are poor. It was noted that the ends of many of the finger piers in the East section are deteriorated and fallen off exposing the interior of the floats. The exact condition of the finger piers in the West section (and all other sections) was not detailed in this inspection other than they were extremely fouled with marine growth, a typical condition seen through the marina.

APPENDIX E – ELECTRICAL INSPECTION REPORT

RONALD W. BUIA, INC.
Electrical Engineers
EST. 1984

May 27, 2020

POPES ISLAND MARINA ELECTRICAL SYSTEM ELECTRICAL REPORT

On 5/20/20 I met with Ryan McCoy, Managing Engineer, Pare Corp. to visually inspect the marina's electrical system. We spoke with the marina's maintenance people who unlocked the main electrical room located in the marina office building as well as the five (5) 480 V – 120/208 V substations located on the marina's pier. These substations each contain a 150 KVA dry type transformer and a 400 Amp, 120/208 V, 3-phase 4-wire panelboard with circuit breakers that feed the power pedestals on each of the finger floats ant the T-Head Pier's 200 Amp power pedestals.

The main 800 Amp, 480/277 V main switchboard is a Challenger Power Master PRL4 Panelboard manufactured in 12/91 which makes the switchboard 29 years old. This switchboard powers the 5 @ 150 KVA 480 V substations that transforms the 480 Volts down to the 120/208V Panelboards that in turn feed the power pedestals throughout the marina. The Challenger Panel appears to be in good condition and the maintenance people did not indicate that they had any problems with this switchboard.

I had reviewed the Eversource electric bills for last year from 7/19 through 12/19 and the peak electrical demand occurred in August (172 KVA) which is 230 Amps @ 480 Volts. The switchboard is rated for 800 Amps so the actual peak demand is only 29 % of the switchboard rating.

Inspecting the five substation panelboards rated 400 Amps, 120/208 Volts I found them to be in fair condition. Four of the five panelboards had 150 Amp circuit breakers to feed the various float mounted power pedestals and one panelboard had 200 Amp circuit breakers to feed the six (6) power pedestals located on the T-Head. There were misc. 30 amp circuit breakers to feed the Pump Out and T-Head lighting circuits.

Speaking with the maintenance people I was told that the Power pedestals on the D-side of the T-Head were being replaced since many of the power pedestal receptacles were broken. They also mentioned that replacing circuit breakers in the panelboards feeding the float power pedestals was a typical occurance.

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The power pedestals located on the floats appeared to be in fair condition and in general operating properly. The maintenance people say that getting replacement parts is difficult.

On the A- Float a temporary ground wire is in use until the pedestal power cable with the defective ground wire can be replaced.

In general, I found that the marina's electrical system if functioning properly with constant maintenance. The system is approximately 29 years old and since replacement parts are becoming harder to find, it is time to start planning for the replacement of the existing marina electrical system with a new system.

If you have any questions, please call me.

Sincerely,

Ronald, W. Buia, P.E.

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APPENDIX F – PHOTO DOCUMENT

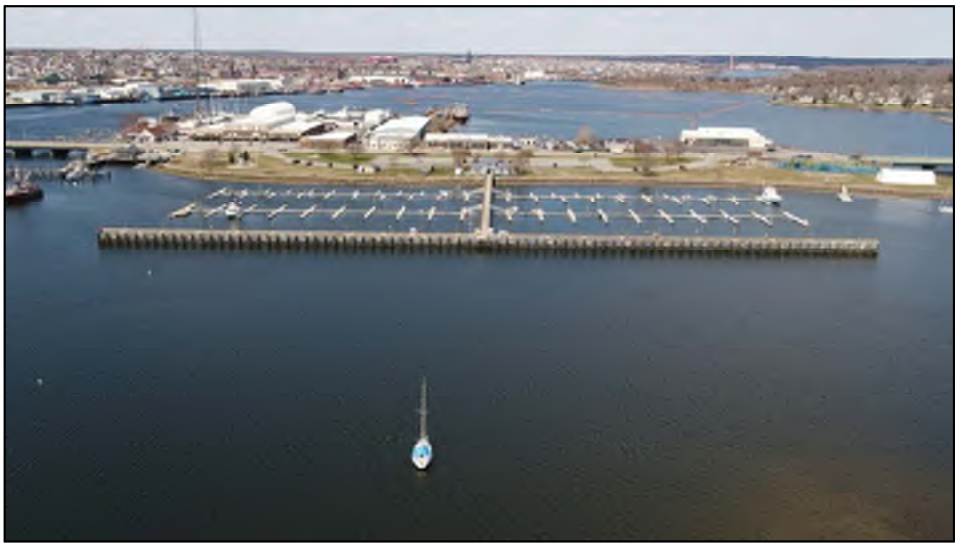

Photo No. 1: Overall view of Pope's Island Marina.

Photo No. 2: Overall view of Pope's Island Marina.

Photo No. 3: Typical spalling, cracking, and deterioration of fiber reinforced concrete modules.

Photo No. 4: Cracking and deterioration of concrete with a trip hazard.

Photo No. 5: Typical deterioration of previously repaired spall

Photo No. 6: Deteriorated concrete encapsulation with exposed polystyrene flotation units.

Photo No. 7: Cracking and deterioration of concrete deck with trip hazard.

Photo No. 8: Deterioration at end of concrete module with exposed polystyrene flotation unit. Note absence of pile guide and replacement with rope.

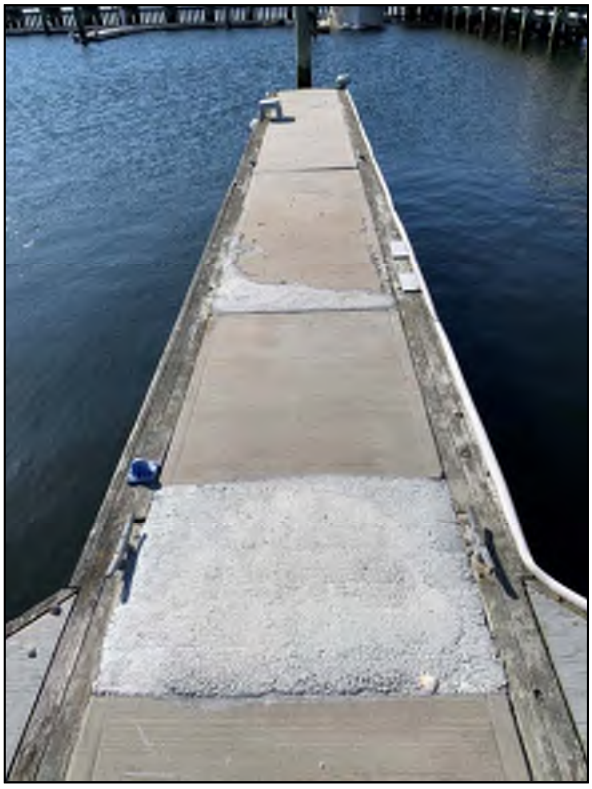

Photo No. 9: Previously repaired spall and minor displacement of deck panel causing trip hazard.

Photo No. 10: Replacement timber finger float.

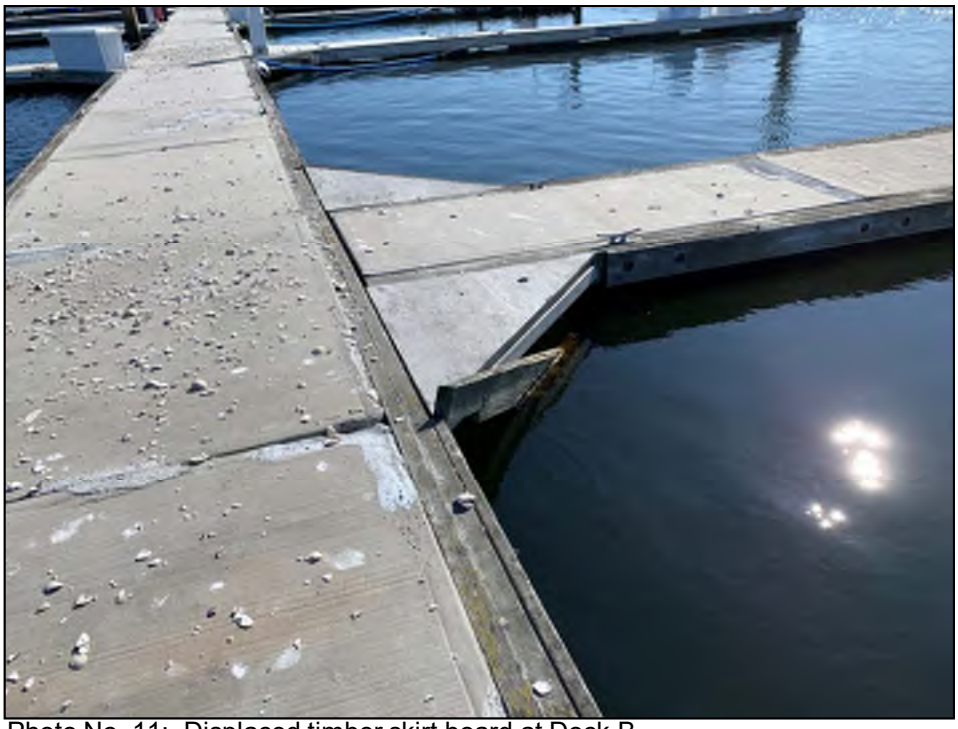

Photo No. 11: Displaced timber skirt board at Dock B.

Photo No. 12: Deterioration at end of concrete module with exposed polystyrene flotation unit. Note displacement of pile guide hardware.

Photo No. 13: Listing of float units along majority of main floats at Dock B.

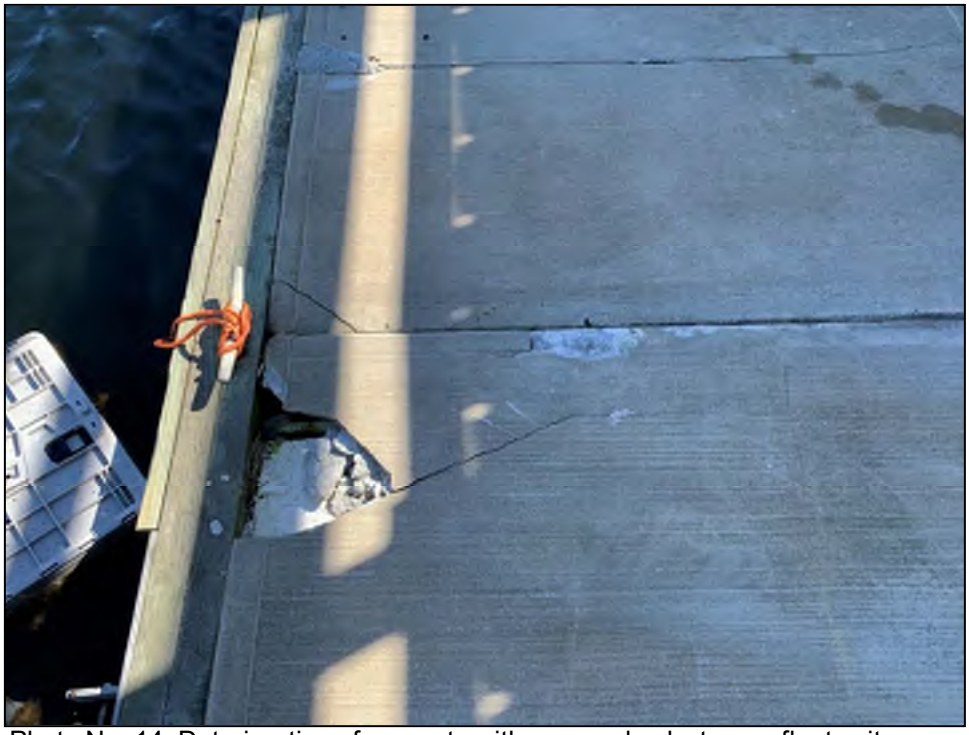

Photo No. 14: Deterioration of concrete with exposed polystyrene float unit. Note cracking at previously repaired spall.

Photo No. 15: Typical uneven timber triangle for finger float connection.

Photo No. 16: Typical top bolts missing on top of steel angle for guide pile.

Photo No. 17: Previously repaired spalls with additional deterioration.

Photo No. 18: Cracking and deterioration of concrete deck with trip hazard and exposed polystyrene float unit. Note deterioration of previously repaired spall.

Photo No. 19: Guide pile hoop with loose connection.

Photo No. 20: Listed finger float at Dock D

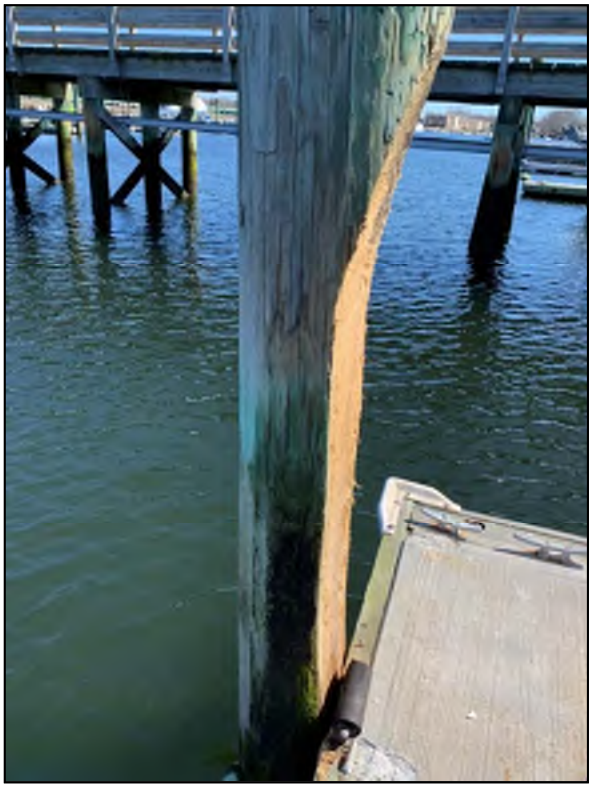

Photo No. 21: Section loss on timber guide pile from finger float.

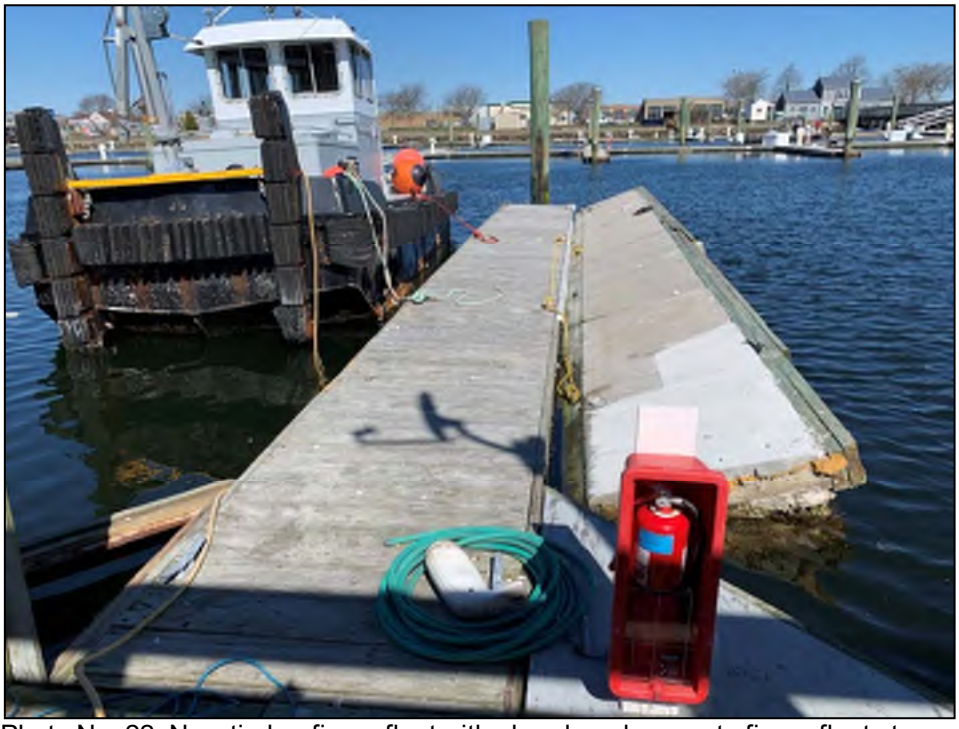

Photo No. 22: New timber finger float with abandoned concrete finger float at Dock D.

Photo No. 23: Disconnected timber triangle connection and overturned power pedestal.

Photo No. 24: Failing timber triangle connection.

Photo No. 25: Previously repaired spall with trip hazard.

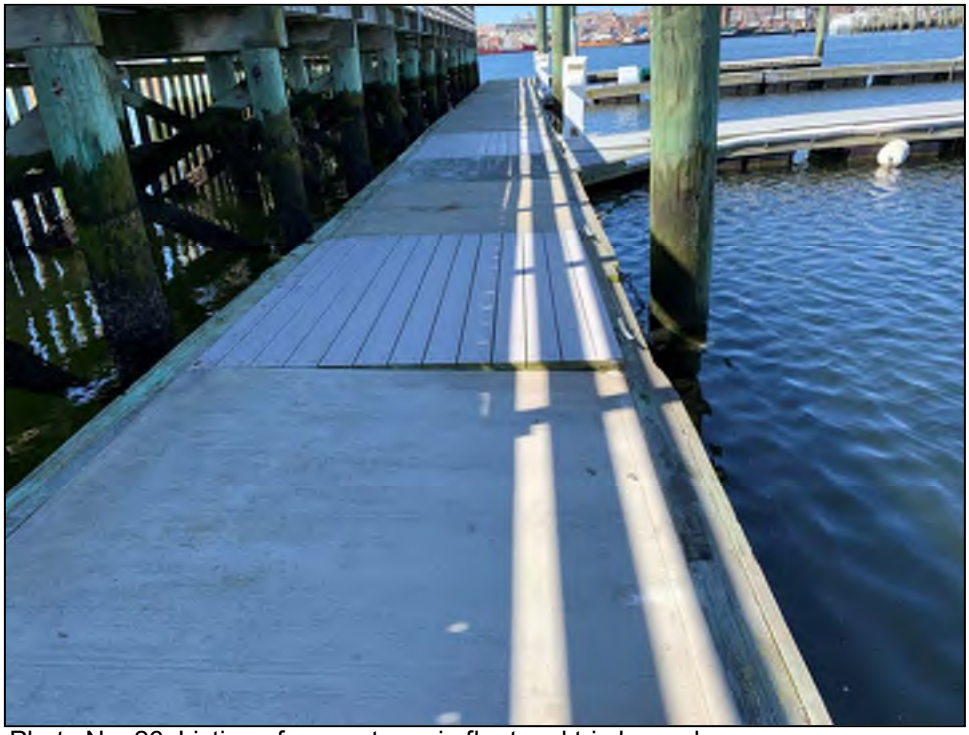

Photo No. 26: Listing of concrete main float and trip hazard.

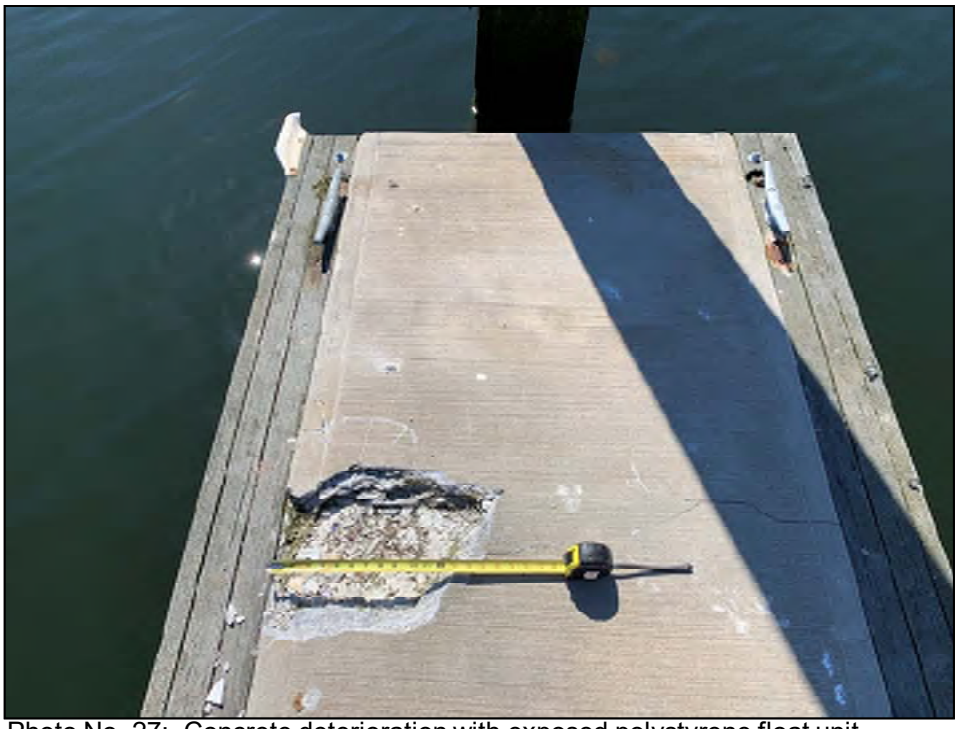

Photo No. 27: Concrete deterioration with exposed polystyrene float unit.

Photo No. 28: Listed and deteriorated concrete float modules with trip hazard.

Photo No. 29: Concrete deterioration with exposed polystyrene float unit and steel reinforcement.

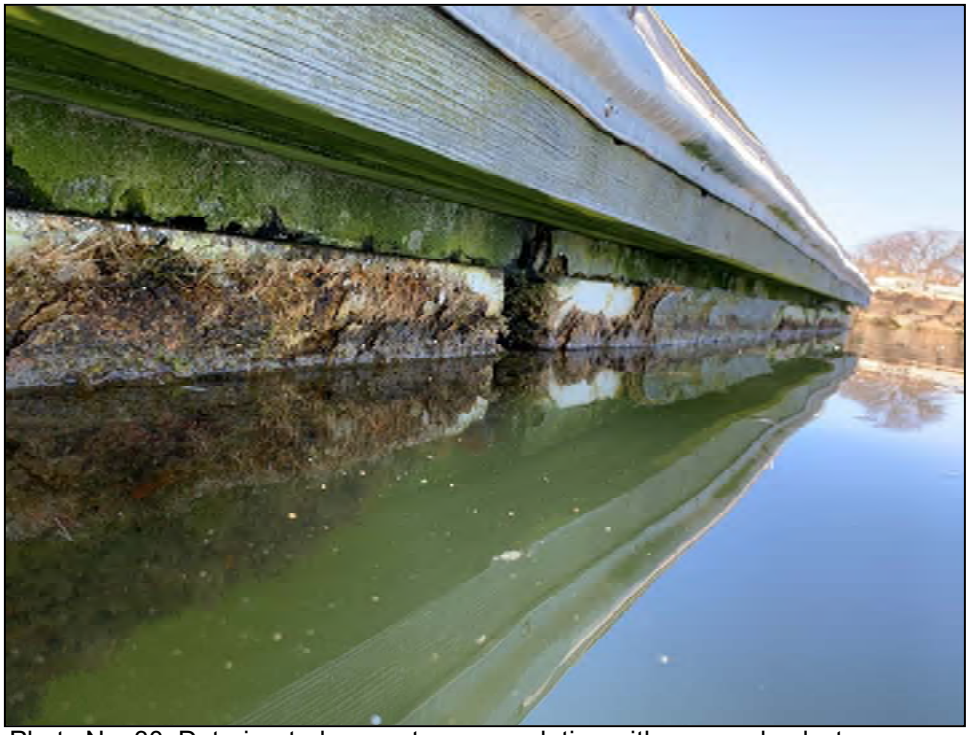

Photo No. 30: Deteriorated concrete encapsulation with exposed polystyrene flotation units.

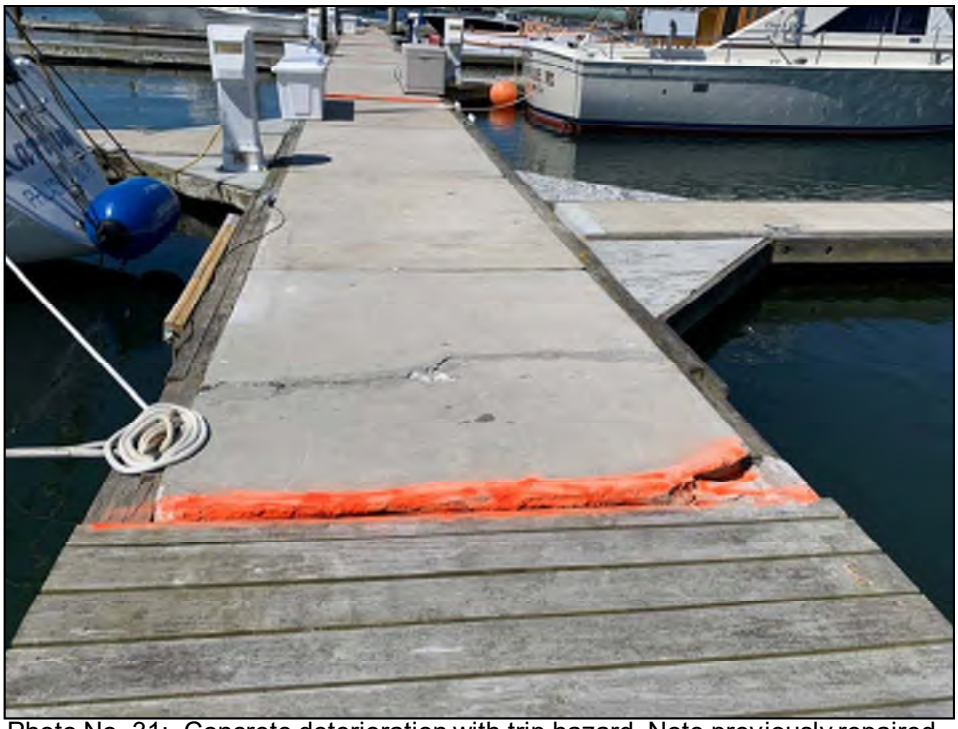

Photo No. 31: Concrete deterioration with trip hazard. Note previously repaired spall with continued deterioration..

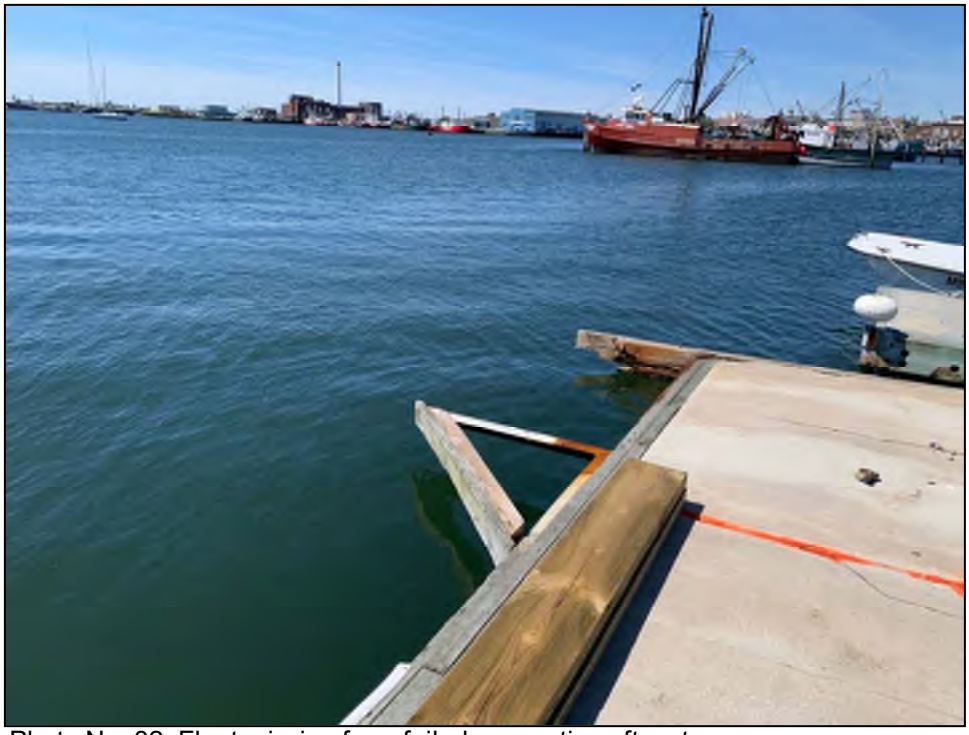

Photo No. 32: Float missing from failed connection after storm.

Photo No. 33: Concrete main float on Dock E before storm.

Photo No. 34: Concrete main float on Dock E after storm. Note displacement of float and trip hazard.

Photo No. 35: Additional damage to concrete after storm.

Photo No. 36: Damage to deteriorated concrete main floats on Dock D.

Photo No. 37: Deteriorated concrete main float along Dock D before storm.

Photo No. 38: Deteriorated concrete main float along Dock D after storm with additional damage and trip hazard.

Photo No. 39: Timber pile damage from missing roller after storm.

Photo No. 40: Displaced polystyrene float units after storm on Dock D.

Photo No. 41: Galvanized chain guide with PVC roller.

Photo No. 42: Timber cross bracing with up to 90% section loss typical along pile supported pier.

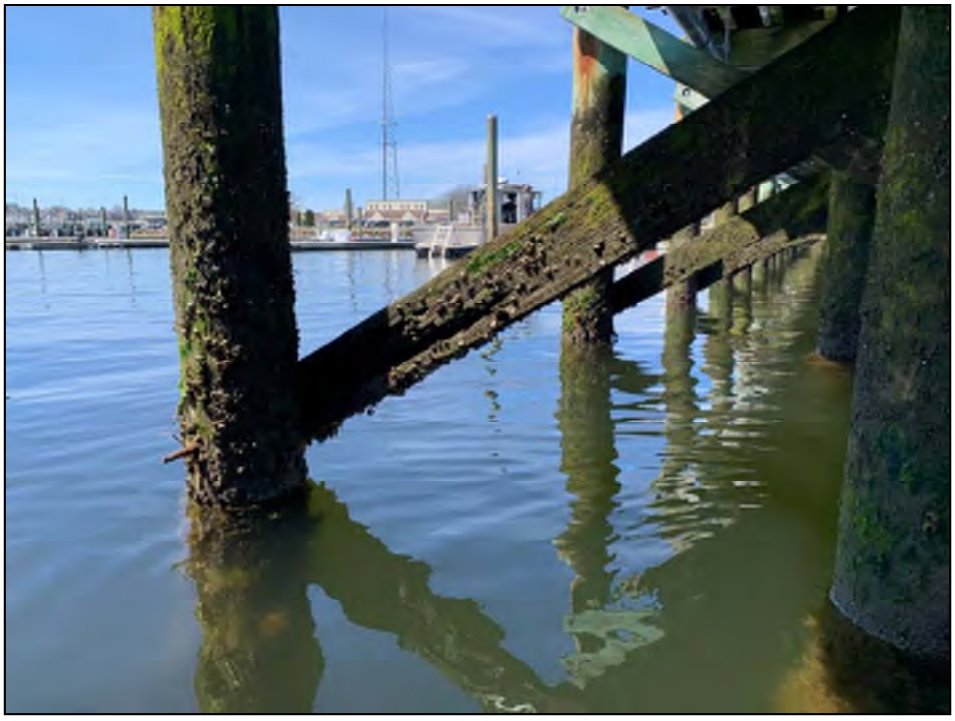

Photo No. 43: Deteriorated cross bracing hardware typical along pile supported pier.

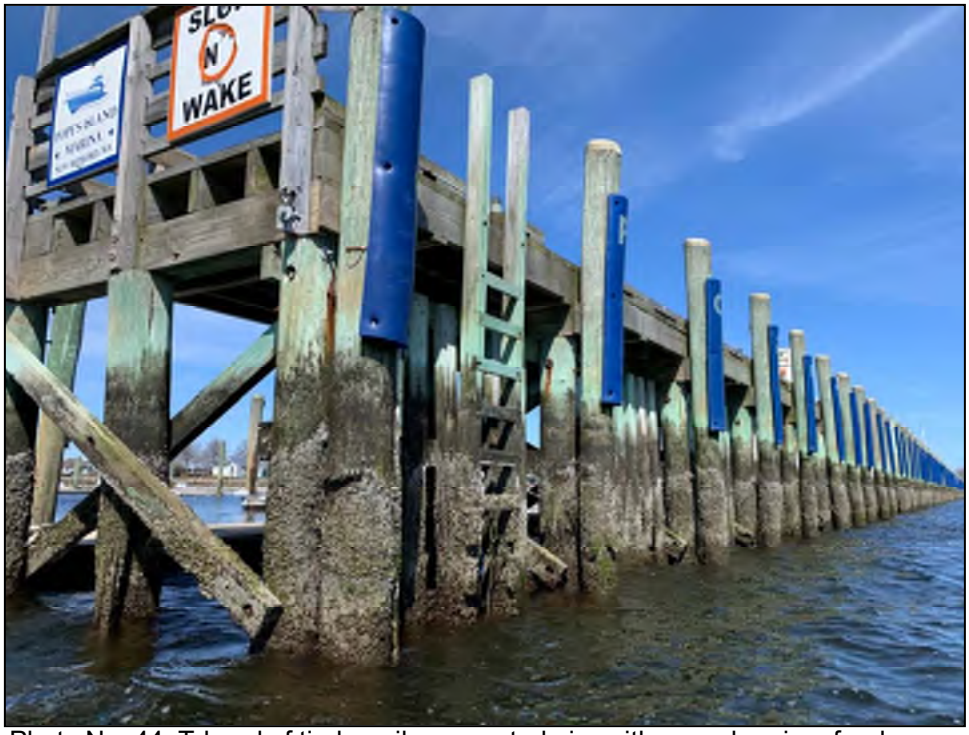

Photo No. 44: T-head of timber pile supported pier with cross bracing, fender piles, and timber wave fence.

Photo No. 45: Deteriorated timber wave fence.

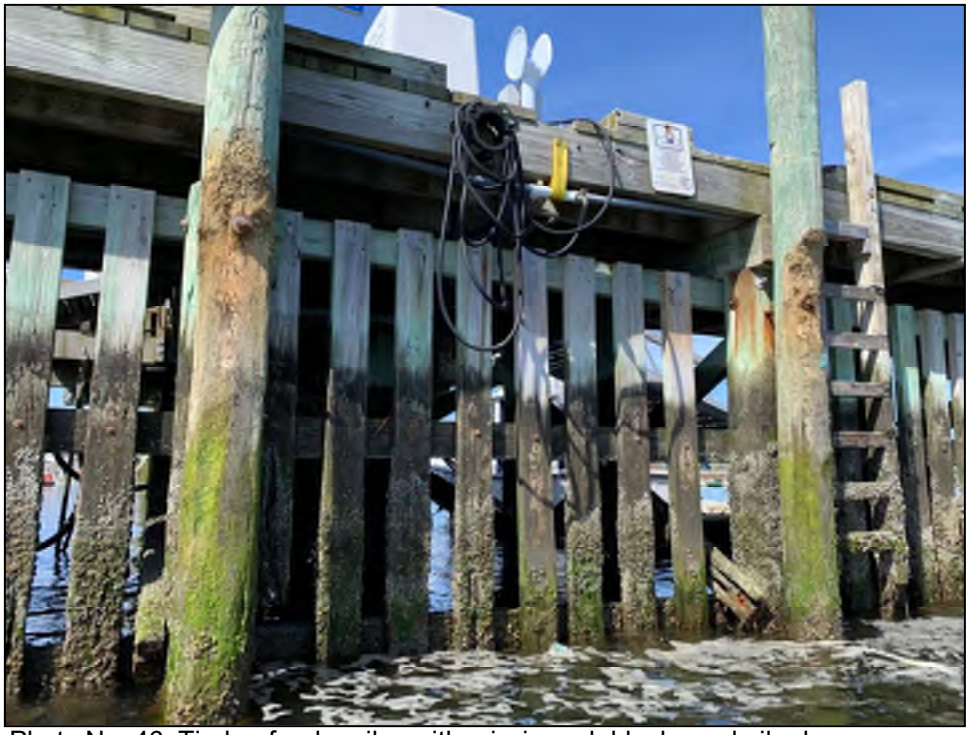

Photo No. 46: Timber fender piles with missing rub blocks and pile damage.

Photo No. 47: Dislocated conduit from light box at T-head.

Photo No. 48: Corroded fire line along T-head.

Photo No. 49: Timber framing along main pier bumpout.

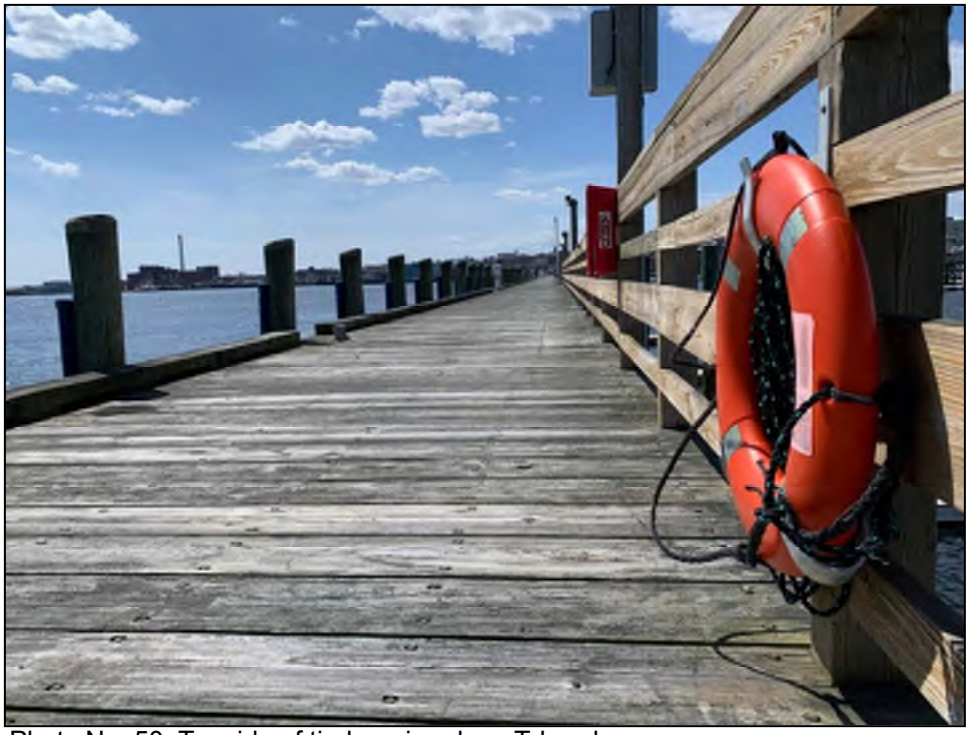

Photo No. 50: Topside of timber pier along T-head.

Photo No. 51: Bottom cross bracing hardware below water.

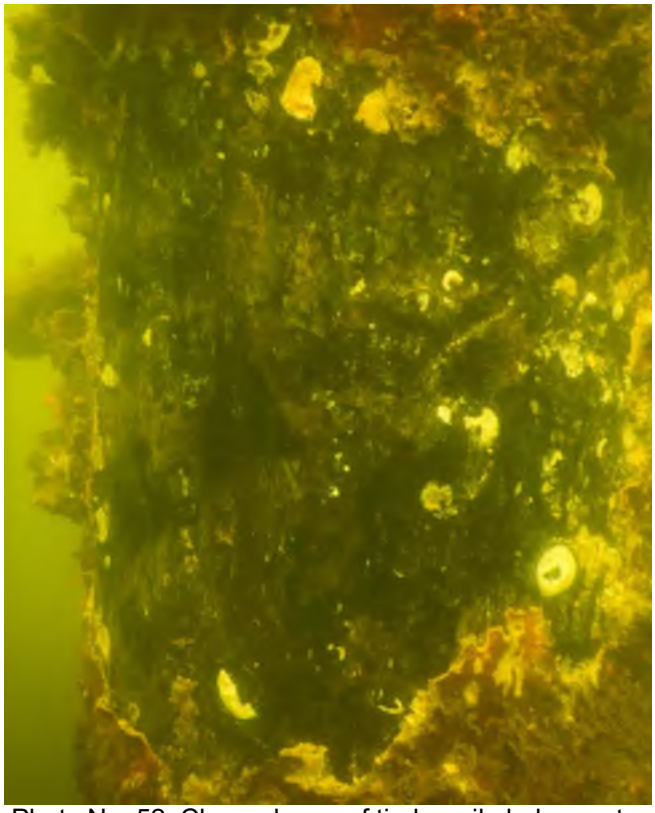

Photo No. 52: Cleaned area of timber pile below water.